Safe Portfolio Withdrawal Rates: Beyond The 4% Solution

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An idea that gets repeated often enough seems to gather weight and, eventually, gets accepted as part of the conventional wisdom. An example of this type of 'wisdom' in investment planning is the belief that retirees can safely plan to withdraw an (inflation adjusted) annual income of no more than 4% of their portfolio value at the time of retirement. In other words, if you are retiring this year and have $1 Million in invested assets, you can "safely" draw only $40,000 per year in 2006 dollars for the rest of your life. The basic issue here is that there is risk in the future performance of your invested assets. If you are drawing a constant annual income against these assets, you will draw proportionately more after a down period than after a period of gains. You must account for the chance of a period of draw-downs—and this is how you end up with a "safe" draw of 4% from a portfolio that is generating 7-8% in average return. It is common to run across advisors who advocate the 4% number as a basis for planning, without critically examining the underlying assumptions—as in this article from ***The Motley Fool***:

http://www.fool.com/news/commentary/2006/commentary06111510.htm

The so-called "4% solution" results when you look at the ability of a generic portfolio of 60% stocks and 40% bonds to reliably support a constant inflation-indexed income draw for 30+ years of retirement. The safety of the four percent draw has been demonstrated from a range of Monte Carlo models, given the assumptions listed above:

http://www.quantext.com/SafeRetirementDraw.pdf

It is important to critically examine the assumptions that have gone into getting this result from historical data and from Monte Carlo simulations. One critic of the efficacy of the suggested "four percent draw" is Jonathan Guyton:

http://www.aaii.com/commentary/articles/200508_portstrategies.cfm

He makes a series of good points, and the two main ones are that (1) the specific asset allocation makes a substantial difference in a safe draw and (2) that the ability to lower your income draw in bad years makes a substantial difference in portfolio survival. Mr. Guyton's analysis uses historical market data from the 1970's forward, which is not a bad idea but thus means that his results may be sensitive to the specific period. He finds that a portfolio with 80% invested in equities would support a 4.7% draw rate, with no modification in income draw from year to year, except to index up with inflation. The stock portfolio in question was "invested" quite broadly, with 20% in international stocks

and 10% in REIT's. He also finds that an investor who can lower his income draw in bad years will substantially increase his potential average income over his entire retirement. I like Mr. Guyton's analysis, but I do have some concerns. First, because this analysis focuses on a single period in history, the success of a specific strategy of altering income draw may be 'over fitted' to this historical period. Second, and more critical, is the issue of the equity risk premium. There is a broad consensus that the average returns that equities have provided to U.S. investors over the past 30-40 years have been anomalously high relative to the risk (i.e. volatility) that investors have been exposed to:

http://www.quantext.com/EquityRiskPremium.pdf

If the economic experts are correct, and the equity risk premium in the future is lower than we have seen over the past 30 years, it may be too rosy simply to look at the last 30 years as the basis for planning.

It would be expected that an investor will try to draw less from his/her portfolio after a bad year. That said, the basic case of a constant inflation-indexed draw provides a good baseline for planning. A good approach is to check that your portfolio will sustain your basic income needs—the constant flow of income needed to sustain your lifestyle. If you happen to hit a major series of good years during retirement, you can always test what would happen for a high withdrawal to 'cash out' some extra gains and then plan accordingly. In other words, I feel that it is most important to ensure that your portfolio has a high probability of sustaining your basic required income draw. If we ignore various income cycling strategies, the main issue that we want to look at is how to allocate a portfolio to give the highest income at a specific level of certainty.

