The Equity Premium: Stock and Bond Returns Since 1802

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Over the period from 1802 through 1990, equity has provided returns superior to those on fixed income investments, gold or commodities. Most strikingly, the real rate of return on equity held remarkably constant over this period, while the real return on fixed income assets declined dramatically. Over the subperiods 1802–70, 1871–1925 and 1926–90, the real compound annual returns on equity were 5.7, 6.6 and 6.4 per cent, but the real returns on short-term government bonds dropped from 5.1 to 3.1 and, finally, 0.5 per cent.

The magnitude of the excess return on equity, especially during this century, appears excessive relative to the behavior of other macroeconomic variables. In the future, the real return on fixed income assets may be closer to the historical norm of 3 to 4 per cent. While stock returns will probably continue to dominate bond returns, they will not do so by nearly as wide a margin as they have over the past 65 years.

Since 1926, the compound real value-weighted return on all stocks listed on the New York Stock Exchange has averaged 6.4 per cent per year, while the real return on Treasury bills has averaged only 0.5 per cent.[1] This means that the purchasing power of a given sum of money invested (and reinvested) in stocks from 1926 to 1990 would have increased over 50 times, while reinvestment in bills would have increased one's real wealth by about one-third. Using these historical returns, it would take 139 years of investing in Treasury bills to double one's real wealth while it would take only 11 years of stock investment. Money managers often use these figures persuasively to convince investors that, over long periods of time, equity has no match as a wealth builder.

The return on stocks in excess of the return on short-term bonds is called the **equity premium.** Because stocks are generally riskier than fixed income investments, it is to be expected that the return on stocks would exceed that on bonds. However, in 1985 Rajnish Mehra and Edward Prescott demonstrated that stocks, despite their risk, appear to offer investors *excessive* returns, while bonds offer puzzlingly low returns.[2] The excessive return on equity is termed the "equity premium puzzle." Investors would have to be extraordinarily risk-averse, given the documented growth and variability of the economy, to accept such low returns on bonds while equity offered such superior returns. Such extreme risk-aversion appears to be inconsistent with data that reveal investor choice under uncertainty.

Many theories have been offered to explain the equity premium puzzle.[3] The data that Mehra and Prescott analyzed covered a sufficiently long period of time and were derived from well documented sources. Thus no one questioned the validity of their return data.

I extended the time period analyzed by Mehra and Prescott back to 1802, while updating the returns on stocks and bonds to 1990. My analysis demonstrates that the returns from bonds during most of the 19th century and after 1980 were far higher than in the period analyzed by Mehra and Prescott. The equity premium is not nearly as large when viewed over this extended time span as it is in the post-1926 period. These data suggest that the excess return of stocks over bonds may be significantly smaller in the future than it has been over the past 65 years.

Long-Term Asset Returns

William Schwert has developed historical stock price series dating back to 1802; there are also some fragmentary data on stock returns dating to 1789.[4] In order to analyze asset returns since 1802, I divided the data into three subperiods. The first period, running from 1802 through 1870, contains stocks of financial firms and, later, railroads. The second period, running from 1871 through 1925, comprises the period studied by the Cowles Foundation.[5] The last subperiod, from 1926 to the present, coincides with the development of the S&P 500 stock index and contains the most comprehensive data on stock prices and other economic variables.[6] I use the Schwert data for the first subperiod and a capitalization-weighted index of all NYSE stocks

Glossary

▶***Equity Premium:***
The expected return (dividends plus capital gains) on equity in excess of the return on safe assets such as government bonds.

▶***Total Return Index:***
An index that measures the increase in wealth generated by assuming that *all* cash flows and capital gains are reinvested in the same asset or class of assets.

▶***Capital Appreciation Index:***
An index that measures the increase in wealth assuming that just the capital gain, and not any income generated, is reinvested in the asset (or class of assets).

▶***Geometric Return:***
Compound return, or the nth root of the n single-year returns.

▶***Synthetic Short-Term Government Series:***
A series of what short-term, risk-free interest rates would be, based on removing the default premium on similar risky assets. Computed in the absence of actual government interest rates.

for the second and third subperiods.

The early stock indexes were not as comprehensive as those constructed today. From 1802 to 1820, the stock index consisted of an equally weighted portfolio of stocks of several banks in Boston, New York and Philadelphia. An insurance company was added later, and in 1834 the portfolio became heavily weighted toward railroad stocks. The Cowles index consisted of all stocks listed on the New York Stock Exchange and recorded, for the first time, dividend payments. The Cowles index is spliced to modern indexes, which calculate averages for all classes of common stock.

Stock Returns

Figure A displays what one dollar invested in various asset classes in 1802 would have accumulated to by the end of 1990. These series are referred to as **total return indexes,** because they assume that all cash flows, including interest and dividends as well as any capital gains, are continually reinvested in the relevant asset. Total return indexes differ from standard stock market indexes such as the S&P 500, which do not include the reinvestment of cash flows. These standard indexes are called **capital appreciation indexes.**[7]

Figure A indicates that, in terms of total return, stocks have dominated all other asset classes since 1802. Over the entire period, equities achieved a compound annual nominal rate of return of 7.6 per cent per year; at this rate, the nominal value of equity approximately doubles every 9.5 years. Figure A also demonstrates that nominal stock returns have also increased over time. The average compound rate of return on stocks was 5.8 per cent from 1802 through 1870, 7.2 per cent from 1871 through 1925 and 9.8 per cent from 1926 through 1990.[8] Table I gives the stock returns in each subperiod.

The average nominal *arithmetic* (or mean) return on stocks is 9.0 per cent per year over the entire period. Although this can be interpreted as the expected return on stocks over a 12-month period, it cannot be converted into a compound annual rate of return over periods longer than one year. Because of the mathematical properties of return calculations, the compound rate of return to a buy-and-hold strategy is measured by the **geometric**, rather than the arithmetic, return.[9]

The power of compound returns is clearly evident in the stock market. One dollar invested in 1802, with all dividends reinvested, would have accumulated to nearly $1 million by the end of 1990. Hypothetically, this means that $3 million, invested and reinvested over these past 188 years, would have grown to the incredible sum of $3 trillion—nearly equal to the entire capitalization of the U.S. stock market in 1990!

