KROLL

U.S. Capital Markets Performance
by Asset Class 1926–2022

2023
SBBI® Yearbook

STOCKS, BONDS, BILLS, AND INFLATION®

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From a theoretical standpoint, the assumption implicit in the calculation of semivariance – that investors do not care about positive variance – has repercussions regarding investor utility functions. Namely, ignoring positive variation implies that an investor is indifferent when presented with the choice between making an uncertain but positive return bet and making a bet that is certain to generate the expected payoff. For example, investors would, under the assumptions of semivariance, be agnostic between a 50-50 bet of generating either 5% or 10% and a sure bet paying 7.5%.

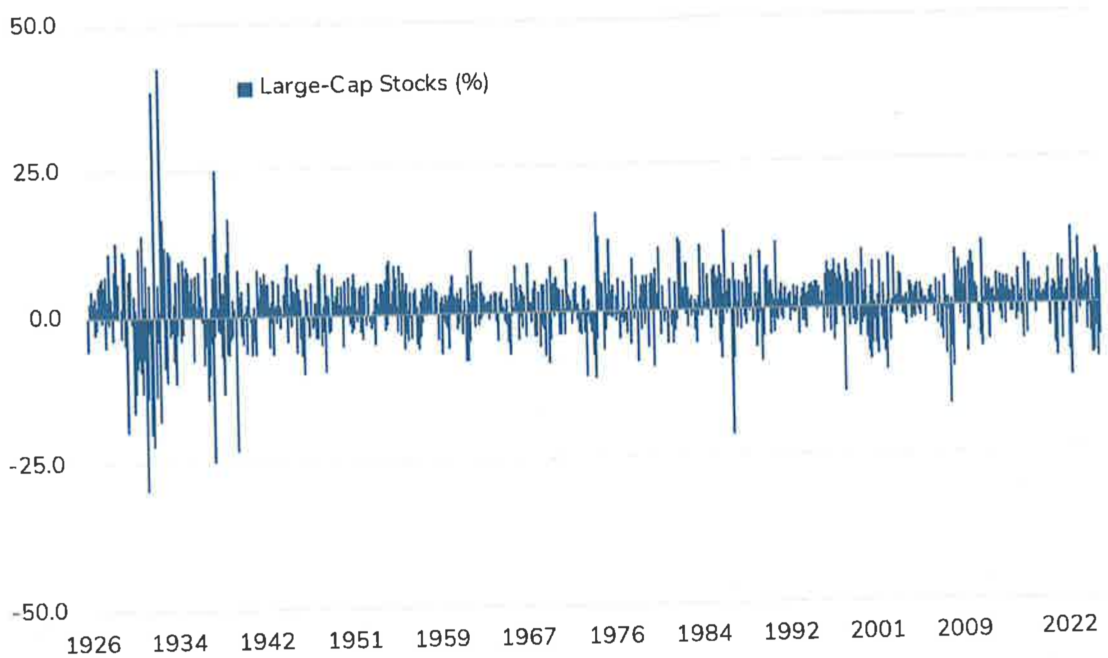
Practically speaking, ignoring upside variation means that we ignore the second aspect of risk mentioned above – a paucity of magnitude. In other words, if one attempts to minimize semivariance, without regard to the degree to which an asset or allocation has upside potential, one runs the risk of generating returns which, while low in downside variance, are also low in upside variance. In this case, one has protected oneself from one class of risk by taking on yet another. Given these issues, semivariance has met with limited acceptance among academics and practitioners alike.

