Getting to the Right Level of Portfolio Risk

Geoff Considine, Ph.D.

One of the most important choices that an investor must make is simply where his or her risk tolerance lies. Portfolio theory hypothesizes that there exists some asset allocation that will generate the highest return for each risk level. Portfolio theory does not help investors to decide how much risk they can (or should) take on in their portfolios, however. This is often treated as a personal choice. Many investors have filled out surveys designed to 'measure' risk tolerance. Obviously, we all hate to see our portfolios lose money over some period of time. That can be very depressing. On the other hand, we intuitively understand that you must take on more market risk in order to get higher long-term returns. The key question, of course, is how much risk we need to take on in order to meet our goals. This hugely important question does not get the attention that it deserves. If you are 45 years old, how much of your portfolio should be in equities vs. bonds? How about if you are 55 years old? You might think that there would be some consensus as to this, but opinions among experts vary greatly. This is partly because one 45 year old may be in a very different situation than another, of course.

Over the last several years, we have seen enormous growth in the popularity of 'target date' mutual funds. These funds are linked to a specific retirement year and adjust the asset allocation (and associated portfolio risk level) as the retirement year approaches (and passes). These funds often show substantial differences in asset allocation (and total portfolio risk) for the same target retirement year:

http://www.forbes.com/home/free_forbes/2005/1114/104_2.html

Some target date funds essentially ignore foreign equities and some have substantial allocation to foreign equity. While these funds are all fairly new, so there is not a lot of market history, the market history that we do have illustrates that there are major differences between the asset allocation and risk/return balance that these funds choose for a target retirement year. Consider, for example, three 'target date' funds with a retirement in date of 2025. Fidelity (FFTWX), Vanguard (VTTVX), and T. Rowe Price (TRRHX) 2025 target funds have all been in existence since the start of April 2004, so we use the period from April 2004 through December 2006 for a look at the

characteristics of these funds. The T. Rowe Price funds are noted to be substantially more aggressive than many of the other offerings in this space, and Vanguard is often cited as being the most conservative. Over this period for which we have data for all three of these funds, there are substantial differences in risk exposure and returns. Over this period, TRRHX has exhibited 50% more volatility (measured by standard deviation in returns) than VTTVX. This is quite a difference in risk levels for two funds that are designed to meet the same retirement date. Similarly, the Beta for VTTVX is around 65% and the Beta for TRRHX is about 99%. What is the "right" level of portfolio risk for an investor who plans to retire in 2025?

A user of our portfolio management software recently sent me a link to a monograph by Alliance Bernstein (AB) that addresses this issue in detail using both historical market data and Monte Carlo simulation:

https://www.alliancebernstein.com/institutional/Registered/ArticleDetail.aspx?cid=27221

(free registration required)

This excellent monograph on asset allocation for long-term planning examines the impact of asset allocation on the probability of successfully funding retirement income. I would strongly recommend this monograph to anyone concerned with asset allocation for long-term planning, even if you only read the executive summary. In a nutshell, this monograph demonstrates that perhaps the greatest risk for a large fraction of investors is being so conservative in allocation that they do not generate the growth needed to fund retirement. They demonstrate this with both historical data and Monte Carlo simulations. Quite often a more aggressive allocation (i.e. a more risky portfolio) is actually less risky when considered in terms of the probability of funding retirement. This analysis mirrors an article that I wrote in early 2006 called **When More Risk is Less Risky** (http://www.quantext.com/AgilePortfolio2.pdf). When considered in terms of the ability to build net worth in the long-term, having too little exposure to equities, for example, is a very risky strategy.

The AB monograph makes the important point that a portfolio that is more heavily weighted to equities (in accordance with principles of good strategic allocation) will, over time, have equal downside (but far more upside) than a portfolio that is more conservative. These results are summarized in the Executive Summary of the AB monograph for those who may not wish to read the entire 60 pages of the report. This point is not at all intuitive to many investors, but it is easy to explain (as we show below) and does not depend on the exact details of the saving and investment strategy. The idea that the short-term downside in a more aggressive equity-focused portfolio simply diversifies away over extended holding periods is a consequence of temporal diversification (i.e. smoothing out in compounded return in time). This effect shows up in both historical analysis and in forward-looking Monte Carlo simulation.

