Equity Floor Investments Increase the Probability of Retirement Success for 401(k) Participants in the Distribution Phase

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While the majority of research has focused on the accumulation phase of retirement plan investing, new information is being developed regarding the distribution phase. Numerous studies have shown that equity exposures are essential for maintaining a sustainable withdrawal rate over an extended period. This article explores the benefits of Equity Floor investments for a distribution phase portfolio and also incorporates the impact of possible future returns on the Equity Floor investment decision.

Introduction

The shift over the past three decades from professionally managed defined benefit (DB) plans to participant-directed defined contribution (DC) plans has raised questions about benefit adequacy and the quality of portfolio choices made by 401(k) plan participants. While most research has focused on the accumulation phase, new information is being developed regarding the distribution phase. The distribution phase is not a "mirror image" of the accumulation phase, but instead has special requirements to allow for sustainability. Just because an investment creates more wealth for the investor in the accumulation phase does not mean it will result in a higher probability of success for a retiree.

A bear market can have a considerable impact on a distribution portfolio that is forced to take withdrawals regardless of market conditions. While limiting a portfolio's equity exposure reduces the potential impact of negative market movements, numerous studies have shown that equity exposures are essential for maintaining a sustainable withdrawal rate over an extended period. Equity Floor investments, or investments that provide investors with both principal protection with equity market upside exposure, are ideal investments for distribution portfolios because they enable an investor to partially obtain equity-like returns while limiting downside risk. This article explores the benefits of Equity Floor investments for a distribution phase portfolio and also incorporates the impact of possible future returns on the Equity Floor investment decision.

Equity Floor Investments

Equity Floor investments, or investments that provide investors with both principal protection and with

equity market upside exposure, appeal to investors for a variety of reasons. The primary reason is that they enable an investor to receive equity returns without the risks associated with fully participating in the equity markets. There are a variety of methods that investors, both retail and institutional, can use to create an Equity Floor investment-type exposure today. Some examples include:

1. The direct purchase of Equity-Linked notes. These are offered by a variety of sponsoring organizations, such as Merrill Lynch & Co., Inc. (MITTs: Market Index Target-Term Securities) or Goldman, Sachs & Co. (SIGN: Stock Index Growth Notes) to name a few. These notes have varying terms, conditions, and maturities.
2. The direct purchase of Long-Term Equity Anticipation Securities (or LEAPS), along with a fixed-income portfolio. LEAPS are long-term American-style options that expire at dates up to two years and eight months in the future, as opposed to shorter-dated options that expire within one year. They are available on approximately 450 equities and 10 indexes and can be exercised and settled in stock prior to the expiration date. (Source: *http://www.cboe.com/TradTool/Symbols/SymbolIndex.aspx*)
3. Equity-Linked CDs: These are CDs that provide market upside potential with the principal and/or any guaranteed interest insured by the FDIC.
4. Equity-Indexed Annuity: This is perhaps the least understood Equity Floor investment. Equity-Indexed Annuities are written and guaranteed by insurance companies and typically have varying terms, conditions, and surrender penalties. There are three common formulas, called indexing methods, used to translate changes in the index level into gross returns on the contract: point-to-point, high watermark, and annual reset. Fees and expenses tend to be high and Equity-Indexed Annuities typically have high surrender penalties, especially in the early years of the contract.

Most of the before-mentioned Equity Floor investments are pre-packaged products. This means they are "off-the-shelf" solutions with general terms and conditions that are not meant to meet the precise needs of one client. These pre-packaged products tend to be expensive and complex, and there are a number of tax, liquidity, and market considerations an investor should consider before purchasing such an investment. In regards to Equity-Indexed Annuities, McCann and Luo (2006) note, "both the SEC and the NASD caution investors to review and understand the impact on likely returns of the myriad equity-indexed annuity features. No registered rep, insurance broker, or retail investor, and precious few finance PhDs, could understand these products."

While the costs are high with currently pre-packaged options, it is possible to create an Equity Floor investment through the purchase of a long call equity index option and zero coupon bond. The equity index option allows the investor to capture upward market movements, and the zero coupon bond provides the principal guarantee. There is, of course, no "free lunch" with Equity Floor investments. Typically the equity market participation rate (*i.e.*, how much the positive market movements that are captured by the investment are realized by the investor) is always less than the market (*e.g.*, 80 percent) and the overall return of such strategies does not typically include dividends (since index options don't include dividends).

Equity Floor investment pricing is impacted by a variety of factors. The first is interest rates. Interest rates are important primarily because they determine how much must be spent to purchase the principal protection component of a packaged strategy (interest rates are also a variable in determining the cost of the option, although volatility is the primary variable in option pricing). Whatever funds are left after buying the principal protection component can be used to purchase the option. Higher interest rates and cheaper options lead to higher equity participation rates because fewer funds are needed to purchase the bond component, and therefore more can be spent on the option.

Literature Review

William Bengen is widely regarded as the first person to address the issue of sustainable real withdrawal rates from a financial planning perspective. In his paper "Determining Withdrawal Rates Using Historical Data," he found that a "first year withdrawal rate of 4%, followed by inflation adjusted withdrawals in subsequent years, should be safe. In no past case has it caused a portfolio to be exhausted before 33 years." In the article, he went on to analyze the probability of five different equity portfolios (zero percent, 25 percent, 50 percent, 75 percent, and 100 percent) to sustain various withdrawal rates (one percent to eight percent), and he concluded that historical returns indicate an equity allocation between

50 percent and 75 percent to be the best starting allocation for retirees.