Figure A Total Nominal Return Indexes, Before Taxes, 1802 – 1990

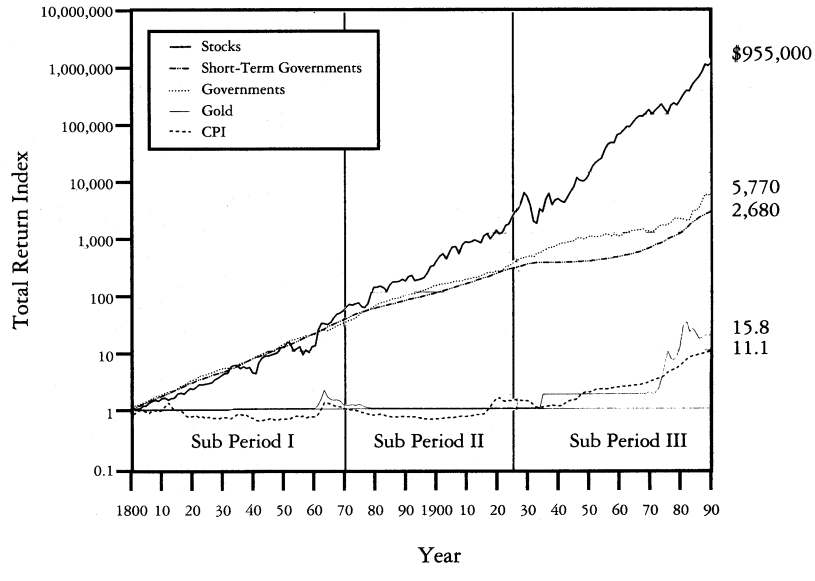


Table I Stock Market Returns (standard deviations in parentheses)*

	Total Nominal Return (%)		*Total Real Return (%)*		*Nominal Capital Appreciation (%)*		*Real Capital Appreciation (%)*		*Dividend Income*	*Average Tax Rate*	*Total Real After-Tax Return (%)*	
Period	*A*	*G*	*A*	*G*	*A*	*G*	*A*	*G*	*(%) A*	*(%) A*	*A*	*G*
1802–1990	9.0	7.6	7.8	6.2	4.0	2.5	2.8	1.2	5.0	6.8	7.3	5.8
	(17.8)		(18.4)		(17.6)		(18.1)		(1.0)		(18.1)	
1871–1990	10.3	8.6	8.3	6.5	5.3	3.6	3.3	1.6	5.0	10.8	7.6	5.9
	(18.9)		(19.3)		(18.6)		(19.0)		(1.3)		(18.9)	
1802–1870	6.8	5.8	6.9	5.7	1.8	0.7	1.9	0.6	5.0	0.0	6.9	5.7
	(15.4)		(16.6)		(15.4)		(16.5)		(0.0)		(16.6)	
1871–1925	8.4	7.2	7.9	6.6	3.1	1.9	2.7	1.3	5.2	0.7	7.9	6.6
	(15.6)		(16.6)		(15.9)		(16.9)		(1.1)		(16.6)	
1926–1990	11.9	9.8	8.6	6.4	7.1	5.0	3.9	1.8	4.8	19.3	7.4	5.3
	(21.1)		(21.2)		(20.4)		(20.5)		(1.4)		(20.7)	
1946–1990	12.0	11.1	7.4	6.2	7.4	6.5	3.0	1.9	4.6	24.4	6.0	4.9
	(14.6)		(15.6)		(13.8)		(14.8)		(1.4)		(14.8)	
1966–1981	7.3	6.2	0.4	−0.7	3.1	2.1	−3.5	−4.6	4.2	26.4	−0.9	−1.8
	(15.1)		(14.3)		(14.3)		(13.8)		(1.3)		(13.5)	
1966–1990	10.7	9.6	4.6	3.5	6.3	5.3	0.6	−0.6	4.3	25.9	3.3	2.2
	(15.1)		(15.2)		(14.4)		(14.6)		(1.2)		(14.3)	
1982–1990	16.7	15.9	12.3	11.4	12.1	11.3	7.9	7.0	4.6	25.1	10.5	9.8
	(13.1)		(13.5)		(12.7)		(13.0)		(1.0)		(12.7)	

*A = arithmetic mean; G = geometric mean.

Three million 1802 dollars—equivalent to about $35 million in today's purchasing power—was a large—but certainly not overwhelming—sum of money to the industrialists and landholders of the early 19th century.[10]

Long-Term Bonds

In comparing past with future bond returns, it is important to choose securities whose risk characteristics match closely. There was an active market for long-term U.S. government bonds over most of the 19th century except for the years 1835 through 1841, when prior budget surpluses eliminated all federal government debt outstanding. Sidney Homer presented a series of long-term government yields in his classic work, *A History of Interest Rates.*[11] Long-term government bond issues were not numerous during the 19th century; maturities generally ranged from three to 20 years, although some bonds had no fixed duration.[12] Figure B displays the interest rates on long-term U.S. government bonds, joining the Homer series with the Ibbotson and Sinquefield series, which begins in 1926.[13]

Despite the good data on federal government bond yields, there are persuasive reasons why high-grade municipal bonds may be more representative of high-quality bonds during much of the 19th and early 20th centuries. Some of the municipal bonds is-