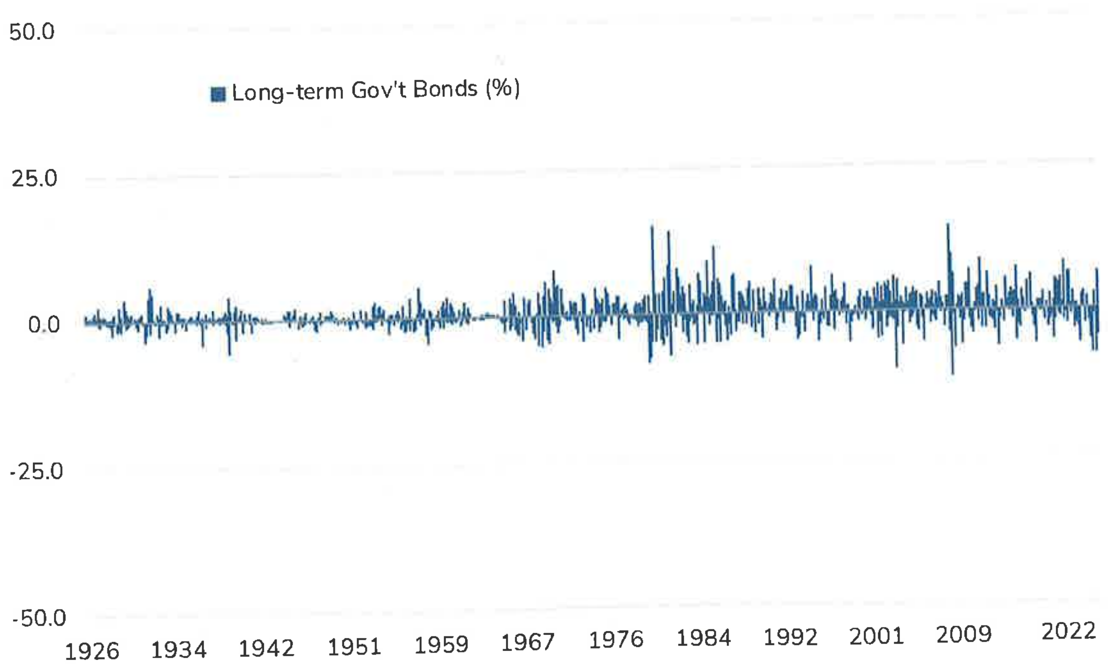
Volatility of the Markets

The volatility of stocks and long-term government bonds is shown by the bar graphs of monthly returns in Exhibit 6.1. The stock market was tremendously volatile in the first few years studied; this period was marked by the 1920s boom, the crash of 1929–1932, and the Great Depression years. The market seemingly settled after World War II and provided more stable returns in the postwar period. In the 1970s and 1980s, stock market volatility increased, but not to the extreme levels of the 1920s and 1930s. In the 1990s, 2000s, and 2010s, volatility was relatively moderate.

Bonds present a mirror image. Long-term government bonds were extremely stable in the 1920s and remained so through the crisis years of the 1930s, providing shelter from the storms of the stock markets. Starting in the late 1960s and early 1970s, however, bond volatility soared; in the 1973–1974 stock market decline, bonds did not provide the shelter they once did. Bond pessimism (i.e., high yields) peaked in 1981 and subsequent returns were sharply positive. While the astronomical interest rates of the 1979–1981 period have passed, the volatility of the bond market remains higher.

Exhibit 6.1: Month-by-Month Returns on Stocks and Bonds (%)
1926–2022





Changes in the Risk of Assets Over Time

Another time series property of great interest is change in volatility or riskiness over time. Such change is indicated by the standard deviation of the series over different subperiods. Exhibit 6.2a shows the annualized monthly standard deviations of the basic data series by decade beginning in 1926 and illustrates differences and changes in return volatility. In this exhibit, the 1920s cover the period 1926–1929. Equity returns have been the most volatile of the basic series, with volatility peaking in the 1930s due to the instability of the market following the 1929 market crash. The significant bond yield fluctuations of the 1980s caused the fixed-income series' volatility to soar compared to prior decades. Small-cap stocks were the *most* volatile SBBI® asset class in all time periods shown in Exhibit 6.2a. Treasury bills were the *least* volatile SBBI® asset class in all time periods shown in Exhibit 6.2a. In Exhibit 6.2b the same statistics are shown over the most recent 10-year period (2013–2022).

Exhibit 6.2a: Annualized Monthly Standard Deviations by Decade (%)

	1920s*	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	2010s
Large-Cap Stocks	23.9	41.6	17.5	14.1	13.1	17.1	19.4	15.9	16.3	14.1
Small-Cap Stocks	24.7	78.6	34.5	14.4	21.5	30.8	22.5	20.2	26.1	19.6
Long-term Corp Bonds	1.8	5.3	1.8	4.4	4.9	8.7	14.1	6.9	11.7	9.0
Long-term Gov't Bonds	4.1	5.3	2.8	4.6	6.0	8.7	16.0	8.9	12.4	10.9
Inter-term Gov't Bonds	1.7	3.3	1.2	2.9	3.3	5.2	8.8	4.6	5.2	3.2
U.S. Treasury Bills	0.3	0.2	0.1	0.2	0.4	0.6	0.9	0.4	0.6	0.2
Inflation	2.2	2.6	3.1	1.3	0.8	1.3	1.3	0.7	1.6	1.0

