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The Declining U.S. Equity Premium*

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Historically, investors holding corporate equities have earned a *premium,* or an extra return for holding equities instead of bonds, which have more predictable returns. Estimates of this equity premium in the United States average around 4 percentage points for the past two centuries (Siegel 1998) and around 7 percentage points for the 1926–99 period (Center for Research in Security Prices).

The historical size of the U.S. equity premium has puzzled economists since the mid-1980s. Economists had assumed that the size of this premium is primarily a measure of the compensation that investors demand for taking on the extra risk inherent in equity investments. But the standard asset pricing model which incorporates this assumption has not been able to account for an equity premium as large as 4 percentage points; with reasonable levels of risk aversion and other standard assumptions, the model predicts instead a premium around 0.25 of a percentage point (Mehra and Prescott 1985, Hansen and Jagannathan 1991). This discrepancy between data and theory has come to be known as the *equity premium puzzle.*

The puzzle has led to some fruitful work. (See the 1996 literature review by Kocherlakota.) The surprising historical size of the equity premium suggests that something else besides inherent risk is determining its size, something related, perhaps, which the standard model is simply not capturing. One view in the finance literature is that this something is market imperfections—things like the inability of investors to fully insure against major risks outside the organized stock markets, such as shocks to their labor income; the significant direct and indirect costs that investors face in order to make transactions; and incomplete knowledge among investors about existing investment opportunities.[1] These imperfections are thought to decrease the willingness of investors to bear risks and so increase the return they require for investing in risky assets, including stocks.

This view about the reason for the large historical equity premium is consistent with recent U.S. experience. If the view is right, and the historical premium is primarily due to market imperfections, then the premium can reasonably be expected to shrink when such imperfections are reduced. That seems to be what has happened in the United States over the last three decades. Dramatic technological improvements clearly have been made since 1970, making it increasingly easier for investors to access information, communicate and transact with others, and enforce contractual obligations. At the same time, the equity premium has decreased significantly (Blanchard 1993, Cochrane 1997, Claus and Thomas 1999, Siegel 1999, Wadhwani 1999, and Fama and French 2001).

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[1]For a discussion of indirect transaction costs, see Treynor 1994.

Here we demonstrate that decrease in the equity premium, using the classic Gordon (1962) stock valuation model. This model gives a formula for calculating the equity premium as a function of the bond yield, the stock dividend yield, and the expected growth rate in dividends. The Gordon model assumes that the expected growth rate in dividends is a constant. We show that the model can be readily modified to accommodate a different assumption, that the expected dividend growth rate changes over time. We use the Gordon formula to calculate the equity premium for several alternative measures of the aggregate U.S. stock portfolio and several alternative assumptions about stock dividends and bond yields, and we get basically the same result: the equity premium has come down significantly in the last three decades. In fact, some of our exercises suggest that the premium is now about where the standard model says it should be.

Note that in calculating the estimate of the equity premium, we do not follow the common practice of simply calculating the historical average difference between returns on stocks and returns on bonds. During a period when the equity premium is declining, that simple calculation with historical averages may not result in a good estimate of the premium that investors actually expect to earn in the future. This is because the calculation misses the changes in prices that would accompany an unexpected decline in the equity premium. Our more complicated method of calculating the premium with a dynamic version of the Gordon model is an attempt to capture all those changes.

Our result, that the U.S. equity premium has declined over the last three decades, confirms the results of other economists. However, we do not provide a definitive explanation for the recent premium decline. Much more work must be done to determine its cause and to build a full theory of asset pricing. Our work does, however, lead to a definite warning for inexperienced investors. If the recent decrease in the equity premium is due to the recent technological improvements—if some major market imperfections have been virtually eliminated—then the premium can be expected to stay at its current small size for the foreseeable future. Investors who rely on history to predict the returns they can expect from the stock market, therefore, are likely to be disappointed.[2]

Formula

Here we derive a formula that we can use to calculate estimates for the size of the equity premium at any particular point in time. To derive the formula, we rely on the basic present value relation discussed in introductory finance textbooks: the stock price equals the discounted present value of expected future dividends.

We measure the equity premium at a given point in time as the difference between the *stock yield* and the long-term *bond yield*.[3] 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 way: 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 from those stocks. 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.

In particular, we define the equity premium r^{ep} at time t as

$$(1) \qquad r_t^{ep} = r_t^s - r_t^b.$$

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

$$(2) \qquad p_t = \sum_{\tau=1}^{\infty} (1+r_t)^{-\tau} E_t d_{t+\tau}.$$

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, the yield and the return should have similar means. Therefore, average yields are often used to forecast average returns.

If we linearize equation (2) and solve for the yield, then we have

$$(3) \qquad r_t \approx E_t(d_{t+1}/p_t) + \omega_1 E_t g_{t+2} + \omega_2 E_t g_{t+3} + \ldots + \omega_\tau E_t g_{t+\tau+1} + \ldots$$

where $\omega_\tau = (1+g)^{\tau-1}(r-g)/(1+r)^\tau$ is the weight given to the expected dividend growth rate in period $t + \tau + 1$, $g_t = (d_t/d_{t-1}) - 1$ is the growth rate of dividends, g is the mean of the dividend growth rates, and r is the mean stock yield.

[2]If, however, the decline in the equity premium and the consequent rise in equity prices are due to "irrational exuberance" as advocated by Shiller (2000), then investors will be even more disappointed. When the exuberance evaporates and the equity premium increases to a size closer to its historical average, stock prices will fall.

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

(It can be verified that the weights ω_τ for $\tau = 1, 2, ..., \infty$ sum to 1.) According to equation (3), the stock yield is the sum of the dividend yield and a weighted average of the expected future growth rates in stock dividends. This is the dynamic version of the Gordon (1962) valuation model, which assumes that the expected dividend growth rate is constant.

Our formula is similar to one derived by Campbell and Shiller (1988). However, Campbell and Shiller log-linearize the budget constraint for stock returns, while we linearize the present value relation in equation (2). If at time t the expected growth rate of future dividends is constant, then our formula for the yield simplifies to the Gordon valuation model's:

$$(4) \qquad r_t = E_t(d_{t+1}/p_t) + g$$

where g is the constant dividend growth rate. This equation will hold even when the expected dividend growth rate is not constant, but then g will be an equivalent constant growth rate that is some weighted average of expected future growth rates.

We use equation (4) to construct our baseline estimates of stock yields. Basically, our estimate for the equity premium is the stock yield thus computed minus the yield on long-term government bonds.

Data

To estimate the equity premium for U.S. stocks at various points in time, we use several different stock portfolios and bonds of different maturities. Our sample period is 1926–99.[4]

Stocks

We use two portfolios of publicly traded stocks and one measure intended to cover all stocks owned in the United States.