Figure B Long-Term Interest Rates, 1800 – 1990

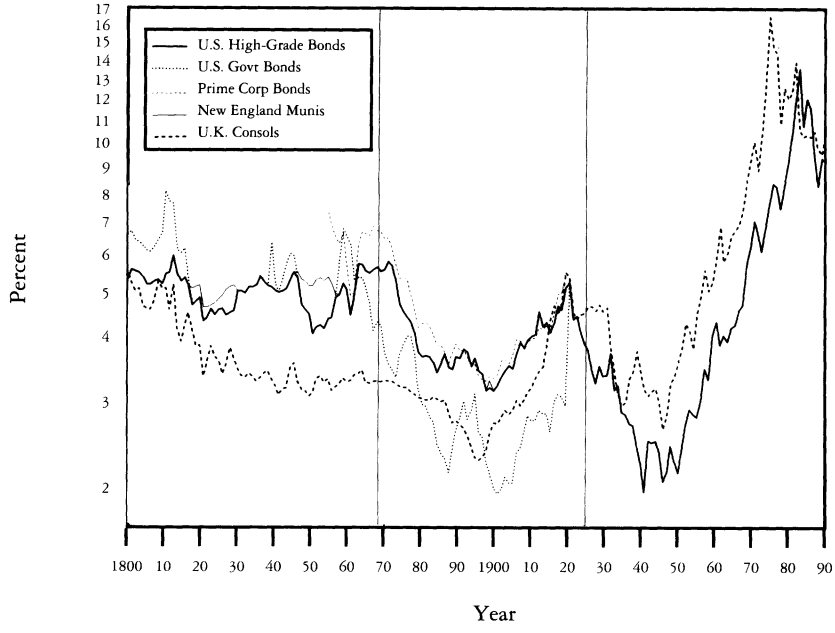


Table II Fixed Income Returns (standard deviations in parentheses)*

	Long-Term Governments							Short-Term Governments				
		Nominal Return (%)		Real Return (%)		Real After-Tax Return (%)			Real Return (%)		Real After-Tax Return (%)	
Period	Coupon (%) A	A	G	A	G	A	G	Rate (%) A	A	G	A	G
1802–1990	4.7	4.8	4.7	3.7	3.4	3.2	2.9	4.3	3.1	2.9	2.8	2.6
	(1.8)	(5.4)		(8.5)		(8.4)		(2.2)	(6.2)		(6.3)	
1871–1990	4.5	4.7	4.5	2.8	2.5	2.1	1.8	3.7	1.8	1.7	1.4	1.2
	(2.3)	(6.5)		(8.5)		(8.3)		(2.5)	(4.7)		(4.8)	
1802–1870	4.9	5.1	5.0	5.2	4.9	5.1	4.8	5.2	5.4	5.1	5.4	5.1
	(0.4)	(2.7)		(8.3)		(8.2)		(1.1)	(7.6)		(7.6)	
1871–1925	4.0	4.5	4.4	4.0	3.8	3.9	3.7	3.8	3.3	3.1	3.2	3.1
	(0.6)	(2.9)		(6.3)		(6.3)		(0.9)	(4.8)		(4.8)	
1926–1990	5.0	4.9	4.6	1.8	1.4	0.6	0.2	3.7	0.6	0.5	−0.2	−0.3
	(2.9)	(8.4)		(9.9)		(9.4)		(3.4)	(4.3)		(4.2)	
1946–1990	5.9	4.9	4.5	0.5	−0.1	−1.1	−1.6	4.9	0.4	0.3	−0.8	−0.9
	(3.1)	(9.6)		(10.5)		(9.5)		(3.3)	(3.6)		(3.3)	
1966–1981	7.2	2.8	2.5	−3.9	−4.2	−5.6	−5.9	6.9	−0.1	−0.2	−1.9	−1.9
	(1.8)	(6.9)		(7.9)		(7.5)		(2.9)	(2.0)		(2.0)	
1966–1990	8.2	7.4	6.8	1.6	0.9	−0.7	−1.3	7.2	1.3	1.2	−0.5	−0.6
	(2.2)	(11.5)		(12.5)		(11.3)		(2.5)	(2.7)		(2.5)	
1982–1990	10.0	15.7	14.9	11.3	10.5	7.9	7.3	7.9	3.7	3.7	1.8	1.8
	(1.8)	(13.2)		(13.3)		(11.7)		(1.6)	(1.8)		(1.4)	

* A = arithmetic mean; G = geometric mean.

sued during the early 19th century, particularly those of the Commonwealth of Massachusetts and the City of Boston, were considered of higher quality than those of the federal government and thus traded at lower yields.[14] Risk of default on federal government bonds increased during both the War of 1812 and the Civil War, hence yields on federal debt rose above the yields on comparable high-grade municipals.[15] Furthermore, these high-grade municipals promised to pay interest and principal only in gold, thereby avoiding the "bimetal" option, which gave the federal government the right to redeem the principal in either gold or silver. This option may have biased the yields on federal government bonds upward.[16]

There is another reason why municipal bond yields should sometimes be substituted for federal government bonds. From the Civil War to 1920, the yields on federal government bonds were biased downward because banks were permitted to issue circulating bank notes against government bonds held as reserves. These rights, called "circulation privileges," motivated banks to bid the prices of federal bonds up above the prices of comparable high-grade securities. The effect of this bias is evident in Figure B. In 1920, circulation privileges were abolished, and the yield on federal government bonds jumped to the level of high-grade municipals.[17]

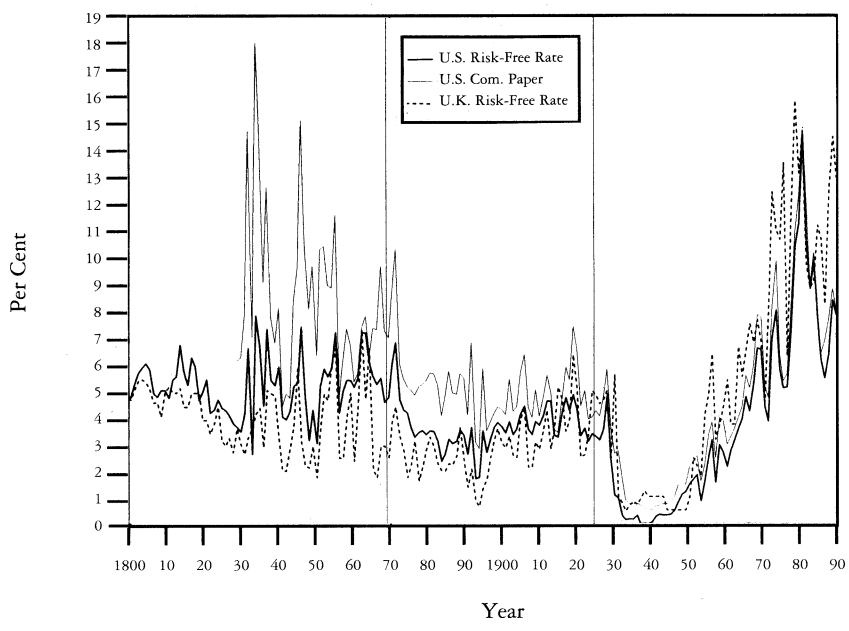
To avoid the noted problems with federal government bond yields, I constructed a high-grade series that uses the minimum yield on Treasury bonds and high-grade municipal bond yields from 1800 to 1865 and high-grade municipal yields from 1865 to 1917. This is the high-grade bond series depicted in Figure A. Table II summarizes the statistics.

Short-Term Bonds

Treasury bills, or short-term governments, did not exist before 1920. Data on commercial paper rates dating back to the 1830s are available from Macaulay, but during the 19th century commercial paper was subject to a high and variable risk premium, as Figure C shows.[18] These premiums often developed during or just prior to liquidity and financial crises (marked by NBER-designated recessions). There were also defaults on this paper, but there is insufficient information to correct the yield series for these defaults. Despite the obvious shortcomings of the data, there are few other short-term rates available for the early 19th century, and those that are available cover very short periods.

To remedy this deficiency, I constructed a **synthetic short-term government series** that removes the risk premium on commercial paper.[19] I did so by using the relation between short and long-term interest rates that prevailed in Britain during the 19th century, where the yields for long and short-term bonds were more representative of high-grade securities. The construction of the U.S. series assumes that the term structure of high-grade interest

Figure C Short-Term Interest Rates, 1800 – 1990



rates was the same over concurrent five-year periods in the U.S. and in the U.K. Figure C shows the short-term, risk-free series, along with other available short-term rates.

It is clear from Figure A that the total return indexes for fixed income assets fall far short of that for equity. With reinvestment of coupons, an initial investment of $1 in long-term bonds in 1802 would have yielded $5,770 in 1990; the same investment in risk-free, short-term assets would have yielded $2,680. Both these returns are less than 1 per cent of the sum accumulated in stocks over the entire period.

Gold and Commodities

The gold series represents the value of gold measured at the market price. Until the mid-1960s, this price was controlled by the government; furthermore, U.S. citizens were not allowed to hold gold in monetary form between 1933 and 1970. Gold has nonetheless been a key asset in world monetary history and many investors still consider it an important hedge asset. One dollar of gold bullion purchased in 1802 would have been worth $15.80 by the end of 1990.

The Consumer Price Index (CPI), provided for comparison, represents the value of a basket of widely diversified goods that could be stored costlessly, with no depreciation.[20] Consumer prices increased about 11-fold from 1802 to 1990, almost all of the appreciation coming in the last subperiod. Table III summarizes the returns for gold and commodities over the various time periods.

Note that, by the end of the first subperiod, 1802–70, the accumulations in government bonds, bills and stocks were virtually identical. It is in the second and especially the third subperiods that stocks clearly dominated fixed income assets. The return on gold is clearly dominated by bonds and stocks over the entire period, but its appreciation did surpass bonds (but not stocks) over the past 65 years.

