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How Large is the Equity Premium?[†]

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ABSTRACT

In this paper we examine how the equity premium has varied over time in the past. We define the equity premium as the difference between the yield on stocks and the yield on bonds. To compute the stock yield we use a dynamic version of the classic Gordon dividend discount model. We find that the equity premium has come down during the 80s and 90s to less than half its large historical average. The equity premium was close to zero at two points in time during this period, 1982 and 1999. A hypothetical bond that had the same duration as equities performed almost as well during this period. An investor who bought such bonds at the end of 1982 and held them on till the end of 1999 would have earned an annualized return of 16 percent. A similar investment in equities would have yielded 18 percent. In contrast long term government bonds which have a much shorter duration yielded a return of only 8 percent.

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1. INTRODUCTION

1.1. Historical Equity Premium

Historically, corporate equities in the U.S. have earned a large *equity premium*, which is the excess return for holding equities over bonds in the long-run. Estimated returns of Siegel (1998), when compounded, illustrate how large the premium has been. Siegel's estimates imply that stocks have earned an average annualized return of 8.4 percent over the last two centuries while bonds have earned an average annualized return of 4.3 percent. This means that one dollar invested in stocks in 1802 could be cashed in for more than 9 million dollars today, while one dollar invested in bonds in 1802 would yield only 4400 dollars. Even if we take inflation into account, we still find that the performance of stocks has been phenomenal. Stocks earned a real annualized return of 7.0 percent and bonds earned a real annualized return of only 2.9 percent. Thus, an investment in stocks in 1802 would provide 2400 times the buying power of an investment in bonds today.

These observations give rise to the following questions, How large is the equity premium now, and will equities continue to earn such a high return over long periods in the future? In order to answer these questions, we need to understand why corporate equities earned such a high return in the past – 4.1 percent per year on average more than bonds over the past two centuries. If the high historical equity premium is mostly compensation for risk that is inherent in equity investments, then the equity premium is likely to be as large in the future, save for changes in risk perceptions and the risk-bearing ability of investors.

1.2. Equity Premium In A Frictionless Benchmark Economy

In order to find out what would be a reasonable value for the equity premium for bearing the higher risk in equities, Mehra and Prescott (1985) measured the risk in equity investments using a standard model in financial economics for pricing assets. The model assumes: (a) capital markets are complete and perfect – investors can trade in any type of financial security without incurring transactions costs, have the same beliefs, and financial markets are informationally efficient; (b) investors are expected utility maximizers and have time-separable constant relative risk aversion utility functions; (c) investors have rational expectations; and (d) dividends are stochastic.

They showed that the "standard model" cannot account for the high historical equity premium. With a real rate of return of 2.9 percent per year for bonds, the standard model predicts an equity premium in the range of 0 to 0.25 percent. If this were the case, the current value of a dollar invested in stocks in 1802 would be a meager 1.05 times the value of a corresponding investment in bonds. Mehra and Prescott (1985) concluded that financial markets were too imperfect and incomplete to satisfy the assumptions of the "standard model". In that case, high direct and indirect transactions costs would make it unattractive for investors to bear the higher risk in equities without the equity premium being substantially higher than what would prevail when the assumptions of the standard model are satisfied.[1] Hansen and Jagannathan (1991) showed that the conclusions Mehra and Prescott reached are very robust – they would not change even if (i) alternative statistical models were used to measure the amount of risk in equities, and (ii) investors' attitude toward risk were described by other non-standard economic models. These results have led to a large body of work that tries to account for the high historical equity premium.

[1] See Treynor, 1994, for a discussion of indirect transactions costs.

(See Kocherlakota (1996) for a comprehensive survey of the literature.)

The consensus view in the literature is that market imperfections like high direct and indirect transactions costs, incomplete knowledge about the available opportunities, and the tendency for investors to hold ill diversified portfolios are the reasons for the high historical equity premium. If this were the case, innovations in the communications and transactions technology will also lead to changes in the equity premium. Such changes are likely to be more permanent than changes that occur due to time variations in risk perceptions and the risk bearing capacity of investors.

1.3. Changes In Equity Premium Over Time

When the equity premium varies over time, the difference between the historical average return on stocks and bonds would not be a good predictor of the equity premium investors expect to get in the future. The following example illustrates why this is the case. Suppose the equity premium that investors required in the past has unexpectedly come down over time. This would have lead to an unexpected run up in equity prices over time in the past. Consider a simple example that illustrates this argument. Suppose dividends are growing at a constant rate of 4 percent per year; the risk-free rate is 4 percent; and the risk premium starts at 7 percent and declines steadily to 1 percent over 50 years. When the equity premium decline is not anticipated, the initial price is only 44 percent of the price that will prevail when the decline in equity premium is fully anticipated because the future dividends are discounted at a higher rate. By the end of the 50 years, the prices in both scenarios will converge to the same value because from then on the discount rates will be the same. Hence, in the case when the equity premium decline is unanticipated, investors would earn a higher rate of return (which will be 12.1 percent) than investors in the fully anticipated case (who will earn only 8.4 percent). Consequently the historical average return differential between stocks and bonds would also be high – but the equity premium investors expect to obtain in the future would be low.

In view of this we measure the equity premium at a given point in time as the difference between the *stock yield* and the long-term *bond yield*.[2] The bond yield is the discount rate at which the price of the bond equals the discounted present value of the stream of future coupon payments and the terminal principal payment. We define the stock yield in an analogous fashion. It is the discount rate at which the market value of stocks in the equity portfolio equals the discounted present value of the stream of expected future dividends. Therefore the stock yield can be thought of as the rate of return investors expect to earn over the long run from their investment in equities.

We use the difference in stock and bond yields as our estimate of the equity premium. For publicly traded stocks, we estimate premia for the period 1926-1999. We use two stock portfolios: the Standard and Poor's Composite index (*S&P stocks*); and the value-weighted index of stocks on the New York Stock Exchange, the American Stock Exchange, and the NASDAQ constructed by the Center for Research in Security Prices (*CRSP stocks*). Our findings for equity premia are robust to the choice of publicly-traded stock index. We also estimate equity premia for a portfolio of all stocks held by U.S. residents for the period 1946-1999. Market values for this portfolio (*FOF stocks*) are taken from the *Flow of Funds of the United States*.

For all three stock portfolios and various assumptions about future dividends, we find that there has been a large decline in the premium to stocks over long-term bonds. For

[2] Note that equity premium is sometimes defined as the expected return on equities in excess of the short term interest rate. This is the case in Mehra and Prescott (1985)

example, assuming a constant growth rate for dividends equal to the historical average, we compute an average equity premium of 6.8 percent on publicly-traded stocks for the period 1926-1970. After 1970, the average is only .7 percent. For all stocks held by U.S. residents, the decline is less dramatic but still significant. Between 1946 and 1970, the average premium was 7.5 percent. After 1970 the average premium was 3.1 percent.

When we assume that the future growth rate of dividends is the same as its historical average, the current (December 1999) equity premia computed using S&P or CRSP stocks, and different assumptions on dividends, fall in the range of 0 to 2 percent. To get an equity premium of as high as 2 percent, we need to assume a much higher growth rate in dividends than what we have seen in the past. We also find that the declining trend in the equity premium over time observed by Blanchard (1993), who compares S&P stock yields and government bond yields for the period 1926-1992, has continued.

For FOF stocks, we compute dividend yields using dividends from the *National Income and Product Accounts* (NIPA) and stock values from the Flow of Funds. We find that stock yields – the sum of dividend yields and expected dividend growth rates – are larger for this data set. Recently, NIPA dividends have grown more rapidly than GNP. As a result, the dividend yields and dividend growth rates for this data set are higher than their counterparts for S&P and CRSP stocks that are publicly traded. As such, we find estimates of the current premium to equities to be in the range of 2 to 3 percent when we use total stock holdings of U.S. residents. While this is higher than estimates for the publicly traded portfolios, it is still significantly smaller than the historical values.

In order to estimate stock yields, we make some key assumptions. In particular, note that the stock yield is the sum of the expected dividend yield and future expected dividend growth rates. Hence the computed stock yield depends critically on assumptions regarding the dividend yield and the future dividend growth rates. To check the robustness of our estimates, we make alternative assumptions about the dividend yield and future growth rates in dividends. We find that empirically relevant variations do not affect our estimates in a significant way.

1.4. Related Literature

For the most part, there is a consensus that equity premia have fallen recently and are more in line with what would prevail in the frictionless benchmark economy that Mehra and Prescott (1985) examined. In earlier work, Blanchard (1993) compares S&P500 stock yields and government bond yields over the period 1926-1992. He finds that stock and bond yields come together in the late 1980s. Wadhwani (1998) compares current real stock yields and the inflation-protected 10 year bond rates. For various assumptions on stock dividends, he finds small differences in yields. Siegel (2000) also estimates low current premia. But he points out that the fall in equity premia may not be as significant as the data suggest because transactions costs and costs of holding diversified portfolios have come down. Fama and French (2000) compare average stock returns and average stock yields over a long horizon. They show that in the post World War II period, the average stock returns have been significantly higher than average stock yields, and argue that it is because equity premium has declined over this period. Bansal and Lundblad (1999) find that the equity premia has come down around the world as well. Cochrane (1997) forecasts that the "expected excess return (stock return less T-bill rate) is near zero for the next five years or so."