To make this point more concrete, let's look at some examples from a specific portfolio developed and analyzed using our portfolio planning software. We are going to look at the risk and return from a portfolio during the savings phase of an investor's life. Let's say that we have an investor who has a conservative portfolio of ETF's

Fund Name	Percentage of Funds
SPY	40.0%
TIP	30.0%
ICF	5.0%
EFA	20.0%
EEM	0.0%
IDU	5.0%
IGE	0.0%

Conservative Portfolio

This portfolio was designed to combine some level of allocation to broad indices. This portfolio has 30% in the iShares TIP ETF which invests in inflation protected bonds. The portfolio has 40% allocated to the S&P500 (via SPY), 20% in the EAFE index (via EFA), 5% in real estate (via ICF) and 5% in the Dow Jones Utilities Index (via IDU). Please be assured that I am not holding this up as a model portfolio. This portfolio is, in my

opinion, very conservative for a person who is actively in the 'accumulation and savings' period of their investing lives. We know, however, that many people are investing too conservatively. Let's now contrast this conservative portfolio to a more aggressive one:

Fund Name	Percentage of Funds
SPY	30.0%
TIP	10.0%
ICF	10.0%
EFA	20.0%
EEM	5.0%
IDU	15.0%
IGE	10.0%

More Aggressive Portfolio

This more aggressive portfolio reduces the bond allocation to 5% and adds assets with higher growth potential. The portfolio has 10% in natural resources (via IGE), 10% in real estate (in ICF), and 5% in the emerging markets index (EEM). There is also a higher allocation to utilities. Let's look at how these portfolios compare statistically:

	3 Years Through Dec 2006	
	Average Annual Return	Annualized Standard Deviation in Return
Conservative Portfolio	9.7%	5.7%
More Aggressive Portfolio	15.8%	7.9%
S&P500	9.6%	7.2%

Trailing 3-Year Performance

The conservative portfolio has generated an average annual return (with dividends reinvested) of 9.7% over the past several years—almost exactly equal to the S&P500 over the same period. What the diversification has achieved for the theoretical holder of the conservative portfolio is considerably lower volatility than the S&P500. The conservative portfolio has an annualized standard deviation in return of 5.7% as compared to 7.2% for the S&P500. Standard deviation in return is a general measure of risk—and it is clear from the standard deviation in return that the conservative portfolio is

5

providing significant risk cover. The more aggressive portfolio has generated much higher returns over the past three years, but with substantially more risk (standard deviation in return of 7.9%). As the AB monograph points out, it is very unwise to simply use historical statistics for planning purposes. Global markets have been running at very low levels of volatility in the last several years and have also delivered returns that are far higher than these levels of volatility can sustain. Over long periods of time, investors are rewarded for bearing risk in equities. The amount of return that investor get for taking on the risk is called the equity risk premium. The equity risk premium over the last several years is way out of balance. Quantext Portfolio Planner (QPP) uses historical data combining long market histories for broad asset classes with nearer-term historical data for specific investments. QPP combines these data with assumptions about the future equity risk premium to generate forward-looking estimates of the future average returns and risk associated with individual assets. QPP then accounts for the correlations between assets to create a projection for the future of the total portfolio and uses Monte Carlo simulation to simulate a range of future outcomes for a portfolio. For our two model portfolios and for the S&P500, the projected futures are shown below:

	Monte Carlo Projections	
	Average Annual Return	Annualized Standard Deviation in Return
Conservative Portfolio	8.2%	11.8%
More Aggressive Portfolio	10.5%	16.5%
S&P500	8.3%	15.1%

Projected Performance

In the QPP output (as in the historical data), the conservative portfolio has average returns that are very close to the S&P500, but with considerably lower volatility than the S&P500 (as measured by Standard Deviation in return). Note that the projected average return for the conservative portfolio is 1.5% per year less than we have gotten over the most recent three years. Further, the projected volatility of the portfolio is much higher than the trailing three-year volatility. The recent three years have shown levels of volatility for broader markets that are very low compared to long-term market data. We

are in a period of low market volatility, but these are typically followed by periods of high volatility:

In other words, there are historical swings in market volatility but it is judicious to plan for the long-term average levels of market volatility. The more aggressive portfolio is projected to generate 2.3% more in average return per year than the conservative portfolio, albeit with 40% more volatility (Standard Deviation of 16.5% vs. 11.8%).

An investor in the conservative portfolio is exposed to far less short-term volatility than the investor in the more aggressive portfolio. Over a series of years, the investor in the more aggressive portfolio accrues the benefits of the higher average return so that even a large single-year downturn tends to leave her with more money in aggregate than the conservative investor. How pronounced is this effect? Consider an investor who starts investing in her portfolio at the rate of $15,000 per year at the age of 25 and continues to do so each year, indexing the savings amount upwards to keep pace with inflation. When we look at the projected future total portfolio values when she is 50 years old:

	Monte Carlo Projected Value At Age 50 (Starting at Age 25)		
	20th Percentile Value	Median Value	80th Percentile Value
Conservative Portfolio	$1,033,837	$1,490,454	$2,008,683
More Aggressive Portfolio	$1,166,038	$1,892,086	$3,022,604

