ASSET ALLOCATION BASED ON ACCUMULATED WEALTH AND FUTURE CONTRIBUTIONS

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ABSTRACT

The median accumulated investment balance for investors with 10 to 15 years to retirement falls drastically short of what is needed with some studies suggesting more than half the population in this age group have virtually zero savings. Individuals who find themselves in this predicament and intend to make near certain future contributions should consider the present value of these future contributions as a risk-less income stream into their retirement account. With this in mind, early contributions should generally be directed towards 100% equity or similar risk-return asset classes. Using a simplified 50/50 stock-bond example, adjusting contributions to account for this unrealized stream of "risk-free" cash into the retirement account will increase expected terminal wealth after 15 years by approximately 10% with minimal increases in end of horizon risk, although within-horizon risk is magnified. For those with significant balances, consideration of future contributions is not as critical.

INTRODUCTION

The typical asset allocation model almost exclusively focuses on the risk/return relationship for assets already realized and invested. There is the classic age in bonds or 100 minus age model to determine the percentage in equities. A variety of target date or life cycle funds follow this type of concept. Other models are based solely on an investor's risk aversion and will often delineate portfolios as conservative, moderate, or aggressive. Regardless of the asset allocation model used, two major considerations are invariably overlooked: current wealth and expected future contributions. Friend and Blume (1975) first pointed this out and even stated, "virtually all empirical applications of portfolio theory have ignored human wealth in spite of its obvious importance to the demand for risky assets." This issue remains in the financial planning area to this day.

To explain further, consider two types of investors with 15 years until retirement. Each earns $50,000 a year and both plan to make $10,000 contributions each year. However, the first investor has zero invested wealth while the second has already accumulated $300,000. A typical age rule might suggest a 50/50 mix. However, this is biased downward for both investors if future contributions are not considered.

Although the first investor has zero accumulated wealth, there is $150,000 in "riskless" future contributions. This is riskless only in the sense that it is assumed the investor will not lose his or her income stream, face unexpected expenses, etc. that would derail future planned contributions. Thus, for the first few years, this investor may want to consider 100% in equities until wealth at risk relative to future contributions has increased. Large losses at this point in the accumulation phase, despite the late start and limited time horizon, will be mitigated by future contributions. In addition, future social security payments which can also be considered a risk-free annuity will be a much larger proportion of retirement income, further increasing the actual percentage of wealth in relatively risk-free low yielding assets.

For the second investor, wealth at risk is much greater as future contributions are only 50% of accumulated value. However, the investor still has 33% in "riskless" future contributions, $150,000/$450,000. At this point, a true 50/50 mix would mean the investor should have $225,000 in equities. Depending on asset returns and how the suggested asset allocation adjusts through time, this investor's initial contributions will be directed towards both bonds and stocks although not at the implied 50/50 ratio.

Thus, financial planners and investors need to focus not just on the risk/return relationship for assets in the retirement account, but also need to account for those assets that have not yet been earned, but will be directed towards retirement. This study shows the risk/return characteristics of the classic investing approach versus considering the inclusion of future contributions. Findings suggest with little difference in terminal risk, expected terminal wealth could be increased by approximately 10% for investors with no accumulated balances. For those with significant balances, the consideration of future contributions is not as critical.

TARGET INVESTMENT GROUP

Although this analysis can be effectively applied to any investor at any age, it is likely more relevant to investors that have greater certainty about future contributions. This would seem to be particularly apt for investors in the 50 to 65 age group category as their children are likely out of college, income is peaking, retirement savings have become a priority, and on average, there is less uncertainty about job security. These factors should lead to greater certainty about what can and will be contributed towards retirement.

Unfortunately, many investors even at this age have little savings. Recent news based on a variety of surveys (Employee Benefit Research Institute (EBRI), Fidelity, Federal Reserve) place median retirement account values for those between 45-65 anywhere from $65,000 to $120,000, (American Association of Retired Persons (AARP), 2013; Average Retirement Savings Guide, 2013; Greenhouse, 2013). The results of many of these surveys are likely biased upwards just based on the clientele surveyed. The Schwartz Center for Economic Policy Analysis (SCEPA) using 2010 Census data estimated that 75% of those in the 50-64 age (43 of 58 million) have a paltry median retirement savings of $6,500, see Table 1.