The most commonly used benchmark portfolio in the financial press is the Standard & Poor's composite index (*S&P stocks*). Before 1957, this index covered 90 companies; since March 1957, it has covered 500. The stocks included in the S&P index are those with the largest stock market value. With the addition of new companies in 1957, the market value of S&P stocks more than doubled. (See Chart 1.) At the end of 1999, the market value of these stocks was roughly 1.2 times the value of the U.S. gross national product (GNP).

The market value of S&P stocks is now about 75 percent of the value of all stocks traded in the major U.S. stock exchanges. To get a broader view, therefore, we also consider a broader stock market index: the value-weighted portfolio of publicly traded stocks in an index constructed by the University of Chicago's Center for Research in Security Prices (*CRSP stocks*). Between 1926 and 1961, these include the stocks traded on the New York Stock Exchange (NYSE); between 1962 and 1972, the stocks traded there and on the American Stock Exchange (AMEX); and since 1973, the stocks traded on the NYSE, AMEX, and the Nasdaq Stock Market. The number of stocks traded on these exchanges has grown from roughly 500 in 1926 to over 8,000 in 1999. (The market value of CRSP stocks over this period is also displayed in Chart 1.)

Still, many corporations issue stocks that are not publicly traded, so we broaden our view further to attempt to include them. We consider as well data on all stocks held by U.S. residents, data which are collected and published by the Federal Reserve System Board of Governors (*BOG stocks*). These data are available only back to 1946. (Chart 1 displays the market value of these stocks too.)[5]

Notice in Chart 1 that in 1946 the market value of BOG stocks is roughly twice the value of CRSP stocks (which, again, in 1946 included only stocks traded on the NYSE). In 1999, that gap is nearly closed, with the value of BOG stocks at 1.9 times GNP as opposed to 1.6 times GNP for CRSP stocks. Some publicly traded stocks are held by foreigners, so the value of stocks held by U.S. residents (BOG stocks) should not necessarily exceed the value of the stocks traded on the major stock exchanges (CRSP stocks). In fact, according to these data, in 1981 the value of publicly traded stocks seems to have been slightly higher than the value of all stocks held by U.S. residents.

In Chart 2, we plot the dividend yields for all three stock portfolios. Recall that our formula for stock yields is the dividend yield for the stock portfolio plus a measure of the expected growth rate in dividends. To calculate stock yields, we use the arithmetic average growth rate in dividends during 1927–99 as the expected growth rate in dividends for the two publicly traded stock portfolios. For the

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[4]For a brief overview of historical returns on U.S. financial assets, see the Appendix. Our primary data sources are Ibbotson Associates 2000 for Standard & Poor's stock data and U.S. government bond data; the Center for Research on Security Prices (http://gsb www.uchicago.edu/research/crsp) for CRSP stock data; and FR Board, various dates, for all stocks held by U.S. residents (BOG stocks).

[5]See FR Board, various dates, Table L.213. To construct the market value of our BOG portfolio, we start with the total corporate issues at market value (line 1) and subtract from that the holdings of U.S. issues by foreign residents (line 8). We exclude the holdings of foreign residents so that we can later match up the stock values with distributions paid on the stocks, which we do not have for foreigners.

Charts 1–2

Three U.S. Corporate Stock Portfolios

Annually, 1926–99

S&P: Standard & Poor's composite index
CRSP: Value-weighted index of publicly traded stocks constructed by the Center for Research in Security Prices
BOG: All stocks held by U.S. residents, according to the Board of Governors of the Federal Reserve System

Chart 1 **Market Value**

Ratio of Each Portfolio's Market Value to U.S. Gross National Product

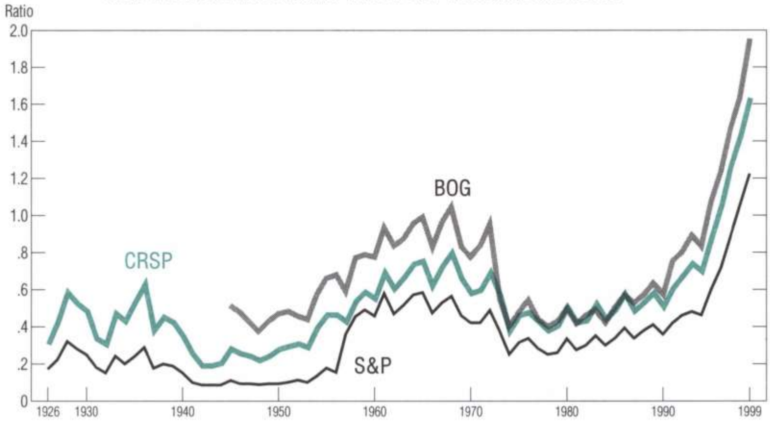
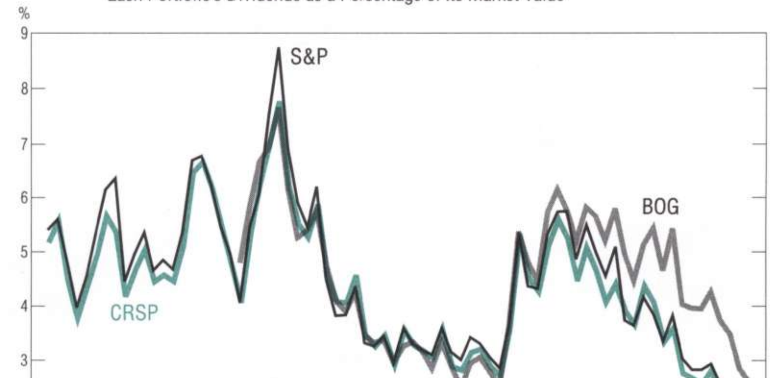


Chart 2 **Dividend Yield**

Each Portfolio's Dividends as a Percentage of Its Market Value*



*The BOG dividend yield is constructed from Federal Reserve Board market values and national income and product account dividends.

Sources: Ibbotson Associates 2000; Center for Research in Security Prices, Graduate School of Business, University of Chicago; FR Board, various dates; U.S. Commerce, various dates third stock portfolio—all stocks held by U.S. residents as reported by the Fed—we construct a dividend yield by dividing the total dividends reported in the U.S. national income and product account (NIPA) data, which are available back to 1929 (U.S. Commerce, various dates), by the beginning-of-year total stock value, which is available back to 1946 (FR Board, various dates).

A comparison of Charts 1 and 2 shows clearly that most of the movements in dividend yields are due to movements in prices. During the 1960s and the 1990s, when stock prices are relatively high, dividend yields are relatively low. Before the 1980s, the three dividend yield series are very close. Thereafter, however, the yield for BOG stocks is higher than those for the standard stock indexes because total NIPA dividends have grown faster than GNP.[6] This growth is 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 compare the growth of nominal dividends for our three portfolios to the growth of nominal output and the price level in the United States during 1927–99. The output measure is nominal GNP, and the price level measure is the consumer price index (CPI).