Additional research by Tezel (2004), Cooley, Hubbard, and Walz (1998), Cassaday (2006), and Guyton and Klinger (2006) confirmed the importance of 50 percent+ equity allocations for distribution portfolios. In an effort to increase the probability of achieving a particular withdrawal rate, a variety of decision rules and/or more advanced withdrawal strategies were introduced by Pye (2000), Bengen (2001), and Guyton and Klinger (2006). Ameriks and Warshawsky (2001) and Robinson (2007) have both noted the potential benefits from including annuities for a distribution portfolio; however, acceptance of annuities has been low historically in the United States, likely due to poor media exposure and the underlying complexity (not to mention surrender penalties) of the products.

Previous research on Equity Floor investments primarily focused on the benefits of such investments during an accumulation period and underlying investment costs. Edelson and Cohn (1993) wrote one of the first papers discussing Equity Floor investments, noting that equity-linked products "provide a risk-return trade-off that some investors desire, essentially providing 'insurance' against catastrophic equity performance for a 'premium'" and that they "offer a feasible alternative for the risk-shy investor." Milevsky and Abaimova (2006) noted "the portfolio protection comes at a price, but the strategy has the potential to play a critical role in mitigating the risk of retirement ruin, especially when used in the early years of retirement."

In a study by Edwards and Swidler (2005), the authors tested to determine whether Equity-Linked CDs had equity-like returns and found that Equity-Linked CDs had a mean expected return and standard deviation that differed little from the five-year Treasury note. The authors suggested that as competition increases in the Equity-Linked CD market, the cost of pre-packaging such strategies should decrease and approach the actual costs of directly creating such a strategy (through the direct purchase of a zero coupon bond and an option).

McCann and Luo recently noted (2006) that, "Equity-linked notes are complex, opaque and expensive—and the more complex and opaque they are, the more expensive they are." While McCann and Luo concluded that such investments fail the "reasonable-basis" test since they "add nothing to retail investors' portfolios that can't be acquired from investments," the authors failed to consider the advantages of Equity Floor investments for a portfolio subject to distributions or possible advantages should future market returns be less than historical returns.

Boyle and Tian (2006) focused on the optimality of such contracts from the perspective of the investor to determine how Equity Floor investments can be tailored to best suit investors' preferences. They concluded that including an additional constraint that provides for the opportunity to beat or match a stochastic benchmark with a positive probability would make Equity Floor-type investments more advantageous to investors.

The Impact of Lower Future Market Returns

Future return assumptions are the most important part of any type of distribution analysis. Previous research on sustainable withdrawal rates has typically been based entirely on historical data. While using purely historical returns to represent the returns of retirees (and pensions) is a reasonable estimate of what may happen in the future, doing so ignores the possibility that future returns may be lower than historical returns. If returns are lower than expected, there could be a material impact on the sustainable withdrawal rate achievable from the distribution portfolio (whether it be a retiree's savings or a pension plan).

Exhibit 1 includes historical return information from the two most common periods used when determining sustainable withdrawal rates: the last 80 years and the last 35 years. The last 80 years is common since it represents the longest available period of market returns available, although the range of indices available is not as great as the previous 35 years (which is why the last 35 years is so common). Note, the allocation for the 60/40 portfolio is 20 percent Cash, 20 percent Intermediate Bond, 20 percent Large Blend Equity, 20 percent Small Blend Equity, and 20 percent International Equity (see the following section for data definitions). For readers not familiar with real and nominal returns, real returns are "inflation adjusted" and are the returns an investor would have earned after subtracting inflation of the period (or the increase in the price level or cost of living, typically defined as the CPI), and nominal returns are the rate of return in monetary terms, unadjusted for any change in the price level (*i.e.*, inflation).

Historically, the real (inflation adjusted) return on a 60/40 portfolio has ranged between 6.05 percent (1927–2006, geometric average) to 7.29 percent (1972–2006, arithmetic average). Since the 1927–2006 returns are more conservative (*i.e.*, lower), these will be considered the base returns for a balanced

Exhibit 1. Historical Market Returns: 1927–2006 and 1972–2006

Historical Returns: 1927–2006 (Last 80 Calendar Years)

	Real Return (Inflation Adjusted)			Nominal Return (Total Return)		
	Geometric Average	Arithmetic Average	Standard Deviation	Geometric Average	Arithmetic Average	Standard Deviation
Cash	0.72%	0.81%	4.10%	3.87%	3.91%	3.18%
Intermediate Bond	2.97%	3.11%	5.37%	6.18%	6.25%	3.89%
Large Blend Equity	7.33%	9.45%	20.96%	10.66%	12.85%	21.23%
Small Blend Equity	10.46%	14.10%	28.55%	13.89%	17.56%	28.88%
International Equity	5.16%	7.25%	21.59%	8.43%	10.50%	21.72%
60/40 Portfolio	6.05%	6.80%	12.73%	9.35%	10.07%	12.54%
CPI (Inflation)	3.09%	3.18%	4.27%			

Historical Returns: 1972–2006 (Last 35 Calendar Years)