1.5. Not Every One Agrees On What The Equity Premium Is

Despite this evidence, not everyone agrees that the equity premium is low or falling. Welch (2000) surveyed over 200 finance professors and found their average estimate of the equity premium to be 4.7 and 6.7 percent per year over the one- and five-year horizons, respectively. Standard textbooks on corporate finance, such as Brealey and Myers (1999), use extrapolated past stock returns for their estimates. Campbell and Shiller (1988) have documented that the equity premium varies over time with periods of high premia and low premia recurring. In fact, Shiller (2000) argues that the current rise in equity prices is due to irrational exuberance which will lead to only a temporary decline in equity premium.

Whether the equity premium has come down recently because of permanent unanticipated changes or because of temporary factors is still an open question. Mehra and Prescott (1985) conjectured that the high premium might be due to incomplete risk sharing. This idea was also advanced by Merton (1987) who showed that increased stock market participation and the resultant increased diversification would lead to a drop in the equity premium and a rise in stock prices. Heaton and Lucas (1999) found that roughly half of the drop in the equity premium can be explained by increased diversification equity investors have been able to achieve.

Without a full theory for the high equity premia of the past, we cannot make accurate forecasts of the equity premium in the future. But any theory of U.S. financial markets must account for the large fall in the equity premium that has occurred during the 80s and 90s. The objective of this paper is to document this fall and to survey the estimates in the literature.

2. NOTATION

The equity premium r^{ep} at date t is defined to be:

$$r_t^{ep} = r_t^s - r_t^b.$$

where r_t^s is the stock yield and r_t^b is the bond yield. By definition, the yield of an asset with price p_t and dividend stream $\{d_t\}_{t=0}^{\infty}$ satisfies the following equation,

$$p_t = \sum_{\tau=1}^{\infty}(1+r_t)^{-\tau} E_t d_{t+\tau}. \tag{2.1}$$

The actual return on the asset is $(p_{t+1} + d_{t+1})/p_t - 1$, which is more volatile than the yield. But, over long horizons, they should have similar means. Therefore, average yields are often used to forecast average returns. If we linearize (2.1) and solve for the yield, then we have

$$r_t \approx E_t \frac{d_{t+1}}{p_t} + \omega_1 E_t g_{t+2} + \omega_2 E_t g_{t+3} + ... + \omega_\tau E_t g_{t+\tau+1} + ... \tag{2.2}$$

where $\omega_\tau = \frac{(1+g)^{\tau-1}(r-g)}{(1+r)^\tau}$ is the weight given to the expected dividend growth rate in $(t+\tau+1)$'st period, $g_t = d_t/d_{t-1} - 1$ is the growth rate of dividends, g is its mean, and r is the mean yield. It can be verified that the weights $\omega_\tau, \tau = 1, 2, ..., \inf$ sum to 1. According to equation (2.2) the stock yield is the sum of the dividend yield and a weighted average of the expected future growth rates in stock dividends. It is [the dynamic version] a generalization of the Gordon valuation model (1962), which assumes that the expected dividend growth rate is a constant. This formula is similar to the one derived by Campbell and Shiller (1988). Unlike Campbell and Shiller, who log-linearize the budget constraint for stock returns to derive the dynamic Gordon valuation model, we linearize the present value relation given in equation (2.1). If at time t the expected growth rate of future dividends is constant, then the formula for the yield simplifies to the Gordon valuation model given by:

$$r_t = E_t \frac{d_{t+1}}{p_t} + g$$

where g is the constant growth rate.

We will use the approximation (2.2) to construct estimates of stock yields as the sum of expected dividend yields plus a weighted sum of expected growth rates.

3. DATA

We now use the formulas derived above to calculate estimates for equity premia over the period 1926-1999. We start by describing the data we use in our analysis. We then calculate yields for the stock portfolios by adding expected dividend yields to the expected growth rate of dividends, as our formulas prescribe. We use alternative assumptions about the dividend growth rate, setting it to some historical average. We then subtract the bond yields reported by Ibbotson and Associates (2000) from the stock yields to get estimates for the equity premia.[3]

3.1. Stock Portfolios

As we mentioned earlier, our estimates for the equity premium are made for three different portfolios of corporate equities – the S&P stock index portfolio, the CRSP stock portfolio, and the FOF stock portfolio.

The most commonly used benchmark portfolio in the financial press is the Standard and Poor's (S&P) Composite. Prior to 1957 the S&P covered 90 companies. After that, it became the S&P500 because it covered 500 companies. The stocks included in the S&P are

[3] For a brief overview of historical asset returns, see the Appendix.

those with the largest stock market value. With the addition of new companies in 1957, the S&P market value more than doubled. As can be seen from Figure 1, the market value of the S&P stocks at the end of 1999 was roughly 1.2 times the value of gross national product (GNP) for the United States. (See the data appendix for details on the series and sources.)

The market value of the S&P stocks has averaged 73 percent of that for all stocks traded on the major U.S. stock markets. In view of this we also considered a broader stock market index – the value weighted portfolio of all stocks in the CRSP database. In Figure 1, we plot the total market value for CRSP stocks: stocks traded on the New York Stock Exchange (NYSE) until 1961, all stocks traded on the NYSE, the American Stock Exchange (AMEX) starting in 1962, and from 1973 onward, all the stocks traded on NYSE, AMEX and the Nasdaq stock exchange. The number of stocks traded on these exchanges has grown from roughly 500 in 1926 to over 8000 in 1999.

Many corporations issue stocks that are not publicly traded. These stocks are also included in the value of corporate equities reported in the Flow of Funds Accounts – what we refer to as the FOF stock portfolio. In Figure 1, we plot the market value of *all* stocks held by U.S. residents either directly or indirectly.[4] Notice that the market value of these stocks is roughly twice the value of stocks traded on the NYSE in 1946. In 1999, the gap was nearly closed with the value of stocks held by U.S. residents at 1.9 GNPs as opposed to 1.6 GNPs for CRSP stocks. Some publicly-traded stocks are held by foreigners – so it is not the case that the value of stocks held by U.S. residents should exceed the value of the NYSE/AMEX/Nasdaq stocks. In fact, in 1981, the value of the publicly-traded stocks

[4] See Table L.213 of the Flow of Funds Accounts. To construct our FOF portfolio value we take total corporate issues at market value and subtract holdings of U.S. issues by foreign residents.

was slightly higher than the value of stocks held by U.S. residents.[5]

In Figure 2, we plot the dividend yields for all three stock portfolios. Recall that our estimate of stock yields is the dividend yield for the stock portfolio plus a measure of the expected growth rate in dividends. In this figure we use the arithmetic average growth rate in dividends for the period 1926-1999 as the expected growth rate in dividends. For the third stock portfolio – all stocks held by U.S. residents as reported in the Flow of Funds – we construct a dividend yield as follows. We take total dividends in the *National Income and Product Accounts of the United States* and divide by the beginning of year total stock value. A comparison of Figures 1 and 2 show clearly that most of the movements in dividend yields are due to movements in prices. During the 1960s and 1990s when stock prices are high, dividend yields are low. Prior to the 1980s, the three series are very close. Afterward, total NIPA dividends grew faster than GNP and therefore the yield is higher than those for the standard stock indices.[6] This growth was not enough though to offset the rise in prices so we do in fact see a significant decline in the dividend yield.

In Table 1, we report average annual growth rates of nominal dividends along with growth rates of nominal GNP and the consumer price index for the period 1927-1999 and various subperiods.[7] Averages over the 1927-1999 period for the S&P and CRSP stock portfolios are similar. The average growth rates of both portfolios have been lower than

[5] We exclude the holdings of foreign residents so that we can later match up the stock values with distributions paid on those stocks – which we do not have for foreigners.

[6] According to economists at the Bureau of Economic Analysis, the difference in NIPA dividends and dividends reported by CRSP is attributable to differences in coverage. NIPA dividends are benchmarked to IRS Statistics of Income (SOI) corporate tax data. The corporate universe in 1997 covered 4.7 million tax returns. In addition to including other public corporations which are not listed on the NYSE, AMEX, and NASDAQ, privately held corporations are included in the SOI universe. A large subset of the privately held sector are the 1120-S corporations, which have grown rapidly during the 1990's. In 1997 they accounted for 18 percent of total cash distributions. These dividend distributions would not be included in any aggregation of public corporate data.

