J. V. Bruni and Company

1528 North Tejon Street
Colorado Springs, CO 80907
(719) 575-9880 or (800) 748-3409

Retirement Nest Eggs . . .
Withdrawal Rates and Fund Sustainability

An Updated and Expanded Analysis

Based on life expectancy data, an investor who retires at 65 can reasonably anticipate living another 20 years. Of course, some people will live longer than average and others less. The key point, however, is that people who expect to withdraw funds from their investment portfolios during retirement need to determine a long-term sustainable rate of withdrawal—that is, a withdrawal rate that can, with reasonable probability, be maintained for 20 years or more.

Given certain investment return and inflation assumptions, some retirement planning software programs provide ways of assessing the amount that can be withdrawn monthly from an investment portfolio without depleting it during the investor's lifetime. While these calculators are useful for determining how particular variables affect a portfolio and its sustainability, too many programs incorporate simplistic—and unrealistic—assumptions.

Since no one can predict the future with certainty, inputs required by retirement calculators must be assumed, and it may seem appropriate to use long-term average historical data. For example, one might choose 3% as the expected inflation rate—the approximate long-term average for the U.S. economy. While this rate may approximate average future inflation, the problem is that it is an ***average*** figure, and as such it ignores significant historical variation above and below average. Put differently, the rate we plug into a calculator typically remains constant over the forecast period, yet the real world is seldom constant. Thus, while we may capture correct averages, we almost always fail to capture fluctuations in rates of return and inflation.

Related to the problem of using averages is the issue of the timing of stock and bond market returns and inflation. For example, even when stock market returns approximate the historical average 9 to 11% per year over one's retirement years, taken as a whole, an investor who begins retirement shortly before ***weak*** years for the overall market will be more likely to drain a portfolio than a person who retires shortly before ***strong*** market years.

Rather than using long-term historical ***averages***, the analysis in this article uses ***actual*** monthly return and inflation data from 1926 through 2012 for:

- the S&P 500
- U.S. Treasury bills
- long-term U.S. government bonds, and
- the Consumer Price Index (CPI).

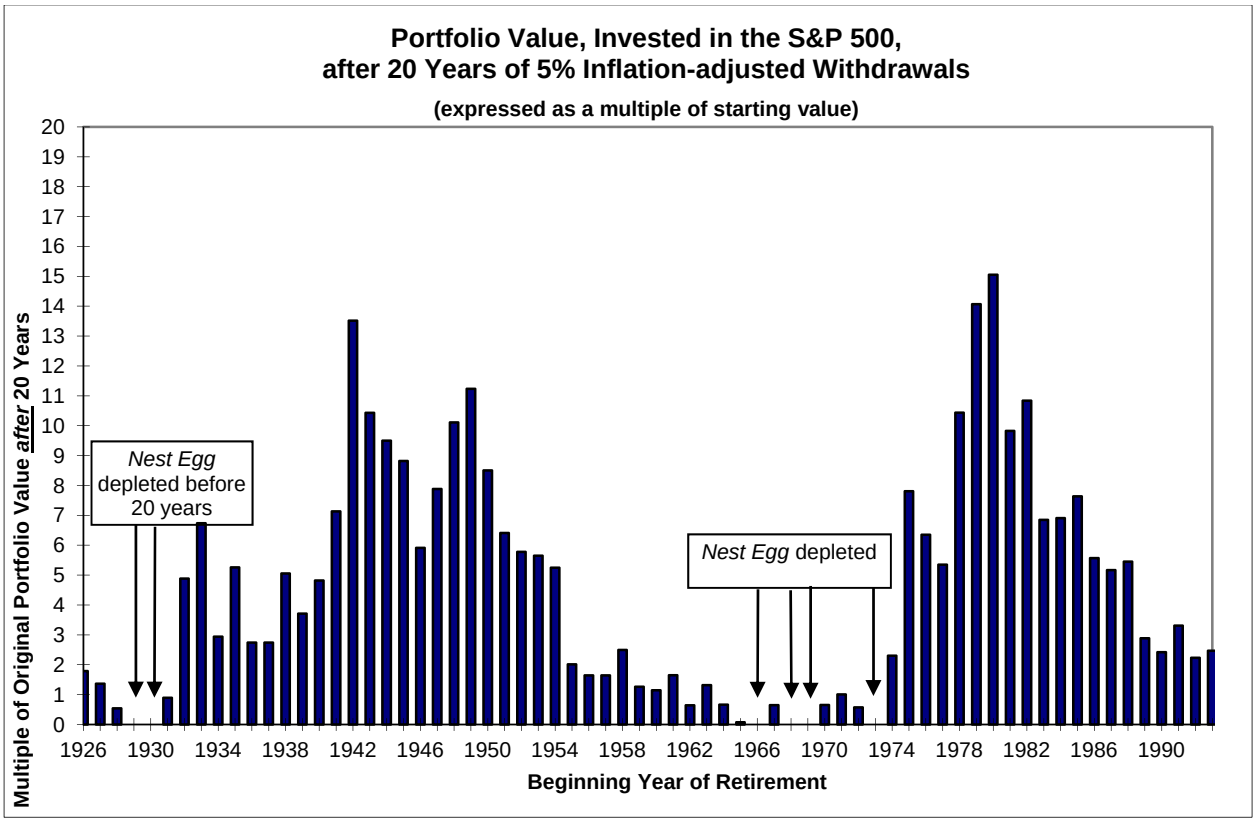
I examine all 68 twenty-year periods starting each January since 1926 and track the value of a hypothetical retirement account, net of monthly withdrawals, to determine whether the account would have survived each 20-year interval. The analysis in this commentary is expanded from its most recent version (which incorporated data through 2008) to include 2009 - 2012 data.