*Based on the period 1926–1929

Exhibit 6.2b: Annualized Monthly Standard Deviations in the Most Recent 10-year Period (2013–2022) (%)

	2013–2022
Large-Cap Stocks	16.7
Small-Cap Stocks	21.8
Long-term Corp Bonds	10.7
Long-term Gov't Bonds	10.9
Inter-term Gov't Bonds	3.6
U.S. Treasury Bills	0.3
Inflation	1.3

Exhibit 6.3 displays the *annualized* standard deviation of the *monthly* returns on each of the basic and derived series from January 1926 to December 2022. The estimates in Exhibit 6.2a, Exhibit 6.2b, and Exhibit 6.3 are not strictly comparable to Exhibits 2.3, 6.8, and 6.9, where the 97-year period standard deviation of *annual* returns around the 97-year annual arithmetic mean is reported. The arithmetic mean drifts for a series that does not follow a random pattern. A series with a drifting mean will have much higher deviations around its long-term mean than it has around the mean during a particular calendar year.

As shown in Exhibit 6.3, large-cap stocks and equity risk premiums have virtually the same annualized monthly standard deviations because there is very little deviation in the U.S. Treasury bill series (the monthly equity risk premium in Exhibit 6.3 is calculated as [(1+ Large Stock total return) ÷ (1+Treasury Bill total return) – 1], as described in Exhibit 4.1). The series with drifting means (U.S. Treasury bills, inflation rates, and inflation-adjusted U.S. Treasury bills) all tend to have very low annualized monthly standard deviations, since these series are quite predictable from month to month. As seen in Exhibits 6.8 and 6.9, however, there is much less predictability for these series over the long term. Because it is difficult to forecast the direction and magnitude of the drift in the long term mean, these series have higher standard deviations over the long term in comparison to their annualized monthly standard deviations.

Equity investors may have the impression that periods of economic turmoil mainly affect equity markets, but a careful look at Exhibit 6.3 will show that this is not true.

For example, during the 2008–2009 global financial crisis the price fluctuation of bonds in general and long-term corporate bonds in particular was dramatic. The annualized standard deviation of long-term corporate bonds recorded an all-time high value of 25.5% in 2008, a year that saw the collapse of storied investment banks Lehman Brothers and Bear Sterns. The previous record annualized standard deviation for long-term corporate bonds of 20.2% (measured during 1981) is more than one-fifth lower than the 2008 value, and more than twice the Depression era record of 11.7%, recorded in 1933. Another mark of the severity of bond price fluctuations can be seen by noting that the annualized standard deviations for long-term corporate bonds in 2008 were only three percentage points shy of the annualized standard deviations for the S&P 500 "Large-Cap Stocks" in Exhibit 6.3 in 2009.

Equity volatility in 2020 reached levels not seen for decades. The annualized monthly standard deviation of large-cap stocks in 2020 reached 31.6%, a level not seen since 1987. The annualized monthly standard deviation of small-cap stocks in 2020 reached 43.2%, a level not seen since 1976.

In 2021 the annualized monthly standard deviation of all of the asset classes shown in Exhibit 6.3 decreased to levels more in line with historical years. The most recent year (2022) tells the opposite story – the annualized monthly standard deviation of all of the asset classes shown in Exhibit 6.3 increased.

Exhibit 6.8: Total Returns, Income Returns, and Capital Appreciation Returns of the SBBI®
Asset Classes; Summary Statistics of Annual Returns (%)
1926–2022

	Geometric Mean (%)	Arithmetic Mean (%)	Deviation (%)	Serial Correlation
Large-Cap Stocks				
Total Return	10.1	12.0	19.8	0.00
Income	3.9	3.9	1.6	0.92
Capital Appreciation	6.1	7.9	19.1	0.00
Small-Cap Stocks (TR)	11.8	16.0	31.2	0.05
Long-term Corp Bonds (TR)	5.7	6.1	9.0	0.05
Long-term Gov't Bonds				
Total Return	5.2	5.6	10.3	-0.11
Income	4.8	4.9	2.6	0.96
Capital Appreciation	0.2	0.6	9.3	-0.21
Inter-term Gov't Bonds				
Total Return	4.9	5.0	5.7	0.17
Income	4.2	4.3	2.9	0.96
Capital Appreciation	0.5	0.6	4.6	-0.13
U.S. Treasury Bills (TR)	3.2	3.3	3.1	0.92
Inflation	2.9	3.0	4.0	0.63

In general, risk is rewarded by a higher return over the long term. For example, Exhibit 6.8 shows that over the 1926–2022 time horizon small-cap stocks were the riskiest asset class with a standard deviation of 31.2%, but also provided the greatest rewards to long-term investors, with an arithmetic mean annual return of 16.0%. Comparably, the risk (as measured by standard deviation) of large-cap stocks was significantly lower at 19.8%, and the reward (as measured by arithmetic average annual return) of large-cap stocks was correspondently lower at 12.0%.