[7] The dividends for the S&P and the CRSP total market are per share. The dividends for the NIPA stocks are corporate dividends in national income.

that of nominal GNP over the sample. The main differences in the growth rates of the S&P dividends and CRSP dividends occur in World War II and the high-inflation period of the 1970s. In those periods, growth in small-cap dividends exceeded growth in the dividends of larger companies. The average dividend growth for the portfolio of FOF stocks is comparable to the growth rate in nominal GNP. However, the periods of high growth for GNP do not coincide with the periods of high growth in dividends. World War II is a time of fast growth in GNP while recent decades have been a time of fast growth in dividends. Between 1985 and 1999, total dividends reported in NIPA rose from 0.023 GNP to 0.04 GNP.

3.2. Bond Portfolios

For bonds, we use data on nominal yields of intermediate and long-term Treasury bonds reported by Ibbotson and Associates (2000). In Figure 3, we plot these yields. Over the 1926-1999 period, the average yield on long-term bonds was 5.3 percent while the average yield on intermediate-term bonds was 4.8 percent. The difference in these yields is most prominent during the Great Depression and World War II. In other periods, the term structure of interest rates is quite flat, and the yields on intermediate and long-term bonds are very close. The long-term bond yields for 1926-1999, as well as the different subperiods, are given in Table 2. As can be seen, bond yields peaked during the seventies and have come down since then.

4. ESTIMATES OF EQUITY PREMIA

For computing the equity premium we first compute the stock yield – the sum of the average growth rate in dividends and the dividend yield. Figure 4 gives a plot of the stock yields for our three stock portfolios for each year during the 1926-1999, along with the yield on the long-term government bond portfolio. The difference between the stock and bond yields is our estimate of the equity premium. Table 2 gives the stock yields for 1926-1999 and the various subperiods when the growth rate in the dividends is assumed to be the same as the historical growth rate in GNP during the 1926-1999 period. We can see that average stock yields during the 60s and the 90s are about the same. However the equity premium during the 90s is much lower since the bond yields are higher. The equity premium was negative during the early eighties and close to zero during the late nineties for the CRSP and S&P stocks. Table 3 and Figure 5 give the time series behavior of the estimated equity premia.

Recall that under the assumption of perfect capital markets, economic theory justifies only a small equity premium (in the range of 0 to 0.25 percent). But, as can be seen from Table 3, for most of the 1926-1999 sample, the estimated premium is large. Between 1926 and 1970, the average premium for the S&P stocks relative to long-term government bonds was 6.8 percent on average. After 1970, the average premium fell to 0.7 percent. In 1999, the dividend yield was 1.36 percent, and the bond yield was 6.82 percent. If we add the average dividend growth rate to the stock yield, then we have

$$r_{99}^{ep} = 1.36\% + 5.19\% - 6.82\% = -.27\% \tag{4.1}$$

or an equity premium that is slightly negative. If we use the CRSP total market portfolio, rather than the S&P500, then the equity premium is very close to zero in 1999.

For the total stocks held by U.S. residents, the fall in the equity premium has been less dramatic because of the recent growth in dividends. Between 1946 and 1970, stock yields were 7.5 percentage points higher than bond yields on average. After 1970, the average premium fell to 3.1 percent. In 1999, the premium is given by

$$r_{99}^{ep} = 2.60\% + 6.93\% - 6.82\% = 2.71\%. \tag{4.2}$$

Note, however, that the assumption of constant growth in dividends is not necessarily a good approximation in the case of total dividends. As we see in Table 1, total NIPA dividends grew much faster than trend in the last few decades.

We next consider alternative assumptions on the dividend processes and bond yields.

4.1. Robustness of the Estimates

Our benchmark calculations show that equity premia have come down. In this section, we consider alternative assumptions to see if they lead us to higher current estimates for the risk premium. It may be that the actual dividend yields are higher than we assume. Another possibility is that our estimate of the growth of dividends is too low. Investors may believe that they are in a "new economy" with higher real growth. Or we may be overstating the yield on bonds.

4.1.1. Adjusted Dividend Yield

During the 1980's, firms increased the amount of their share repurchases, possibly as a way of providing a tax advantage for shareholders. We now incorporate net share repurchases in our notion of payouts to shareholders and construct an adjusted dividend yield. In Figure 6, we plot the adjusted and unadjusted dividend yields using data from NIPA and FOF.[8] The unadjusted series is total dividends divided by the stock market value of the prior year (as shown in Figure 3). The adjusted series is total dividends less net new equity issues for both domestic nonfinancial corporations and financial corporations, all divided by the stock market value in the prior year. Net new equity issues are equal to new share issues less share repurchases. Figure 6 shows that the net new equity issues can add significantly to the volatility of payouts.

Note that the formulas we derived earlier are still relevant even if we include new equity issues and share repurchases. Consider the following simple example of Wadhwani (1998). Suppose that firms make a steady annual profit of \$1000 and pay the entire profit as dividends. Suppose also that the number of shares outstanding is 1000 (which implies dividends per share are equal to \$1). If the discount rate R^s on equity is 10 percent, then, price of the stock is \$10, (i.e., $p_{s,0} = d_1/(R^s - g)$ =\$1/.1).

Consider a second scenario which involves repurchasing shares. Suppose that the firm instead pays half of its \$1000 profits in dividends and half to repurchase shares. Let N_t equal the number of shares outstanding in year t. Dividends per share in t are therefore \$500/N_t with a growth rate given by

$$g_t = \frac{d_t}{d_{t-1}} - 1 = \frac{500/N_t}{500/N_{t-1}} - 1 = \frac{N_{t-1}}{N_t} - 1.$$

[8] We get a similar pattern when we use data from the merged Compustat/CRSP database. There is a significant increase after 1985.

In words, the growth rate of dividends per share is equal to the rate of decrease in the number of shares outstanding. Let $p_{s,t}$ be the share price in year t. Because shareholders stand to get the whole profit stream regardless of the corporate dividend policy, it should be the case that

$$N_t p_{s,t} = \$1000/.1.$$

If \$500 is used to repurchase shares at price $p_{s,t}$ then,

$$p_{s,t}(N_{t-1} - N_t) = 500.$$

Combining the two equations above, we get N_t/N_{t-1}=1/1.05, hence the growth rate for dividends of 5 percent per year.

Without share repurchases, we compute a dividend yield of 0.1 and a dividend growth rate of 0 percent. With share repurchases, we compute a dividend yield of 0.05 and a dividend growth rate of 5 percent. In either case, the initial share price is \$10 and the stock yield is 10 percent. For the second scenario, we simply treat the share repurchases as if they were a one-to-one substitute for dividends. We should get the same result whether we use the cash dividends and the cash dividend growth rate or the adjusted dividends and the adjusted dividend growth rate.

Consider the series in Figure 6. Unadjusted and adjusted dividend yields both averaged 4.4 percent over the post World War II period. The main difference in the series is that adjusted dividend yields are more volatile. Therefore, it is more difficult to form expectations for the adjusted yield than for the unadjusted yield. We would also need to form expectations of future growth rates in the dividends. Again, with greater volatility, this is more difficult for the adjusted dividend series. Because the unadjusted dividend is much less stationary and because it does not affect the long-run estimate, we are better off using our estimate based on unadjusted dividends.

4.1.2. Higher Dividend Growth

There is a view that information technology has led to sustainable higher productivity growth (see for example Jovanovic and Rousseau, 2000). This "new economy" view assumes that the 1990s are much like the post-industrial revolution period that enjoyed the fruits of the technological advances. Higher productivity translates into higher growth in output, earnings, and dividends.

But ultimately real growth is determined by growth in factors of production like labor and increases in output per worker. In the 1990's, growth in the U.S. labor force has been roughly one percent – which is lower than in earlier years when more women and babyboomers entered the workforce. Similarly, productivity has grown only about 1 percent per year. (See Krugman 1997.)

Suppose that we experienced a temporary increase in growth with the rate eventually returning to the postwar trend. We see at least for the dividends for corporate equities held by U.S. residents that the recent growth rate has accelerated vis a vis GNP. (See Table 1.) Other evidence on a temporary increase is the recent IBES consensus forecasts which predict above average earnings growth over the next five years. With earnings projected to be higher, we would expect higher dividends.

Suppose that we assume that the growth in dividends will continue to be high, say for the next five years and then revert back to its long-run rate. Between 1980 and 1999, the NIPA dividends grew roughly 3 percent per year faster than the average, which would give us a 9.9 percent growth rate. If we expect this growth to continue for five years and the start reverting to the long-run rate of 6.9 percent, the formula for the price in 1998 is

$$\begin{aligned} p_{s,98} &= \frac{d_{99}}{1+R^s} + \frac{d_{00}}{(1+R^s)^2} + \frac{d_{01}}{(1+R^s)^3} + \dots \\ &= \frac{d_{99}}{1+R^s}\Bigg[1 + \frac{1.099}{1+R^s} + \frac{1.099^2}{(1+R^s)^2} + \frac{1.099^3}{(1+R^s)^3} + \\ &\quad \frac{1.099^4}{(1+R^s)^4} + \frac{1.099^5}{(1+R^s)^5} + \frac{1.099^5 1.069}{(1+R^s)^6} + \frac{1.099^5 1.069^2}{(1+R^s)^7} + \dots\Bigg] \end{aligned} \tag{4.3}$$

We can use the dividend yield and back out a value for R^s. Doing this calculation, we find $R^s = 9.86$ percent. If $R^b = 6.82$ percent, the equity risk premium is 3.06 percent. This is higher than our baseline estimate of 2.70 percent for 1999 but still well below the average of 6.84 percent prior to 1975.