	Real Return (Inflation Adjusted)			Nominal Return (Total Return)		
	Geometric Average	Arithmetic Average	Standard Deviation	Geometric Average	Arithmetic Average	Standard Deviation
Cash	1.43%	1.46%	2.68%	6.15%	6.20%	3.07%
Intermediate Bond	4.30%	4.44%	5.44%	9.16%	9.23%	4.03%
Large Blend Equity	8.10%	9.35%	16.28%	13.15%	14.32%	16.30%
Small Blend Equity	10.94%	12.99%	20.47%	16.13%	18.12%	20.93%
International Equity	6.75%	8.92%	22.00%	11.75%	13.83%	21.97%
60/40 Portfolio	6.75%	7.29%	10.57%	11.73%	12.19%	10.12%
CPI (Inflation)	4.65%	4.70%	3.21%			

portfolio. However, if the consensus predictions from a variety of experts turn out to be true, as is outlined in Exhibit 2, the actual future real return on a 60/40 might be actually closer to four percent.

Based on the average consensus of the studies considered in Exhibit 2, the average expected future real return for equities is 5.2 percent. Based upon an average expected equity premium of 2.6 percent, the implicit real rate of return for fixed income is 2.6 percent. This suggests a real return of 4.1 percent for a 60/40 portfolio on a forward-looking basis (or a 6.1 percent nominal return). Based upon the 1927–2006 return series, an expected future real return of 4.1 percent for a 60/40 portfolio is considerably less than the 6.80 percent historical real arithmetic return and the 6.05 percent historical real geometric return and represents a forecasted decrease in real returns of *at least* two percent. Note, had the 1972–2006 period been selected, the necessary reduction of historical returns to incorporate the expected future returns would have been closer to three percent. The implications of lower future market returns on a distribution portfolio are considerable.

Equity Floor Investment Success Probability Analysis

The authors examined whether or not introducing Equity Floor investments increased the probability of success for a distribution portfolio. Our analysis also included the impact of a lower future return environment. Monthly data from 1927 until 2006 (960 months) was obtained on five asset categories for the analysis:

1. Cash: defined as the yield on the 3-Month Treasury Bill: Secondary Market Rate. Data obtained from

Exhibit 2. Future Forecasted Market Returns

Study	Real Equity Returns	Nominal Equity Returns	Equity Risk Premium
O'Shaughnessy (2007)—Historical	3–5%		
O'Shaughnessy (2007)—Various Models	4–7%		
Seigel (2006)	6%	8%	4%
Niederhoffer and Castaldo (2004)	6.30%		
Dimson, Marsh, and Staunton (2004)	5%	7–8%	3%
Ibbotson and Chen (2003)*	2.36%	5.44%	0.24%
Ibbotson and Chen (2003)**	6.29%	9.37%	3.97%
Arnott and Bernstein (2002)	2–4%	3.2%	0%
Welch (2001)		9.1%g, 10%a	5.5%
Campbell, Diamond, and Shoven (2001)—Campbellg	5–5.5%		1.5–2.5%
Campbell, Diamond, and Shoven (2001)—Campbella	6.5–7%		3–4%
Campbell, Diamond, and Shoven (2001)—Diamond	6–6.5%		1–1.5%
Campbell, Diamond, and Shoven (2001)—Shoven	6–6.5%		3–2.5%
Approximate Average	**5.2%**	**7.2%**	**2.6%**
	Real Return	**Nominal Return**	
Implicit Bond Return Based on the Equity Premium	**2.6%**	**4.5%**	
Estimated Return of a 60/40 Portfolio	**4.1%**	**6.1%**	

* Using forward-looking earnings
** Using forward-looking dividends
g = geometric
a = arithmetic

Tradetools.com (1927–1933) and the St. Louis Federal Reserve (1934–2006): *http://research.stlouisfed.org/fred2/*.

2. Intermediate-Term Bond: defined as the return on the Moody's Seasoned Aaa Corporate Bond Yield, assuming a duration of 10 years. Data obtained from the St. Louis Federal Reserve Web site: *http://research.stlouisfed.org/fred2/*.
3. Domestic Large Blend Equity: defined as the return on the "Big Neutral" portfolio based on the 2×3 portfolio return information publicly available on Kenneth French's Web site: *http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html*.
4. Domestic Small Blend Equity: defined as the return on the "Small Neutral" portfolio based on the 2×3 portfolio return information publicly available on Kenneth French's Web site: *http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html*.
5. International Equity: defined as the return on the Global Financial Data World ex-USA Return Index. Data obtained from Global Financial Data.

The monthly returns were adjusted into real terms by subtracting the monthly inflation rate, which was defined as the increase in the Urban Consumer Price Index (data obtained from the Bureau of Labor Statistics). Real returns were considered because people seek to maintain a constant level of purchasing power as prices increase with inflation. While there are different types of inflation (*e.g.*, health care inflation), the CPI was used since it is the most common definition. The annual geometric real returns and annual standard deviations for the five asset categories considered in the analysis were included in Exhibit 2.

The balanced portfolio tested for the analysis was a 60/40 portfolio with an equal weighted allocation between the five asset categories. Therefore, the

portfolio would consist of 20 percent Cash, 20 percent Intermediate-Term Bond, 20 percent Domestic Large Blend, 20 percent Domestic Small Blend, and 20 percent International Equity. Such a balanced allocation represents an allocation that is broadly diversified and is one that could reasonably be expected to be implemented by an investment professional for a client.