The Price Level and Asset Returns

The behavior of price levels is critical to any interpretation of asset price movements over time. Figure D displays various U.S. price indexes. They all tell the same story. Before World War II, the price level displayed no over-

Figure D Price Indexes, 1800 – 1990

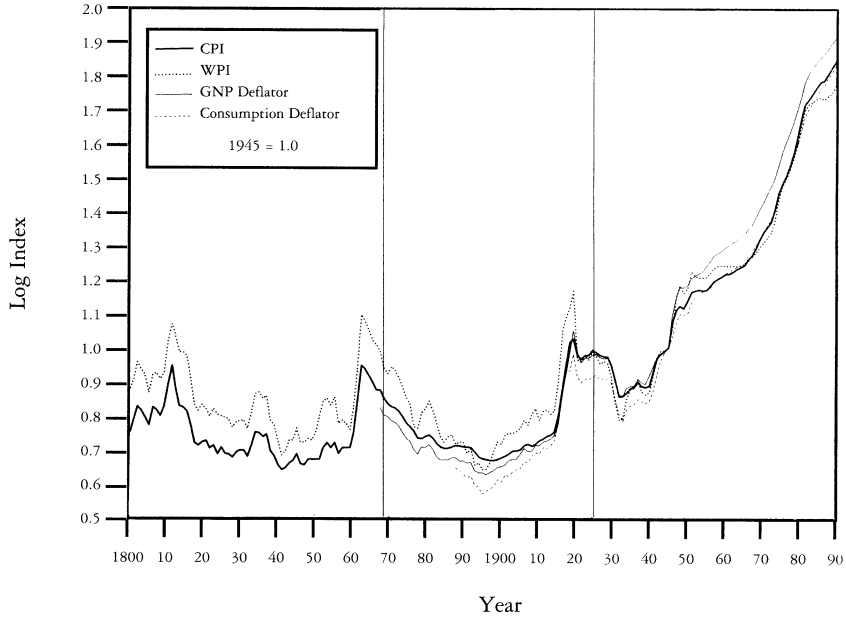


Table III Economic Variables (standard deviations in parentheses)*

	Prices							*Output*				*S&P 500 (per share)*			
	CPI (%)		*WPI (%)*		*GNP Deflator (%)*		*Gold (%)*	*Real GNP (%)*		*Industrial Production (%)*		*Real Earnings (%)*		*Real Dividends (%)*	
Period	*A*	*G*	*A*	*G*	*A*	*G*	*A*	*A*	*G*	*A*	*G*	*A*	*G*	*A*	*G*
1802–1990	1.5	1.3	1.4	1.0	—	—	2.3	—	—	—	—	—	—	—	—
	(6.1)		(9.0)				(14.8)								
1871–1990	2.1	2.0	2.0	1.6	2.3	2.2	3.3	3.5	3.3	5.5	4.0	6.0	3.0	3.9	3.1
	(5.0)		(8.1)		(5.3)		(17.7)	(5.6)		(17.7)		(25.7)		(12.8)	
1802–1870	0.4	0.1	0.4	−0.1	—	—	0.5	—	—	—	—	—	—	—	—
	(7.5)		(10.3)				(7.0)								
1871–1925	0.7	0.6	0.7	0.2	0.9	0.7	−0.2	3.8	3.7	5.6	4.1	6.5	2.1	2.5	1.6
	(5.1)		(9.6)		(5.5)		(1.2)	(4.9)		(18.2)		(31.9)		(13.4)	
1926–1990	3.2	3.1	3.1	2.9	3.5	3.4	6.2	3.2	3.0	5.4	4.0	5.6	3.7	5.2	4.4
	(4.7)		(6.4)		(4.7)		(23.6)	(6.1)		(17.4)		(19.1)		(12.1)	
1946–1990	4.6	4.5	4.3	4.1	4.9	4.9	7.4	2.6	2.5	3.7	3.5	7.1	6.1	6.4	6.2
	(3.9)		(5.3)		(4.0)		(26.5)	(4.3)		(6.1)		(14.9)		(5.9)	
1966–1981	7.0	7.0	6.8	6.7	6.6	6.6	22.0	2.8	2.8	3.4	3.3	7.6	7.0	5.8	5.7
	(3.3)		(4.2)		(2.1)		(39.2)	(2.3)		(5.1)		(10.8)		(4.5)	
1966–1990	6.0	5.9	5.2	5.2	5.6	5.6	13.4	2.8	2.8	3.2	3.1	4.7	3.9	5.4	5.3
	(3.1)		(4.1)		(2.2)		(34.4)	(2.3)		(4.9)		(12.7)		(3.7)	
1982–1990	4.0	4.0	2.5	2.5	3.9	3.9	−2.0	2.8	2.8	2.8	2.7	−0.4	−1.4	4.6	4.6
	(1.2)		(2.1)		(1.0)		(13.4)	(2.4)		(4.6)		(14.3)		(1.6)	

*A = arithmetic mean; G = geometric mean.

all trend. Since the war, the price level has increased steadily. Prices accelerated until the 1980s, when the rate of inflation slowed. The CPI in 1990 was nearly seven times its 1945 value. Over the entire period, prices increased at an average compound annual rate of 1.3 per cent. Inflation averaged 0.1 per cent per year in the first subperiod and 0.6 and 3.1 per cent in the second and third subperiods. Table III gives the statistics.

Over long periods of time, increases in the price level are strongly associated with increases in the money supply. Throughout the 19th and the early part of the 20th centuries, the money stock was closely tied to the amount of gold held by the Treasury and central bank. The abandonment of the gold standard, a process that started in 1933 but gained momentum in the post-World War II period, reduced constraints on the monetary authority's issuance of money. Chronic inflation, which cannot occur under a gold standard, became the norm in the postwar period.

Figure E depicts total *real* return indexes—total (nominal) return indexes deflated by the price level. Because of inflation, real returns are much more modest than nominal returns, especially in the final subperiod. One dollar invested in equities in 1802 would have accumulated to $86,100 of constant purchasing power, or real dollars, by 1990.

