The Power of Diversification and Safe Withdrawal Rates

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by Geoff Considine

When Bill Bengen published his seminal research in 1994, a 4% safe withdrawal rate (SWR) was clearly attainable with a variety of asset allocations. But bond yields are lower now than they were then, and equity returns for the next 20 years are unlikely to exceed those of the prior two decades. Indeed, a new paper by three highly respected researchers showed that SWRs for stock-bond portfolios are well below 4%. But as I will demonstrate, a 4% SWR is still possible with a more diversified portfolio – and without subjecting clients to additional risk.

The 4% rule is increasingly being called into question. A March article in the *Wall Street Journal,* ***Say goodbye to the 4% rule****,* and a *New York Times* article, ***The 4% rule for retirement withdrawals may be outdated***,summarized the growing sentiment that historically low bond rates may be with us for an extended period, as global economies continue to struggle.

The three researchers – David Blanchett, Michael Finke and Wade Pfau (BFP) – published Asset Valuations and Safe Portfolio Withdrawal Rates in June. They showed how stock market valuations and bond yields at the time of retirement affect sustainable income draws during retirement. Their article followed an earlier one in January that focused on bond yields.

The central theme of their research was that the amount of income that you can draw from a portfolio is a function of key fundamental variables at the time of retirement, along with how these variables evolve during retirement. They used Shiller's PE10 to predict expected equity returns and current bond yields to predict expected fixed-income returns. While classic work in this area (by Bengen, for example) used long-term historical average returns to determine safe withdrawal rates, BFP based their analysis on market conditions at retirement. If bond yields are low or stocks are expensive, the SWRs will be lower than if one retires into an environment with high bond yields and a depressed stock market.

BFP's research concluded that the traditional "4% rule" is far too aggressive for the current environment. Using a portfolio allocated 20% to equities and 80% to bonds, the authors found that a 4% rate now has only a 48% chance of being sustainable for a 30-year retirement. When they included a portfolio expense ratio of 50 basis points, they found that a 90% success rate for funding a 30-year retirement could only be achieved a maximum 3% income draw rate. A 40% equity/60% bond portfolio can sustain a 2.8% draw rate. This was consistent with the authors' January article.

This research raises a number of critically important issues for advisors. How can one best estimate SWRs without unnecessarily relying on long-term historical data? What are the alternatives for incorporating valuation measures into forward-looking estimates of returns from other asset classes?

A limitation of the work to date is that very few portfolios are invested in just stocks and bonds. The additional diversification benefits from other asset classes will improve risk-adjusted returns. How can we test the potential impact of emerging-market stocks, commodities or other asset classes on SWRs?

I will explore an alternative approach to estimating SWRs and then use this approach to identify better strategies for constructing retirement portfolios. Let's begin by examining the framework for predicting future bond and equity returns and the source of uncertainties in those estimates.

Managing estimation risk

Estimation risk is an important idea that is implicit in BFP but was not discussed. Our ability to estimate future equity returns is far worse than for bond returns. As BFP showed, future returns from bonds can be accurately predicted on the basis of current yields, while no such methodology lends itself to forecasting equity returns. The r-squared of the linear relationship between current yield and future 10-year annualized return for the Ibbotson Intermediate-Term Bond index was 92%. The r-squared between the PE10 and future 10-year annualized return was 24% (r-squared is a standard measure of the strength of a relationship; higher r-squared corresponds to higher predictability). Attempts to predict SWRs will be more robust if they first focus on estimating fixed-income returns.

We must estimate equity returns, however, and to address the substantial difference in predictability one can incorporate asset class risk premia into this analysis. There is a link between expected returns on stocks and bonds. Low bond yields in the current market drive investors to stocks. This drives up the valuations and drives down the expected future returns from stocks. Expected returns from stocks and bonds, therefore, will be commensurate with their respective risk levels.