As another example, consider our calculations for the S&P500. In earlier calculations, we used a dividend growth rate of 5.19 percent which is the average growth rate in dividends for 1926-1999. This growth rate is significantly lower than that of GNP which grew 6.71 percent on average over the same period. Suppose that we forecasted future growth in S&P500 dividends to be more in line with average GNP growth. This would increase our estimate of the equity premium by 1.52 percent, from -.27 percent to 1.25 percent. But, again, this estimate falls well below the historical average.

4.1.3. Lower Bond Yields

Equity premia have fallen in large part because bond returns and yields have risen dramatically. (See Table A in the Appendix and Figure 3.) In our calculations for the equity premium in 1999, we used a nominal yield of 6.8 percent, that is the yield of a 20-year government bond. Is this too high?

The average yield on 20-year government bonds was 50 basis points higher than the average yield on 5-year government bonds over the period 1926-1999. (See Figure 3.) In 1999, the 5-year bond yield was 6.5 percent, 30 basis points lower than the 20-year yield. Using this value would imply that r^{ep} is 0.1 percent for the publicly traded portfolio and 3 percent for the total stock portfolio.

A more reasonable argument for a higher premium is based on costs due to illiquidity. There are costs incurred in shifting out of Treasury securities which can be as much as 50 basis points. If we subtracted 50 basis points from our estimate of 6.8 percent for illiquidity concerns, we would then have an estimate of the equity premium of 0.3 percent for the publicly traded portfolio and 3.2 percent for the total stock portfolio.

4.1.4. The Bottom Line

Adding net share repurchases should not affect our estimates of equity premia. Allowing for higher dividend growth will increase our estimate. But extraordinary growth in dividends would be needed to get estimates of equity premia close to the historical averages. Lower risk-free rates increase our estimate but bond yields have increased dramatically over the sample period that we consider. One needs to assume large costs due to illiquidity and low rates of inflation to get significant changes in our estimates.

The bottom line is that equity premia have come down significantly during the 80s and 90s – that is true even if we use the higher stock yields for total stock holdings of U.S. residents. Reasonable assumptions lead to premia around 3 percent. If dividend yields continue to fall, so too will the premia.

For stock portfolios that most people analyze, namely the S&P500 or the CRSP total market, the premia are in the range of 0 to 2 percent. To get premia around 2 percent, we need to assume much faster dividend growth in the near-term than observed historically, and large transaction costs for bonds.

The calculations suggest that the equity premium puzzle is vanishing.

4.2. A Comparison to Other Estimates

The exercise of comparing stock and bond yields was done in earlier work by Blanchard (1993). Blanchard compares expected real yields on stocks and bonds. Expected yields are computed as fitted values of regressions on a list of variables assumed to be in individuals' information sets when expectations are made. Similarly to us, he uses intermediate and the long-term bonds. The stock portfolio he uses includes only publicly traded stocks. He does not consider the total stock portfolio reported in the FOF. The results of his exercise are very close to ours for the S&P500 and the CRSP total market portfolio. For example, the difference between the yield on the S&P500 and the yield on 20-year bonds in Figure 4 over the period 1927-1993 is close to the estimates of Blanchard's Figure 11 despite differences in our computations. With additional data in the 1990s, we find that little has changed. The premia in the 1990s has remained in the range of 0 to 2 percent for publicly traded stocks. (See Table 3 Panel B.)

Wadhwani (1998) compares recent real stock yields with returns on inflation-protected Treasury bonds. Like Blanchard (1993), Wadhwani only considers stocks that are publicly traded on the major U.S. stock exchanges. His best guess using data through 1997 is an equity premium of 1.7 percent. Wadhwani estimates a real stock yield of 4.9 percent – 2.55 percent for the expected dividend yield (adjusted for buybacks) and 2.35 percent for the expected growth in dividends. He uses a bond yield of 3.2 percent calculated as the TIPS yield less the cost of illiquidity. The premium is therefore 4.9 less 3.2 or 1.7 percent.

Using data through the mid-year of 1999, Siegel (1999) estimates a real stock yield of 3.3 percent which is the sum of a 1.2 percent dividend yield and a growth rate of real dividends of 2.1 percent. Since this falls below the yield on TIPS bonds he looks for sources of dividend growth that could potentially increase his estimate for equity yields. He argues that nothing in the data leads one to extrapolate the high historical stock yields forward. He also argues that the fall in premia may be less significant because transactions costs have come down significantly.

Fama and French (2000) conclude that equity premium is coming down but their reasoning is based on a different type of calculation than in this paper. They compare stock yields to average stock returns and find that these averages line up well prior to 1950. After 1950, they diverge because stock prices grew much faster than dividends. The actual stock return is the sum of the dividend yield and the growth rate of the stock price. The stock yield, in turn, is the sum of the expected dividend yield and a weighted sum of expected dividend growth rates. See equation (2.2). Fama and French show that over the post World War II period, the growth in stock prices has been significantly higher than the growth rate in dividends and therefore actual stock returns are higher than the stock yields which are used to forecast returns. Fama and French argue that this implies a fall in future stock returns and hence a fall in future equity premia.

In all of these papers, there is a consensus that equity premia are currently low. Such estimates are in sharp contrast to the predictions made by finance professors as described in the Welch (2000) survey. Welch asked 226 professors of finance to forecast the equity premium over different horizons. At the one-year horizon, the mean forecast was 4.7 percent, with a standard deviation of 4.2 percent. At the five-year horizon, the mean forecast was 6.7 percent, with a standard deviation of 2.3 percent. For longer horizons, the mean forecast was roughly 7 percent. Thus, the finance professors do not believe that the equity premium will fall.

This view is also stated clearly in standard financial textbooks. Take, for example, Brealey and Myers (1999), who describe how to estimate a return for a diversified stock market portfolio. They do this by taking the current interest rate on U.S. Treasury bills plus the average risk premium for some historical time period (see page 158 of Brealey and Myers (1999).) The risk premium they use is 9.2 percent. In other words, they simply extrapolate past returns forward.

They note that this is consistent with security analysts' earnings-growth forecasts used in the same way we used dividend-growth forecasts in Section 2. If dividends and earnings grow at similar rates, how can we get such different estimates for the premium? The difference in estimates is due to assumptions about future dividend and earning growth rates beyond the analysts' forecast horizon. To get a high equity premium, one must assume that growth rates stay high forever. But one would need growth rates in dividends or earnings to be significantly above growth rates in GNP in order to compute a risk premium on the order of 9 percent.

To see this, consider our calculation using NIPA dividends in equation (4.3). If we had assumed that dividends grow forever at 9.9 percent, then our estimate of the equity premium would have been 5.7 percent. Instead we assumed that dividend growth reverted back to the trend growth of GNP. Thus, our estimate was 3.06 percent. To get as high as the Brealey and Myers estimate of 9 percent, we would need to assume nominal dividend growth of 13.2 percent per year – almost twice as fast as the growth in nominal GNP. We think that this is very unlikely.

4.3. Discussion

Low predictions for stock returns have important implications for future investments and for new financial theories. It is hard to rationalize a vanishing equity premium as a permanent shift in preferences. But there are institutional changes that have occurred that would result in a permanent shift in stock returns. One possibility is greater opportunities for portfolio diversification. This idea was actually advanced by Merton (1987) before the large increase in stock prices and more recently has been pursued by Heaton and Lucas (1999). Merton shows that the equity risk premium can be substantially higher in an economy with incomplete diversification when compared to an economy with perfect capital markets. Heaton and Lucas estimate that the increased participation in stock markets can lead to as much as a 2 percent reduction in the equity premium and can therefore partially explain the current high level of stock prices. This work goes part way in accounting for the facts, but it seems to be going in the right direction.

4.4. How Reasonable Are Our Equity Premium Estimates?

We used the stock valuation model given in equation (2.2) to calculate the equity premium at different points in time. The equity premia we computed would correspond to what investors expected to get only if their expectations about the future dividend growth rate matched our number. In what follows we argue that this probably was the case.

There are two years in our sample when the implied risk premium was very close to zero. At the end of 1999, the implied risk premium was -0.27%, and at the end of 1982, it was -0.26%. If these estimates are indeed correct, then the stocks and bonds would have earned the same rate of return during this period – i.e., \$100 invested in stocks at the end of 1982 would have the same value at the end of 1999 as an investment of \$100 made in bonds at the end of 1982. A look at the data reveals that the S&P 500 index earned an annualized average return of 18.35% during this period. In contrast, an investor who bought 30-year government bonds at the end of 1982 and held them till the end of 1999 would have realized an annualized average return of 8.00% – which is substantially lower than the return on stocks.