Figure E Total Real Return Indexes, Before Taxes, 1802 – 1990

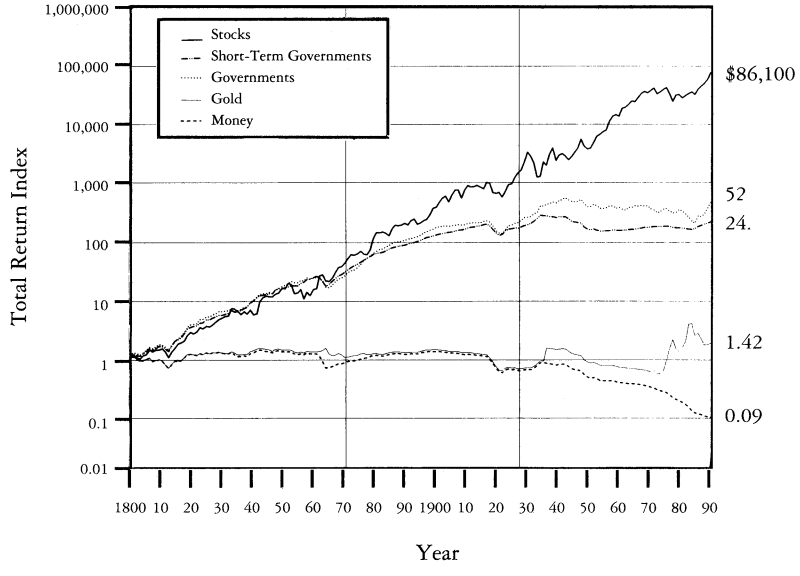
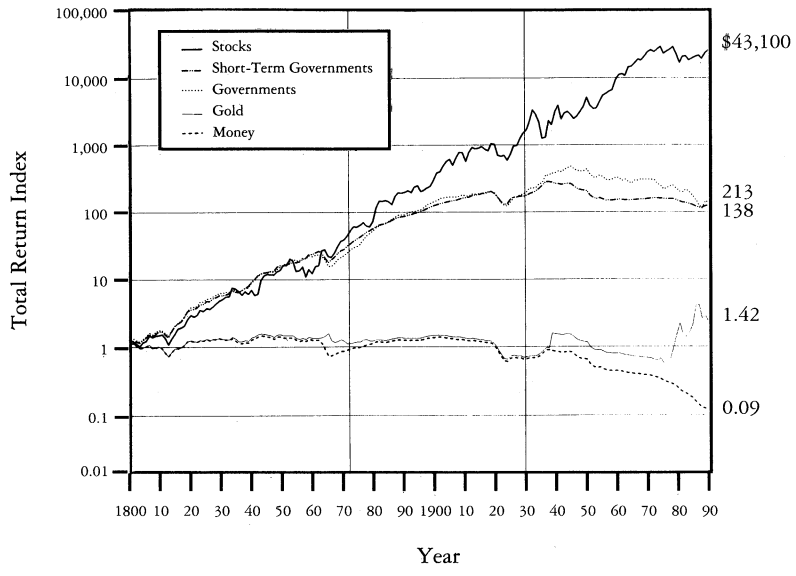


Figure F Total Real Return Indexes, After Taxes, 1802 – 1990



Over the same period, one dollar would have accumulated to $520 in real dollars if invested in long-term governments, to $242 in real dollars if invested in short-term governments, and to only $1.42 if invested in gold. A dollar of hoarded currency, which pays no return and whose value is eroded by inflation, would have left an investor with only 9 cents of purchasing power in 1990.[21]

Taxes and Returns

Figure F displays the total return index corrected for both federal taxes and inflation. Average federal income tax rates were taken from studies by Robert Barro and Chaipat Sahasakul and are reported in Table I.[22] Because no state or local taxes are considered, tax rates before 1913, when the federal income tax was instituted, are set at zero. It is assumed that dividends and interest income are taxed at the average marginal tax rate prevailing in the year they were earned and that capital gains are taxed (and losses remitted) at one-fifth the prevailing average marginal tax rate.[23] The reduced tax rate on capital gains arises primarily from the deferment of taxes on gains accrued but not realized and secondarily from the lower tax rate on realized gains.

Because a significant part of the returns on equity has been earned through capital gains, while virtually all the returns on bonds are in the form of taxable interest, the returns on equity are taxed at a lower effective rate than those on fixed income securities. In the third subperiod, 1926–90, when taxes became significant, the compound after-tax real return on stocks is reduced by 1.1 percentage points, to 5.3 per cent; the after-tax real return on short-term bonds is reduced by 0.8 percentage points, to −0.3 per cent, while the return on long-term government bonds falls 1.2 percentage points, to 0.2 per cent.

These results indicate that, on an after-tax basis, investors rolling over long-term bonds in the third subperiod have barely kept up with inflation, while those rolling over short-term bonds have fallen behind inflation. In fact, investors in short-term bonds have earned *no* after-tax real return from 1900 through 1990. Over the same period, the after-tax real return index for equities increased 90-fold!

Trends in Returns

Figure G displays 30-year centered moving averages of compound real rates of return on stocks, short and long-term government bonds.[24] One of the

Figure G Real Returns on Stocks and Bonds, 1806 – 1900
(30-year centered geometric moving average)

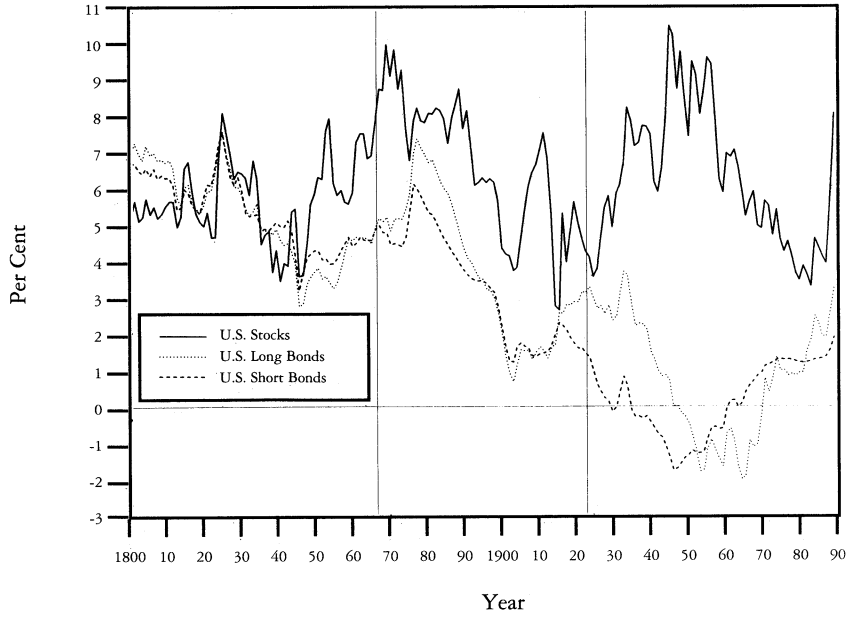


Table IV Holding-Period Returns on Stocks, Long Bonds and Short Bonds

Holding Period	*Time*	*Stock Return > Long Bond (%)*	*Stock Return > Short Bond (%)*	*Long Bond > Short Bond (%)*
	1802–1870	49.3	49.3	34.8
	1871–1925	56.4	60.0	65.5
1 Year	1926–1990	67.7	69.2	86.2
	1802–1990	57.7	59.3	61.4
	1871–1990	62.5	64.7	76.5
	1802–1870	52.9	48.5	44.1
	1871–1925	58.2	61.8	56.4
2 Years	1926–1990	75.4	69.2	60.0
	1802–1990	62.2	59.6	53.2
	1871–1990	67.5	65.8	58.3
	1802–1870	47.7	49.2	43.1
	1871–1925	67.3	67.3	60.0
5 Years	1926–1990	78.5	80.0	61.5
	1802–1990	64.3	65.4	54.6
	1871–1990	73.3	74.2	60.8
	1802–1870	46.7	43.3	46.7
	1871–1925	83.6	83.6	60.0
10 Years	1926–1990	83.1	83.1	56.9
	1802–1990	71.1	70.0	54.4
	1871–1990	83.3	83.3	58.3
	1802–1870	54.0	60.0	46.0
	1871–1925	94.5	100.0	52.7
20 Years	1926–1990	95.4	98.5	64.6
	1802–1990	82.9	87.6	55.3
	1871–1990	95.0	99.2	59.2
	1802–1870	55.0	52.5	40.0
	1871–1925	100.0	100.0	60.0
30 Years	1926–1990	100.0	100.0	63.1
	1802–1990	88.8	88.1	56.3
	1871–1990	100.0	100.0	61.7

striking aspects of these data is the relative constancy of the real returns on equity across all the subperiods. In the first subperiod, the average geometric real return on equity is 5.7 per cent; it is 6.6 per cent in the second subperiod and 6.4 per cent in the third.[25] These figures imply that, although inflation increased substantially in the third subperiod, the nominal return on equity increased by an almost identical amount, so the return after inflation remained essentially unchanged. To the extent that stocks are claims on *real* assets, they might be expected to be good hedges against inflation over the long run.[26]