Table 1 Estimated retirement balances based on analysis and surveys from SCEPA, EBRI, Fidelity, and the Federal Reserve		
SCEPA, Age 45-65	Retirement Balances	
Income	Median	Mean
Bottom 25%: $0 to 10,800	$0	$16,034
25-50%: $10,801 to $27,468	$0	$21,606
50-75%: $27,469 to $52,200	$6,500	$41,544
75-100%: $52,201+	$52,000	$105,012
EBRI, Age 50-54	NA	111,900
Fidelity, 55-64	NA	$65,000
Federal Reserve, 55-64	NA	$120,000

This changes the dynamic of contribution value to accumulated wealth. It is commonly suggested that at the age of 55, one should have saved approximately 5x their salary, (Fidelity; Greenhouse, 2013). With an income of $50,000, that would mean an investor should have $250,000 at this point. For investors with little or no accumulated wealth, focusing on the target date risk/return tradeoff instead of the instantaneous risk/return tradeoff will improve the expected ending outcome while adapting to risk preferences of the individual as quickly as possible. In addition, this method avoids the use of margin and leverage which few beginning investors are likely to employ, nor are even able to if using standard work related 401k accounts.

INVESTMENT PLANNING AND RISK AVERSION

Several studies have suggested investors have constant relative risk aversion led by Friend and Blume, (1975). Thus, regardless of wealth, the percentage held in the risky asset would remain the same. Most of the studies that come to this conclusion are based on cross sectional data and do not give any indication how relative risk aversion may change for an individual with changes of wealth. Guiso and Paiella (2008) conclude there is decreasing absolute risk aversion as wealth increases while Chiappori and Paiella (2011) conclude there could be decreasing relative risk aversion depending on the underlying assumptions. If this is the case, and allowing the additional assumption that wealth for retirement includes future contributions, then the amount of equity exposure should be higher than usually considered prudent. For those with no accumulated wealth, this increase can be dramatically higher.

Using Friend and Blume's (1975) derivations, it is easy to show how the amount in the risky asset is a function of wealth. They show the following:

$$E(R_m - r_f)/\sigma^2_m = C^*[R/W + \beta_{hm^*} H/W] \qquad (1)$$

where $E(R_m - r_f)/\sigma^2_m$ is the expected risk premium per unit of risk for the market portfolio, R is the liquid wealth amount in the risky asset, β_{hm} is the ratio between the market covariance and an investor's human capital divided by the variance of the market, H is the value of the investor's human wealth, W is the sum of all wealth, and C is the risk aversion parameter. Their study involved estimating C, while R/W is of concern here. Setting $\beta_{hm} = 0$ which assumes future contributions are not correlated to market returns, C = 2 which is the general average estimate of risk aversion, $E(R_m - r_f) = 0.05$ which is the approximate historical equity risky premium, and $\sigma^2_m = 0.04$ which corresponds to a 20% market standard deviation, equation (1) simplifies to:

$$R/W = 0.55. \tag{2}$$

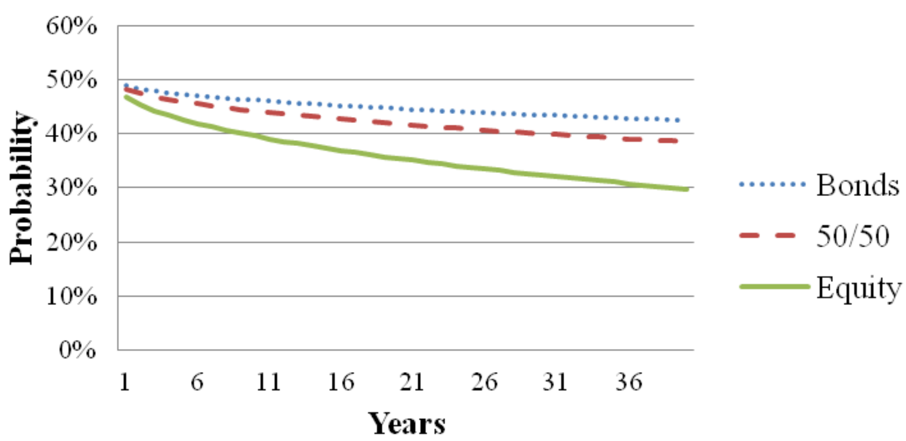
This suggests 55% of total wealth should be invested in the risky asset. Including human capital as part of wealth, the actual amount of liquid wealth invested in the risky asset increases. As an example, assume human capital is ignored and the investor has $50 of liquid capital. 55% of this is $27.50 which would be invested in the risky asset. If another $50 in human capital or future contributions is expected, 55% of $100 is $55, suggesting 100%+ of liquid wealth should be in the risky asset. If C is indeed related to wealth suggesting decreasing relative risk aversion, an even greater percentage in the risky asset would be calculated. Including human wealth defined here as the present value of future contributions suggests a greater percent of realized or liquid wealth should be in the risky asset. Adding the present value of social security payments to wealth would further increase the equity percentage of liquid wealth.