U.S. Treasury bills, with a standard deviation of 3.1%, were nearly riskless and had the lowest arithmetic mean annual return at 3.3%.

Inflation-Adjusted Series Summary Statistics

Inflation-adjusted basic series summary statistics are presented in Exhibit 6.9. Note that the real rate of interest is close to zero (0.4%) on average. For the 97-year period, the geometric and arithmetic means are lower by the amount of inflation than those of the nominal series.

The standard deviations of large-cap and small-cap stock returns remain approximately the same, and a little lower, respectively, after adjusting for inflation, while inflation-adjusted returns of long-term corporate bonds, long-term government bonds, intermediate-term government bonds, and U.S. Treasury bills are more volatile (i.e., have *higher* standard deviations).

Exhibit 6.9: Inflation-Adjusted Series Summary Statistics of Annual Returns (%)
1926–2022

	Geometric Mean (%)	Arithmetic Mean (%)	Standard Deviation (%)	Serial Correlation
Large-Cap Stocks	7.0	8.9	19.8	0.00
Small-Cap Stocks	8.6	12.7	30.6	0.02
Long-term Corp Bonds	2.7	3.2	10.1	0.16
Long-term Gov't Bonds	2.2	2.8	11.3	-0.03
Inter-term Gov't Bonds	1.9	2.1	6.8	0.23
U.S. Treasury Bills	0.3	0.4	3.8	0.66

Rolling-Period Standard Deviations

Rolling-period standard deviations are obtained by rolling a window of fixed length along each time series and computing the standard deviation for the asset class for each window of time. They are useful for examining the volatility or riskiness of returns for holding periods similar to those actually experienced by investors. Exhibits 6.10 and 6.11 graphically depict this volatility. Monthly data are used to maximize the number of data points included in the standard deviation computation. The first 60-month (i.e., 5-year) rolling period covered is January 1926–December 1930, so each of the graphs start at 1930.

Exhibit 6.10 examines the 60-month rolling standard deviation for large-cap stocks, small-cap stocks, and long-term government bonds. It is interesting to see the relatively high standard deviation for small- and large-cap stocks in the 1930s, with an apparent lessening of volatility for 60-month holding periods during the 1980s. Note also how the standard deviation for long-term government bonds reaches the level of both stock asset classes during part of the 1980s. Exhibit 6.11 examines the 60-month rolling standard deviation for long-term and intermediate-term government bonds and U.S. Treasury bills. Note that the vertical scale (from 0.0% to 25.0%) of Exhibit 6.10 is different than the vertical scale (from 0.0% to 5.0%) of Exhibit 6.11.

Exhibit 10.8: Equity Risk Premium Calculated Using the S&P 500 and the Income Return on Three Government Bonds of Different Horizons (%)
1926–2022

	Long-horizon	Intermediate-horizon	Short-horizon
S&P 500	7.17	7.74	8.73

 Calculations by Kroll. Series used: (i) SBBI Large-cap Stocks total return series (essentially the S&P 500 Index), (ii) SBBI Long-term Government Bond income return series (20-year maturity), (iii) SBBI Intermediate-term Government Bond income return series (5-year maturity), (iv) SBBI 30-Day T-Bill total return series. Maturities are approximate.

The equity risk premium is calculated by subtracting the arithmetic mean of the government bond income return from the arithmetic mean of the stock market total return. Exhibit 10.9 demonstrates this calculation for the long-horizon equity risk premium, the intermediate-horizon equity risk premium, and the short-horizon equity risk premium.