As noted, the average real compound rate of return on stocks over the entire period has been 6.2 per cent. Over every 30-year period from 1802 through 1990, there have been only two when the compound real annual rate of return on stocks fell below 3.5 per cent, and those occurred in the depths of the Depression, in 1931 and 1932. The periods of the highest real returns on stock ended in the early 1960s, when the real compound annual return exceeded 10 per cent.

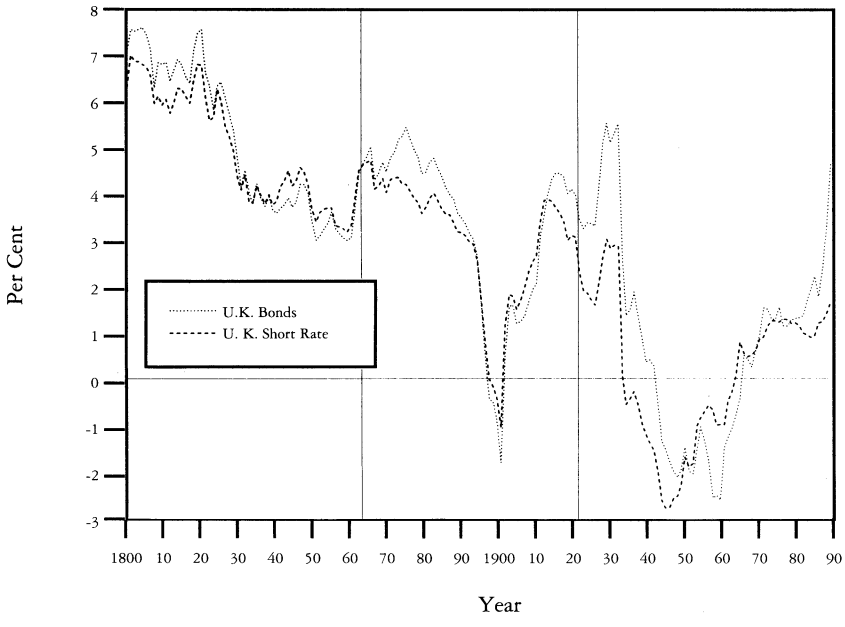
The most striking pattern in Figure G is the decline in the average real return on fixed income assets. In all 30-year periods beginning with 1888, the year that Mehra and Prescott began their analysis, the real rate of return on short-term government securities has exceeded 2 per cent in only three periods, ending in the Depression years 1932–34. Since the late 19th century, the real return on bonds and bills over any 30-year horizon has almost never matched the average return of 4.5 to 5 per cent reached during the first 70 years of our sample period. Since 1878, the real return on long-term bonds has never reached 4 per cent over any 30-year period; it exceeded 3 per cent in only six years. One has to go back to the 1831–61 period to find any 30-year period where the return on either long or short-term bonds exceeded that on equities. The dominance of stocks over fixed income securities, so evident from Figures A, E and F, is borne out by examining long-term holding-period returns.

Table IV compares the compound returns on stocks, long and short-term bonds. Over the entire period, stocks outperformed short-term bonds 57.7 per cent of the time on a year-to-year basis but 88.8 per cent of the time over 30-year horizons. Since 1871, over horizons of 20 years or longer, stocks have underperformed short-term assets only once and have outperformed long-term bonds 95 per cent of the time. Even with holding periods as short as five years, stocks have outperformed long and short-term bonds by a four-to-one margin since 1926 and a three-to-one margin since 1872. In contrast, in 1802–71, stocks outperformed short or long-term bonds only about one-half the time over any holding period.

Trends in the U.K.

In the 19th century, as London emerged as the world's financial center, capital markets in Great Britain were far more developed than in the U.S. The British consol, depicted in Figure B, is a security that pays interest only; it was first floated in 1729. The consol has long been used by economists to construct a continuous and homogeneous long-term interest rate series stretching over 250 years. British short-term in-

Figure H Real Returns on U.K. Bonds, 1806 – 1900
(30-year moving average)



terest rates are represented, with some exceptions, by the open-market rate at which high-quality commercial paper is discounted.[27] Figure H shows the 30-year average real returns on U.K. short and long-term bonds.

There is remarkable similarity in the yield trends in the U.K. and the U.S. The sharp decline in the real yields on fixed income securities in the U.S. was closely mirrored in the U.K. Statistical tests cannot reject the hypothesis that the return process was identical for both long and short-term real interest rates in the U.S. and the U.K. over the entire period.

Explanations of Trends

Although the data demonstrate that returns on equities have compensated investors for increased inflation over the postwar period, the returns on fixed income securities have not. One possible explanation is that lenders did not anticipate inflation during much of the period.

One could argue that a large part of the increase in the price level since World War II, especially since 1970, was unanticipated, hence bondholders did not have a chance to adjust their required returns. The progressive abandonment of the gold standard only slowly reduced investors' convictions about the stability of the long-run price level.

Unanticipated inflation certainly lowered the real return on long-term bonds. Buyers of such instruments in the 1960s and early 1970s could scarcely have imagined the double-digit inflation that followed. But unanticipated inflation is less important for short-term bonds. The inflationary process, although increasingly subject to long-term uncertainty, has been quite persistent and inertial in the short run. Short-term investors thus have a better opportunity to capture the inflation premium in the rate of interest as they roll over their investments. Short-term bonds should therefore provide better protection against unanticipated inflation than longer-term bonds. Of course, this protection is not perfect; unanticipated inflation may account for up to one percentage point of the decline in the real yield on short-term bonds over the sample period.[28]