Note that over the 1927–99 period, the average annual growth rates for the S&P and CRSP stock portfolios are similar. The average growth rates of both portfolios have been lower than that of nominal GNP over the sample period. The main growth differences between these portfolios occur in the World War II years and the high inflation years of the 1970s. In those periods, dividends of smaller companies grew more than those of larger companies.

In contrast, the average dividend growth for the portfolio of BOG 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 for BOG 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 BOG stock dividends rose from 0.023 of GNP to 0.040 of GNP.

Bonds

For bonds, we use data on nominal yields of U.S. Treasury securities reported by Ibbotson Associates (2000). In Chart 3, we plot yields for bonds of two maturities. Over the 1926–99 period, the average yield on intermediate-term (5-year) bonds was 4.8 percent while the average yield on long-term (20-year) bonds was 5.3 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 close.

In our equity premium estimates, we concentrate on the long-term bond yields. Table 2 lists their average values during 1926–99 as a whole and over various subperiods. Chart 3 shows clearly that long-term bond yields peaked in 1981 and have come down significantly since then.

Table 1

Growth of U.S. Stock Dividends

Average Annual Rates of Growth in Various Periods, 1927–99

Period		Dividends of Stock Portfolios*			Nominal U.S. GNP	U.S. Consumer Price Index
		S&P	CRSP	BOG†		
Since 1926	1927–99	5.19	5.36	6.93	6.72	3.21
Since WWII	1946–99	6.34	6.20	8.37	7.34	4.18
By Decades	1930–39	−1.00	−1.37	.00	−.30	−1.96
	1940–49	6.78	7.86	6.81	11.69	5.64
	1950–59	5.15	5.53	5.98	6.69	2.07
	1960–69	5.66	5.48	6.79	6.89	2.33
	1970–79	5.83	7.09	9.21	10.14	7.09
	1980–89	7.11	8.04	10.52	7.83	5.56
	1990–99	4.72	3.24	9.19	5.37	3.01

*The stock portfolio growth rates are based on dividends per share for the S&P and CRSP stocks and on corporate dividends from the national income and product accounts for the BOG stocks. For definitions of the stock portfolios, see Charts 1–2.

†These data begin in 1930.

Sources: Ibbotson Associates 2000; Center for Research in Security Prices, Graduate School of Business, University of Chicago; FR Board, various dates; U.S. Commerce, various dates

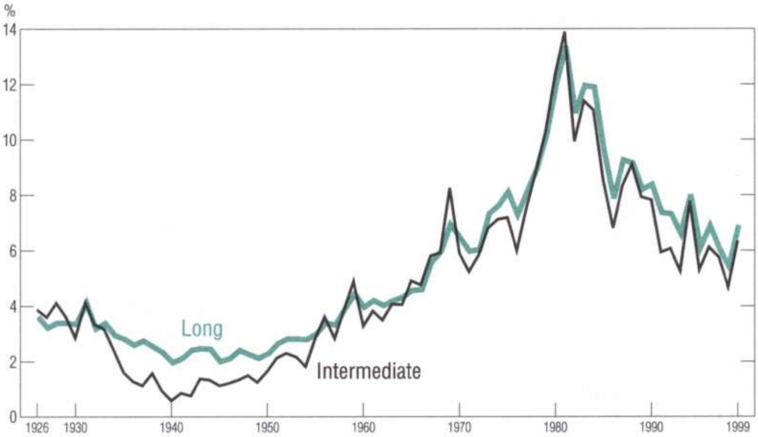
[6] According to economists at the U.S. Commerce Department's Bureau of Economic Analysis, the difference between NIPA dividends and dividends reported by the CRSP is attributable to differences in coverage. NIPA dividends are benchmarked to corporate tax data collected by the U.S. Internal Revenue Service. The IRS's 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, this universe includes privately held corporations. A large subset of the privately held sector is the category of S corporations, which grew rapidly during the 1990s. According to the IRS, in 1997, this category accounted for 18 percent of total cash dividend distributions. Dividend distributions from S corporations would not be included in any aggregation of public corporate data.

There is an issue about how some dividend distributions from S corporations should be categorized. If some of this income is not distributions for consumption, then we would want to recategorize that income. Doing that would imply a lower dividend yield (and thus a lower equity premium) than we report for the BOG stock portfolio.

Chart 3

U.S. Treasury Bond Yields

Annual Yield on Intermediate-Term (5-Year) and Long-Term (20-Year)
U.S. Treasury Securities, 1926–99



Source: Ibbotson Associates 2000

Estimates

Now we use our formula and the data just described to calculate estimates of the U.S. equity premium over our sample period.

The formula requires that, before computing the equity premium, we compute the *stock yield*—the sum of the dividend yield and the average growth rate of dividends. Chart 4 displays the results of that computation for our three stock portfolios for each year during 1926–99, 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 lists the average stock yields for the entire 1926–99 period as well as for the various subperiods. These calculations assume, remember, that the dividend growth rates are constant, the same as their average historical growth rates during the 1926–99 period.

From Chart 4 and Table 2, we can see that average stock yields during the 1960s and the 1990s are about the same. However, the equity premium must be much smaller during the 1990s because the bond yields are higher then. Chart 5 and Table 3 display our estimates of the equity premium itself. For two of our stock portfolios (the S&P and CRSP stocks), the equity premium is actually negative during the 1980s and close to zero during the 1990s.

Recall that under the assumption of perfect capital markets, economic theory justifies only a small equity premium (in the range of from 0 to 0.25 of a percentage point). As can be seen from Chart 5 and Table 3, our estimated premium is much larger than that for most of the 1926–99 sample period. Recently, however, the premium has shrunk to a size closer to that which theory predicts.

Between 1926 and 1970, for example, the average premium for the S&P stocks relative to long-term government bonds is 6.8 percentage points. Since then, this premium has averaged 0.7 of a percentage point. In 1999, the dividend yield is 1.36 percent, and the bond yield is 6.82 percent. If we add the average S&P dividend growth rate to the S&P dividend yield and subtract the long-term bond yield, we have

$$(5) \qquad r_{99}^{ep} = \left(1.36 \text{ percent} + 5.19 \text{ percent}\right) - 6.82 \text{ percent}$$
$$= -0.27 \text{ of a percentage point}$$

or an equity premium that is slightly negative.

If we use the CRSP portfolio, then the equity premium is close to zero (−0.05 of a percentage point) in 1999.