This evidence appears to indicate that our equity premium estimates are probably unreliable. A more careful examination of the data indicates that this is not the case. It is important to remember that stocks have a longer duration than 30 year government bonds. When the equity premium at two different points in time are the same, bonds that have the same duration as stocks would earn the same return as stocks over this time period. In our calculations we assumed that equity dividends grew at a constant rate of 5.19% per year. Hence consider a console that pays annual coupons – where the first coupon of \$1 is paid at the end of this first year and the coupons grow at 5.19% per year. Such a console will have the same duration as stocks. At the end of 1982 the price of this the console would have been

$$p_{82}^{console} = \frac{\$1}{r_{83}^{LT} - g} = \$19.27. \tag{4.4}$$

The market value of the console at the end of 1999 would have been

$$p_{99}^{console} = \frac{\$1(1+g)^{17}}{r_{99}^{LT} - g} = \$145.00. \tag{4.5}$$

An investor who had invested \$100 in this console at the end of 1982 and sold it at the end of 1999, collecting all the coupon payments in between, would have realized an annualized average return of 15.93%. This number is much closer to the 18.35% annualized average return on the S&P 500 over the same period.

This calculation implies that stocks earned, on average, a 2.42% higher annual return that bonds of similar duration. This difference between stock and bond returns may be due to a small increase in the expected dividend growth rate. In fact, an unanticipated increase in the expected dividend growth at the end of 1999 – from 5.19% to 5.76% – would lead to a higher console price at the end of 1999 such that the average return on the bonds would equal to that on stocks.

5. CONCLUSION

Historical asset returns in the United States pose a serious challenge to applied economists. But large equity premia of the past seem to be coming down. A naive investor who looks only at the past when planning for his retirement may be sadly disappointed if he simply extrapolates historical returns. This point seems to be well understood for bonds – when interest rates come down, bond prices go up. Bond investors do not use past returns to forecast the future. This point, however, seems to have been missed by stock investors.

For stocks, one needs to forecast both the discount rate changes and changes in future cash flows. The latter is often difficult to predict and one must disentangle the two effects. This is what we have done in this paper and our calculations show that expected future cash flows do not warrant high future equity premia.

Appendix. Historical Returns

In this appendix, we give an overview of historical financial asset returns. These data have motivated much of the recent asset-pricing literature and serve as a useful background for those unfamiliar with the U.S. experience.

Table A is a summary of average historical returns for stocks, long-term government debt, and short-term government debt. The first panel has annualized compounded nominal returns for different historical time periods.[9] Returns for the period 1802-1997 are taken from Siegel (1998). Between 1871 and 1997, the stock returns are computed from capitalization-weighted indexes of all New York Stock Exchange (NYSE) stocks, and starting in 1962, all NYSE, American (AMEX) and NASDAQ stocks. Capitalization-weighted indexes use a firm's stock price times shares outstanding as weights for individual firms. Prior to 1871, the series is based primarily on stocks of financial institutions like banks and insurance companies. Siegel's returns on debt are returns on long-term government bonds and short-term government bills when available. When unavailable, comparable highly rated securities with low default premia are used. After 1926, the data on small- and large-firm stocks and U.S. Treasuries are taken from Ibbotson Associates (2000). The large-firm stocks are those in the S&P500. The Treasury bond has a 20-year maturity and the Treasury bill has a 1-month maturity. The value-weighted stock returns are taken from the database of the Center for Research in Security Prices (CRSP). As in the case of Siegel's stock returns, this return is a weighted return of all publicly traded firms on

[9] Given nominal returns r_t, $t = 1, \ldots, T$, we calculate the compounded annual return as follows:

$$100\left(\left[(1+r_1)(1+r_2)\cdots(1+r_T)\right]^{\frac{12}{T}} - 1\right).$$

For real returns we first subtract the monthly inflation rate, π_t, from r_t before doing the calculation.

NYSE, AMEX, and NASDAQ. The weight for each firm in a particular month is its market value (i.e., stock price times shares outstanding) as of the previous month, divided by the total market value.

Consider the period 1802-1997. Stocks in this period earned a premium of 4.1 percent over short-term debt. In the twentieth century, stocks earned an even higher premium. Take for example the period 1926-1999. The difference in average returns on the value-weighted portfolio over U.S. Treasury bills was 7.8 percent – despite the fact that the United States experienced the Great Depression and World War II. Large and small firm stocks both did better, earning premia of 9.5 and 8.3, respectively. Even during the period of the Great Depression and World War II, we find a high return for stocks. Returns on stocks were higher than bills by 6.4 to 8.3 percentage points.

In the second panel of Table A, we display standard deviations of annual returns. Historical stock returns are considerably more volatile than Treasury bills and bonds – especially when we consider small firms stocks. For example, the standard deviation for small firm stocks, that yielded the highest returns in each subperiod we consider was 33.6 percent whereas the standard deviations for large-firm stocks in the S&P500, for Treasury Bonds and Treasury Bills was 20.14 percent, 9.3 percent, and 3.2 percent respectively. There was a significant increase in the variability of Treasury bond returns after 1970 due to inflation uncertainty. Notice that investors in the 1970's and 1980's demanded a higher return on these bonds to compensate for the perceived higher risk.

In the last panel of Table A, we report real returns, which are the relevant numbers for investors. For the historical period, we see that the real return on the value-weighted portfolio was 7 percent while the real return on short-term debt was 2.9 percent. In the twentieth century, the return to short-term debt was even lower – falling below 1 percent in the period after 1926 – with real stock returns around 8 percent.

In Figure A, we show graphically how various assets have performed by plotting the value of a dollar invested in 1926. The plot is intended to further illustrate the large differences in returns across the asset categories that we are analyzing. We use a logarithmic scale for this figure because the values of the investments are vastly different. We see from the figure that a $1 investment in 1926 in small firm stocks could have been cashed in for $6,639.70 in December 1999. A $1 in a portfolio with larger firms, for example the S&P500 or the value-weighted portfolio would have made roughly $2000 to $3000. While not as good as the small-firm portfolio, these stock values dwarfed Treasury securities. A $1 investment in 1926 in 20-year Treasury bonds could have been cashed in for only $40.12, and the same investment in 1-month Treasury bills could have gotten only $15.64. This is a small gain for such a long horizon.

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Table 1

Average Annual Growth Rates, 1927-1999

			Dividends		
Years	GNP	CPI	S&P	CRSP Total	NIPA[†]
1927-1999	6.72	3.21	5.19	5.36	6.93
1947-1999	7.34	4.18	6.34	6.20	8.37
1930-1939	-0.30	-1.96	-1.00	-1.37	0.00
1940-1949	11.69	5.64	6.78	7.86	6.81
1950-1959	6.69	2.07	5.15	5.53	5.98
1960-1969	6.89	2.33	5.66	5.48	6.79
1970-1979	10.14	7.09	5.83	7.09	9.21
1980-1989	7.83	5.56	7.11	8.04	10.52
1990-1999	5.37	3.01	4.72	3.24	9.19

[†] Data are available since 1929.

Table 2

Average Stock and Bond Yields, 1926-1999

Years	S&P	CRSP Total	FOF †	Long Term Bonds
Panel A: Using the mean dividend growth rate				
1926-1999	9.65	9.63	NA	5.30
1946-1999	9.32	9.34	11.37	6.30
1930-1939	10.33	10.12	NA	2.96
1940-1949	11.06	11.10	NA	2.24
1950-1959	10.51	10.49	12.01	3.11
1960-1969	8.47	8.56	10.04	4.78
1970-1979	9.33	9.38	11.08	7.57
1980-1989	9.80	9.75	12.28	10.40
1990-1999	7.83	7.84	10.84	6.86
December 1999	6.55	6.77	9.52	6.82
Panel B: Using the mean GNP growth rate				
1926-1999	11.17	10.98	NA	5.30
1946-1999	10.85	10.69	11.15	6.30
1930-1939	11.85	11.47	NA	2.96
1940-1949	12.58	12.44	NA	2.24
1950-1959	12.03	11.83	11.79	3.11
1960-1969	9.99	9.91	9.81	4.78
1970-1979	10.86	10.72	10.86	7.57
1980-1989	11.33	11.10	12.06	10.40
1990-1999	9.36	9.19	10.62	6.86
December 1999	8.07	8.12	9.30	6.82

† Data are available since 1946.

NOTE: NA indicates not available.