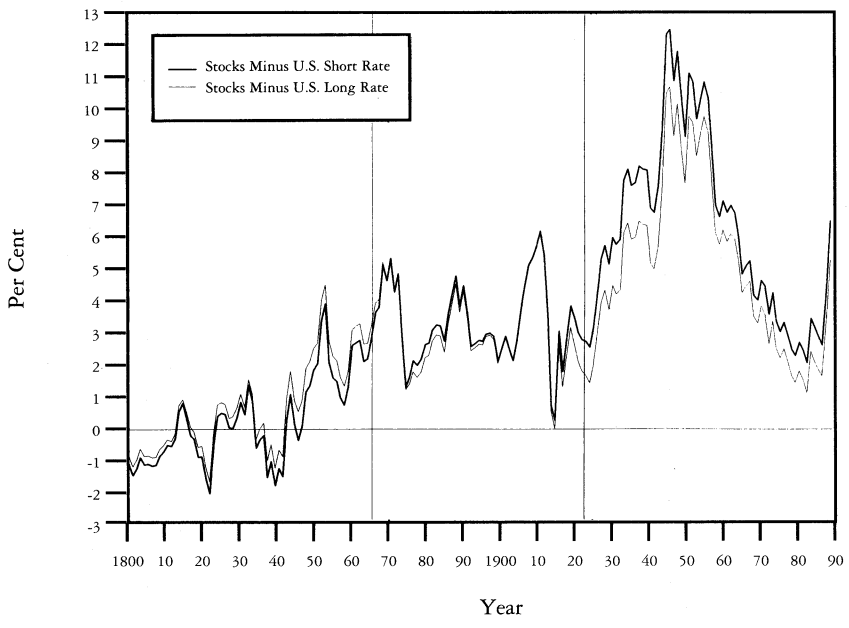
Other Factors

Other factors influence the real rate of interest. Slower or more variable economic growth, for example, will generally lower the real rate investors demand to hold fixed income assets. Slower growth may have depressed real yields over short periods of time, including the 1970s, when real returns on short-term Treasury bills were negative. Economic growth in general, however, has been as high in the 20th as in the 19th century.

There is no evidence that the economy has become more volatile. In fact, Table III suggests that the real economy has actually been more stable since World War II, but real rates have been very low in this period. Intuition would suggest that the yield differential between risky assets such as stocks and less risky assets such as bonds would be smaller, the less risky the economy. If the real return on stocks has remained constant (and this is what the data suggest), then the real return on fixed income should have risen. The decline in the real yields on bonds suggests that changing variability of the real economy can not adequately explain the decline in real returns.

Perhaps the low real interest rates during much of this century can be explained by a combination of historical and institutional factors. The 1929–32 stock market crash and the Depression left a legacy of fear; most investors clung to government securities and insured deposits, driving their yields down. Redistribution policies undertaken by the government subsequent to the Depression may also have lowered real rates by shifting wealth to more risk-averse segments of the population. Furthermore, during World War II and the early postwar years, interest rates were kept low by the Federal Reserve. Because of its inflationary conse-

Figure I Equity Risk Premium, 1806 – 1900
(30-year centered geometric moving average)



quences, this policy was abandoned in 1951, but interest rate controls, particularly on deposits, lasted much longer.

Finally, one cannot ignore the development of the capital markets, which transformed a highly segmented market for short-term instruments in the 19th century into one of the world's most liquid markets in this century.

The Equity Premium

The decline in the real return on fixed income investments has meant that the advantage of holding equities, which have experienced a remarkably steady real return, has increased over time. The equity premium, plotted in Figure I, has trended up over the last 200 years and was particularly high in the middle of this century. The premium, computed from real geometric returns, averaged 0.6 per cent in the first subperiod, 3.5 per cent in the second, and 5.9 per cent in the third.

The primary source of this equity premium has been the fall in the real return on bonds, *not* the rise in the return on equity. Nonetheless, it is not unreasonable to believe that the low real rates on bonds may, on occasion, have fueled higher equity returns, because the costs of obtaining leverage were so low. The highest 30-year average equity return occurred in 1931–61, a period that also experienced very low real returns on bonds.

One might take an even broader view of the superior returns on equity. Certainly investors in 1802 (or even 1872) did not universally expect the United States to become the greatest economic power in the next century. This was not the case in many other countries. What if one had owned stock in Japanese or German firms before World War II? Or consider Argentina, which, at the turn of the century, was one of the great economic powers. In some sense, the returns on U.S. stocks might not be representative of the broader international context.[29]

Conclusions

The high real interest rates in the 19th century may have reflected the possibility that the U.S. would default on its bonds or abandon the gold standard. Since the inflation shocks of the 1970s, fear of outright default has been replaced by an inflationary premium in nominal interest rates. Future inflation may be caused by growing U.S. government deficits or by inflationary policies pursued by the Federal Reserve in response to political pressures or economic crises.

The last 10 years represent only about 5 per cent of the total time examined in this study, but the period since 1980 contains the highest real long-term bond returns during any consecutive 10-year period since 1884 and the highest real short-term bond returns since the 19th century (excepting the sharp deflationary periods of the Depression). It is not unreasonable to assume that the current higher real rates will turn out to be more characteristic of future returns than the unusually low real rates of the earlier part of this century. If they do, then the advantage of holding equities over bonds will shrink from the levels reached over the past several generations. The holders of fixed income investments should enjoy enhanced real returns in the future. Equities, however, still appear to be the best route to long-term wealth accumulation.[30]

Footnotes

1. *The average compound real return on the S&P 500 has been 6.7 per cent over the same period. Very small stocks (bottom quartile of capitalization) have performed better, averaging 8.2 per cent compound real return since 1926.*
2. *R. Mehra and E. Prescott, "The Equity Premium: A Puzzle,"* Journal of Monetary Economics *15 (1985), pp. 145–61. The time period covered by Mehra and Prescott was 1889–1978. The returns on stocks and bonds were very similar to the returns since 1926.*
3. *Some rely on non-standard preference functions; see, for example, G. M. Constantinides, "Habit Formation: A Resolution of the Equity Premium Puzzle,"* Journal of Political Economy *98:3 (1990), pp. 519–43; A. Abel, "Asset Prices under*

Habit Formation and Catching up with the Joneses," American Economic Review *2:80 (1990), pp. 38–43; S. Benninga and A. Protopapadakis, "Time Preference and the 'Equity Premium Puzzle',"* Journal of Monetary Economics, *January 1990; and P. Weil, "The Equity Premium Puzzle and the Risk-free Rate Puzzle,"* Journal of Monetary Economics, *November 1989. Others rely on individual stocks and segmented asset holdings; see N. G. Mankiw, "The Equity Premium and the Concentration of Aggregate Shocks,"* Journal of Financial Economics *17 (1986), pp. 211–19 and N. G. Mankiw and S. P. Zeldes, "The Consumption of Stockholders and Non-Stockholders,"* Journal of Financial Economics *29 (1991), pp. 97–112. See A. Abel, "The Equity Premium Puzzle," Federal Reserve Bank of Philadelphia* Business Review, *September-October 1991, for a summary.*