The ***Quantext Portfolio Planner*** is a Monte Carlo portfolio planning model that accounts for portfolio risk. In ***Quantext Portfolio Planner*** (QPP), the default settings assume that the S&P500 will return an average of 8.3% per year, on a going forward basis. This is pretty conservative and reflects the assumption that the equity risk premium for U.S. equities will be lower in the next decades than in recent ones. When I use ***Quantext Portfolio Planner*** (QPP) to project into the future for a portfolio that is invested 60% in stocks and 40% in a bond fund, I get a projected average annual return for the portfolio of

7.2% per year, with a standard deviation of 10.1% per year. I have used SPY, an S&P500 ETF, for the stock portfolio of the portfolio and VBIIX, a Vanguard low-cost bond fund, for the bond portfolio of the portfolio. QPP's projections include annual fees on funds. Are these projections reasonable? If you compare QPP's projections for the 60% SPY /40% VBIIX portfolio to historical data generated by Robert Schiller of Yale, it is clear that our projections are quite consistent with history—if less rosy than recent decades:

S&P500: 60%		Short Bond: 40%	
Years	Period	Average Annual Return	Standard Deviation in Annual Return
100	1905-2004	6.68%	11.29%
90	1915-2005	7.02%	11.50%
80	1925-2004	7.17%	11.52%
70	1935-2004	7.12%	10.54%
60	1945-2004	7.35%	9.87%
50	1955-2004	7.09%	9.40%
40	1965-2004	6.73%	9.70%
30	1975-2004	8.53%	9.48%
20	1985-2004	8.62%	10.10%
10	1995-2004	8.14%	12.16%
Raw Data: Website of Robert Schiller at Yale (http://www.econ.yale.edu/~shiller/data.htm)			

Historical performance of a 60/40 portfolio

Dr. William Bernstein (author of ***The Intelligent Asset Allocator***) wrote a series of articles that helped to establish the "4% solution" in which he assumed that a 60/40 portfolio with a broadly-diversified 60% in equities and 40% in bonds will generate 7.5% per year (on average, if we assume a 3% inflation rate) with a standard deviation of return of around 10%:

http://www.efficientfrontier.com/ef/901/hell3.htm

Given historical variability in asset returns, an assumption of 7-8% per year in average annual return, with a standard deviation of 10-11% is pretty reasonable for a generic 60/40 portfolio. Note that QPP's projections include fees—something you will pay. VBIIX has a total expense ratio of 0.18% and SPY has an expense ratio of 0.1%.

So, starting with this basic 60/40 in SPY and VBIIX, what is a 'safe' withdrawal rate? When I look at a 55-year-old person retiring at age 55, with $1M in his/her portfolio and a draw of $40K per year, indexed up with inflation, I get the following survival rates from QPP:

Probability of Running Out of Money	Age
10%	82
15%	84
20%	87
25%	90
30%	93
35%	95
40%	97
45%	100
50%	106

QPP Projections for 4% Draw for Generic 60/40 Portfolio

The results above suggest that your odds of failure to fund a forty year retirement are 35% (i.e. to age 95). This means that you have a 65% chance of funding your 4% draw for 40 years. Your have an 80% chance of funding your retirement through age 87—more than 30 years of retirement. This is the kind of calculation from which the so-called "4% solution" comes from.

There are a few key statistics that are worth mentioning here. This portfolio has a dividend yield of 3% and a Beta of 62%. This is reasonable. The main issue that QPP raises with respect to this portfolio is that the Diversification Metric (DM), which measures how effectively you have used diversification among your assets, is only 28%. This is low. You are getting generic stock-bond diversification benefits, but you have no strategic diversification benefit here.

The next question, of course, is whether this kind of portfolio is what one would actually wish to follow? If you have read any of my other articles, you will know my answer. I

believe that you can do better with a smarter strategic asset allocation plan. I have come up with an alternative portfolio that uses a series of stocks that I examined in a recent article on a portfolio that exploits low-correlations between positions to achieve high strategic diversification:

http://www.quantext.com/SampleLowBeta.pdf

Fund Name	Percentage of Funds	Average Annual Return
SPY	0.0%	8.47%
VBIIX	30.0%	5.33%
-	0.0%	-
BUD	5.0%	12.03%
BAC	4.0%	12.62%
BBT	5.0%	14.78%
BCE	5.0%	16.39%
C	5.0%	13.67%
ED	7.0%	11.94%
GIS	6.0%	13.73%
JNJ	6.0%	11.40%
PEG	6.0%	20.66%
WYE	5.0%	17.04%
SO	6.0%	10.19%
VWEHX	10.0%	2.60%
-	0.0%	-
-	0.0%	-
-	0.0%	-
-	0.0%	-
-	0.0%	-
Sums to	100.0%	