Table 3

Average Equity Premia, 1926-1999

Years	S&P	CRSP Total	FOF[†]
Panel A: Using the mean dividend growth rate			
1926-1999	4.34	4.33	NA
1946-1999	3.02	3.04	5.07
1930-1939	7.36	7.16	NA
1940-1949	8.82	8.86	NA
1950-1959	7.40	7.38	8.90
1960-1969	3.69	3.79	5.26
1970-1979	1.76	1.81	3.51
1980-1989	-0.59	-0.65	1.89
1990-1999	0.98	0.99	3.98
December 1999	-0.27	-0.05	2.71
Panel B: Using the mean GNP growth rate			
1926-1999	5.88	5.68	NA
1946-1999	4.55	4.39	4.86
1930-1939	8.90	8.51	NA
1940-1949	10.35	10.21	NA
1950-1959	8.93	8.73	8.69
1960-1969	5.23	5.14	5.05
1970-1979	3.30	3.16	3.30
1980-1989	0.94	0.71	1.67
1990-1999	2.51	2.35	3.77
December 1999	1.26	1.31	2.50

[†] Data are available since 1946.

NOTE: NA indicates not available.

Table A

Financial Asset Returns, 1802-1999

	Stocks			U.S. Treasury	
	Small-Firm	S&P500	Value-Weighted	Bonds	Bills
			Annual Nominal Returns		
Compounded Average					
1802-1997	NA	NA	8.4	4.8	4.3
1926-1999	12.6	11.3	10.9	5.1	3.8
1945-1999	14.7	13.3	12.9	5.4	4.7
1926-1945	9.4	7.1	6.5	4.7	1.1
1945-1972	13.7	12.8	12.4	2.2	2.7
1972-1999	15.4	14.1	13.6	8.7	6.8
Standard Deviation					
1802-1997	NA	NA	17.5	6.1	NA
1926-1999	33.6	20.1	20.2	9.3	3.2
1945-1999	25.7	16.5	16.6	10.4	3.1
1926-1945	51.1	28.3	28.3	4.8	1.5
1945-1972	28.5	16.6	16.5	6.0	1.8
1972-1999	22.6	16.4	16.7	12.5	2.7
			Annual Real Returns		
Compounded Average					
1802-1997	NA	NA	7.0	3.5	2.9
1926-1999	9.3	8.0	7.5	1.9	0.7
1945-1999	10.1	8.8	8.4	1.1	0.5
1926-1945	9.4	7.1	6.4	4.6	0.9
1945-1972	10.2	9.3	9.0	-1.0	-0.5
1972-1999	9.7	8.4	8.0	3.3	1.5

NOTE: NA indicates not available.