There were two primary types of 60/40 portfolios tested. The first type was a traditional long-only, option free portfolio, while the second type used an Equity Floor investment for the entire equity portion of the 60/40 portfolio (*i.e.*, 60 percent of the total allocation; the fixed income piece would not be altered). In order to incorporate the costs associated with implementing an Equity Floor investment strategy, two adjustments were made to the real returns for the equity portion of the Equity Floor 60/40 Portfolio. First, each monthly real return was reduced by 20 basis points in order to reflect the fact that these types of investments typically exclude dividends. Second, the annual equity participation rate was only targeted to be 80 percent, and this targeted reduction was in addition to the 20 basis point monthly reductions. Although the annual equity participation for Equity Floor investments has varied historically, 80 percent was selected as the equity participation rate as a conservative estimate.

An example can illustrate the impact of the reductions. Assume a regular equity portfolio gained 1.00 percent each month for a year, resulting in an annualized return of 12.68 percent. First, the return on the equity portion of the Equity Floor portfolio would be reduced by 20 bps each month, resulting in a period performance of 10.03 percent. Next, only 80 percent would actually be the realized return by the investor. The final investor net return would then be 8.03 percent. While Equity Floor investments mandate varying holding periods, it was assumed that the holding window was only one year and all tax implications are ignored.

The actual returns used for testing purposes were created through a process known as bootstrapping. Bootstrapping is a type of simulation analysis where the in-sample test period returns are randomly recombined to create sample annual returns. For the analysis, the 960 monthly returns available from the 80-year test period were randomly recombined to create hypothetical real annual rates of return for the analysis. A benefit of using actual returns (through bootstrapping) is that no assumption needs to be made regarding the distribution of returns (*e.g.*, lognormal or leptokurtic) and that the return series can be easily adjusted to reflect the possibility of lower future returns. A potential problem with bootstrapping, though, is that it assumes the correlations among the asset categories are maintained for each recombined bootstrapped subperiod. However, since the recombination period was small (monthly) and the recombination sample group was large (960 months spanning 80 years), the cross-correlation impact was considered to be minimal.

In order to incorporate the possibility of lower future returns, annual return reductions between zero percent (*i.e.*, no change) and five percent in one percent increments were considered for the analysis. The return reduction is applied to the monthly real return of each of the five asset categories separately, which are then combined to get the aggregate performance of the 60/40 portfolio. The monthly reduction is based on the necessary amount to make the geometric reduction equal to the actual reduction. For example, if the overall reduction was two percent, one twelfth of two percent was not deducted from each monthly return. Instead, the monthly reduction would be .168 percent, which generates a total (geometrically linked) annual return of -2 percent. While the reader may question the likelihood of a four percent return reduction, this analysis did not incorporate the impact of advisor fees and investment expenses (which can easily be greater than 1.5 percent) as well as the impact of taxes (*see* Pye (2001) for more information on this).

The annual distribution for each portfolio was assumed to take place at the beginning of the year during the distribution period. Each test scenario (*e.g.*, 30-year distribution period and four percent real withdrawal rate) was subjected to a 10,000 run Monte Carlo simulation and viewed on a pass/fail basis. A portfolio was considered successful if it did not run out of money during the distribution period, while a portfolio is viewed as failing if it did not last the entire distribution period. The portfolios were assumed to be held in tax-deferred accounts, and any tax implications of the withdrawals are ignored. Because the monthly returns were bootstrapped and recombined to determine the overall portfolio return, the implicit assumption was that the portfolios are rebalanced back to the target allocation monthly.

Results

Introducing an Equity Floor investment dramatically decreased the probability of failure for a number of the test scenarios, primarily those with shorter distribution periods and smaller withdrawal percentages.

The results for the Traditional 60/40 Portfolio are included in Appendix I, the results for the Equity Floor 60/40 Portfolio (where the equity floor component is the equity portion, assuming a 20 bps monthly reduction and 80 percent market upside participation rate for the equity floor portion) are included in Appendix II, and the differences between the two portfolios are included in Appendix III. Exhibit 3 includes the results for the 30-year distribution period, assuming a –2 percent future return for the Traditional 60/40 and Equity Floor 60/40 Portfolios.

As the reader can see in Exhibit 3, as well as in the appendices, the Equity Floor provided the greatest benefit for smaller distribution rates and shorter time periods. As an example, for the 30-year distribution period, assuming a five percent real distribution rate, and a –2 percent future change in returns, the probability of failure for the Traditional 60/40 Portfolio is 41.84 percent versus 20.49 percent for the Equity Floor 60/40 Portfolio.

While the results of this analysis may appear to conflict with the findings of previous studies, primarily those of McCann and Luo, it is important that the reader understand that McCann and Luo's research focused on the benefits of Equity Floor investments from an *accumulation* perspective, while this research discusses their *distribution* benefits. Just because an investment creates more wealth for the investor does not mean it will result in a higher probability of success for a retiree. Exhibit 4 shows the median account values for a number of distribution periods (years) for the Traditional 60/40 Portfolio and Equity Floor 60/40 Portfolio. Note, that for every period the Traditional 60/40 Portfolio results in a higher expected median value than the Equity Floor 60/40 Portfolio (*e.g.*, $833,530 versus $538,652 for a 30-year distribution period).