Portfolio Stats	
Average Annual Return	Standard Deviation(Annual)
10.22%	9.96%

Historical Data	
Start: 11/1/2003	End: 10/31/2006
Average Annual Return	Standard Deviation (Annual)
8.78%	4.66%
Historical Beta: **24.36%**	
Historical Yield: **4.40%**	
Portfolio R^2: **15.0%**	

Market Index (S&P500)	
Average Annual Return	Standard Deviation (Annual)
8.30%	15.07%

Simulated Portfolio Beta
24.36%

Diversification Metric:	54%

QPP Output for Modified Portfolio

This portfolio (call it the ***Modified Portfolio***) was designed to keep the projected future standard deviation in annual return at or below 10% and to have a considerably better strategic allocation. This portfolio still has 40% in bonds: 30% in VBIIX and 10% in VWEHX, a high-yield bond fund from Vanguard. The portfolio has a 4.4% dividend yield. Note that the total projected average annual return is 10.22% per year, with a projected standard deviation of slightly less than 10%. This portfolio make effective use of diversification, with a Diversification Metric of 54%--far better than in the generic portfolio.

Probability of Running Out of Money	Age
10%	79
15%	83
20%	87
25%	92
30%	100
35%	111
40%	120
45%	120
50%	120

QPP Projections for 5.6% Draw for Modified Portfolio

I increased the income draw against this portfolio until it matched the 20th percentile failure age from the generic 60/40 portfolio (above). The initial portfolio draw is $56K from the $1M portfolio and is indexed up with inflation—and this equates to a 5.6% draw. This portfolio has a 20% chance of running down by age 87, the same as for the original generic portfolio. These results suggest that you can move from a 4% draw to a 5.6% draw with the same portfolio survival rate simply by better use of strategic allocation. These results are for one sample portfolio, but I believe that it is quite reasonable that **smarter asset allocation can increase safe retirement income by 40% (i.e. 5.6% draw vs. 4% draw), without increasing short-term risk**.

Okay, so this looks good. There is another major factor to be considered here that will improve things further. The results above were obtained by attempting to get more return with the same risk level as the generic portfolio, but is ten percent in standard deviation the right risk level? This is a key issue that does not receive enough attention. Advisors often give their clients surveys to determine risk tolerance, but this is not a complete approach. The ability to handle portfolio volatility without losing sleep is important – and this is a personality issue – but there is another important factor that determines how to choose the risk level of your portfolio. **From a quantitative perspective, you want to find the portfolio with the risk/return balance that maximizes your probability of funding your desired income level.** If you are too conservative, there is more risk that you will not get enough capital appreciation to sustain your income. If you are too aggressive, the potential for a major portfolio meltdown will decrease the probability of your being able to fund your retirement. The generic 60/40 portfolio gives a standard deviation of 10%. Mr. Guyton's article cited earlier suggests that a portfolio with 80% in stocks is better capable of sustaining income for thirty years and beyond. While he does not discuss this issue, I am pretty sure that his 80% stocks portfolio has an historical standard deviation in return greater than 10%. Unfortunately, he does not discuss the relative impacts of increasing risk tolerance in the portfolio, as opposed to better allocation. It is hard to look at these in a completely independent fashion, but we can give it a shot.

Consider the case in which we take the ***Modified Portfolio*** from above and make it more aggressive by increasing the portfolio exposure to stocks. I have constructed a case in which the bond exposure is reduced to 10% (5% in VBIIX and 5% in VWEHX). The additional 30% of the portfolio (that was in bonds) is put into SPY. We will call this the ***Aggressive Modified Portfolio***. In truth, this portfolio is not all that aggressive (see below). This portfolio is projected to have a standard deviation of 11.08% per year, with an average annual return of 11.3%. The increase in allocation to stocks actually increases the diversification metric of this portfolio to 58%. Imagine that you are faced with the choice between this portfolio and the previous portfolio. Which would you choose? The

Aggressive portfolio has higher risk and higher return. Is the extra return worth the extra risk?