DATA AND METHODOLOGY

The Center of Research and Security Prices (CRSP) S&P 500 value weighted index is used as a proxy for monthly equity returns. 10-year Treasury returns are used as a proxy for bond returns, although prior to May 1941, 90-day T-bill returns are used as 10-year data is not available before 1941. Data covers the Jan. 1926 to the Dec. 2012 time frame. Since this study looks at a 15-year horizon, data is limited even using overlapping monthly time periods. In an effort to project what may occur, while still maintaining the correlation between bond and equity returns, along with any intertemporal correlation among stock and especially bond returns, bootstrapping is employed. To create 15 years of monthly returns, data is re-sampled 6 months at a time with replacement from 1044 months of historical data that is available. This still leaves 1039 overlapping 6 month periods to sample from. 10,000 simulations are employed for each run resulting in trivial differences between separate 10,000 runs.

Both means and medians of terminal wealth are reported. This is particularly relevant when dealing with compounded returns as they are lognormally instead of normally distributed. This creates the situation when the probability of reaching the mean is much less than 50%, (Booth, 2004). Figure 1 shows these probabilities based on the data. For an all equity portfolio, the probability of actually reaching the mean in 15 years is less than 40%. Thus, medians may be the more relevant statistic to consider.

Figure 1
Probability of Reaching Expected Value



This also makes the interpretation of the standard deviation problematic and thus, standard deviations are not reported. To give a more accurate picture of the risk, 90% confidence intervals are given to indicate the range of values. In addition, within horizon risk is also measured. Both the median worse loss during the 15 years is shown, along with 90% confidence intervals for this loss. This becomes relevant for any investor who is wary of large losses and may exit the market during non-fortuitous times. Mutual fund flows suggests this behavior is common as investors tend to exit out of funds after they drop in value.