However, just because the Traditional 60/40 Portfolio results in a higher expected median portfolio does not mean it is more likely to meet the needs of a retiree. For example, while the Traditional 60/40 Portfolio had a higher median account value than an Equity Floor 60/40 Portfolio 30 years following a six percent distribution rate ($833,530 versus $538,652), its 10th percentile account value (*i.e.*, the worst one in 10 outcomes) was likely to fail four years before the Equity Floor 60/40 Portfolio. Exhibit 5 includes the 10th percentile results based upon the same assumptions as Exhibit 4.

A different method to view the relative benefits of each strategy (Traditional 60/40 and Equity Floor 60/40) is to look at the probabilities of failure. Exhibit 6 is based upon the same scenario assumptions as Exhibits 4 and 5 ($1 million starting balance with a six percent distribution rate) but looks at the probability of failure instead of account value.

Exhibit 3. Probability of Failure for a Variety of Distribution Rates: Traditional 60/40 Portfolio vs. Equity Floor 60/40 Portfolio

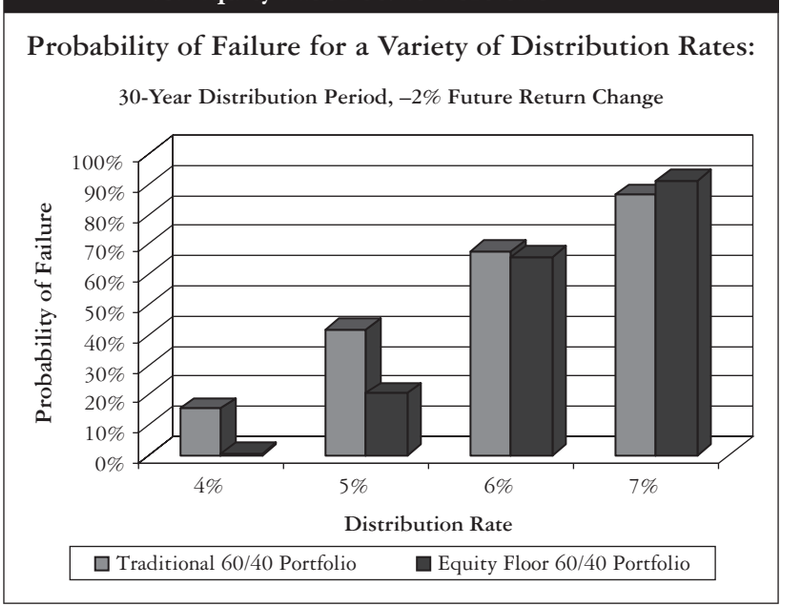


Exhibit 4. Median Portfolio Value for a Number of Distribution Periods: Traditional 60/40 Portfolio vs. Equity Floor 60/40 Portfolio

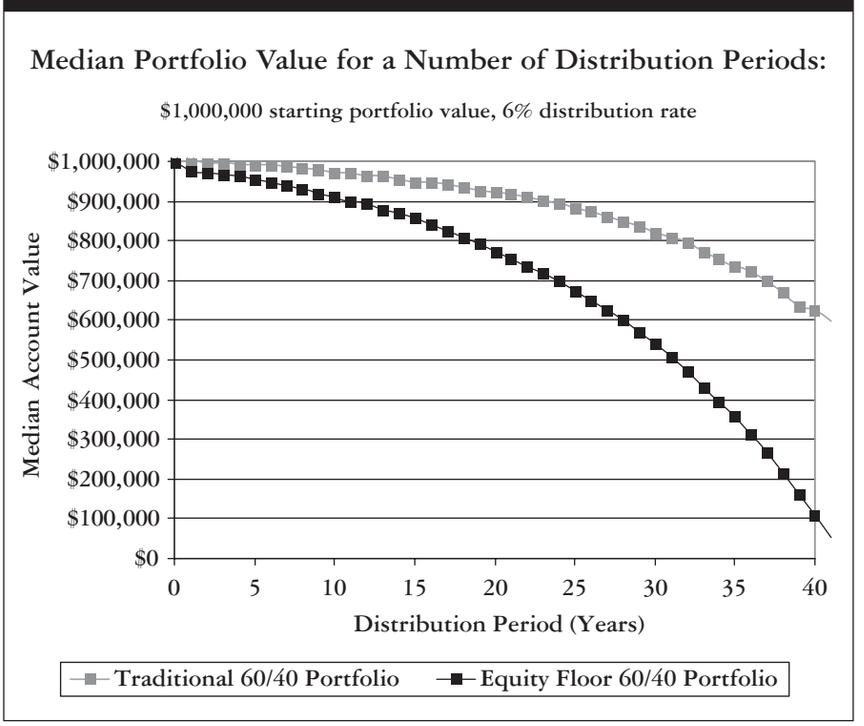


Exhibit 6 also attests to the fact that just because an investment has a higher return doesn't mean that it will provide a higher degree of certainty of achieving a distribution goal. The Traditional 60/40 Portfolio had a higher geometric real return than the Equity Floor 60/40 Portfolio example used in Exhibits 4, 5, and 6 (6.28 percent versus 5.86 percent, respectively); it did not increase the probability of success of achieving a distribution rate of six percent.

Why Equity Floor Investments Add Value

The primary reason for introducing an Equity Floor investment to a 60/40 portfolio (as the equity piece) was that it was able to lower probabilities of failure related to the overall distribution of returns experienced by the portfolio. Exhibit 7 includes the distribution of annual returns for 10,000 simulated 60/40 portfolios, assuming a no future change in equity returns, for both the 60/40 Traditional and 60/40 Equity Floor Portfolios. Note, had a negative equity adjustment been made, it would have made the Equity Floor Portfolio look more attractive because the minimum equity return would be zero percent.