Fund Name	Percentage of Funds	Average Annual Return
SPY	30.0%	8.47%
VBIIX	5.0%	5.33%
-	0.0%	-
BUD	5.0%	12.03%
BAC	4.0%	12.62%
BBT	5.0%	14.78%
BCE	5.0%	16.39%
C	5.0%	13.67%
ED	7.0%	11.94%
GIS	6.0%	13.73%
JNJ	6.0%	11.40%
PEG	6.0%	20.66%
WYE	5.0%	17.04%
SO	6.0%	10.19%
VWEHX	5.0%	2.60%
-	0.0%	-
-	0.0%	-
-	0.0%	-
-	0.0%	-
-	0.0%	-
Sums to	100.0%	

Portfolio Stats	
Average Annual Return	Standard Deviation(Annual)
11.30%	11.08%

Historical Data	
Start: 11/1/2003	End: 10/31/2006
Average Annual Return	Standard Deviation (Annual)
10.77%	5.23%

Historical Beta: **53.24%**
Historical Yield: **3.28%**
Portfolio R^2: **56.9%**

Market Index (S&P500)	
Average Annual Return	Standard Deviation (Annual)
8.30%	15.07%

Simulated Portfolio Beta
53.24%

Diversification Metric: 58%

QPP Output for Aggressive Modified Portfolio

You can examine the impact of changing the risk-return balance in your portfolio very easily using QPP. Once again, I have adjusted the constant (inflation-indexed) income draw on this portfolio so that the 20th percentile failure rate occurs at age 87 (below). In this case, the portfolio can sustain an income of $61,500 that indexes upwards with

inflation. This 6.15% draw is substantially higher than the 5.6% draw that we could sustain with the same portfolio survival rate in the previous portfolio.

Probability of Running Out of Money	Age
10%	78
15%	83
20%	87
25%	91
30%	100
35%	120
40%	120
45%	120
50%	120

QPP Projections for 6.15% Draw for Aggressive Modified Portfolio

In these results, the riskier portfolio (as measured by standard deviation in return) is actually less risky in the long-term. If you were to draw the 5.6% against the ***Aggressive*** portfolio, your 20th percentile outcome is to run down your portfolio at an age of 103—as compared to an age of 87 with the previous portfolio. The higher average return more than offsets the increased volatility over the long term.

I hasten to point out that I am not holding this portfolio out as ideal. These are examples designed to illustrate two key concepts. If you are projecting reasonable income draws, you can get far higher income than the generic "4% solution" with good strategic asset allocation and by finding the optimal risk level for your overall strategy. In these examples, we find that our hypothetical investor can draw an income of 6.15% of the retirement value of the portfolio with the same survival rate as the generic approach with the 4% draw. I have model portfolios that are projected to be considerably better than those shown here, but this case suffices to show the basic effects.

I will conclude by returning to the starting concept of this paper. It is well known that you need to account for investment risk in calculating the 'safe' income that you can count on drawing from a portfolio in the future. If you ignore the risks of investing in

stocks, your projections will be far too rosy. Some authors have used historical data and Monte Carlo simulations for a generic portfolio of 60% stocks and 40% bonds to suggest that when you account for risk, you can safely count on an annual (inflation adjusted) income of about 4% of the value of your portfolio value at retirement. This result came as a shock to many investors, but it is used by many advisors as a rule of thumb. Fortunately, even if the future returns on the S&P500 as a whole are fairly tame, it should be possible to do substantially better than a 4% draw by using strategic asset allocation and by finding the right risk/return balance. I have shown examples here of a portfolio which supports a 6.15% draw.

Before leaving this topic, I want to emphasize one final point. All projections about future performance—both risk and average return—have considerable uncertainty. With some luck, the future equity premium will rise and these projections will turn out to be conservative. Then again, things might turn out worse. Conservative planning helps you make the best decisions today—with the understanding that your strategy will almost undoubtedly change in the future. Even with all that we cannot know, practicing good strategic asset allocation and adjusting your total portfolio risk/return balance to match your income and planning horizon are critical steps in making good investing decisions.

Quantext Portfolio Planner *is a Monte Carlo portfolio management tool. Extensive case studies, as well as access to a free extended trial, are available at http://www.quantext.com/gpage3.html*