Estimating future risk and return

I will use a form of portfolio analysis that I developed and incorporated into Quantext Portfolio Planner (QPP). The starting assumption is that stocks, bonds and other asset classes and sub-classes have a consistent linear relationship between risk and return, with the slope of this relationship established by the equity risk premium (ERP), expressed as the average annual return expected from the S&P 500. All analysis used data through June 2013.

QPP uses a modified form of the capital asset pricing model (CAPM) to generate estimates of risk and return for asset classes. This approach starts with an estimate of the ERP, and (like CAPM) uses beta to predict expected return. Where this QPP model differs from CAPM is that it also accounts for non-market correlation between asset classes and allows for non-market risks to add to expected return. In the classical CAPM approach, the only risk that you are rewarded for taking is beta. Portfolio analysis using CAPM assumes that the component of returns not captured by beta is noise and thus ignores correlations between assets that are not due to beta. QPP accounts for those effects.

QPP's only inputs are an assumed ERP and volatility for the S&P 500 and historical price data on each asset class. The model calculates betas, volatilities and correlations and generates expected returns for each asset class, such that the relationships between asset classes are maintained. QPP is a total return model, meaning that it simulates total returns and does not distinguish between price gains and yields. QPP is not a new model, and I have written a large number of articles that go into more detail on the simulation methodology. I have also written a number of articles estimating SWRs using this model.

QPP provides a platform for calculating SWRs from portfolios that include a wide range of asset classes. Let's start by analyzing bonds, the easiest asset class to forecast.

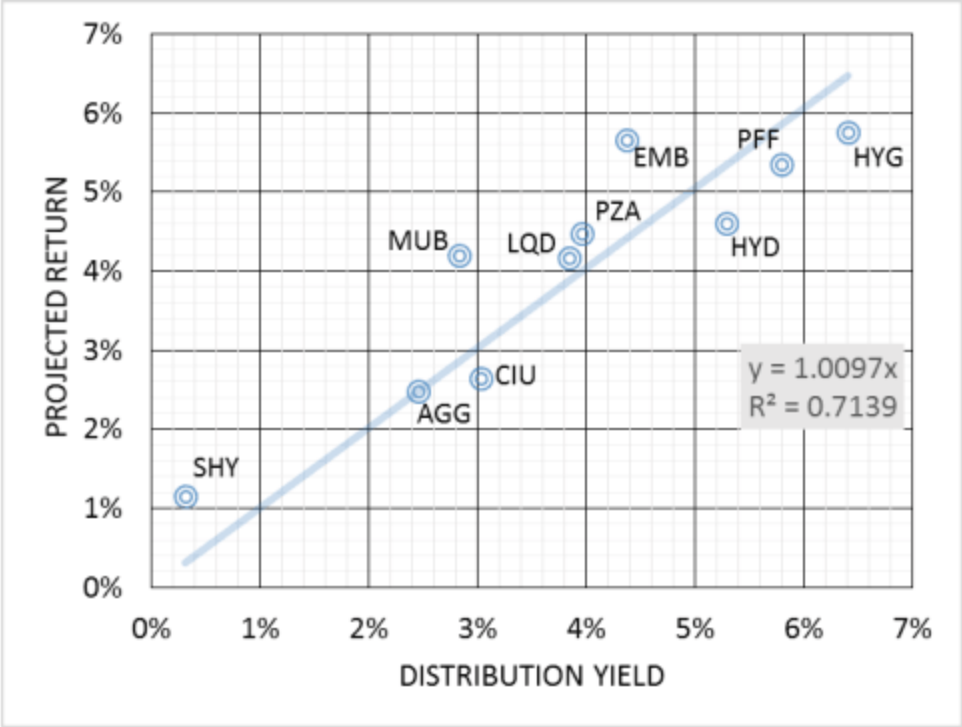
QPP's expected future average annual returns for a series of bond exchange-traded funds (ETFs) are shown below; they closely correspond to the yields of these funds. For all yields cited in this article, I am using the trailing 12-month distribution yield, which is the sum of the trailing 12 months' income distributions divided by net asset value at the end of the most recent month.