The distribution of the Traditional 60/40 Portfolio is approximately normal, but the distribution for the Equity Floor 60/40 Portfolio is clearly non-normal and is more option-like (which is to be expected due to the nature of the Equity Floor investment). While the 60/40 Regular Portfolio had a higher geometric average return than the Equity Floor 60/40 Portfolio (6.26 percent versus 5.86 percent, respectively) and a higher potential for upside returns, it also had a much greater exposure to the possibility of negative returns. This increased variability is reflected in the annualized standard deviations of the 60/40 Regular and 60/40 Equity Floor Portfolios at 10.86 percent versus 6.96 percent, respectively; however, the distribution of returns of the 60/40 Equity Floor Portfolio (which are very option-like) are clearly non-normal.

The non-normality of the return distribution for the Equity Floor Portfolio suggests that standard deviation is of limited use in describing the variability of such a portfolio and that a more appropriate measure, such as downside risk (or semi-standard deviation) should be used. For more information on downside risk please *see Managing Downside Risk in Financial Markets* by Frank Sortino and Stephen Satchell or "Post Modern Portfolio Theory" by Pete Swisher and Gregory Kasten, published in the September 2005 edition of the *Journal of Financial Planning*.

Exhibit 5. 10th Percentile Portfolio Value for a Number of Distribution Periods: Traditional 60/40 Portfolio vs. Equity Floor 60/40 Portfolio

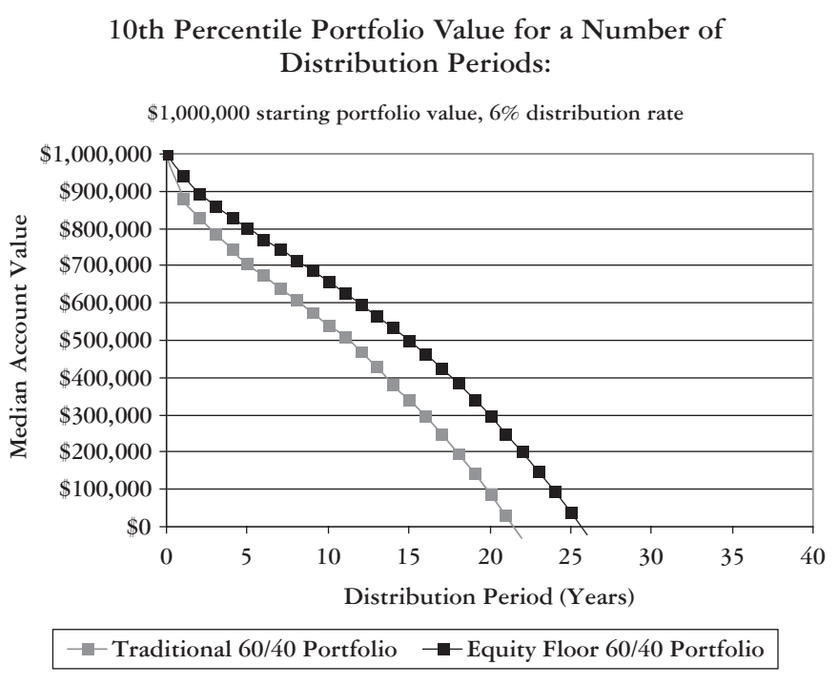


Exhibit 6. Probability of Failure for a Number of Distribution Periods: Traditional 60/40 Portfolio vs. Equity Floor 60/40 Portfolio

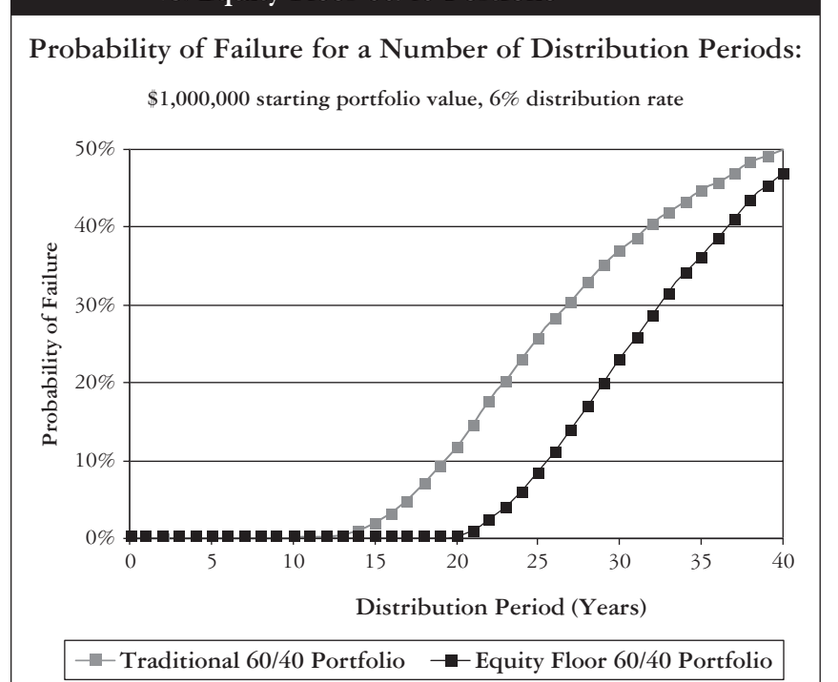
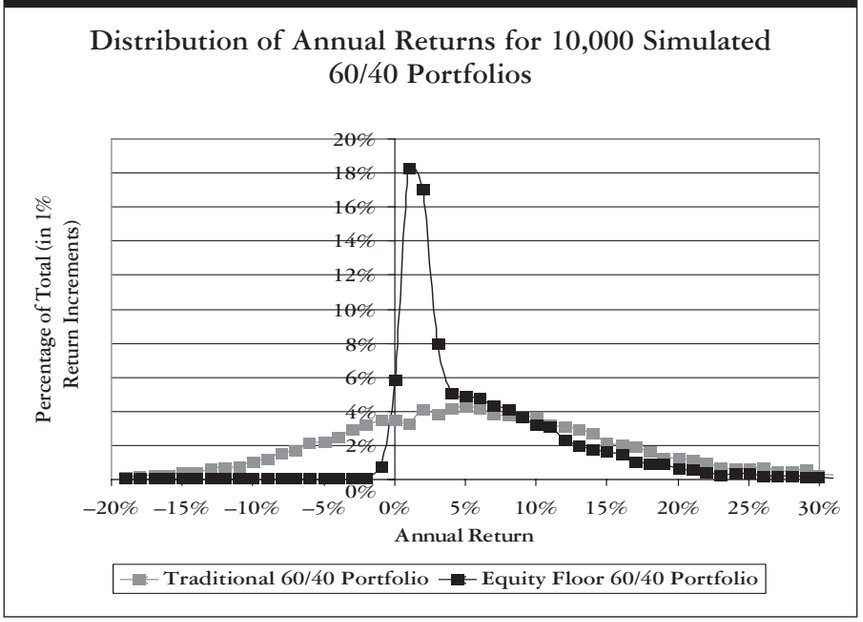


Exhibit 7. Distribution of Returns for Traditional 60/40 Portfolio and the 60/40 Portfolio with Equity Return Floor: No Future Equity Return Adjustment



When downside risk is considered when comparing the two portfolios, opposed to standard deviation, the benefits of an Equity Floor investment become clearer. Assuming a target return of zero percent (where only those returns of less than zero percent would be considered for the downside risk calculation), the downside risk of the 60/40 Regular Portfolio would be 4.10 percent while the 60/40 Equity Floor Portfolio would be only 0.23 percent. If more complex strategies were introduced along with an Equity Floor investment (*e.g.*, annuities), the usefulness of standard deviation as describing the return variability would likely diminish even further.

Conclusion

For 401(k) plan participants, accumulation and distribution time frames represent two very different investment periods and therefore call for specific investment strategies. While an Equity Floor investment may not lead to a higher expected portfolio value in the accumulation phase (which has been the focus of previous research regarding Equity Floor investments), it can increase the probability of success for a distribution portfolio, especially for those retirees with shorter distribution time periods and lower distribution rates. The importance of an Equity Floor investment is even further increased if future returns are lower than historical returns (as is projected by a number of experts) due to the focus of Equity Floor investments on principal protection.

Equity Floor investments are gaining some traction by the public in terms of retail client investors, but have seen little use in 401(k) plans during either the accumulation or distribution phases. Our research has shown that they are probably not helpful in the accumulation phase, but they can add value in the distribution phase. As the market demand for these investments increases, the costs and complexity associated with prepackaged Equity Floor investments is likely to decrease. At the present time more research is indicated to examine the benefits and risk of Equity Floor investments before their use is expected to be widespread.

Fiduciary best practices dictate that plan fiduciaries utilize a process to make certain they understand the Equity Floor investments' return parameters, various aspects of risk ("What can go wrong?"), and both explicit and implicit cost structures. Only after thoroughly examining these features can plan fiduciaries opine on whether or not such investments are prudent. Additional research is required to develop a state of the art fiduciary review process for Equity Floor investments. ■

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Appendix I. Probabilities of Failure for a Variety of Scenarios for a Traditional 60/40 Portfolio							
		PROBABILITY OF FAILURE					
Distribution Period (Years)	Withdrawal Percentage	Change in Historical Real Return					
		0.00%	–1.00%	–2.00%	–3.00%	–4.00%	–5.00%
20	4%	0.23%	0.48%	1.29%	3.14%	7.47%	15.04%
25	4%	1.06%	2.66%	6.65%	14.63%	27.07%	43.14%
30	4%	2.55%	6.87%	15.61%	29.97%	46.97%	65.32%
35	4%	4.65%	12.30%	25.37%	42.70%	62.38%	79.87%
40	4%	7.06%	17.24%	33.56%	52.91%	73.33%	88.33%
20	5%	1.75%	4.06%	9.19%	17.21%	29.43%	43.81%
25	5%	6.77%	14.47%	26.08%	41.25%	57.75%	73.09%
30	5%	13.82%	25.97%	41.84%	59.22%	75.74%	88.46%
35	5%	19.86%	35.33%	53.29%	71.48%	86.29%	94.60%
40	5%	25.00%	42.42%	62.17%	79.72%	91.67%	97.29%
20	6%	9.35%	17.31%	28.92%	42.65%	58.25%	71.72%
25	6%	22.98%	36.77%	52.57%	67.89%	81.50%	91.24%
30	6%	35.17%	51.09%	67.72%	82.11%	92.12%	97.02%
35	6%	43.40%	61.05%	77.46%	89.84%	96.07%	98.79%
40	6%	49.22%	67.97%	83.65%	93.28%	97.79%	99.60%
20	7%	26.89%	39.56%	54.40%	67.90%	80.02%	89.56%
25	7%	46.06%	61.62%	75.39%	86.85%	93.87%	97.61%
30	7%	58.60%	73.84%	86.43%	94.00%	97.77%	99.36%
35	7%	66.55%	81.45%	91.60%	96.85%	99.01%	99.86%
40	7%	72.15%	85.94%	94.32%	98.07%	99.62%	99.97%
Annual Standard Deviation		10.86%	10.76%	10.66%	10.56%	10.46%	10.37%