Projected total portfolio values at age 50

These projections are generated using the Quantext Portfolio Planner, a Monte Carlo simulation. As we might expect, the median portfolio value for the more aggressive portfolio is considerably higher than for the conservative portfolio—27% percent higher, to be specific. What is perhaps less intuitive is that the 20th percentile value (the projected value of the portfolio in the worst 20% of projected future outcomes) is actually 12% higher for the more aggressive portfolio than for the conservative portfolio. The short-term risk is overcome by the higher long-term average returns so that your worst outcomes are actually better for the more aggressive portfolio than for the more conservative portfolio. Which portfolio is more risky and which one is more conservative from this perspective? The result that we are showing here is a natural

consequence of statistics and the AB paper shows the same force at work. The AB simulation and historical analysis make different (and more complex) assumptions about the savings rate for the investor, but the AB results still show that their substantially more aggressive strategy ends up with about the same 5th percentile portfolio value as the more conservative choices, but with far higher median and 95th percentile values. Taken together, our results and those from AB suggest that one must be very careful in determining the right risk level in a portfolio.

While we have shown the hypothetical investor during the savings phase of his life, the same effect is present even during the period of retirement, when you are drawing income from your portfolio.

This example is just that: a single example. Many factors such as the period of savings and the specific investments can change the results. It is also possible to do far better in terms of strategic diversification than these portfolios if you are willing to look beyond simple index ETF's. That said, the basic lesson holds for a range of portfolios. Portfolio risk is a function of time horizon. The prospect of ending up with 27% more in the median case in return for bearing more short-term market risk and being disciplined about investing seems to be an obvious choice. This is not to suggest that it makes sense to invest more aggressively in an indiscriminate manner. These are both reasonably well diversified portfolios (in the statistical sense). These analyses using Quantext Portfolio Planner (QPP) took about sixty seconds to set up and run—this type of analysis can be done quickly and efficiently and QPP can handle any publicly listed stock or fund.

For an investor, the goal is to invest such as to maximize the probability of having sufficient funds to generate the desired level of income in retirement. For the types of time horizons involved in retirement planning, the greatest risk is often that asset allocation is too conservative to generate sufficient growth. Our results from a range of simulations like the one shown here, along with those from the AB paper, suggest that choosing the correct level of risk tolerance will be crucial in maximizing the probability of generating sufficient wealth to fund future income. The choice of the proper risk

tolerance is quite personal, depending on wealth, savings rates, remaining working life, and projected income in retirement. Further, the risk level that you take on will be a function of the types of assets that you have available to you. This is especially critical for participants in 401(k) plans who may have fairly limited allocation choices. Clearly this issue also has a major bearing on the attractiveness of 'target date' funds.

The AB study helps to motivate the importance of balancing the relative risks to an investor by defining three risk categories:

1) Market risk
2) Longevity risk
3) Inflation risk

Market risk is the potential for losses due to moves in the market price of assets. *Longevity risk* is the potential that you will live longer in retirement than your assets can provide for. *Inflation risk* is the potential for high inflation to eat away at your real buying power. Many investors think in terms of Market risk, but ignore the need for fairly high-earning investments in order to address Longevity and Inflation risks. The tools exist to help investors determine the best asset allocation to account for all three sources of risk. While the AB analysis seems to suggest that these analyses are arcane and difficult, Quantext Portfolio Planner puts these capabilities in the hands of individual investors and advisors. This allows investors to come up with truly tailored plans and allocation strategies to manage these three sources of risk.

The AB study cited in this article is largely written to demonstrate that target date funds should be more aggressive than many of the offerings. Given that most investors will have only a single choice of target data funds in their 401(k) plans, what is an investor to do if the fund offering available is on the conservative end? This, of course, is the major dilemma of target date funds. They are designed for inexperienced investors, but an investor really needs to have a grasp of the basic risk/return properties for a target date fund in order to determine whether it is a good choice.

Looking at the broader issue of how uninvolved an investor with a defined contribution (DC) plan or other self-directed retirement savings can be, where does this leave us? There is no question that there are many people with DC plans or other self-directed investments who have neither the interest nor the knowledge to determine their proper asset allocation. In my opinion, no investor can afford to be this ill-informed. The good news is that tools are available to help investors look at their specific and unique situations and determine the best personalized asset allocation. The bad news, of course, is that many investors are simply ignoring the specifics of their financial planning and are thus highly likely to make long-term planning decisions that are far from ideal. While many plan sponsors feel that the solution is to provide a single 'no thinking' option in the form of a target date fund, I side with those who feel that the best approach is to educate individual investors to make better decisions. Individual investors and / or their advisors need to gain the knowledge to use tools such as Monte Carlo simulation to develop portfolios that are tailored to an investor's personal needs. Derek Bok, the current president of Harvard University, is said to have quipped "if you think education is expensive, try ignorance." This certainly applies to investment planning.

__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