While past economic performance is never a guarantee of future results, this historical approach reveals the impact of realistic fluctuations in rates of return and inflation. Over the past 87 years, the United States has experienced a world war, the cold war, a war on terrorism, multiple recessions (including the Great Depression and the recent Great Recession), simultaneous inflation and slow growth, wage and price controls, expansion and contraction of government regulation, and control by both major political parties. In other words, the data of the last 87 years reflect a wide variety of economic and political conditions, and thus provide some idea of the variation we might experience in the future.

Consider the hypothetical case of Mr. Brown, who plans to supplement his retirement income with monthly withdrawals from his investment portfolio. Further, suppose he determines that an ***initial*** 5% annual withdrawal rate from his account will adequately augment his monthly pension and Social Security income. Should inflation occur, I assume that Brown's withdrawal amount would be increased to maintain its purchasing power. Similarly, in the event of deflation (falling prices, such as occurred during the Great Depression) his dollar withdrawal would be reduced accordingly. The use of inflation-adjusted withdrawals and actual inflation data are important, realistic aspects of this analysis.

Will Mr. Brown's 5% initial annual withdrawal rate (inflation-adjusted each month) be sustainable for 20 years? Answer: "It depends," a typical reply for an economist. Since the S&P 500's returns, bond market returns and consumer prices fluctuated substantially over the past 87 years, the ending value of his nest egg would depend as much on ***when*** he retired as the amount he withdrew. As depicted in Chart 1 below, with a portfolio invested in the S&P 500, had his retirement begun in one of six specific years (two at the beginning of the Great Depression and four between 1966 and 1973), Mr. Brown would have run out of funds before reaching the 20-year mark.

Chart 1



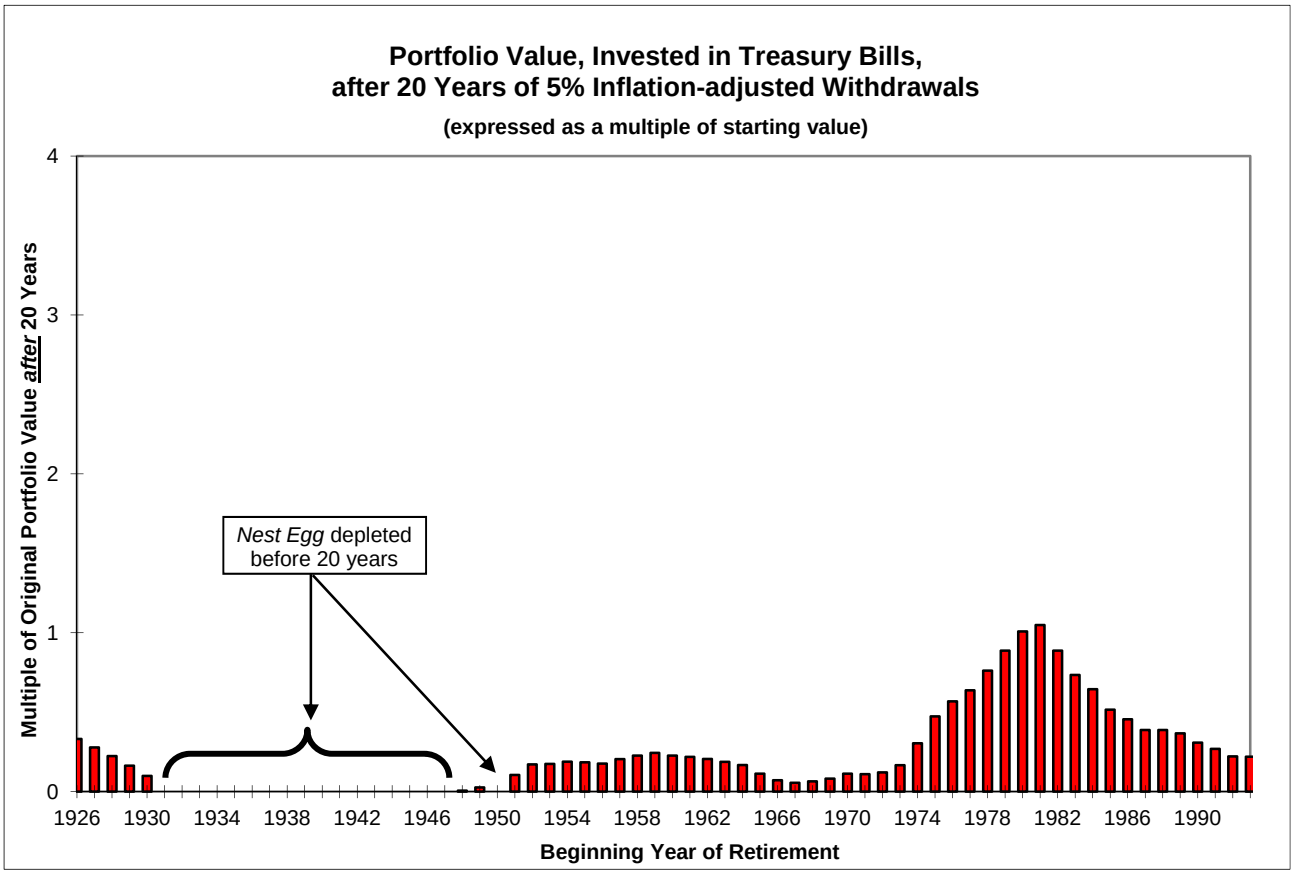
On the other hand, had his retirement started in any of the other 62 years, Brown's ending account value would have been positive—in some cases his nest egg would have grown dramatically. For example, if he started his retirement in January 1980, invested in the S&P 500, and withdrew at an inflation-adjusted 5% rate, his portfolio value on December 31, 1999 would have grown to over 15 times its initial 1980 value! Interestingly, had Brown retired in January 1993 and maintained 5% withdrawals through both the recession and bear market of 2000 – 02 and during the financial crisis and Great Recession of 2007–2009, his portfolio value on December 31, 2012 still would have grown, in this case to almost 2.5 times its initial 1993 value.

The wide range in ending values for the 68 different retirement periods is due essentially to timing. Retiring in the 1960s or early 1970s meant that the nest egg was either depleted entirely or had a lower ending value than for other periods. As many recall, during the turbulent times of OPEC oil shocks and other economic/political turmoil, the U.S. economy experienced recession or relatively slow economic growth combined with rapidly rising prices ("stagflation")—leading to an anemic stock market. Thus, if Mr. Brown retired early in or midway through this period, it was less probable that his 20-year withdrawal objective would have been met.

Paradoxically, while the ***average*** annual rates of growth for the S&P 500 over the 20-year periods starting in 1966, 1968, 1969 and 1973 were all greater than ***8%*** (and over 11% in 1973), had Mr. Brown retired in any of these years, his account would have been exhausted in less than 20 years—by ***5%*** withdrawals. This account depletion resulted in part because the S&P 500 performed poorly in the early years of retirement—and partly because relatively high inflation further strained the portfolio. Withdrawal amounts had to expand repeatedly to keep pace with the advancing CPI, which peaked at a 13.3% annual increase in 1979. As Mr. Brown's situation illustrates, although long-term stock market ***averages*** provide useful information, ***without consideration of both the magnitude and the timing of fluctuations in rates of return and inflation, it is difficult to get an accurate reading of the sustainability of a retirement account.***

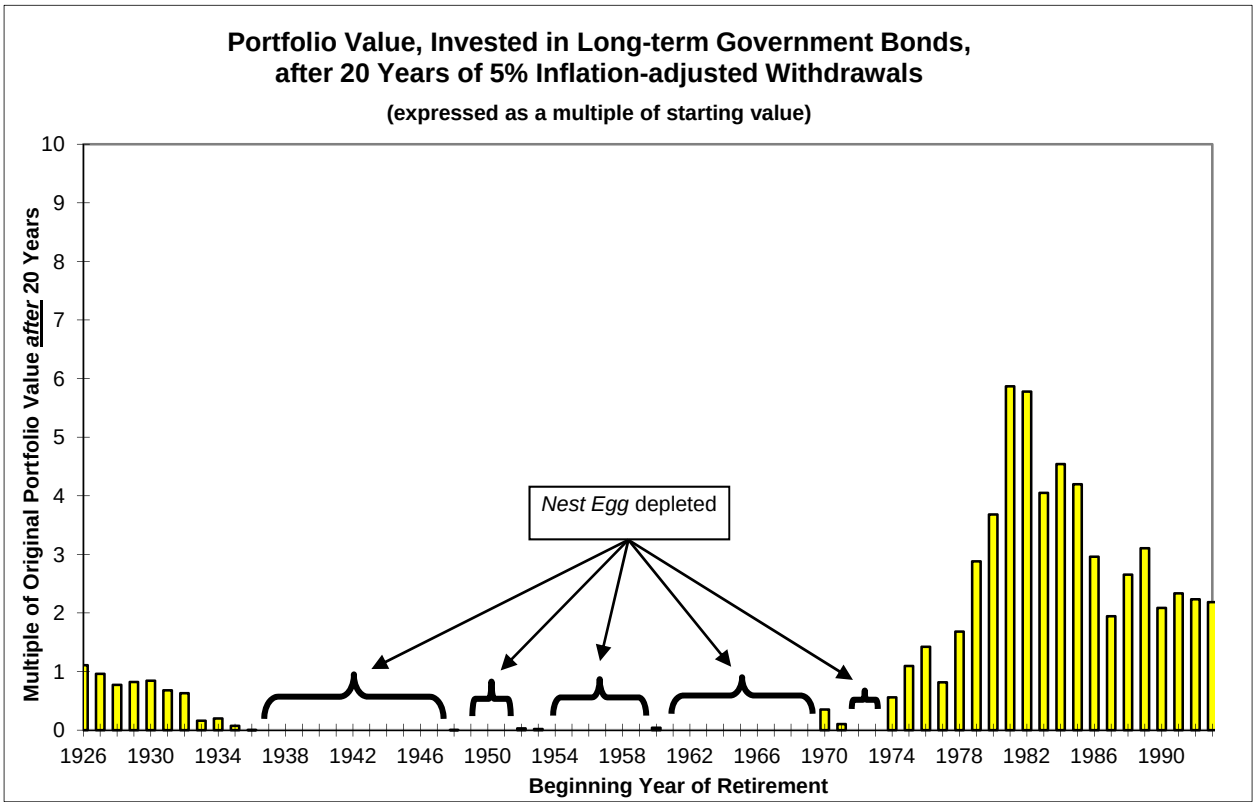
When the stock market performs poorly, such as during 2007–2008, some investors consider other investment options, including U.S. Treasury bills and long-term U.S. government bonds. Using the same approach as above, I calculated what would have happened to Mr. Brown's portfolio had he invested in either Treasury bills or long-term government bonds and maintained a 5% inflation-adjusted monthly withdrawal rate over all the 20-year retirement horizons. As shown in Chart 2, had Brown invested in Treasury bills, his portfolio would have run dry 18 times—triple the number when invested in the S&P 500. Additionally, in only two initial retirement years (1980 and 1981) does the ending multiple (20 years later) exceed the initial retirement-year nest egg – and in both cases the multiple barely exceeds one. Compare Chart 1 and Chart 2, paying special attention to the different vertical scales.

Chart 2



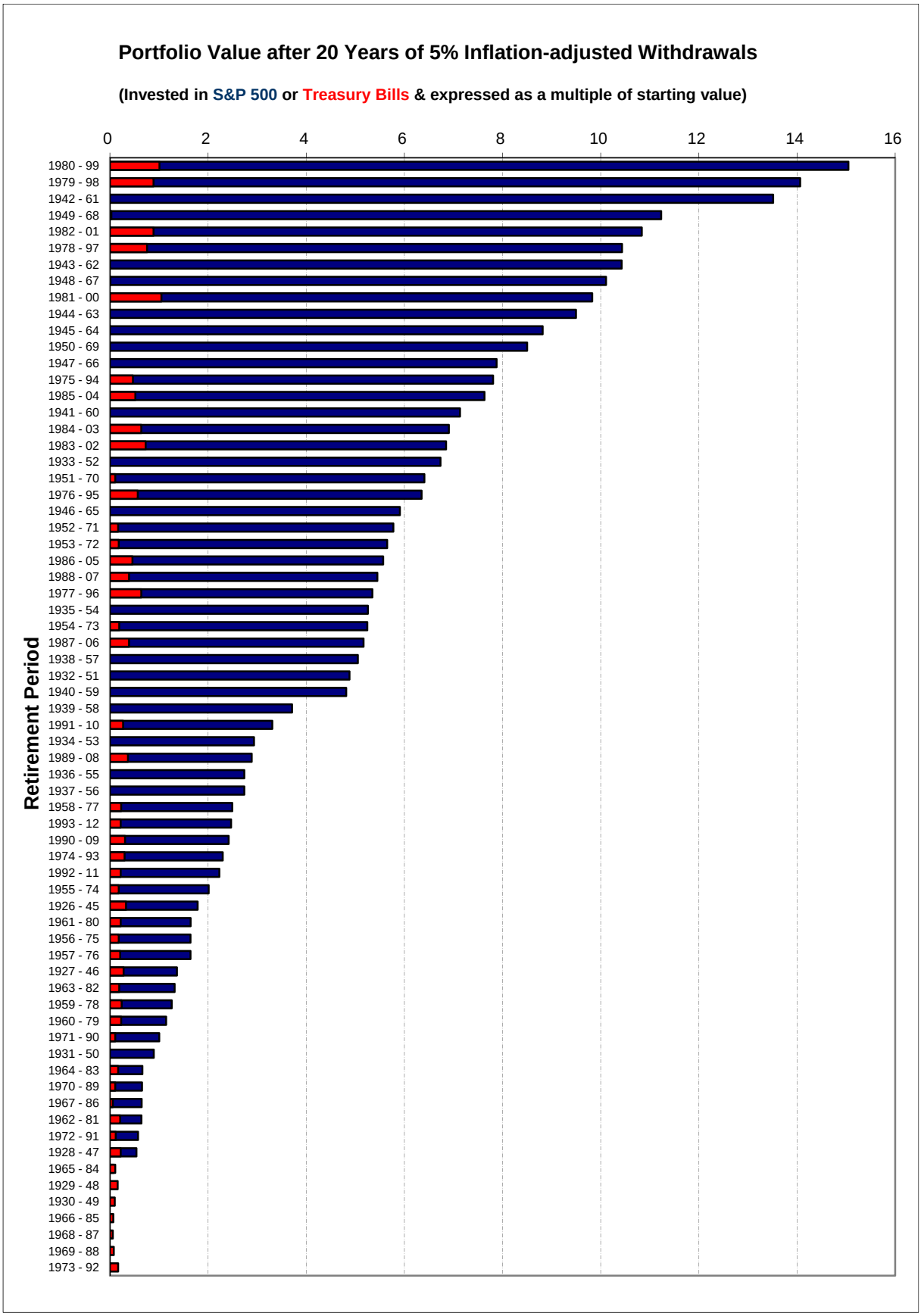
Similarly, Chart 3 shows that had Brown invested in long-term U.S. government bonds, his portfolio would have run dry 31 times—over ***five times*** the number when invested in the S&P 500. The two retirement years (1981 and 1982) showing the greatest ending multiples—both approaching six times the initial retirement nest egg—generated substantially lower multiples than had the same initial portfolio been invested in the S&P 500, with multiples of 9.8 and 10.8 in 1981 and 1982 respectively (from Chart 1). Again, please note the different vertical scales in Chart 1, Chart 2 and Chart 3.

Chart 3



We can get a clearer comparison of stocks and T-bills by viewing Chart 4, where I show the same information depicted in Charts 1 and 2, except this time the 20-year ending multiples are displayed in the order of the highest to lowest for stocks. Note the extreme variation in the ending multiples for the S&P 500 portfolio (blue)—from a high of 15 times the starting value to a low of zero. Given historical S&P 500 returns, this wide variation is essentially due to ***one*** factor—the timing of retirement. As you can see, for many retirement periods, the investor ends 20 years with a substantially larger portfolio. At the high end, a retiree who started with $600,000 and withdrew an inflation-adjusted 5% per year from 1980 through 1999 would end with a portfolio valued at about $9 million—a multiple of 15 times the starting value.

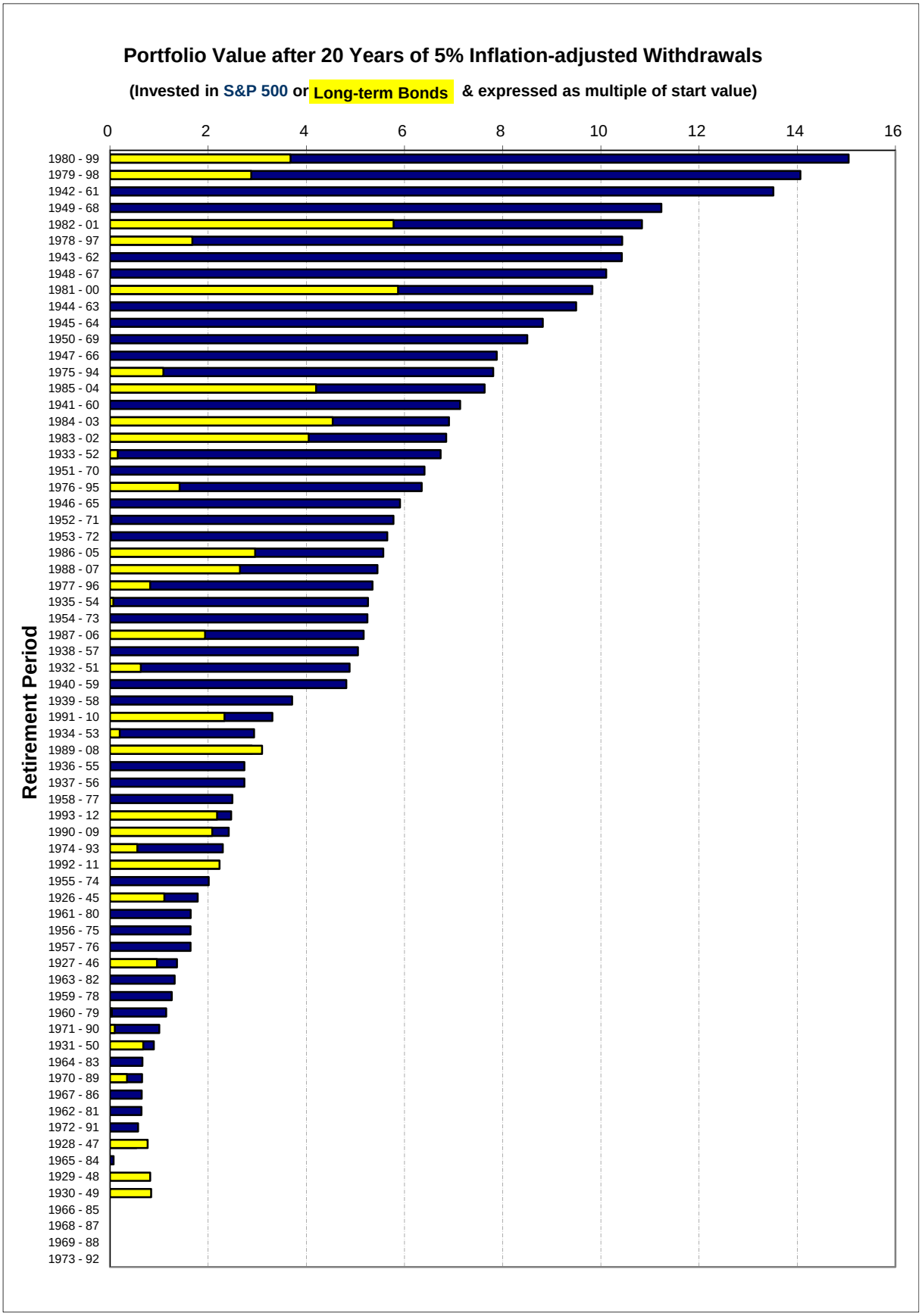
Chart 4


Portfolio Value after 20 Years of 5% Inflation-adjusted Withdrawals
(Invested in S&P 500 or Treasury Bills & expressed as a multiple of starting value)
0
2
4
6
8
10
12
14
16
Retirement Period
1980 - 99
1979 - 98
1942 - 61
1949 - 68
1982 - 01
1978 - 97
1943 - 62
1948 - 67
1981 - 00
1944 - 63
1945 - 64
1950 - 69
1947 - 66
1975 - 94
1985 - 04
1941 - 60
1984 - 03
1983 - 02
1933 - 52
1951 - 70
1976 - 95
1946 - 65
1952 - 71
1953 - 72
1986 - 05
1988 - 07
1977 - 96
1935 - 54
1954 - 73
1987 - 06
1938 - 57
1932 - 51
1940 - 59
1939 - 58
1991 - 10
1934 - 53
1989 - 08
1936 - 55
1937 - 56
1958 - 77
1993 - 12
1990 - 09
1974 - 93
1992 - 11
1955 - 74
1926 - 45
1961 - 80
1956 - 75
1957 - 76
1927 - 46
1963 - 82
1959 - 78
1960 - 79
1971 - 90
1931 - 50
1964 - 83
1970 - 89
1967 - 86
1962 - 81
1972 - 91
1928 - 47
1965 - 84
1929 - 48
1930 - 49
1966 - 85
1968 - 87
1969 - 88
1973 - 92

The so-called “equity premium,” the amount by which S&P 500 returns outdistance low volatility T-bills, is clearly visible in Chart 4, as the S&P 500 ending multiples (in blue) noticeably dominate those of T-bills (in red). While there were only seven 20-year periods when a T-bill-invested portfolio outperformed the stock portfolio, there were 61 periods when the S&P 500 outperformed T-bills, and in most of those winning periods, the blue bars (stocks) are much longer than the red bars (T-bills), reflecting a relatively large premium provided equity investments.

In Chart 5, I incorporate the information displayed in Charts 1 and 3, again with the 20-year ending multiples displayed from highest to lowest for stocks. Once again, the dominance of the S&P 500 stock portfolio, this time over a long-term government bond portfolio, is evident by the degree to which the blue bars (stocks) exceed the yellow bars (long-term bonds). In only five of the 68 periods would a long-term bond portfolio have ended the 20-year period with a greater multiple of starting value, and then only slightly exceeding the stock portfolio. For example, had Brown retired in 1992 and invested in stocks, after 20 years of inflation-adjusted 5% withdrawals, the portfolio would have ended at 2.232 times its starting value, whereas a long-term bond portfolio would have finished at a slightly higher 2.237 times its starting value. For four other initial years, 1928–1930 and 1989, Brown would have finished a 20-year retirement with a higher ending multiple if invested in long-term bonds instead of the S&P 500. For all other intervals, stocks performed better, sometimes substantially better.

Chart 5

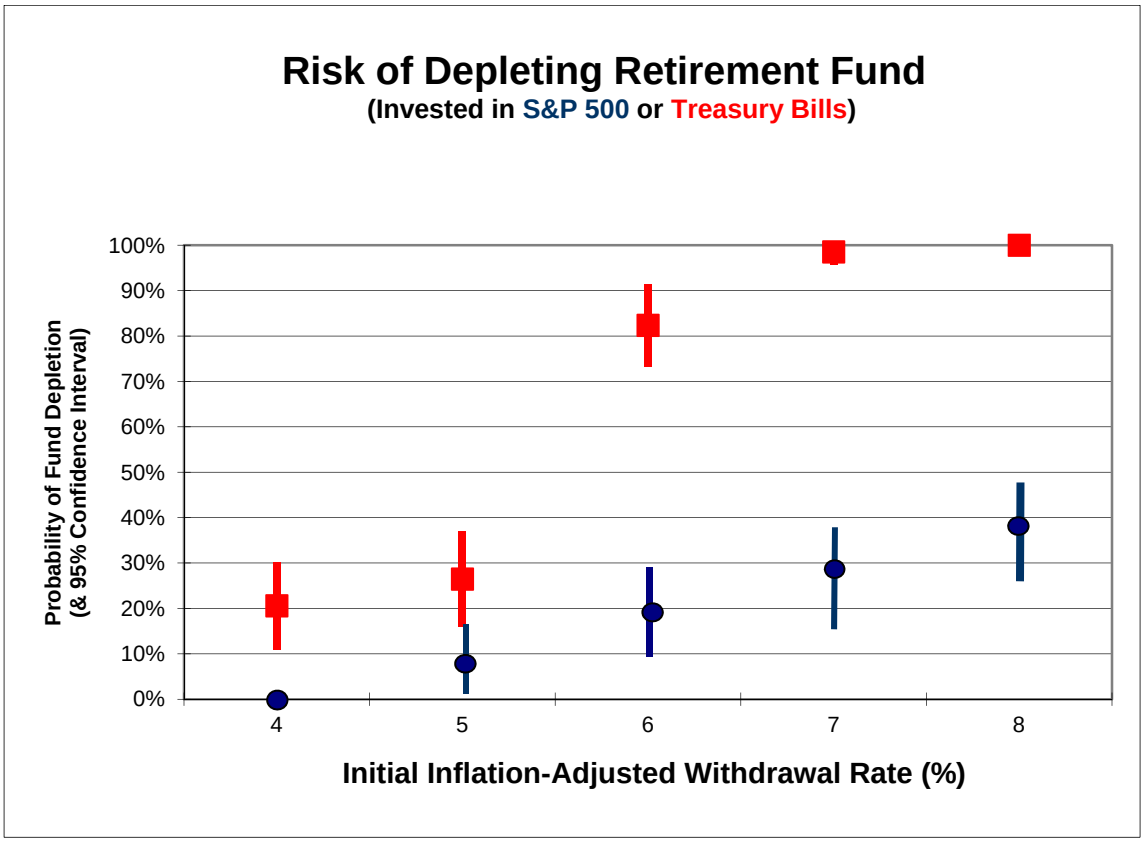

Portfolio Value after 20 Years of 5% Inflation-adjusted Withdrawals
(Invested in S&P 500 or Long-term Bonds & expressed as multiple of start value)
0
2
4
6
8
10
12
14
16
Retirement Period
1980 - 99
1979 - 98
1942 - 61
1949 - 68
1982 - 01
1978 - 97
1943 - 62
1948 - 67
1981 - 00
1944 - 63
1945 - 64
1950 - 69
1947 - 66
1975 - 94
1985 - 04
1941 - 60
1984 - 03
1983 - 02
1933 - 52
1951 - 70
1976 - 95
1946 - 65
1952 - 71
1953 - 72
1986 - 05
1988 - 07
1977 - 96
1935 - 54
1954 - 73
1987 - 06
1938 - 57
1932 - 51
1940 - 59
1939 - 58
1991 - 10
1934 - 53
1989 - 08
1936 - 55
1937 - 56
1958 - 77
1993 - 12
1990 - 09
1974 - 93
1992 - 11
1955 - 74
1926 - 45
1961 - 80
1956 - 75
1957 - 76
1927 - 46
1963 - 82
1959 - 78
1960 - 79
1971 - 90
1931 - 50
1964 - 83
1970 - 89
1967 - 86
1962 - 81
1972 - 91
1928 - 47
1965 - 84
1929 - 48
1930 - 49
1966 - 85
1968 - 87
1969 - 88
1973 - 92