For the total stocks held by U.S. residents, as measured by our BOG stock portfolio, the decrease in the equity premium has been less dramatic because of the recent

Table 2
Yields on U.S. Stocks and Bonds
Annual Averages, 1926–99

Period		Stock Yields* S&P	Stock Yields* CRSP	Stock Yields* BOG†	Bond Yields: 20-Year Treasury Bonds
Since 1926	1926–99	9.65	9.63	n.a.	5.30
Since WWII	1946–99	9.32	9.34	11.37	6.30
By Decades	1930–39	10.33	10.12	n.a.	2.96
	1940–49	11.06	11.10	n.a.	2.24
	1950–59	10.51	10.49	12.01	3.11
	1960–69	8.47	8.56	10.04	4.78
	1970–79	9.33	9.38	11.08	7.57
	1980–89	9.80	9.75	12.28	10.39
	1990–99	7.83	7.84	10.84	6.85
December 1999		6.55	6.77	9.53	6.82

n.a. = not available

*Dividends for the S&P and CRSP stocks are assumed to grow at their 1927–99 annual averages; dividends for the BOG stocks, at the 1930–99 annual average of their series. For definitions of the stock portfolios, see Charts 1–2.

†Values of the BOG stocks begin in 1946.

Sources: Ibbotson Associates 2000; Center for Research in Security Prices, Graduate School of Business, University of Chicago; FR Board, various dates; U.S. Commerce, various dates

growth in dividends. Between 1946 and 1970, these stock yields are 7.5 percentage points higher than bond yields on average. After 1970, this difference shrinks to 3.1 percentage points. In 1999, the BOG equity premium is[7]

$$(6) \qquad r_{99}^{ep} = \big(2.60 \text{ percent} + 6.93 \text{ percent}\big) - 6.82 \text{ percent}$$
$$= 2.71 \text{ percentage points.}$$

Robustness

The assumption that dividends are expected to grow at a constant rate through time may be too restrictive; after all, dividend growth rates have varied considerably across decades (Table 1). Therefore, we next consider alternative assumptions on the dividend process. We also consider the sensitivity of our results to different measures of dividends and bonds of different maturities. We try here to determine whether the apparent decline in the equity premium is due to mistaken assumptions behind our calculations. It does not appear to be; these exercises do not change our result.

Is Our Dividend Growth Too Low?

We start by adjusting the dividend growth to take account of what may be higher productivity growth in the real U.S. economy. Some think that recent improvements in information technology have 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, which enjoyed the fruits of tremendous technological advances. Higher productivity translates into higher growth in output, earnings, and dividends, which our original estimates of constant dividend growth did not capture.

But we don't think such growth bursts are permanent. Ultimately, real growth increases are determined by growth in factors of production like labor and output per worker. And recent growth in these elements has not been impressive. In the 1990s, annual growth in the U.S. labor force has been roughly 1 percent—lower than in earlier years, when more women and baby boomers were entering the workforce. Similarly, productivity has grown only about 1 percent per year (Krugman 1997).

Still, suppose that the U.S. economy experienced not a permanent, but a temporary increase in growth, with the rate eventually returning to the postwar trend. Recall that we saw on Table 1 that the growth rate of dividends for BOG stocks—all corporate equities held by U.S. residents—has recently accelerated along with GNP. Other evidence for a temporary increase is the recent consensus forecasts from the Institutional Brokers Estimates System (IBES); they predict above-average earnings growth over the next five years. With earnings projected to be higher, dividends should be too.

Suppose that we assume that the growth in dividends will continue to be high for, say, the next five years and then will revert back to its long-run rate. Between 1980 and 1999, the BOG stock (NIPA) dividends grew roughly 3 percentage points per year faster than their historical annual average of 6.9 percent. If we expect dividend growth to run at 9.9 percent for five years and then revert to the long-run rate of 6.9 percent, the formula for the price of BOG stocks in 1998 can be written as

[7] Again, if some dividend income from S corporations were excluded from our measure of dividends, then this estimate of the equity premium would be lower.

Charts 4–5 and Table 3

The U.S. Equity Premium

Annually, 1926–99

Chart 4 **Yields on Stocks and Bonds**

Stock Yields = Each Portfolio's* Dividend Yield + Average Growth Rate of Its Dividends
Bond Yield = Annual Yield on Long-Term (20-Year) U.S. Treasury Bonds

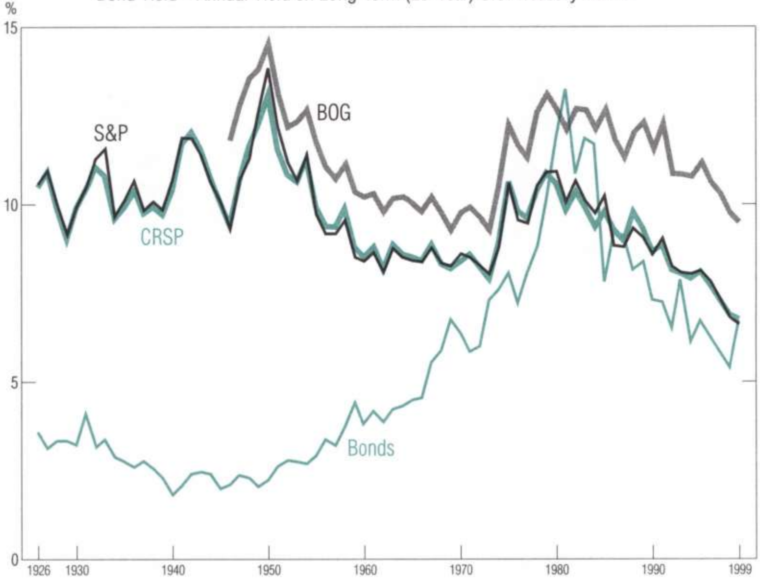


Chart 5 **Differences Between Yields on Stocks and Bonds**

Yield on Each Stock Portfolio* Less Yield on Long-Term Bond

Sources: Ibbotson Associates 2000; Center for Research in Security Prices, Graduate School of Business, University of Chicago; FR Board, various dates; U.S. Commerce, various dates

*For definitions of the stock portfolios, see Charts 1–2.

Table 3 Average Yield Differences
Over Various Time Periods

Period		Stock Portfolio* S&P	CRSP	BOG†
Since 1926	1926–99	4.34	4.33	n.a.
Since WWII	1946–99	3.02	3.04	5.07
By Decades	1930–39	7.36	7.16	n.a.
	1940–49	8.82	8.86	n.a.
	1950–59	7.40	7.38	8.90
	1960–69	3.69	3.79	5.26
	1970–79	1.76	1.81	3.51
	1980–89	-.59	-.65	1.89
	1990–99	.98	.99	3.98
December 1999		-.27	-.05	2.71

n.a. = not available

*For definitions of the stock portfolios, see Charts 1–2.

†Values of the BOG stocks begin in 1946.