Asset Class	Ticker	Yield	Expected Average Annual Return
Aggregate Bond	AGG	2.5%	2.5%
High Yield Bond	HYG	6.4%	5.8%
Corporate Bond	LQD	3.8%	4.2%
Credit Bond	CIU	3.0%	2.7%
Preferred Shares	PFF	5.8%	5.3%
High Yield Muni Bond	HYD	5.3%	4.6%
Insured National Muni Bond	PZA	4.0%	4.5%
National Muni Bond	MUB	2.8%	4.2%
Short Treasury Bond	SHY	0.3%	1.2%
Emerging Market Bond	EMB	4.4%	5.7%

Yield vs. expected annual return

The correlation between the yield and the simulated expected return is 90%. The fixed-income classes

that have projected returns furthest from their current yield are muni bonds (MUB) and emerging market bonds (EMB), although the expected return and yield for the insured muni bond fund (PZA) are very close.



Distribution yield vs. projected return for fixed income ETFs

QPP projected a 2.5% arithmetic annual average return for AGG, the aggregate bond index. The yield on AGG is 2.45%. So QPP projected an average annual return that is very close to the yield. QPP's baseline arithmetic average annual return for the S&P 500 is 8.3% per year, with a volatility of 15.1%.

High-yield bonds (HYG) have an expected return of 5.75% and a yield of 6.56%. Similarly, investment-grade corporate bonds (LQD) have an expected return of 4.2% and a yield of 3.96%.

The projected total returns for the two high-yield bond funds (HYD and HYG) are below their yields, which should be the case because some level of defaults are likely with these riskier bond classes.

There are two classes of bonds for which QPP's baseline projections did not generate expected returns in line with yields: intermediate (IEF) and long-term (EDV) Treasury bonds. For this reason, I reduced their expected returns to equal their yield. These two classes of bonds require adjustment because of the extraordinary nature of quantitative easing in the current environment. With this adjustment, they are reasonably represented.

Yields are low from a historical perspective, but the important result is that QPP generates expected returns for a range of fixed-income asset classes that are consistent with these yields.

We now consider equities. QPP's baseline settings are for an average annual return of 8.3% per year (arithmetic) and annualized volatility of 15.1% for the S&P 500. In BFP, the average expected return for the S&P 500 varied from year to year, but the average was 8.95%.

QPP uses historical data for each asset class (represented by ETFs) to calculate an expected return and volatility. Validating the expected returns for equity asset classes is much harder than for bonds, and there is considerably higher estimation risk.

In testing a range of portfolios that could provide the highest SWRs, I have found that an effective small set of asset classes is represented by the following:

Monte Carlo projections for (arithmetic) average annual returns and volatilities

Asset Class	Ticker	Beta (with respect to S&P500)	Annualized Volatility	Average Annual Return (Arithmetic)
	Base Case: Expected Return for S&P500 = 8.3%			
S&P500	SPY	1.00	15.0%	8.3%
EAFE	EFA	1.24	20.7%	11.1%
Emerging Mkt Equity	EEM	1.39	25.4%	13.4%
Commodities	DBC	1.02	20.0%	10.7%
MLPs	MLPI	0.71	15.4%	8.4%
Small Cap Stocks	VB	1.29	19.4%	10.4%
International REITs	DRW	1.21	23.4%	12.4%
Equity Energy	IGE	1.41	24.4%	12.9%

EAFE stocks (represented by EFA) have a higher return than domestic equities that is consistent with their higher beta and risk level. The same is true for emerging market stocks and small-capitalization stocks.

The expected average annual return for commodities (represented by DBC) is 10.7% per year. This is consistent with Gorton and Rouwenhorst's calculation of the long-term historical return for commodity futures (11.97% for an annually rebalanced, fully collateralized commodity futures strategy). Over the period of their study (1959-2004), inflation averaged 4.1%, higher than our forward-going estimate of 3%, so it is reasonable that the expected returns from commodity futures will also be somewhat lower.