30-Year Distribution Period

Appendix II. Probabilities of Failure for a Variety of Scenarios for an Equity Floor 60/40 Portfolio							
		PROBABILITY OF FAILURE					
Distribution Period (Years)	Withdrawal Percentage	Change in Historical Real Return					
		0.00%	–1.00%	–2.00%	–3.00%	–4.00%	–5.00%
20	4%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
25	4%	0.00%	0.00%	0.00%	0.05%	0.59%	3.64%
30	4%	0.00%	0.03%	0.46%	3.05%	10.21%	24.35%
35	4%	0.03%	0.58%	3.39%	11.12%	27.12%	49.58%
40	4%	0.24%	2.00%	7.91%	21.96%	44.06%	67.39%
20	5%	0.00%	0.02%	0.04%	0.40%	2.46%	7.55%
25	5%	0.15%	1.60%	5.52%	14.45%	29.98%	50.39%
30	5%	2.66%	8.37%	20.49%	39.34%	60.66%	77.86%
35	5%	6.77%	17.95%	36.67%	59.34%	77.91%	90.14%
40	5%	11.33%	27.05%	49.64%	71.32%	86.75%	95.38%
20	6%	1.08%	4.03%	10.24%	22.00%	38.73%	57.01%
25	6%	11.10%	23.63%	42.36%	61.88%	77.26%	88.23%
30	6%	25.90%	45.96%	65.97%	81.21%	91.40%	96.72%
35	6%	38.67%	61.01%	78.57%	90.37%	96.44%	99.02%
40	6%	48.62%	69.97%	85.35%	94.38%	98.39%	99.45%
20	7%	18.40%	33.26%	51.62%	67.63%	80.30%	89.15%
25	7%	47.52%	66.10%	80.04%	90.06%	95.69%	98.39%
30	7%	65.97%	80.91%	91.14%	96.45%	98.91%	99.52%
35	7%	75.82%	88.35%	95.37%	98.63%	99.45%	99.74%
40	7%	81.36%	92.09%	97.36%	99.24%	99.66%	99.91%
Annual Standard Deviation		6.96%	6.77%	6.57%	6.38%	6.18%	5.99%

30-Year Distribution Period

Appendix III. Decrease in Probability of Failure (*i.e.*, Benefit of the Equity Floor): Traditional 60/40 Portfolio Minus the Equity Floor 60/40 Portfolio Results

		DECREASE IN PROBABILITY OF FAILURE					
Distribution Period (Years)	Withdrawal Percentage	Change in Historical Real Return					
		0.00%	–1.00%	–2.00%	–3.00%	–4.00%	–5.00%
20	4%	0.23%	0.48%	1.29%	3.14%	7.47%	15.04%
25	4%	1.06%	2.66%	6.65%	14.58%	26.48%	39.50%
30	4%	2.55%	6.84%	15.15%	26.92%	36.76%	40.97%
35	4%	4.62%	11.72%	21.98%	31.58%	35.26%	30.29%
40	4%	6.82%	15.24%	25.65%	30.95%	29.27%	20.94%
20	5%	1.75%	4.04%	9.15%	16.81%	26.97%	36.26%
25	5%	6.62%	12.87%	20.56%	26.80%	27.77%	22.70%
30	5%	11.16%	17.60%	21.35%	19.88%	15.08%	10.60%
35	5%	13.09%	17.38%	16.62%	12.14%	8.38%	4.46%
40	5%	13.67%	15.37%	12.53%	8.40%	4.92%	1.91%
20	6%	8.27%	13.28%	18.68%	20.65%	19.52%	14.71%
25	6%	11.88%	13.14%	10.21%	6.01%	4.24%	3.01%
30	6%	9.27%	5.13%	1.75%	0.90%	0.72%	0.30%
35	6%	4.73%	0.04%	–1.11%	–0.53%	–0.37%	-0.23%
40	6%	0.60%	–2.00%	–1.70%	–1.10%	–0.60%	0.15%
20	7%	8.49%	6.30%	2.78%	0.27%	–0.28%	0.41%
25	7%	–1.46%	–4.48%	–4.65%	–3.21%	–1.82%	–0.78%
30	7%	–7.37%	–7.07%	–4.71%	–2.45%	–1.14%	–0.16%
35	7%	–9.27%	–6.90%	–3.77%	–1.78%	–0.44%	0.12%
40	7%	–9.21%	–6.15%	–3.04%	–1.17%	–0.04%	0.06%

30-Year Distribution Period