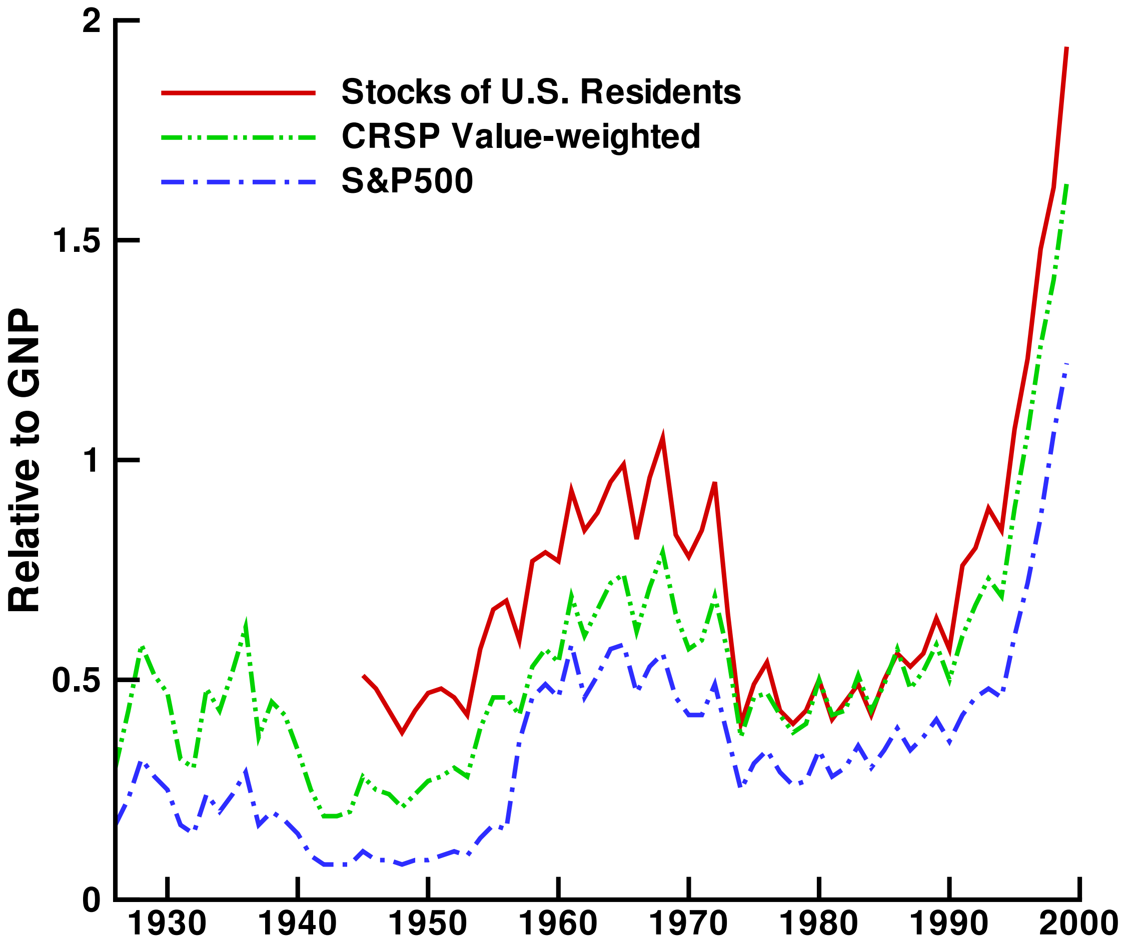

Figure 1. Stock Portfolio Values Relative to GNP

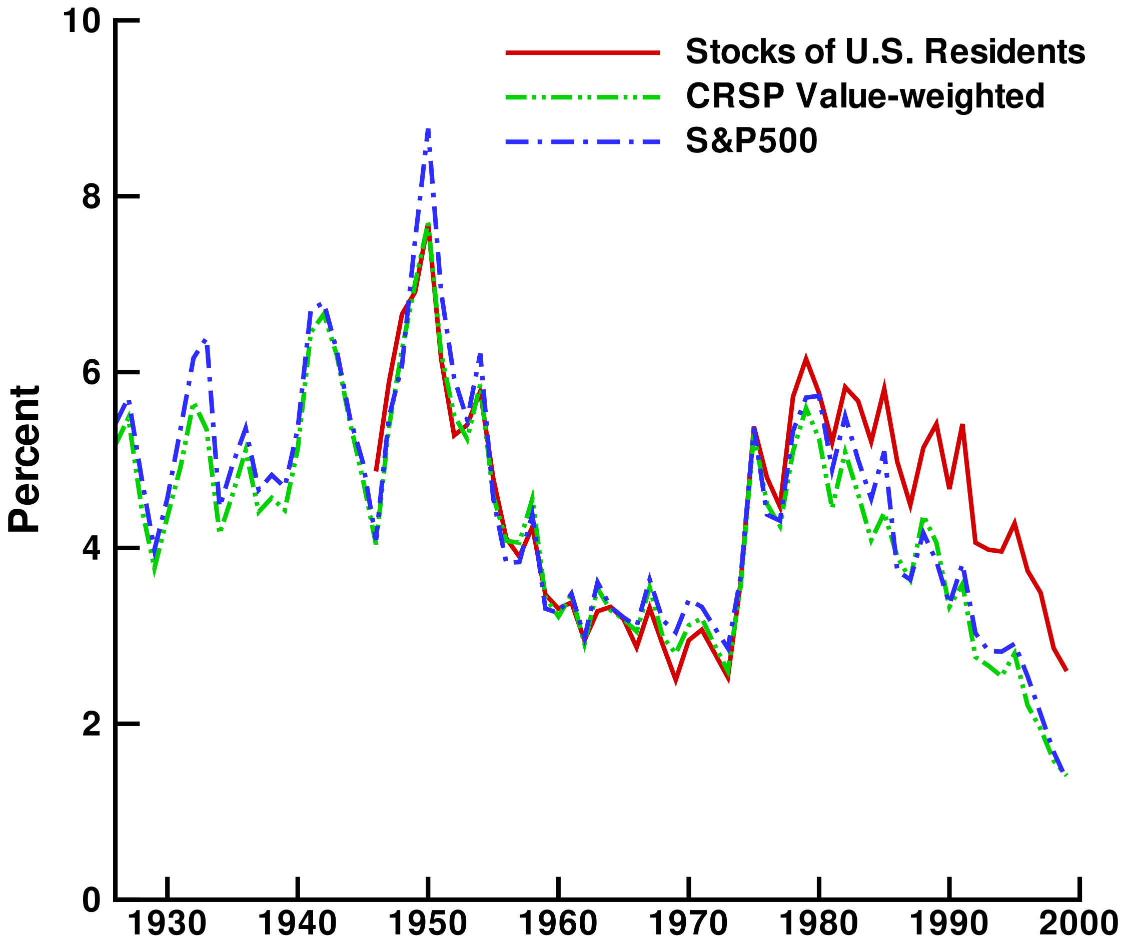

Figure 2. Stock Dividend Yields

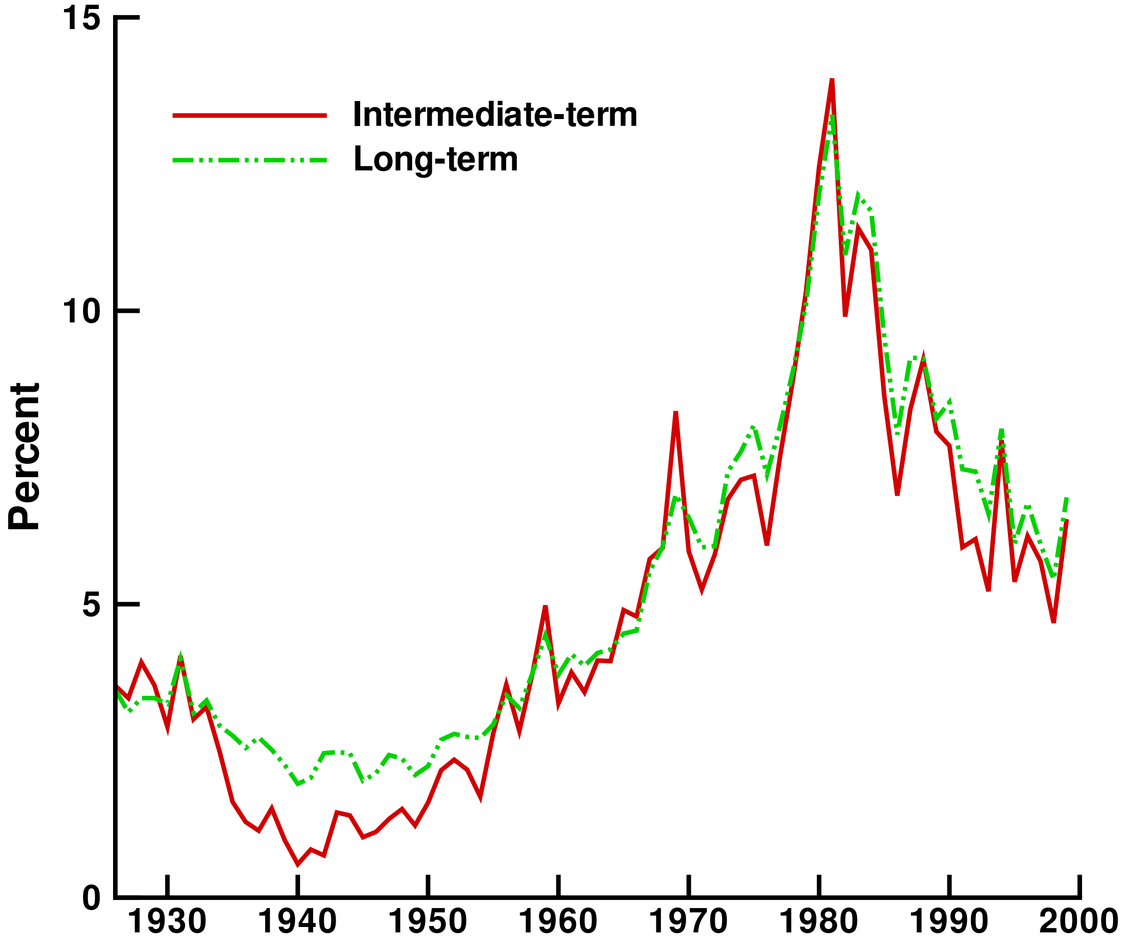

Figure 3. Government Bond Yields

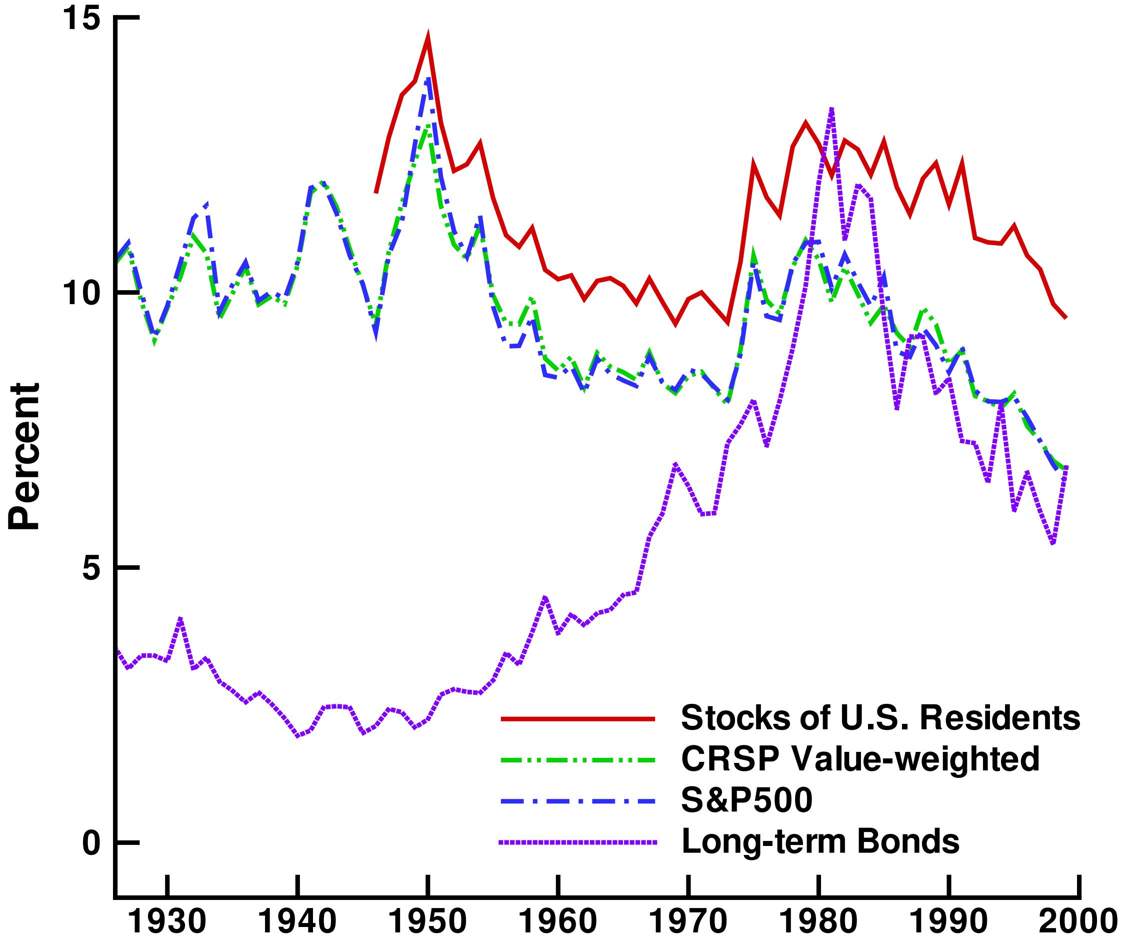

Figure 4. Stock Yields and Long-term Government Bond Yield