The volatility projection for the S&P 500 is 15%, which is close to historical levels. According to Morningstar, the annualized volatility for the S&P 500 over the last 15 years was 16.2%, while the annualized volatility over the past 10 years was 14.6%. In the last 20 years (through June), the annualized volatility of the S&P 500 was 15.2%, according to my calculations.

David Blanchett helpfully provided Ibbotson's 2013 projections for long-term (20-year) expected returns for the major asset classes that I have used here. Those numbers are very close to QPP's.

Ibbotson 20-year projected arithmetic average annual returns for 2013

(Source: David Blanchett, personal communication) and QPP equivalents

Asset Class	Benchmark	Ibbotson Expected Return	Equivalent QPP Expected Return
Bonds	Barclays US Agg Bond TR USD	3.5%	2.5%
Bonds	BofAML US Corp Master TR USD	4.3%	4.2%
High Yield Bonds	Barclays US Corporate High Yield TR USD	7.6%	5.8%
Emerging Market Bonds	JPM EMBI Plus TR USD	7.2%	5.7%
Large Cap Equity	Russell 1000 TR	9.3%	8.3%
Small Cap Equity	Russell 2000 TR	11.2%	10.4%
Emerging Markets Equity	MSCI EM GR	14.5%	13.4%
International Equity	MSCI EAFE GR	9.7%	11.1%
International REITs	FTSE EPRA/NAREIT Dvlp Ex US TR USD	12.2%	12.4%
Preferred Stocks	BofAML Preferred Stock Fixed Rate TR USD	6.1%	5.3%
Commodities	S&P GSCI TR	6.2%	10.7%

Safe withdrawal rates

Let's now focus on calculating SWRs. Following the format proposed in BFP, I am defining the target SWR as the income that will provide a 90% chance of funding a 30-year retirement. The SWR is the amount of inflation-adjusted income to be drawn every year, expressed in terms of a percentage of the portfolio in the year of retirement. A person who retires with $1 million and who plans to draw $40,000 in his first year of retirement and escalate that amount each year to keep pace with inflation (i.e. to draw a real income of $40,000 per year) has a 4% withdrawal rate.

I calculated SWRs for four portfolios invested in varying mixes of a stock index and a bond index, as well as a series of alternative portfolios that are invested in a wider selection of asset classes. For the two-asset portfolios, I varied the fixed-income allocations from 70% to 40% of the portfolio. In the more diversified portfolios, I selected allocations that provide the highest estimated SWRs within the range of risk represented by the two-asset portfolios.

The first four portfolios, S1-S4, are two-asset allocations using a stocks index (SPY) and a bond index (AGG). The next five portfolios, P1-P5, use QPP to determine the mix of assets with the highest expected return for a series of risk levels.

While QPP's results favor long-term Treasury bonds (represented by EDV), I have limited the portfolios to a maximum of 5% allocation to this asset class because many advisors are likely to be reluctant to allocate more than this amount to such a volatile asset class.

Baseline results

	Monte Carlo Results								
Portfolio Name	S1	S2	S3	S4	P1	P2	P3	P4	P5
SWR	3.2%	3.3%	3.3%	3.4%	4.0%	4.0%	4.1%	4.1%	4.1%
Volatility	4.4%	5.8%	7.2%	8.8%	6.0%	7.0%	7.5%	8.0%	9.0%
% Fixed Income	70.0%	60.0%	50.0%	40.0%	55.5%	54.0%	54.5%	52.5%	49.7%
Ticker	Weight								
SPY	30%	40%	50%	60%	28%	22%			
AGG	70%	60%	50%	40%					
IEF					10%	8%	7%	5%	1%
LQD					11%	8%	9%	10%	7%
CWB									4%
EEM					3%	5%	5%	6%	7%
DBC					3%	3%	4%	5%	5%
HYD						8%	8%	8%	8%
PZA					15%	17%	19%	19%	19%
MLPI					4%	3%	4%	5%	4%
VB							22%	22%	22%
MUB					15%	7%	6%	6%	6%
DRW					2%	3%	5%	5%	6%
IGE					5%	10%	5%	5%	7%
EDV					5%	5%	5%	5%	5%

The results for the two-asset portfolios are consistent with those produced by BFP. The SWRs are higher than those in BFP by 0.4%-0.6%, but BFP assumed a portfolio expense ratio of 0.5% per year. Because SPY has an expense ratio of 0.09% and AGG has an expense ratio of 0.16%, it is not surprising that QPP's projected two-asset SWRs will be higher by about 0.4% per year. The remaining differences between BFP and QPP's results are due to model variations.