Sources: Ibbotson Associates 2000; Center for Research in Security Prices, Graduate School of Business, University of Chicago; FR Board, various dates; U.S. Commerce, various dates

$$(7)\quad p_{s,98} = [d_{99}/(1+r^s)] + [d_{00}/(1+r^s)^2] + [d_{01}/(1+r^s)^3] + \ldots$$
$$= [d_{99}/(1+r^s)] \times \{1 + [1.099/(1+r^s)] + [1.099^2/(1+r^s)^2] + [1.099^3/(1+r^s)^3] + [1.099^4/(1+r^s)^4] + [1.099^5/(1+r^s)^5] + [(1.099^5)(1.069)/(1+r^s)^6] + [(1.099^5)(1.069^2)/(1+r^s)^7] + \ldots\}.$$

We can use the latest available dividend yields for BOG stocks to back out a value for r^s. Doing this calculation, we find that r^s = 9.86 percent. If r^b = 6.82 percent, then the equity premium is 3.04 percentage points. This is a bit larger than our baseline 1999 estimate of 2.71 percentage points, but it is still much smaller than the 1946–70 average of 7.5 percentage points.

As another example, consider our calculations for the S&P stocks. Earlier, we used a dividend growth rate for these stocks of 5.19 percent, which is the average growth rate in their dividends during 1927–99 (Table 1). This growth rate is significantly lower than that of GNP, which grew 6.72 percent on average over the same period. Suppose that we forecast future growth in S&P stock dividends to be more in line with average GNP growth. This would increase our estimate of the S&P-based equity premium from −0.27 of a percentage point to 1.26 percentage points. (See Table 4.) But again, even adjusted for potential temporary increases in dividend growth, the estimated equity premium is much smaller than the historical average.

Is Our Dividend Yield Too Low?

Now we see if using different measures of dividends in our formula makes a difference to our estimates of the equity premium. In our earlier computations, we considered cash dividends only. During the 1980s, however, corporations increased the amount of their share repurchases, possibly as a way of providing a tax advantage for shareholders. Since share repurchases form a part of the total distributions to shareholders, some think they should not be ignored when measuring dividends.

Theoretically, adding share repurchases to cash dividends should not change our calculated equity premium. When a broader measure of dividends—cash dividends plus share repurchases—is used in equation (4), g should be the growth rate in that broad measure. When a narrow measure of dividends—just cash—is used, then g should be the growth rate in that narrow measure. If share repurchases are simply substitutes for cash dividends, then the level of the stock yield, and thus the size of the equity premium, should be the same for both measures.

To see this, consider a simple example of Wadhwani (1999).

As a first scenario, suppose that a firm makes a steady annual profit of $1,000 and pays the entire profit as dividends. Suppose also that the number of shares outstanding is 1,000 (which implies dividends per share equal to $1). If the discount rate r^s on equity is 10 percent, then the price of the stock is $10 [$p_{s,0} = d_1/(r^s - g) = 1/0.1$].

Now consider a second scenario which involves repurchasing shares. Suppose that the firm instead pays half of

Table 4

The Recalculated U.S. Equity Premium

Average Yield Differences Between Stocks and Bonds Over Various Time Periods With Stock Yields Recalculated as the Sum of Each Portfolio's* Dividend Yield and the Average Growth Rate of U.S. Gross National Product in 1927–99

Period		Stock Portfolio* S&P	CRSP	BOG†
Since 1926	1926–99	5.88	5.68	n.a.
Since WWII	1946–99	4.55	4.39	4.86
By Decades	1930–39	8.90	8.51	n.a.
	1940–49	10.35	10.21	n.a.
	1950–59	8.93	8.73	8.69
	1960–69	5.23	5.14	5.05
	1970–79	3.30	3.16	3.30
	1980–89	.94	.71	1.67
	1990–99	2.51	2.35	3.77
December 1999		1.26	1.31	2.50

n.a. = not available

*For definitions of the stock portfolios, see Charts 1–2.

†Values of the BOG stocks begin in 1946.

Sources: Ibbotson Associates 2000; Center for Research in Security Prices, Graduate School of Business, University of Chicago; FR Board, various dates; U.S. Commerce, various dates

its $1,000 profit 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

$$(8) \quad g_t = (d_t/d_{t-1}) - 1$$
$$= [(500/N_t)/(500/N_{t-1})] - 1$$
$$= (N_{t-1}/N_t) - 1.$$

In words, the rate of growth of dividends per share is equal to the rate of decline 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 true that

$$(9) \quad N_t p_{s,t} = \$1{,}000/0.1.$$

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

$$(10) \quad p_{s,t}(N_{t-1}-N_t) = 500.$$

Combining equations (9) and (10), we get

$$(11) \quad N_t/N_{t-1} = 1/1.05.$$

Hence, the growth rate for dividends is 5 percent per year.

Without share repurchases, we compute a dividend yield of 0.10 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 both scenarios, 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. Therefore, we should get the same equity premium whether we use the narrow or the broad measure of dividends.

We display in Chart 6 both of these measures of dividend yields, calculated for the BOG stock portfolio.[8] The *narrow* series is the portfolio's total dividends each year divided by the stock market's total value in the preceding year (as shown in Chart 2). The *broad* 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 preceding year. Net new equity issues are equal to new share issues less share repurchases. Chart 6 shows that the net new equity issues can add significantly to the volatility of payouts.

However, the levels of the narrow and broad measures of dividend yields both average 4.4 percent over the post–World War II period. The main difference between the two series is that broad dividend yields are more volatile. That makes it harder to form expectations for the broad yield and for future dividend growth rates. We thus are better off using the narrow measure of dividends in our estimate of the equity premium.

Is Our Bond Yield Too High?

All that we have left to tinker with is estimates of bond yields. The equity premium has decreased in the 1990s primarily because bond returns and yields have been dramatically higher than average during those years. (See Chart 3.) In our calculations for the equity premium in

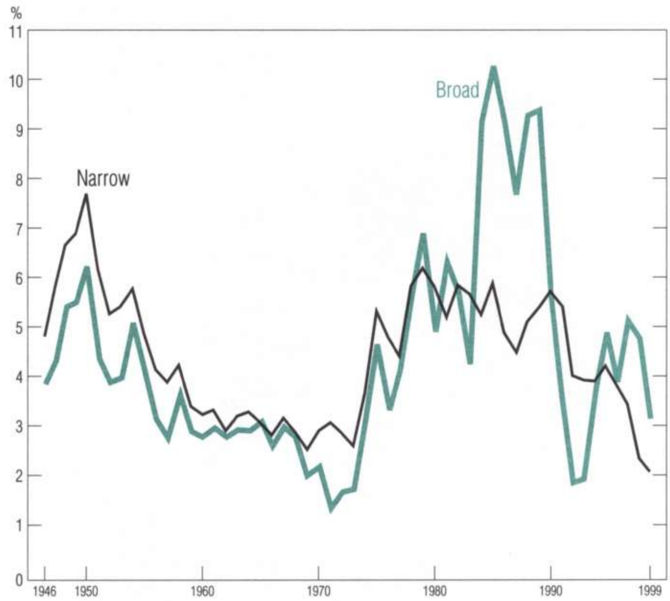
[8]We get a similar pattern when we use data from the CRSP/COMPUSTAT Merged Database. The dividend yield increases significantly after 1985.