Exhibit 10.9: Calculation of the Long-Horizon Equity Risk Premium, the Intermediate-Horizon Equity Risk Premium, and the Short-Horizon Equity Risk Premium (%)
1926–2022

	Arithmetic Annual Mean			
	S&P 500 (the "Market")	Risk-free Rate		Equity Risk Premium
S&P 500	12.02	4.85	=	7.17
Intermediate-horizon	12.02	4.28	=	7.74
Short-horizon	12.02	3.28	=	8.73 *

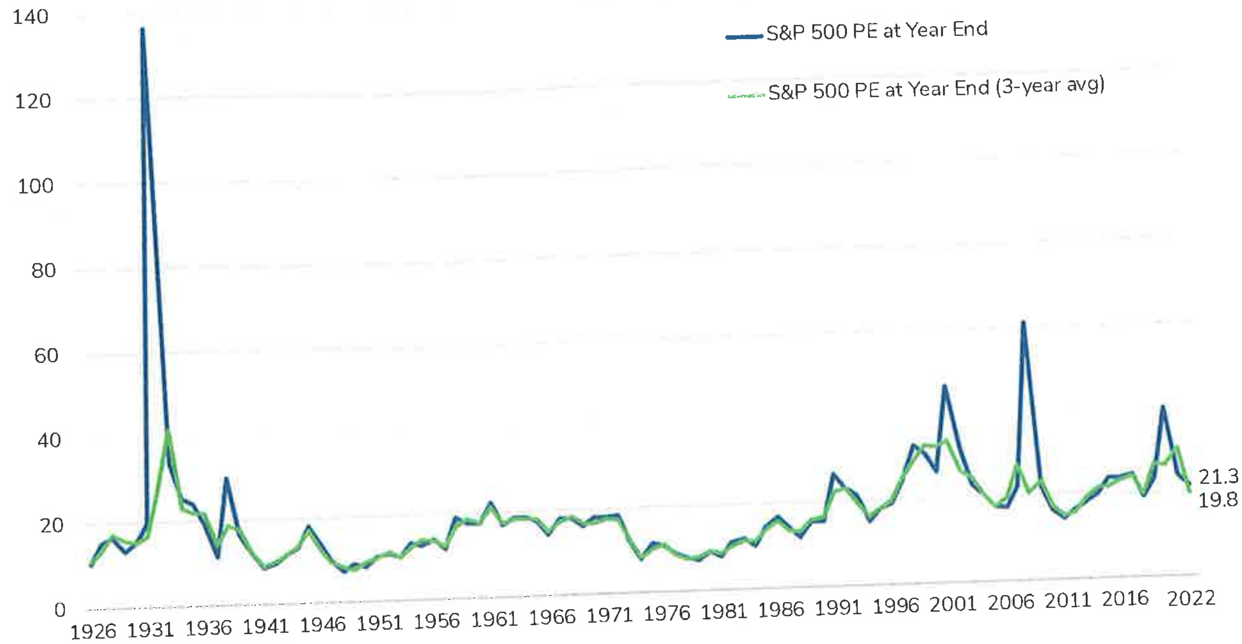
* difference due to rounding

 Calculations by Kroll. Series used: (i) SBBI Large-cap Stocks total return series (essentially the S&P 500 Index), (ii) SBBI Long-term Government Bond income return series (20-year maturity), (iii) SBBI Intermediate-term Government Bond income return series (5-year maturity), (iv) SBBI 30-Day T-Bill total return series. Maturities are approximate.

The Market Benchmark and Firm Size

Although not restricted to the 500 largest companies, the S&P 500 is considered a large-cap index. The returns of the S&P 500 are market-cap-weighted. The larger companies in the index therefore receive the majority of the weight. If using a large-cap index to calculate the equity risk premium, an adjustment is usually needed to account for the different risk and return characteristics of small stocks. This was discussed in Chapter 7 on the size premium.

Exhibit 10.13: Large-cap Stocks P/E Ratio
1926–2022



This is because reported earnings are affected not only by the long-term productivity, but also by one-time items that do not necessarily have the same consistent impact year after year. The three-year average is more reflective of the long-term trend than the year-by-year numbers. The P/E ratio calculated using the three-year average of earnings had an increase of 0.64% per year.

The historical P/E growth factor, using three-year earnings, of 0.64% per year is subtracted from the equity forecast because it is not believed that P/E will continue to increase in the future. The market serves as the cue. The current P/E ratio is the market's best guess for the future of corporate earnings and there is no reason to believe, at this time, that the market will change its mind. Using this top-down approach, the geometric supply-side equity risk premium is 4.39%, which equates to an arithmetic supply-side equity risk premium of 6.35%.

Another approach in calculating the premium would be to add up the components that constitute the supply of equity return, excluding the P/E component. Thus, the supply of equity return only includes inflation, the growth in real earnings per share, and income return. This forward-looking earnings model calculates the long-term supply of U.S. equity returns to be 9.45%: