

***The 4% Rule is Not Safe in a Low-Yield World***

by

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### **Executive Summary**

- The safety of a 4% initial withdrawal strategy depends on asset return assumptions. Using historical averages to guide simulations for failure rates for retirees spending an inflation-adjusted 4% of retirement date assets over 30 years results in an estimated failure rate of about 6%. This modest projected failure rate rises sharply if real returns decline.
- As of January 2013, intermediate-term real interest rates are about 4% less than their historical average. Calibrating bond returns to the January 2013 real yields offered on 5-year TIPS, while maintaining the historical equity premium, causes the projected failure rate for retirement account withdrawals to jump to 57%. The 4% rule cannot be treated as a safe initial withdrawal rate in today's low interest rate environment.
- Some planners may wish to assume that today's low interest rates are an aberration and that higher real interest rates will return in the medium-term horizon. Although there is little evidence to support this assumption, we estimate how a reversion to historical real yields will impact failure rates.
- Because of sequence of returns risk, portfolio withdrawals can cause the events in early retirement to have a disproportionate effect on the sustainability of an income strategy. We simulate failure rates if today's bond rates return to their historical average after either 5 or 10 years and find that failure rates are much higher (18% and 32%, respectively for a 50% stock allocation) than many retirees may be willing to accept.
- The success of the 4% rule in the U.S. may be an historical anomaly, and clients may wish to consider their retirement income strategies more broadly than relying solely on systematic withdrawals from a volatile portfolio.

For the data used in William Bengen's pioneering study on safe withdrawal rates, the average real return on bonds was 2.6%. Sustainable retirement withdrawal simulations assume this real rate of return on bond investments within a portfolio. At the start of 2013, real bond yields are much lower. Investors in inflation-protected treasury bonds (TIPS) are currently accepting a negative real return on bond investments for maturities below 20 years. Treasury rates of return are below current and projected near-term inflation rates, and even the nominal rate of return on 10-year treasuries is below 2 percent.

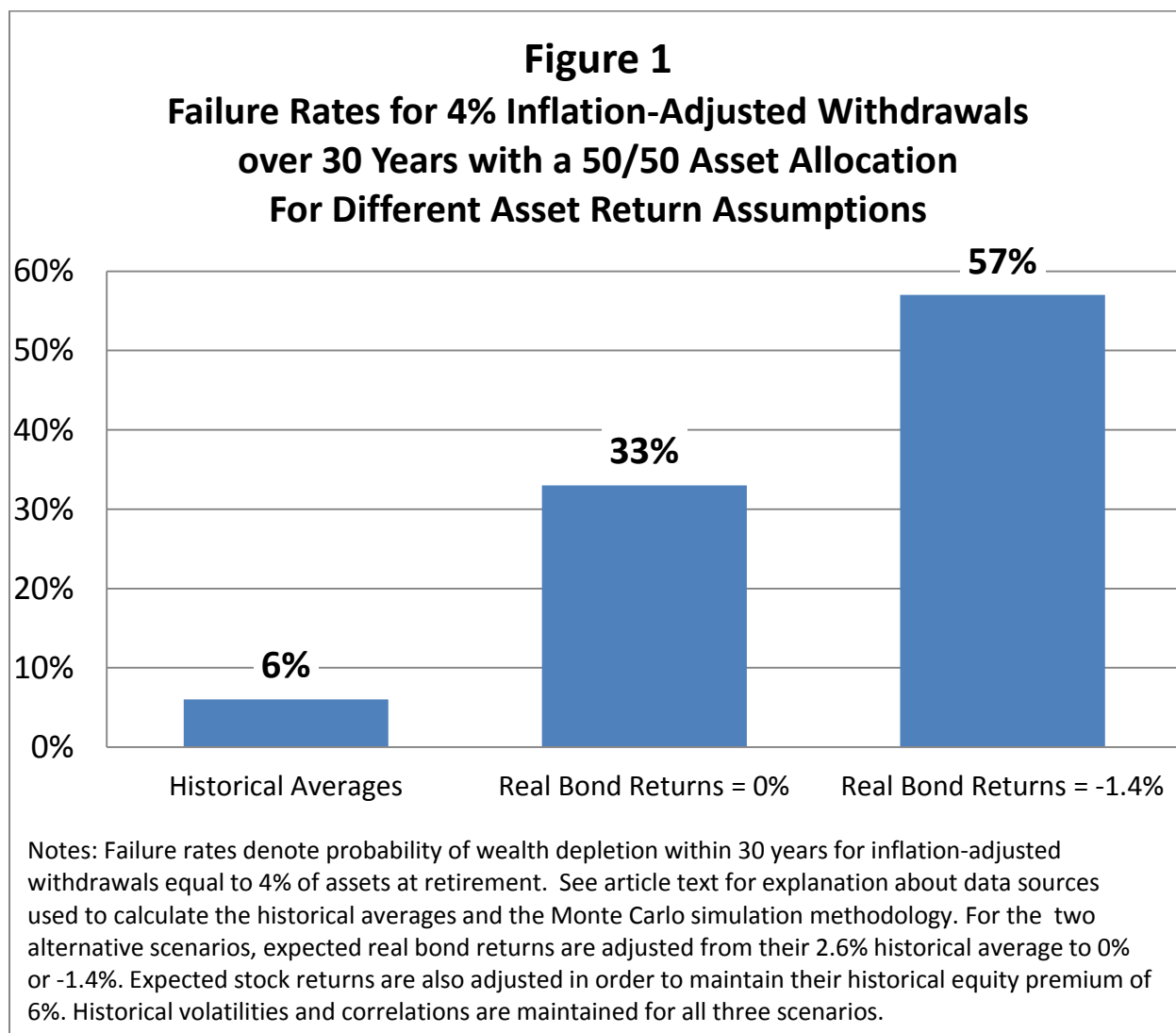
Financial planners faced with low current bond yields have two principal choices if they want to follow a traditional safe withdrawal strategy in retirement. The first is to assume that the current market price is the best estimate of future bond yields. This allows us to simulate a safe withdrawal rate in a low yield environment. There is convincing empirical evidence that today's return is a consistent predictor of 10-year returns, and that the first ten years of returns in retirement have a disproportionate impact on retirement failure rates (Milevsky and Abaimova, 2006, Pfau, 2011b).

The second is to assume that low bond yields are an aberration and that higher real yields will eventually return. The implicit assumption is that bond returns are mean reverting and will likely increase in the future. We find very little evidence to support this scenario in the literature. We do, however, estimate what will happen to retirement income failure rates if real yields go back up. Our results suggest that even relying on rosier future yield assumptions is not a panacea that will dramatically improve the safety of an inflation-adjusted withdrawal amount calibrated to 4% of retirement date assets.

Our primary objective is to explore what happens when we assume that today's interest rates reflect future expectations of bond returns within a retirement portfolio. If we assume that the future real bond return for today's retirement portfolios is near zero and follow the traditional withdrawal rate methodology that has given us the 4% rule, what withdrawal rate will be safe for today's retirees? In other words, what percentage of retirement date assets can be spent, with that amount adjusted for inflation in subsequent years, to provide sustainability over a 30-year retirement with a sufficiently high probability? With equity market returns corrected for these lower risk-free rates, we provide scenarios with flat real bond yields and with current negative real yields.

To illustrate the sensitivity of failure rates to changes in yield assumptions, we estimate in Figure 1 failure rates using current market yields. Using historical data, William Bengen had shown that the 4% rule had always worked over in overlapping 30-year historical periods using an asset allocation of 50% stocks and 50% bonds. With Monte Carlo simulations based on the same historical data, the increasing number of simulated runs tends to result in a failure rate, which is the percentage of cases in which withdrawals are not sustainable for 30 years, of about 6% for the same retirement strategy. These Monte Carlo simulations are based on average real bond returns of 2.6% and average real stock returns of 8.6%. If we adjust both the bond and stock return downward by 2.6% (this maintains the

same historical average premium that stocks earned over bonds), the failure rate jumps to 1 in 3. And if we calibrate bond returns to the January 2013 real yields offered on 5-year TIPS, while maintaining the historical equity premium, the failure rate jumps to a whopping 57%. These results illustrate that the 4% rule cannot be treated as a safe initial withdrawal rate in today's low interest rate environment.



We also discuss the implications of the second scenario – that bond yields will increase in the future, allowing higher sustainable withdrawals today. To do this, we simulate the impact of an increase in real rates to their historical average. But because of sequence of returns risk, research shows a future climb in real interest rates is not as promising as one might suspect. If real bond returns center around -1.4% for 10 years and then revert to the historical 2.6% average, the failure rate drops from 57% to 32%. And if the interest rate reversion happens in 5 years, the failure rate is still 18%. In both cases, these failure rates are significantly higher than when using historical averages for the entire retirement period. And these failure rate estimates are really best case scenarios for a future

interest rate rise, as they do not incorporate any capital losses which many retirees may experience on their medium and long-term bond holdings when real interest rates suddenly rise by 4%.

Assuming that interest rates will rise in the medium term is not a valid justification for using historical averages when simulating retirement outcomes since asset returns during the first few years of retirement have an overwhelming impact on eventually running out of money. Below-average returns cause retirees to consume a larger percentage of their portfolios earlier in retirement, leaving less assets available with which to capture any subsequent market rebounds. This is why William Bengen found that the safe withdrawal rate is less than the average portfolio return. Pfau (2011b) estimated that the cumulative portfolio returns and inflation in the first 10 years of retirement explain about 80% of the final retirement outcomes.

### **Can We Rely on Rising Bond Rates?**

A basic bond pricing model is the so-called Fisher equation that decomposes the bond interest rate into two basic features – the real rate of interest and inflation expectations. Our current low interest rates can be seen as extremely low inflation expectations or a very low real yield (or both). Fortunately, TIPS eliminate any consideration of inflation expectations since their values rise and fall to counteract changes in periodic inflation rates. We can look at current and future TIPS rates to place a market value on the current real rate of return on bonds.

The real rate of return with financial markets represents the marginal investor's willingness to trade consumption over time. In other words, when they give up \$1 in spending today by buying a bond, how much additional purchasing power will they receive in the future? Current TIPS rates indicate that the market is essentially trading purchasing power across time without any real premium for deferred consumption for durations up to 20 years. In other words, investors are willing to give up a dollar today to receive a dollar's worth of inflation-protected spending in twenty years<sup>1</sup>. They are willing to give up a dollar in spending today to receive 92 cents worth of spending in ten years.

Low yields on bonds appear to be the result of excess demand fueled both by the demographics of an aging population and the growth of economies with higher average savings rates (Arnott and Chaves, 2011). As populations continue to age, it is likely that demand for fixed-income securities and equities will continue to be strong (Bakshi and Chen, 1994). Governments have also increased the supply of bonds, adding to national debt among many developed countries. Any rise in nominal rates as a result of excessive debt, however, will likely be accompanied by inflation rather than real yields.

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<sup>1</sup> A recent working paper by Carolin Pflueger and Luis Viceira of the Harvard Business School argues that TIPS rates also include an illiquidity premium of roughly 70 basis points above comparable short-term bond investments. This is because TIPS are traded less frequently than other government bonds. A less liquid market implies that current TIPS rates underestimate the market's willingness to trade real consumption over time (the rate is higher than it would be in the absence of an illiquidity premium).

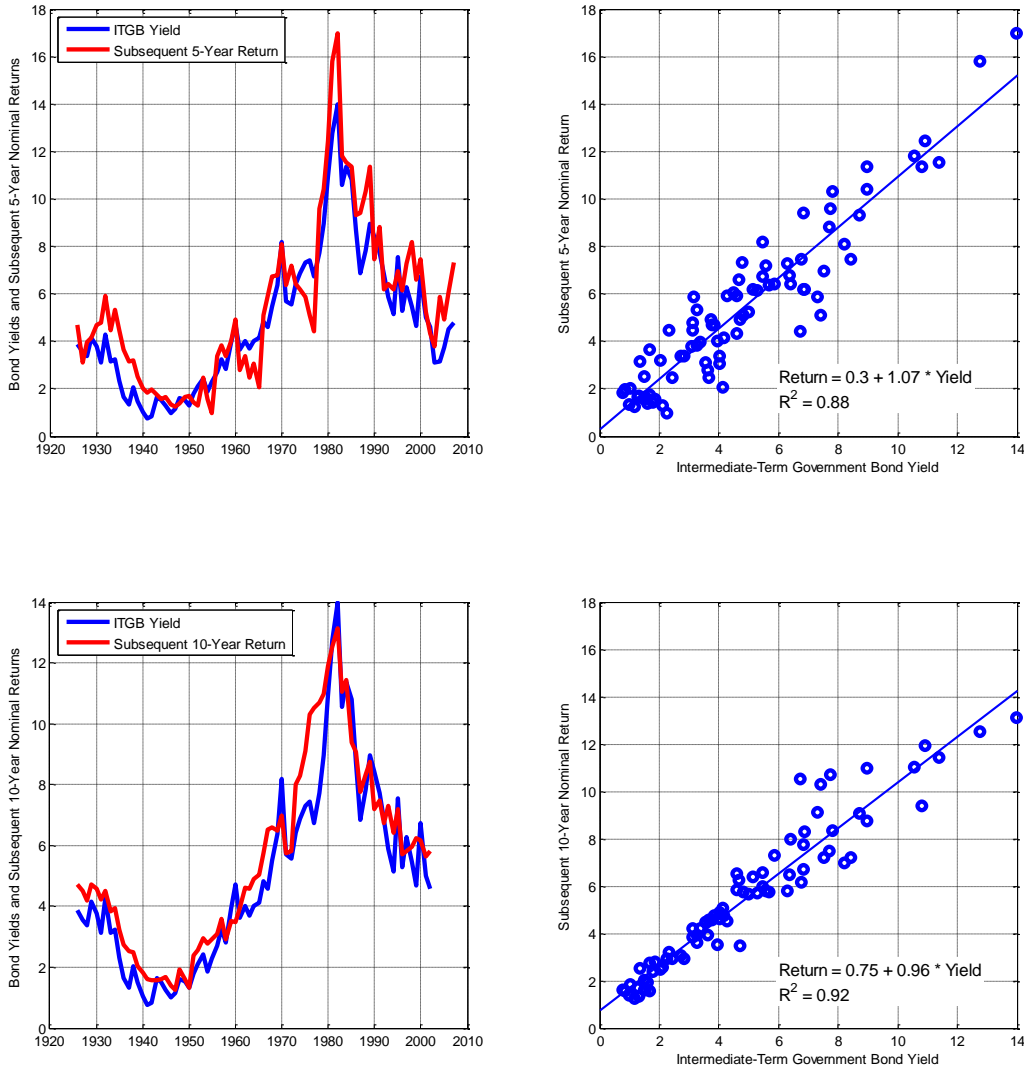
An investor may reject the hypothesis that demographic and macroeconomic factors will keep real rates low. Beyond this, there is little empirical evidence that bond yields do tend to revert back to the mean. An early model theory of bond mean reversion introduced by mathematician Oldrich Vasicek (1977) suggests that interest rates tend to bounce around a mean historical long-run trend. There are three components of this model – the long run trend itself, drift, and dispersion. Retirees today should be most interested in the drift concept. Think of the historical interest rate average as a magnet attracting extreme interest rates back to the central tendency. Each year interest rates vary according to some random effect, the size of which is part of the process and can be estimated with an historical standard deviation, but generally move back in the direction of the mean. The drift component means that tomorrow's interest rates are likely to look exactly like today's interest rates within a band of randomness. But the general direction of that drift is likely going to be toward the mean. Our best guess of tomorrow's interest rates is whatever they are today, plus or minus a certain amount of random movement, but in the general direction of the historical average.

In a recent review of the evidence on interest rate mean reversion using 200 years of data across four countries including the U.S. (van den End, 2011), there appears to be little evidence that bonds consistently revert back to their historical average in any predictable manner. In other words, interest rates can be higher or lower than the average for long periods of time and it is impossible to predict when they will return to the mean. Evidence of the persistence of nominal bond rates can be found by simply comparing the relation between current yields and subsequent returns in the United States. Figure 2 shows the relationship between bond yields and the future average annualized return on bonds using the Ibbotson Intermediate-Term Government Bond (ITGB) index as a proxy for bonds.

The historical relation between bond yields and the future average annualized return on bonds has been quite strong, with a coefficient of determination ( $R^2$ ) of 88% for subsequent 5-year returns and 92% for subsequent 10-year returns. This means that the current yield on bonds can describe 92% of variation in the average annual 10-year compounded bond return. If we assume a current bond yield of 0.7% (which is the nominal yield on a 5-year constant maturity nominal Treasury bond at the start of January 2013), the average annualized bond return is expected to be 1.1% over the next 5 years and 1.4% over the next 10 years, using the linear regression model in Figure 2. This is considerably less than the average nominal return of 5.5% for the ITGB index since 1926. It is also likely to be considerably less than inflation, as the best estimates for inflation can be found by comparing constant maturity Treasury yields and TIPS yields. At the start of January, these breakeven inflation rates are 2.1% over the next 5 years (5-year Treasury of 0.7% and 5-year TIPS of -1.4%) and 2.5% over the next 10 years (10-year Treasury of 1.9% and 5-year TIPS of -0.6%).

Figure 2

Relationship Between Bond Yields and Subsequent Bond Returns



While increasing bond yields would result in higher returns for new bond investors, it would negatively affect those currently holding bonds. One method to approximate the impact of a change in interest rates on the price of bonds is to multiply the bond's duration by the change in interest rates times negative one. For example, if interest rates increase by 2%, a bond with a duration of 5 years (the approximate current duration of the Barclays Aggregate Bond index) would decrease in value by 10%. The impact on bonds with longer durations (e.g., 15 years) would obviously be even more extreme.

### Safe Withdrawal Rate Studies

We can classify existing withdrawal rate studies into several categories. First are studies that use overlapping periods from the historical data. The most common historical data are Ibbotson Associates' *Stocks, Bonds, Bills, and Inflation* (SBBBI) data for total returns in U.S. financial markets since 1926. Studies of this nature tend to support a relatively high stock allocation in retirement and tend to provide the strongest support for the safety of the 4 percent rule. For instance, the seminal Bengen (1994) article concludes that retirees in all historical circumstances could safely withdraw 4 percent of their assets at retirement and adjust this amount for inflation in subsequent years for a 30-year retirement duration. Using the S&P 500 and intermediate-term government bonds (ITGB), he determines that retirees are best served with a stock allocation between 50 and 75 percent, concluding "stock allocations below 50 percent and above 75 percent are counterproductive."

A second approach to studying withdrawal rates is to use Monte Carlo simulations which are parameterized to the same historical data used in historical simulations. This can be done either by randomly drawing past returns from the historical data to construct 30-year sequences of returns in a process known as bootstrapping, or by simulating returns from a distribution (usually a normal or lognormal distribution) that matches the historical parameters for asset returns, standard deviations, and correlations. This simulation approach has the advantage of allowing for a greater variety of scenarios than the rather limited historical data can provide (between 1926 and 2012, there are only 58 rolling 30-year periods). Monte Carlo simulation studies generally show slightly higher failure rates for stock allocations in the 50 to 75 percent range. At the same time, if past returns do not reflect the distributions for future returns - for example if the mean return on assets is lower - then these Monte Carlo simulations will overestimate the sustainability of various withdrawal rates.

We follow a third approach, which is to base Monte Carlo simulations on current market conditions rather than using historical averages. This is not to say that we are skilled at forecasting. As illustrated in Figure 2, there is strong evidence that current bond yields explain future bond returns consistently. Since current intermediate-term real bond yields are 4% less than the historical average, a cautious retiree must plan for lower bond and stock returns in the future, even if the equity premium for stocks maintains its historical average. Some previous studies consider asset returns that are based on current market indicators rather than on historical averages. Blanchett and Blanchett (2008) make the point that future returns for a 60/40 portfolio could be one or two percentage points less than historical averages and show how portfolio failure rates relate to changes in both the assumed return and standard deviation. Kitces (2008) explains how sustainable withdrawal rates can be linked to stock market valuation levels, and Pfau (2011a) demonstrates how sustainable withdrawal rates can be explained fairly well with a regression model using stock market valuations, dividend yields, and bond yields at the retirement date. Pfau (2012) provides a framework for planners to develop their own estimates for safe withdrawal rates based on their own capital market expectations and asset class choices.



## Methodology and Data

The maximum sustainable withdrawal rate (MWR) is the highest withdrawal rate that would have provided a sustained real income over a given retirement duration. At the beginning of the first year of retirement, an initial withdrawal is made equal to the specified withdrawal rate times accumulated wealth. Remaining assets then grow or shrink according to the asset returns for the year. At the end of the year, the remaining portfolio wealth is rebalanced to the target asset allocation. In subsequent years, the withdrawal amount adjusts by the previous year's inflation rate and the order of portfolio transactions is repeated. Withdrawals are made at the start of each year and the amounts are not affected by asset returns, so the current withdrawal rate (the withdrawal amount divided by remaining wealth) differs from the initial withdrawal rate in subsequent years. If the withdrawal pushes the account balance to zero, the withdrawal rate was too high and the portfolio failed. The MWR is the highest rate that succeeds. Taxes are not specifically incorporated and any taxes would need to be paid from the annual withdrawals. To be consistent with Bengen's original study, we do not incorporate fees, which suggests that our results are more optimistic than otherwise. Monte Carlo simulations are performed using a lognormal distribution for  $(1 + \text{return})$ .

**Table 1**  
Summary Statistics for U.S. Real Returns and Inflation Data, 1926 - 2011  
Correlation Coefficients

	Arithmetic Means	Geometric Means	Standard Deviations	Stocks	Bonds	Bills	Inflation
Stocks	8.6%	6.5%	20.3%	1	0.08	0.10	-0.19
Bonds	2.6%	2.3%	6.8%	0.08	1	0.70	-0.60
Bills	0.7%	0.6%	3.9%	0.10	0.70	1	-0.73
Inflation	3.1%	3.0%	4.2%	-0.19	-0.60	-0.73	1
Equity Premium	6.0%						
5-Year TIPS Yield	-1.4%						

Source: Own calculations from Stocks, Bonds, Bills, and Inflation annual data provided by Morningstar and Ibbotson Associates. The U.S. S&P 500 index represents the stock market, intermediate-term U.S. government bonds represent the bond market, and bills are U.S. 30-day Treasury bills. The current 5-Year TIPS yield (at the start of 2013) is from the St. Louis Federal Reserve Bank.

To consider how capital market expectations affect withdrawal rates and asset allocation, planners can identify the expected real arithmetic returns, standard deviations, and correlations between assets which they intend to include in their clients' portfolios. Frequently, studies are based on historical data parameters, and Table 1 provides this information for large-capitalization stocks, intermediate-term governments bonds, and Treasury bills. Our simulations investigate the impact of current market conditions, with expected returns adjusted for the current yield on 5-year TIPS, a real asset with the same maturity as the ITGB index. Our assumption that risk-free bond rates are lower than the historical average also affects estimates of real equity yields since stock returns are a combination of real risk-

free returns and a risk premium according to the capital asset pricing model (CAPM). The historical real average equity return of 8.6% can be seen as a combination of the real return on risk free assets (2.6%) and the equity premium (8.6% - 2.6%, or 6.0%). Current risk free real yields from TIPS are -1.4%. If we project the same 6% risk premium on stocks, then the projected net real return from equity investments is 4.6%<sup>2</sup>. If we project no real return on risk free assets, then the equity premium would be 6%.

In addition to maintaining the same return assumptions throughout the entire retirement, we will also consider cases in which current market conditions define the returns for the first part of retirement, and then returns revert back to their historical averages later in retirement. The purpose of doing this is to investigate the role of sequence of returns risk, and whether failure rates will increase dramatically even if historical averages return in five or 10 years. These estimates would really be the best case scenarios, because any increase in interest rates will likely result in capital losses for bond holdings which are not considered in the analysis.

## Results

Figure 1 in the introduction summarized our main results. Table 2 provides more detailed information about failure rates for inflation-adjusted withdrawals set equal to 4% of retirement date assets (the 4% rule) over a 30-year period using several different asset allocations and capital market expectations. The stock allocations shown in Table 2 include 30%, 50%, and 70%. With the historical data, failure rates range between 6 and 8%. What may be surprising, however, is how dramatically failure rates can increase when return assumptions are reduced. For instance, return assumptions for a popular financial planning software program include average real bond returns of 1.75% and average real stock returns of 5.5%. With these assumptions, the failure rates for our selected asset allocations ranged from 24 to 27%. Moving closer to current conditions, if we assume real bond returns of 0% and the historical equity premium, failure rates are 47% for 30% stocks, 33% for 50% stocks, and 28% for 70% stocks. And considering the historical equity premium connected to current real bond yields, we estimate failure rates for the 4% rule of 77% for 30% stocks, 57% for 50% stocks, and 46% for 70% stocks.

The next two sets of assumptions in Table 2 begin with current market conditions and adjust upward to historical averages later in the retirement. In the first example, historical averages guide the simulations after 10 years. In this case failure rates range from 32% to 43% for the selected asset allocations. In the final example, historical averages return after five years. In this case, failure rates range from 18% to 22% for the selected asset allocations. As mentioned, these are really best case scenarios that do not account for additional potential market losses when

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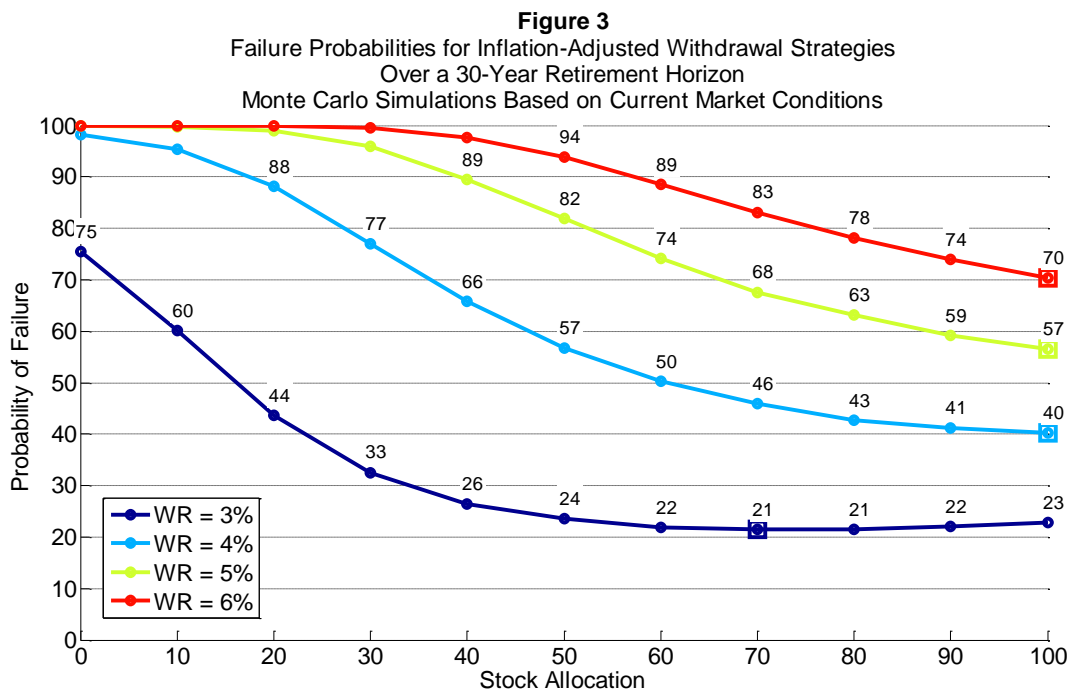
<sup>2</sup> The assumption that the equity risk premium will equal the historical premium may be overly optimistic. Current equity valuations scaled by 10-year corporate earnings are about 30 percent higher than their historical average. A recent review of the equity premium by New York University professor Aswath Damodaran (2012) finds strong empirical evidence that current valuation is a much better predictor of future equity returns than the historical premium. A 2010 survey of Chief Financial Officers found an average equity premium estimate of 3% (Graham and Harvey, 2010).

interest rates rise. Yet even if current market conditions only defined the first five years of retirement, we see that failure rates are still dramatically higher than in the case that the historical averages define the entire retirement.

**Table 2**  
Failure Rates for 4% Inflation-Adjusted Withdrawals over 30 Years  
For Different Asset Return Assumptions

	30% Stocks	50% Stocks	70% Stocks
Historical Characteristics from Table 1	6%	6%	8%
Historical, Except: real bond returns = 1.75% real stock returns = 5.5%	24%	24%	27%
Historical, Except: real bond returns = 0% real stock returns = 6%	47%	33%	28%
Historical, Except: real bond returns = -1.4% real stock returns = 4.6%	77%	57%	46%
Historical, Except: real bond returns = -1.4% for 10 Years (then 2.6% thereafter) real stock returns = 4.6% for 10 Years (then 8.6% thereafter)	43%	32%	38%
Historical, Except: real bond returns = -1.4% for 5 Years (then 2.6% thereafter) real stock returns = 4.6% for 5 Years (then 8.6% thereafter)	22%	18%	18%

Next, Figure 3 provides a more detailed investigation of the failure rates over a 30 year retirement for a variety of asset allocations and withdrawal rates using the current market conditions of a -1.4% average real bond return and the historical equity premium. Squares are shown at the asset allocations which minimize the failure rate for each withdrawal rate. With current market conditions, even a 3% withdrawal rate has a more than 20% failure rate for all asset allocations. These results measure the probability of failure rather than the magnitude of failure, and with a 4% withdrawal rate the probability of failure is minimized with 100% stocks. That failure rate is 40%. For a conservative client with less than 60% stocks, failure rates are more than 50%. The historical market environment in the US contributed greatly to the idea that a 4% withdrawal rate in retirement is sufficiently conservative to prevent asset depletion. Forward looking estimates using a similar methodology suggest that the 4% rule should not continue to be treated as safe.



As a final illustration, Table 3 follows the methodology outlined in Pfau (2012) to show the maximum sustainable withdrawal rates and optimal asset allocations for a variety of accepted failure rates and retirement durations. The earlier study provided results using historical averages. With historical averages, a 30 year retirement and 10% acceptable failure rate, the maximum sustainable withdrawal rate was 4.3%, and it was supported with an asset allocation of 45% stocks and 55% bonds. The corresponding numbers here, when using the current market conditions of a -1.4% real bond return and the historical equity premium, are a 2.5% sustainable withdrawal rate with an almost identical optimal asset allocation. This withdrawal rate is 1.8% less than found with historical averages.

## Conclusion

Estimating a withdrawal rate from retirement assets that will preserve capital over a long life requires assumptions about future asset yields. Current bond yields are at historical lows, and the R-squared between current and 5-year and 10-year bond yields is about 0.90. Research shows returns during the first ten years of retirement have an inordinately large impact on failure rates. In this study, we estimate the impact of current low bond yields on two retirement planning scenarios - one where estimates of future bond returns are equal to or near current yields, and the other where bond yields and returns revert back to their historical mean.

We find that failure rates are surprisingly sensitive to a downward adjustment of expected bond returns. With no real bond yield, hypothetical retirees experience a one in three chance of running out of money after 30 years with a 50% stock portfolio. With the current negative real yield, odds are more than half that one will run out of money. These estimates also assume that the historical equity premium will persist and that there are no asset management fees.

**Table 3**

**Withdrawal Rate and Asset Allocation Guidelines for Retirees Using Current Market Conditions**

Retirement Duration (Years)	Failure Rate (%)	Withdrawal Rate (%)	Optimal Asset Allocation			For Withdrawal Rates Within 0.1% of Maximum					
			(%)			Range Stocks		Range Bonds		Range Bills	
			Stocks	Bonds	Bills	Min	Max	Min	Max	Min	Max
10	1	7.5	11	24	65	11	18	24	50	32	65
10	5	8.0	27	73	0	11	35	24	76	0	65
10	10	8.4	24	76	0	17	48	48	76	0	35
10	20	9.0	48	52	0	24	57	43	76	0	0
15	1	4.5	17	48	35	11	28	24	76	0	65
15	5	5.0	27	73	0	16	39	44	76	0	40
15	10	5.4	32	68	0	22	52	48	76	0	10
15	20	5.9	50	50	0	31	73	27	69	0	0
20	1	3.1	17	48	35	11	39	24	76	0	65
20	5	3.6	32	68	0	20	50	50	76	0	22
20	10	3.9	37	63	0	23	57	43	76	0	5
20	20	4.4	50	50	0	32	83	17	68	0	0
25	1	2.3	28	72	0	15	44	40	76	0	45
25	5	2.7	33	67	0	22	56	44	76	0	12
25	10	3.0	44	56	0	26	62	38	74	0	0
25	20	3.5	73	27	0	39	92	8	61	0	0
30	1	1.8	35	65	0	16	46	42	76	0	43
30	5	2.2	39	61	0	22	58	42	76	0	10
30	10	2.5	44	56	0	28	71	29	72	0	0
30	20	2.9	73	27	0	43	95	5	57	0	0
35	1	1.5	37	63	0	17	50	46	76	0	38
35	5	1.8	43	57	0	23	62	38	76	0	7
35	10	2.1	49	51	0	29	74	26	71	0	0
35	20	2.5	71	29	0	44	100	0	56	0	0
40	1	1.3	37	63	0	20	53	47	76	0	22
40	5	1.6	44	56	0	24	69	31	76	0	2
40	10	1.8	50	50	0	29	82	18	71	0	0
40	20	2.2	80	20	0	49	100	0	51	0	0

Reversion to historical mean bond returns will not save the 4% rule. Hypothetical retirees experience a nearly one in five chance of running out of money even if bond returns revert back to the historical mean after only five years with a 50% stock portfolio. If bonds mean revert in ten years, the failure rate rises to one in three. These estimates do not take into account the capital loss to a bond portfolio if interest rates rise. If a planner increases the duration of bonds early in retirement to reach for a greater bond yield, this reversion can have a particularly negative impact on failure rates.

As Pfau (2010) showed, the success of the 4% rule is partly an anomaly of the US historical data. In most other countries sustainable initial withdrawal rates fell below 4%. We find there is nothing inherently safe about the 4% rule. When withdrawing from a portfolio of volatile assets, surprises may happen. This study demonstrates that when we recalibrate our assumptions for Monte Carlo simulations to the current market conditions facing retirees, the 4% rule is anything but safe.

We also show that a 2.5% real withdrawal rate will result in an estimated 30 year failure rate of 10 percent. Few clients will be satisfied spending such a small amount in retirement. It is possible to boost optimal withdrawal rates by incorporating assets that provide a mortality credit and longevity protection. Pfau (2013), for example, estimates that combining stocks with single premium immediate annuities, rather than bonds, provides an opportunity for clients to jointly achieve goals related both to meeting desired lifestyle spending, and to preserving a larger reserve of financial assets. In the absence of some added income protection, there is a high likelihood that low yields will require planners to rethink the safety of a traditional investment-based retirement income plan.

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