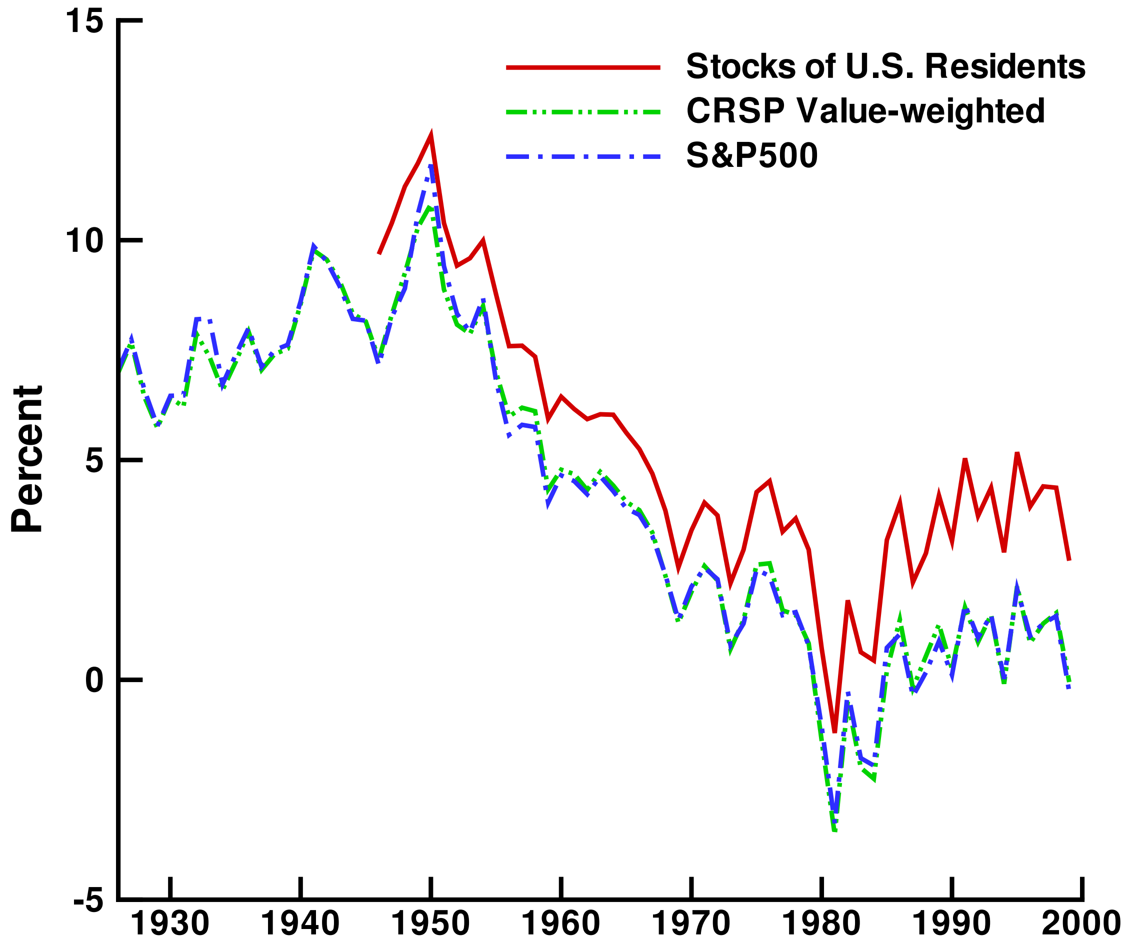

Figure 5. Equity Premia

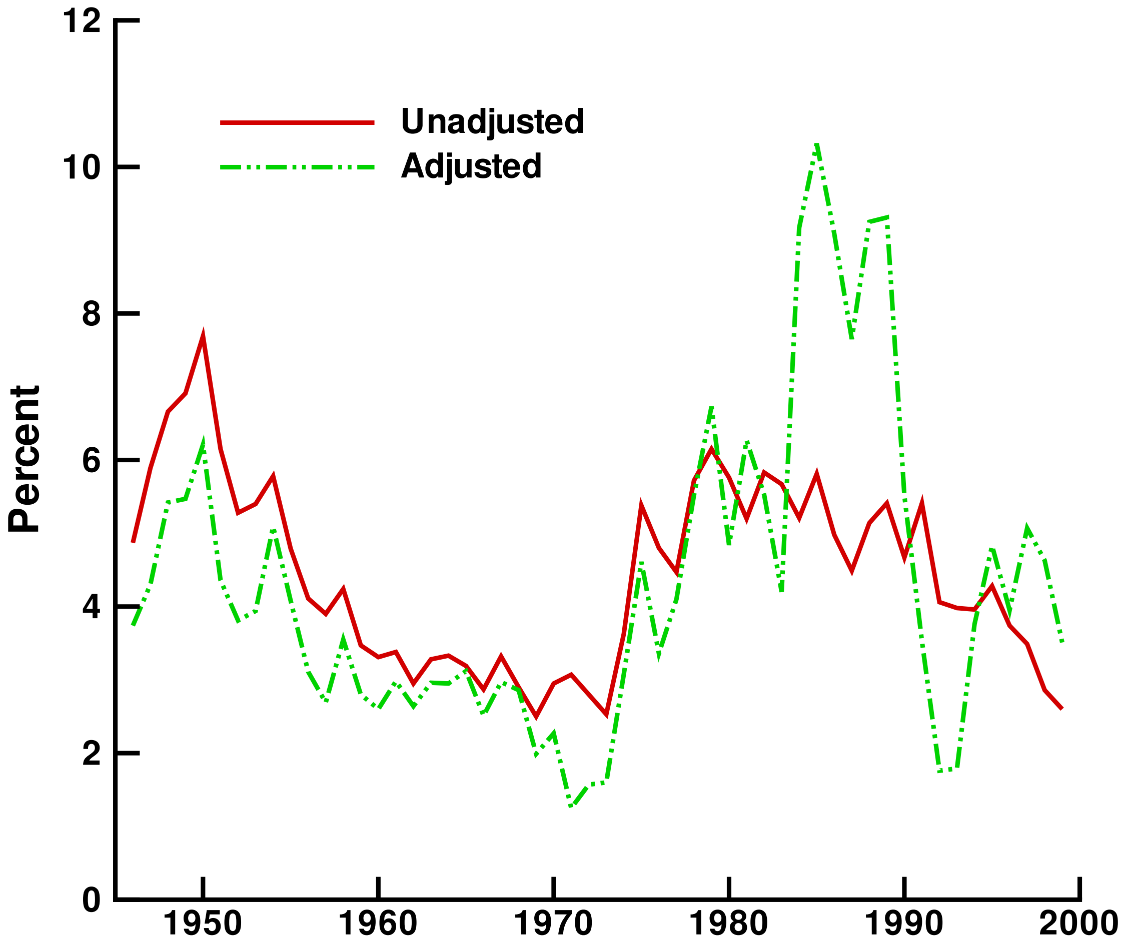

Figure 6. Unadjusted and Adjusted Dividend Yields for Corporate Equities Held by U.S. Residents

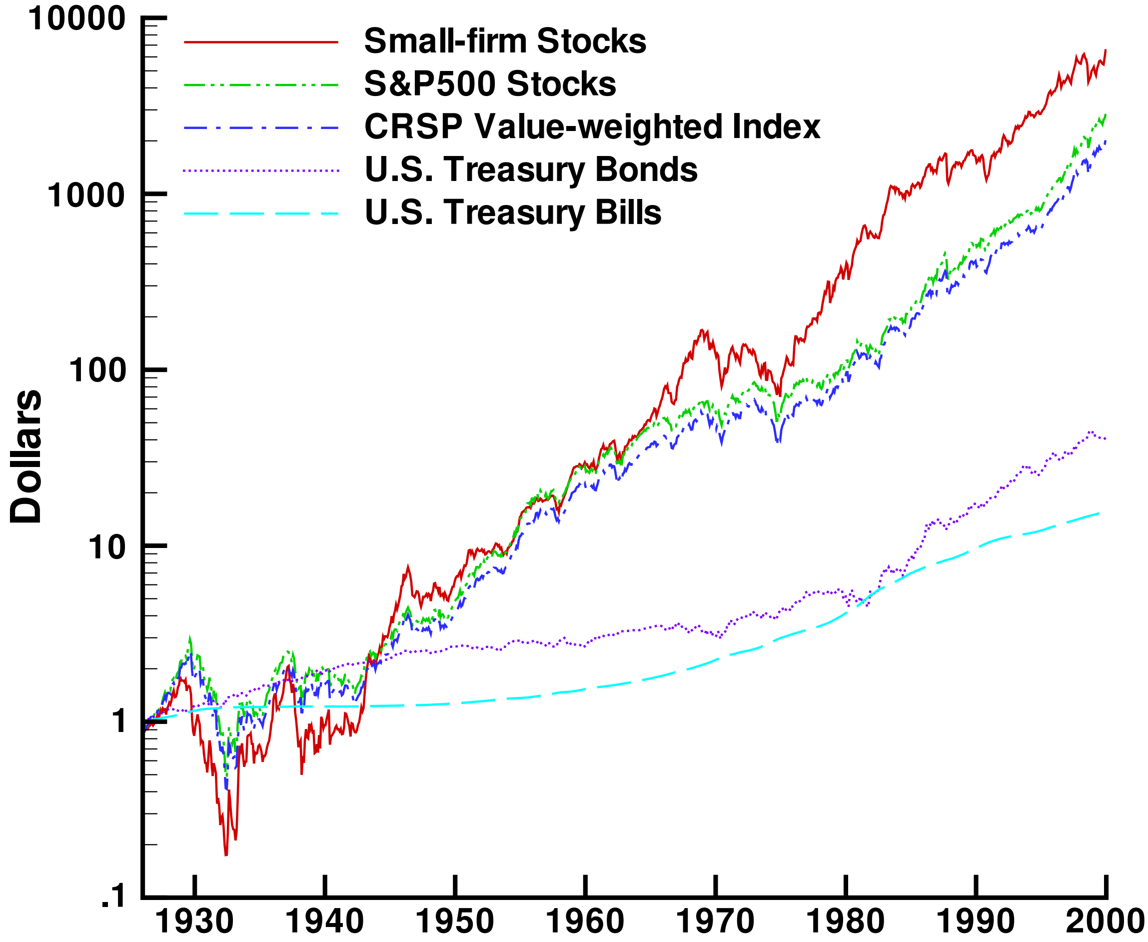

Figure A. The Value of $1 Invested in 1926