The equity premium we observe in our analysis has been analyzed by many financial experts and economists over the years. Extending the S&P 500 data to include the entire twentieth century, Yale economist Robert Shiller estimated an average ***inflation-adjusted*** (real) equity return of 6.0% per year. Similar gaps between stock and short-term money returns have also been observed in other countries, including Japan, Britain and Germany. In a 2009 research report published in the *Journal of Economic Perspectives*, University of California Berkeley economist J. Bradford DeLong concluded that "it is likely that the equity premium return is not just part of our past, but of our present and future as well." Without a plausible explanation as to why the future is likely to be significantly different from the wide range of economic environments of the past, my own reasoning also leads to the conclusion that the long-run premium on equity investments should continue over the coming decades.

So how should retirees establish a withdrawal percentage? To assist with this discussion, I have calculated the sustainability of Brown's nest egg for a number of initial withdrawal rates, from a low of 4% to a high of 8%. Chart 6 shows the historical probability of running out of funds at each rate, for both a stock portfolio (blue) and a portfolio of Treasury bills (red). For example, at a 5% initial withdrawal rate, Brown's S&P-invested nest egg would have run dry in six of 68 twenty-year retirement periods—an 8.8% historical probability of depletion, shown with a blue circle (consistent with Chart 1).

In addition, the vertical bars in the chart depict 95% confidence intervals above and below the average probability of portfolio depletion. That is, the probability of future account depletion is estimated (with historical data and the use of statistics) to fall in the ranges depicted. For instance, had Brown chosen a 6% withdrawal rate from his stock portfolio (blue), his account balance would have fallen to zero in 13 of 68 twenty-year retirement periods. Based on this historical data, we can estimate that the chance of running out of funds in the future is between 9.8% and 28.5%, given an equity portfolio and a 6% annual withdrawal rate. Obviously, as the withdrawal rate rises, the chance of exhausting one's nest egg also climbs. As shown in Chart 6, an 8% withdrawal rate from an S&P 500 portfolio generates a probability of 25.3% to 48.2% that the account will become depleted in less than 20 years.

Chart 6



You can see why some researchers recommend an annual withdrawal rate of 4% from a diversified stock portfolio. At this rate, Mr. Brown could have retired in any year from 1926 through 1993, and his nest egg would have survived a 20-year retirement. If the future is similar to the past, then a 4% withdrawal rate appears quite safe. Given the past 87-year history of stock returns and inflation, some may argue that a 5% withdrawal rate—with only a 2.1% to 15.6% chance of depletion—represents an acceptable risk to bear.

One way to have your cake and eat it too is to follow the approach advocated in *The Adaptive 5% Solution* commentary (at *http://jvbruni.com/commentary-adaptive5%202013.htm*) on our website —use a 5% withdrawal rate that's based on a portfolio's changing value. The benefit of this approach is, as *The Adaptive 5% Solution* states, "investors who can tighten their belts after lean investment returns can relax their withdrawal limits after stronger years to enjoy the fruits of better years." In other words, investors can enjoy the benefits of a greater withdrawal amount following strong market periods, but still protect against account depletion after market declines; thus making it more likely that the nest egg and adaptive withdrawals are sustainable over a 20-year retirement.

As you can also see in Chart 6, if a retiree chooses to withdraw at any of the rates shown, the probability of depleting a portfolio invested in Treasury bills (red) is significantly higher. While the T-bill portfolio displays less volatility in its rate of return, it carries substantial risk of depletion prior to the 20th year of withdrawals. Put differently, although T-bills are not commonly regarded as risky investments, they do carry significant risk of long-term portfolio depletion. Even at a low 4% withdrawal rate, the historical average probability of depletion rises to 21%, and we can be reasonably sure (with 95% confidence) that the chance of running out of funds is between 11% and 30%. At a 6% withdrawal rate, the probability of fund depletion rises to over 82%, well above an appropriate level for any retiree. At a 5% withdrawal rate, long-term

government bonds (not shown in Chart 6) have greater historical probability of depletion (45.6%) than a T-bill portfolio.

In conclusion, while a stock portfolio tends to display greater volatility in annual returns than a portfolio invested in Treasury bills or long-term government bonds, when viewed over a 20-year horizon, the S&P 500 provides significantly lower risk of running out of funds during retirement. If the actual 20th century pattern of returns is a good proxy for the future set of returns investors will experience, then investors who want to guard against running out of funds during their retirement years would be well advised to consider including sufficient equities in their portfolio.

John R. Brock, Ph.D.
Vice President