Chart 6

Two Measures of the Dividend Yield

Dividend Yields of the BOG Stock Portfolio* (Dividends as a Percentage of Market Value)
Calculated With Share Repurchases (*Broad* Measure) and Without Them (*Narrow* Measure)

Annually, 1946–99



*The BOG stock portfolio's dividend yields are constructed from Federal Reserve Board market values and national income and product account dividends.
Sources: FR Board, various dates; U.S. Commerce, various dates

1999, we used a nominal bond yield of 6.82 percent, which is the yield of a 20-year U.S. Treasury bond. Is this yield too high?

It is certainly higher than the yield on bonds with shorter maturities. Over the period 1926–99, the average yield on 20-year Treasury bonds was 0.5 of a percentage point higher than the average yield on 5-year Treasury bonds. (See Chart 3.) In 1999, the 5-year bond yield was 6.5 percent, 0.3 of a percentage point below the 20-year yield. However, using this adjusted 1999 value in our formula doesn't change the premium estimates much. The value would imply that r_{99}^{ep} is 0.1 of a percentage point for the publicly traded (S&P and CRSP) stock portfolios and 3 percentage points for the total (BOG) stock portfolio—more or less the values we got with the longer-term bonds.

A more reasonable argument for a higher premium is based on transaction costs due to the illiquidity that investors face with government securities. Costs incurred in shifting out of such securities can be as much as 0.5 of a percentage point. If we subtract that much from our bond yield estimate of about 6.8 percent, then our equity premium formula gives an estimate of 0.3 of a percentage point for the publicly traded portfolios and 3.2 percentage points for the total stock portfolio. Yet, again, these estimates are fairly close to our original estimates.

The Bottom Line

Thus, our exercises with alternative assumptions have not shaken our result. Adding net share repurchases to our calculations does not affect our equity premium estimates. Allowing for higher dividend growth does—but extraordinary growth in dividends is needed to get estimates close to the historical averages. Lowering bond yields also increases our estimates a bit, but bond yields have increased dramatically over our sample period. Taking account of large transaction costs due to illiquidity increases our estimates only mildly.

Our bottom line is that the U.S. equity premium has declined significantly during 1970–99. We see this even when we use the higher stock yields for total stock holdings of U.S. residents (the BOG stock portfolio); reasonable assumptions lead to a premium of about 3 percentage points. For the stock portfolios that most people analyze—S&P stocks and CRSP stocks—the premium is between 0 and 2 percentage points. To get a value around 2, though, we need to assume much faster dividend growth in the near term than is observed historically as well as large transaction costs for bonds.

Reasonableness

We have used the stock valuation model in equation (3) to calculate the equity premium at different points in time. The sizes of premium we computed should correspond to what investors expect to get only if their expectations about the future dividend growth rate match ours. While some may think that this is not likely, we argue that it is.

At face value, some of our estimates might not seem reasonable. For several years in our sample, our calculated equity premium is quite close to zero. For example, the premium calculated with S&P stocks is −0.26 of a percentage point at the end of 1982 and −0.27 of a percentage point at the end of 1999. If these estimates are indeed correct, then between 1982 and 1999, investors must have earned the same rate of return from stocks and bonds, aside from the differences between the actual dividends they received and what they expected to get from stocks. That is, $100 invested in either stocks or bonds at the end of 1982 would have about the same value at the end of 1999. Yet a look at the data seems to show something else. During 1982–99, S&P stocks earned an annualized average return of 18.35 percent, while an investment in 30-year government bonds, made at the end of 1982 and held until the end of 1999, earned an annualized average return of 11.68 percent—substantially less than the stock return. Does this mean our equity premium calculations are faulty?

No; the comparison itself is faulty. It is comparing assets which have different maturities. Stocks have a significantly longer life than 30-year government bonds, so these two types of assets would not necessarily have the same return over any particular period. A more appropriate asset to compare to stocks is bonds that have no maturity at all: *consol bonds* with coupons that grow at the same rate that stock dividends are expected to grow.

In our equity premium calculations, we assumed that S&P stock dividends grew at a constant rate of 5.19 percent per year (their average annual growth during 1927–99). Hence, consider a consol bond that pays annual coupons—a first coupon of $1, paid at the end of the first year, and after that the coupons growing at 5.19 percent per year, forever. Then, at the end of 1982, with the long-term bond yield at 10.95 percent, the price of this consol bond will be $17.36. At the end of 1999, with the long-term bond yield at 6.82 percent, the bond's price will be $145. Thus, an investment of $100 in this consol bond at the end of 1982, which is sold at the end of 1999, after having paid all the coupons in between, will earn an annualized average return of 16.88 percent—a return close to the actual 18.35 percent annualized average return on S&P stocks over the period.

Why the 1.47 percentage point difference, if our equity premium estimates are close to zero for the period? By the end of 1999, the expected S&P dividend growth rate may have increased somewhat from our assumed 5.19 percent. That would increase the yield of S&P stocks and so the equity premium. We saw that, recall, when we changed our assumption of growth in dividends from their 5.19 percent historical average to the 6.72 percent historical average growth of GNP. That changed assumption increased our premium estimate to 1.42 percentage points—which is still small, but in the range of the value calculated with the sample consol bond.

Confirmation

Our bottom line is consistent with those of several other recent studies that have compared U.S. stock and bond yields over time.

Perhaps the earliest is the study done by Blanchard (1993). He compares expected real yields on stocks and bonds during 1929–93. He computes expected yields as fitted values of regressions on a list of variables assumed to be part of investors' information sets when expectations are made. As we do, Blanchard uses both intermediate- and long-term bonds. However, the stock portfolio he uses includes only publicly traded stocks; he does not consider the total stock portfolio reported by the Fed (BOG stocks).

The results of Blanchard's (1993) exercise are very close to ours for the S&P and CRSP portfolios. For example, the difference between the yield on S&P stocks and the yield on 20-year bonds that we display in Chart 4 is close to Blanchard's estimates in his Figure 11. With additional data in the 1990s, we find that little has changed. The premium for publicly traded stocks has remained between 0 and 2 percentage points.

More recently, Wadhwani (1999, Table 15) has compared real stock yields with returns on U.S. Treasury inflation-protected securities (TIPS). Like Blanchard (1993), Wadhwani only considers stocks that are publicly traded on the major U.S. stock exchanges. Using data through 1997, 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. Wadhwani's premium for 1998 is, therefore, 4.9 less 3.2, or 1.7 percentage points.

Using data as of August 1999, Siegel (1999, p. 14) gets an even smaller premium. He estimates a real S&P stock yield of 3.3 percent, which is the sum of a 1.2 percent dividend yield and a real dividend growth rate of 2.1 percent. This estimated stock yield falls below the August 1999 yield on TIPS bonds (3.3 vs. 4.0), producing a negative equity premium. Thus, Siegel looks for sources of dividend growth that could potentially increase his premium. He argues that nothing in the data can justify extrapolating the high historical stock yield forward. He also argues that the shrinking of the equity premium may be less significant because transaction costs have come down significantly.

Fama and French (2001) conclude as well that the equity premium is shrinking, but their reasoning is based on a different type of calculation than ours. They compare stock yields (calculated as in our equation (3)) to average stock returns (calculated as the sum of the dividend yield and the growth rate of the stock price), and they find a discrepancy over time. These averages line up well for data between 1872 and 1949. From 1950 through 1999, however, the average stock yields and returns diverge because stock prices grew much faster than dividends. Fama and French show that over the post–World War II period, the growth in stock prices has been significantly higher than the growth in dividends. Stock returns are thus higher than the stock yields which are used to forecast returns.

Fama and French (2001) argue that this implies that in the future both stock returns and the equity premium will decrease. 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 equity premium starts at 7 percentage points and shrinks steadily over 50 years to 1 percentage point. When the equity premium decrease is not expected, a stock's initial price is only 44 percent of the price that will prevail when that decrease is fully expected and taken account of. By the end of the 50 years, the prices will converge to the same value regardless of whether the equity premium decrease was expected. Hence, investors would earn a higher rate of return when the decrease is not expected than when it is (12.1 percent vs. 8.4 percent).

Whatever their approach to the issue, all of these studies agree that the U.S. equity premium is currently lower than it has been historically.[9] These estimates seem, however, to be in sharp contrast to the view of many academic economists. Welch (2000, p. 514) recently asked 226 professors of finance to forecast the equity premium over different horizons. At the one-year horizon, their mean forecast was 5.8 percentage points, with a standard deviation of 4.5. At the five-year horizon, their mean forecast was 6.7 percentage points, with a standard deviation of 2.6. For longer horizons, their mean forecast was roughly 7 percentage points, with a standard deviation of about 2. Apparently, finance professors do not expect the equity premium to shrink.

This view is also stated clearly in standard finance textbooks. Take, for example, Brealey and Myers (2000, p. 158), 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 equity premium over some historical time period. The premium they use is 9.2 percentage points. In other words, they simply extrapolate past returns forward.

Brealey and Myers (2000) note that their result is consistent with security analysts' forecasts of earnings growth. But if dividends and earnings grow at similar rates, how can we get such different estimates for the equity premium? The difference in estimates is due to assumptions about growth rates beyond the analysts' forecast horizon. To get a large equity premium, we must assume that growth rates stay high forever. To get a premium as large as 9.2 percentage points, we need to assume growth rates

[9] Bansal and Lundblad (2000) find that the equity premium has declined around the world as well.

in dividends or earnings to be significantly faster than growth rates in GNP.

To see this, consider our calculation using NIPA dividends in equation (7). If we had assumed there that dividends grow forever at 9.9 percent, then our estimate of the equity premium would have been 5.7 percentage points. Instead, we assumed that dividends grow at 9.9 percent for 5 years and then revert back to the trend growth rate of GNP. Thus, our estimate of the equity premium is 3.04 percentage points. To get the estimate up to Brealey and Myers' 9.2 percentage points, we would need to assume nominal dividend growth of 13.2 percent per year—almost twice as fast as the growth in nominal GNP. This is an unreasonable assumption.

Concluding Remarks

Low predictions for stock returns have important implications for future investments and for new financial theories. It is hard to rationalize a shrinking equity premium as a permanent shift in preferences. But institutional changes have occurred in the United States that would result in a permanent shift in stock returns.

One possibility not mentioned earlier is greater opportunities for portfolio diversification. This idea was actually advanced by Merton (1987) before the 1990s stock price boom, and more recently, the idea has been pursued by Heaton and Lucas (2000). Merton shows that the equity premium can be substantially larger in an economy with incomplete diversification than in one with perfect capital markets. Heaton and Lucas estimate that the recent increased participation in stock markets can lead to as much as a 2 percentage point reduction in the equity premium and can therefore partially explain the high level of stock prices in the 1990s. This work goes only part way in accounting for the facts, but it seems to be going in the right direction.

Appendix
Historical Returns on U.S. Financial Assets

In this appendix, we give an overview of historical U.S. 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.

The Series

The accompanying table summarizes the average historical returns for stocks, long-term U.S. government debt, and short-term U.S. government debt. The top panel of data in this table lists annualized compounded nominal returns for different historical time periods.*

Returns for the period 1802–1997 are taken from Siegel 1998. For 1871–1997, Siegel computed the stock returns from capitalization-weighted indexes of all stocks traded on the New York Stock Exchange (NYSE) and, starting in 1962, all stocks traded on the American Stock Exchange (AMEX) and in the Nasdaq Stock Market as well. Capitalization-weighted indexes use a firm's stock price times shares outstanding as weights for individual firms. Before 1871, the series are based primarily on stocks of financial institutions, like banks and insurance companies.

Siegel's returns on debt are returns on U.S. government securities, both short-term bills and long-term bonds, when available. When these are not available, comparable highly rated securities with low default premiums are used.

After 1926, the data on most stocks and on U.S. Treasury securities are taken from Ibbotson Associates 2000. The small-firm stocks are those of firms in the smallest quintile of firms in terms of their market value of equity, as listed in the New York Stock Exchange. The S&P stocks are those in the Standard & Poor's 500-stock price index. The Treasury bill has a 1-month maturity; the Treasury bond, a 20-year maturity. The value-weighted stock returns are taken from the data base of the Center for Research in Security Prices (CRSP). As with Siegel's stock returns, these returns are a weighted index of all publicly traded firms on the NYSE, AMEX, and Nasdaq. The weight for each firm in a particular month is its market value (that is, its stock price times its shares outstanding) as of the previous month divided by the total market's value.

*Given nominal returns r_t, $t = 1, ..., T$, we calculate the compounded average annual return as follows:

$$100\{[(1+r_1)(1+r_2)\ldots(1+r_T)]^{12/T}-1\}.$$

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

U.S. Financial Asset Returns Over the Last Two Centuries

Compounded Annual Average Returns (%) on Various Stock Portfolios
and on U.S. Treasury Securities, 1802–1999

		Stocks			U.S. Treasury Securities	
Type of Return	Type of Calculation and Period	Small-Firm	S&P	Value-Weighted	20-Year Bonds	1-Month Bills
Annual Nominal Returns	Compounded Average					
	1802–1997	n.a.	n.a.	8.4	4.8	4.3
	1926–99	12.6	11.3	10.9	5.1	3.8
	1945–99	14.7	13.3	12.9	5.4	4.7
	1926–45	9.4	7.1	6.5	4.7	1.1
	1945–72	13.7	12.8	12.4	2.2	2.7
	1972–99	15.4	14.1	13.6	8.7	6.8
	Standard Deviation					
	1802–1997	n.a.	n.a.	17.5	6.1	n.a.
	1926–99	33.6	20.1	20.2	9.3	3.2
	1945–99	25.7	16.5	16.6	10.4	3.1
	1926–45	51.1	28.3	28.3	4.8	1.5
	1945–72	28.5	16.6	16.5	6.0	1.8
	1972–99	22.6	16.4	16.7	12.5	2.7
Annual Real Returns*	Compounded Average					
	1802–1997	n.a.	n.a.	7.0	3.5	2.9
	1926–99	9.3	8.0	7.5	1.9	.7
	1945–99	10.1	8.8	8.4	1.1	.5
	1926–45	9.4	7.1	6.4	4.6	.9
	1945–72	10.2	9.3	9.0	-1.0	-.5
	1972–99	9.7	8.4	8.0	3.3	1.5

n.a. = not available

*Real returns are based on changes in the U.S. consumer price index.

Sources: Siegel 1998; Ibbotson Associates 2000; Center for Research in Security Prices, Graduate School of Business, University of Chicago

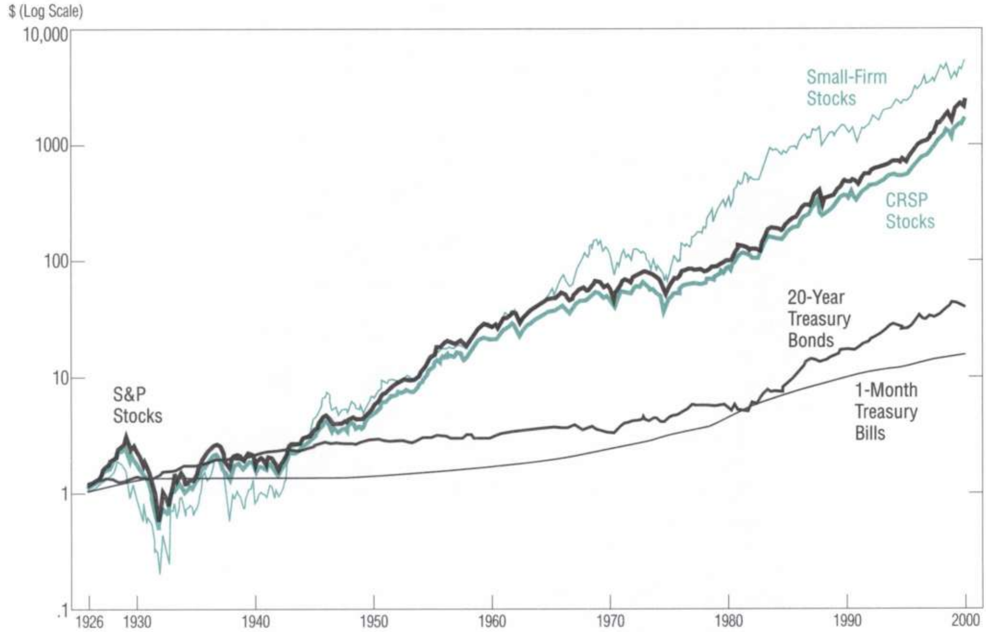
The Relative Values

Consider compounded annual nominal returns over the past two centuries. In the period 1802–1997, stocks earned a premium of 4.1 percentage points over Treasury bills. In the 20th century, the premium is even larger. Take, for example, the period 1926–99. The difference in average returns on the value-weighted portfolio over Treasury bills is 7.1 percentage points—despite the fact that during this period the United States experienced both the Great Depression and World War II. Small-firm and S&P stocks both did better during 1926–99 than the value-weighted CRSP port-

The Relative Returns of U.S. Financial Assets in the 20th Century

How the Value of $1 Invested in Each Type of Asset* in 1926
Would Have Changed by the End of 1999

Monthly, January 1926–December 1999



*For definitions of the stock portfolios, see the accompanying text.
Sources of basic data: Ibbotson Associates 2000; Center for Research in Security Prices, Graduate School of Business, University of Chicago

folio, earning a premium of 8.8 and 7.5 percentage points, respectively. Even during the period of the Great Depression and World War II, stocks earned a high return—higher than bills by between 6.0 and 8.3 percentage points.

In the middle panel of the table, we display standard deviations of the annual nominal returns. Historically, stock returns are considerably more volatile than Treasury securities—especially small-firm stocks. For example, the standard deviation for small-firm stocks, which yielded the highest returns in every subperiod, is 33.6 in 1926–99, whereas the contemporaneous standard deviations for S&P stocks, Treasury bills, and Treasury bonds are 20.1, 3.2, and 9.3, respectively. The variability of Treasury bond returns increased significantly after 1970 due to inflation uncertainty. Investors demanded a higher return on these bonds to compensate for the perceived higher risk.

In the bottom panel of the table, we report the real returns, which are the relevant numbers for investors. (These are the nominal returns, adjusted for inflation, as measured by the consumer price index.) Over the two centuries, the real return on the value-weighted CRSP portfolio is 7 percent while that on Treasury bills is only 2.9 percent. In the 20th century, the return to that short-term debt has been even lower—falling below 1 percent after 1926. At the same time, real returns for both small-firm and S&P stocks have been around 8 percent.

In the accompanying chart, we show graphically how the various types of financial assets have performed by plotting the changing value of $1 invested in each type in 1926. The plot is intended to further illustrate the large differences in returns across the asset types. We use a logarithmic scale for this chart because the values of the investments are vastly different.

The relative values are clear in the chart. A $1 investment in small-firm stocks in 1926 could have been cashed in for more than $6,600 in December 1999. A $1 investment in a portfolio with S&P or CRSP stocks would have turned into around $2,000 or $3,000. While not as good as the small-firm portfolio, these stock values dwarf those of Treasury securities of either maturity. A $1 investment in 20-year Treasury bonds in 1926 could have been cashed in for only about $40 at the end of 1999, and the same investment in 1-month Treasury bills could have returned only about $15.

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