4. *G. William Schwert, "Indexes of United States Stock Prices from 1802 to 1987,"* Journal of Business *63:3 (1990), pp. 399–426. R. Ibbotson and G. Brinson (*Investment Markets: Gaining the Performance Advantage *(New York: McGraw Hill, 1987), p. 73) report that the Foundation for the Study of Cycles, in Pittsburgh, has published data from an internal stock index entitled "Historical Record: Stock Prices 1789–Present," Data Bulletin 1975–1. However, attempts to obtain documentation for this series have not been successful.*
5. *A. Cowles,* Common Stock Indexes, 1871–1937 *(Bloomington, IN: Principia Press, 1938).*
6. *In the 1970s and 1980s, Roger Ibbotson and Rex Sinquefield analyzed data on inflation, stock and bond returns since 1926 (see* Stocks, Bonds, Bills, and Inflation, 1991 Yearbook *(Chicago: Ibbotson Associates, 1991)). Several authors (see for example J. W. Wilson and C. P. Jones, "A Comparison of Annual Common Stock Returns: 1871–1925 with 1926–85,"* Journal of Business, *April 1987, and "Stock, Bonds, Paper, and Inflation, 1870–1985,"* Journal of Portfolio Management, *Fall 1987) have extended much of the data back to 1872.*
7. *Standard stock indexes do, however, reflect increases in the value of shares resulting from reinvestment of retained earnings and changes in the capitalization of expected earnings.*
8. *The data from the Foundation for the Study of Cycles (found in Ibbotson and Brinson,* Ivestment Markets, op. cit.*) show a compound return of 7.95 per cent from 1802 through 1870 and 7.92 per cent from 1789 through 1870.*
9. *The geometric, or compound, return is the nth root of the one-year returns; it is always less than the average or mean arithmetic return, except when all yearly returns are equal. The geometric return can be approximated by the arithmetic mean minus one-half the variance of the individual yearly returns.*
10. *S. Blodget, Jr. (*A Statistical Manual for the United States of America, *1806 ed., p. 68) estimated that wealth in the U.S. was $2.45 billion in 1802. Total wealth today is estimated at nearly $15 trillion, of which about $4 trillion is in the stock market.*
11. *S. Homer,* A History of Interest Rates *(New Brunswick, NJ: Rutgers University Press, 1963).*
12. *The first federal government debt was the Hamilton refunding 6s of 1790, "redeemable at the pleasure of the government at 100 in an amount not exceeding 2% a year."*
13. *Ibbotson and Sinquefield,* Stocks, Bonds, Bills, op. cit.
14. *See Homer (*A History, op. cit., *pp. 296 and 301) and J. G. Martin (*Boston Stock Market, *1871) for a description of these municipals. The lower yield for municipals was not due to any tax advantage, because tax considerations did not emerge until the early 20th century.*
15. *The Greenback period, when the government issued notes not redeemable in specie, provides a fascinating episode in monetary theory. For further discussion, see R. Roll, "Interest Rates and Price Expectations During the Civil War,"* Journal of Economic History, *June 1972.*
16. *For a discussion of the issues involved in the bimetal standard and the potential distortion in yields see P. M. Garber, "Nominal Contracts in a Bimetallic Standard,"* American Economic Review, *December 1986.*
17. *The magnitude of this distortion can be seen by examining the yields in 1917–20 on government bonds issued with and without circulation privileges (see Homer,* A History, op. cit., *Table 46). The yield differential between bonds with and without circulation privileges ranged from 50 to 100 basis points.*
18. *F. R. Macaulay (*The Movements of Interest Rates, Bond Yields, and Stock Prices in the United States since 1856 *(New York: National Bureau of Economic Research, 1938)) reported rates for choice 60 to 90-day commercial paper after 1856, while data from 1831 through 1856 were collected from E. B. Bigelow (*The Tariff Question . . ., *(Boston, 1862)), which covers "Street rates on First class paper in Boston and New York, at the beginning, middle, and end of the month." The paper floated in Boston is said to be of three to six months in duration. See Macaulay, p. A341, for a more detailed discussion of these sources.*
19. *For details of the construction of U.S. short-term rate series, see J. J. Siegel, "The Real Rates of Interest from 1800–1900: A Study of the U.S. and U.K.,"* Journal of Monetary Economics, *forthcoming.*
20. *The CPI includes services that cannot be stored. Since World War II, commodity prices have risen slower and service prices faster than the CPI. When futures markets exist, investors can buy futures, putting up margin in interest-bearing Treasury bills. This may result in returns higher than the CPI.*
21. *An investor would actually have done far better hoarding paper money than gold bullion. The first U.S. currency, a one dollar U.S. note issued in 1862, now catalogues for $1000 in uncirculated condition, while earlier colonial paper goes for even more. Of course, gold coins have also increased in value far more than bullion.*
22. *R. J. Barro and C. Sahasakul, "Measuring the Average Marginal Tax Rate from the Individual Income Tax,"* Journal of Business *56 (1982), pp. 419–52 and "Average Marginal Tax Rates from Social Security and the Individual Income Tax,"* Journal of Business *59 (1986), pp. 555–66.*
23. *This adjustment is consistent with research done by A. Protopapadakis, "Some Indirect Evidence on Effective Capital Gains Tax Rates,"* Journal of Business *56 (1982), pp. 127–38.*
24. *The averaging period is progressively shortened to 15 years at the end points of these series.*
25. *If the stock data from the Foundation for the Study of Cycles (see footnote 4) are considered, the real compound annual return in equity from 1802 to 1870 is 6.8 per cent.*
26. *In the short run, stocks have proved poor hedges against inflation. This is particularly true if inflation is induced by supply shocks, which*

Footnotes concluded on page 46.

12. *The more sophisticated method that has been developed on Wall Street to measure option cost can also be applied to the holding-period return. A project is now under way at the Wharton School to develop this methodology.*
13. *H. P. Wallace ("The Total Return Calculation for Mortgage Pass-Throughs," in F. J. Fabozzi, ed.,* The Handbook of Mortgage-Backed Securities *(Chicago: Probus, 1985)) refers to the four components of the wealth increase shown in Equation (3) as the market value return, principal payment return, interest return and reinvestment return, respectively. The first two components, however, defy any analytically useful interpretation. The market value return component combines the change in price and the change in balance, whereas we want to know the impact of the price change alone. Furthermore, showing the return of principal as a component of return is misleading, because most of the principal repaid during any period was in fact part of the investor's wealth at the beginning. The only part that was not is the recovery of the discount—the difference between the market value of the security and its face value at the beginning of the period. After this article was drafted, Andrew Carron provided me with some unpublished tabulations that indicate that the First Boston Corporation breaks down holding-period yields in a way very similar to that developed here.*
14. *The best way to do this is by multiplying the total holding-period return by the ratio of the dollar value of the components to the total dollar increase in wealth. This is no more than an approximation, however. The annual equivalent holding-period return is not the sum of the annual equivalents of the components because the price change component is realized only at the end of the period, while the other components are received during the period.*
15. *I thank Andrew S. Carron, Allan Redstone and Kenneth R. Scott for their helpful suggestions.*

Siegel *footnotes concluded from page 38.*

affect the productivity of capital. See E. F. Fama, "Stock Returns, Real Activity, Inflation and Money," The American Economic Review, *September 1981.*
27. *These series can be found in Homer (*A History, op. cit., *Table 23). He describes the paper as of "nonuniform maturity of a few months" before 1855 and thereafter "three month bills." These series are based on data compiled by the NBER from British Parliamentary papers and from various editions of* The Economist *(1858–1900). Details are contained in Siegel, "The Real Rate of Interest,"* op. cit.
28. *This has been suggested to me by some preliminary work done by Charles Calomaris.*
29. *Of course, even on a worldwide basis, who might have expected the triumph of capitalism and market-oriented economies 100 or even 50 years ago? We may be living in the golden age of capitalism, the fortunes of which may decline in the next 100 years (or sooner)!*
30. *I thank Peter Scherer and Ashish Shah for their research assistance.*