Getting to 4%

The key issue is whether an SWR of 4% can be achieved in the current environment.

My optimized portfolios (P1-P5) show that a 4% SWR is possible with fixed-income allocations in the range from 50% to 56%. The optimized portfolios have substantial allocations to muni bonds (PZA, MUB and HYD). QPP injects a small-capitalization tilt (VB vs. SPY), but this is not terribly surprising given the well-known return boost provided by those stocks. The model portfolios favored international real-estate investment trusts (DRW) as opposed to domestic REITs, and this is consistent with the high valuations of domestic REITs.

A 4% SWR is possible in the current environment, depending on the assumed ERP and the volatility that investors will tolerate. I conducted two sensitivity tests to determine how changes in the ERP and volatility impact SWRs. If the average annual return of the S&P 500 is 7.3% per year (arithmetic), the optimal portfolios can provide no better than a 3.7% SWR. If the volatility of the S&P 500 is raised to 20%, the maximum achievable SWR from the model portfolios drops to 3.5%.

Stress tests for SWRs vs. baseline S&P500 return of 8.3% per year and volatility of 15.1% per year

	Monte Carlo Safe Withdrawal Rates								
Portfolio Name	S1	S2	S3	S4	P1	P2	P3	P4	P5
Baseline	3.2%	3.3%	3.3%	3.4%	4.0%	4.0%	4.1%	4.1%	4.1%
S&P500 Return = 7.3%	2.9%	2.9%	3.0%	3.0%	3.6%	3.6%	3.7%	3.7%	3.7%
S&P500 Volatility = 20%	2.9%	2.9%	2.9%	2.8%	3.5%	3.5%	3.5%	3.4%	3.4%

While the assumptions underlying these stress tests are reasonable, the results are consistent in indicating that it should be possible to add 0.7% to 0.8% to the two-asset SWRs of 2.8%-3.4%. This would achieve SWRs approaching 4%.

Discussion

The current challenges for investors are low bond yields and the implication that future bond returns will be below long-term historical averages. An additional concern is that equities are expensive based on Shiller's PE10. More broadly, there is the question of whether using historical returns for the U.S. stock market overstates what can reasonably be expected on a going-forward basis due to a range of economic headwinds such as the aging population and slower economic growth. The pressing question that BFP addressed was how this environment should inform retirees' decisions about sustainable income streams that their portfolios will support. They concluded that a 4% SWR is unattainable with a two-asset (equity and fixed income) portfolio.

I agree with BFP that fixed-income returns will be low by historical standards. My estimated SWRs for two-asset portfolios are consistent with those from BFP.

But my results show that a more broadly diversified portfolio will provide a SWR of 4%.

All of these conclusions are highly dependent on projections of risk, return and correlations across asset classes. While those estimates are fraught with uncertainty, they are grounded in empirical data. Average returns for most bonds (other than the high-yield sector) have been consistent with their yields. QPP's estimates for equity returns are consistent with Ibbotson's long-term values, but both could turn out to be too optimistic.

Planning for future income depends on current market conditions, as BFP's and my analysis demonstrate. What is notable and unique in my results, however, is that it is not necessary to explicitly introduce a model that relates fundamentals (such as yield and price-to-earnings ratio) to expected future returns. QPP's projects low bond returns, consistent with today's yields, for example, without explicitly modifying the model inputs.

As the focus of financial planning shifts from the accumulation to the withdrawal phase, new analytical approaches are necessary to estimate and manage income draws. BFP focused crucially on the role of market valuations in this process, and I have presented an approach that estimates SWRs with

broader diversification.

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