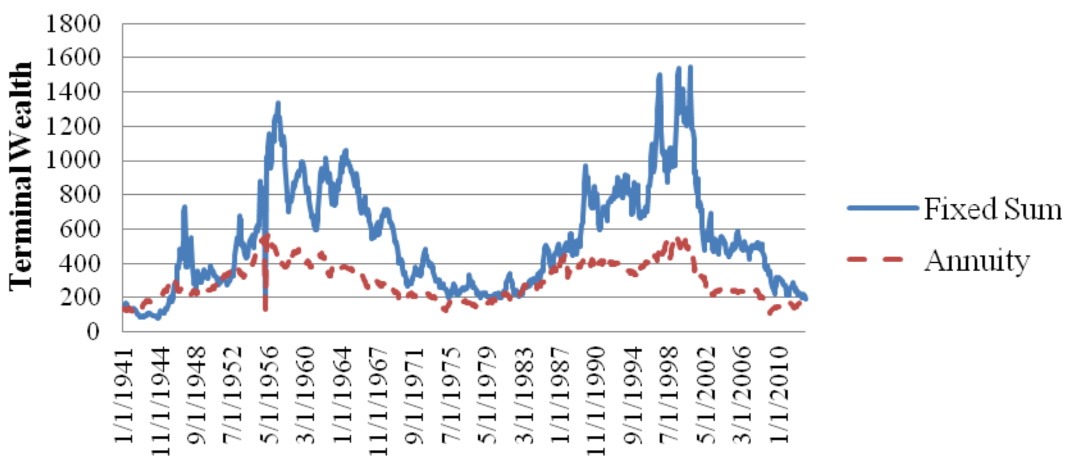
EMPIRICAL RESULTS

Standard analysis usually compares lump sum investing to dollar cost averaging. The literature is fairly extensive in this area, with most all studies agreeing lump sum investing results in the highest expected value, although depending on the particular return path, dollar cost averaging can result in higher returns, (Constanides, 1979; Knight and Mandell, 1993; Williams and Bacon, 1993; Rozeff, 1994; Israelson 1999; Abeysefera and Rosenbloom 2000; Leggio and Lien, 2003, Milevsky and Posner 2003 to name a few). Studies tend to show that the advantage of dollar cost averaging is less risk, especially when it comes to within horizon risk (Dubil 2004; Trainor, 2005)

A. Historical Results

Figure 2 shows the historical results for a 15-year horizon in comparing lump sum to dollar cost averaging with one caveat. That is, for the annuity, the present value of $100 is spread out over the 15-year horizon using a 2% discount rate. The annuity itself increases once a year by 2%. This is to show the difference between someone who has $100 to invest right now versus someone who has just started to contribute. Thus, the results here may differ quantitatively from most studies since it is usually assumed that the amount not invested in equities is invested in some risk-free asset, and the time to dollar cost average into the market is generally assumed to occur over a much shorter time-period, usually 2 to 5 years.

Figure 2
Terminal Wealth After 15 Years per $100 Equity Investment



As expected, having $100 and immediately investing the whole sum in equities results in much higher values of terminal wealth. Figure 2 also demonstrates how critical the start date can be showing the beginning of the early 1940's and 80's being very profitable. Annuity values are much less variable as might be expected when investing over a 15-year period. At the very least, if one does indeed have a large fixed sum, dollar cost averaging over 15 years has rarely paid off relative to investing in stocks immediately.

Table 2 demonstrates how skewed these values can be with the medians significantly less than the mean. Within horizon risk is also significant for fixed sum investors with an average loss of 13% sometime during the 15 year period and a lower confidence interval limit of being down 69%. This means there is still a 5% chance of being down more than -69% at sometime during the investment period. As expected, bonds have the least risk reducing the average within horizon loss to -3%, with a lower confidence interval level of 13%.

Table 2
Overlapping monthly 15 year periods from Jan. 1926 to Dec. 2012. Terminal Values per $100 invested.

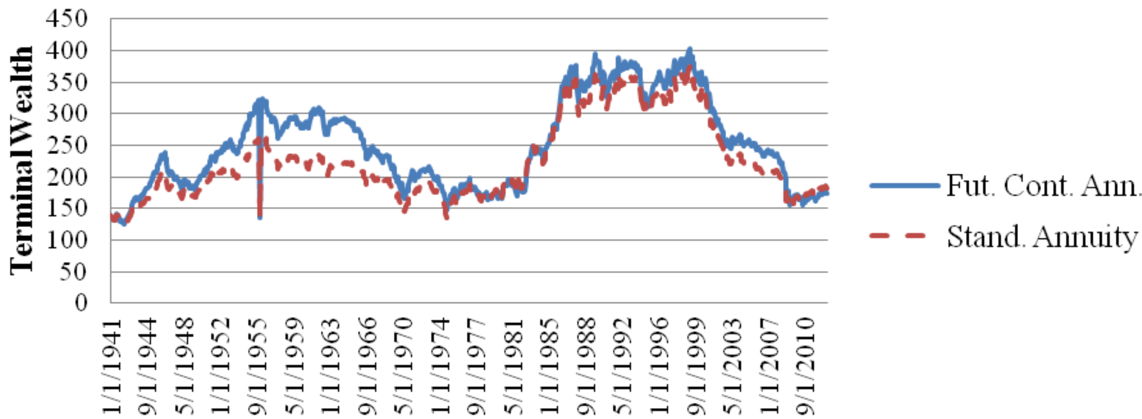
	Median	Mean	Lower limit	Upper Limit	Median Within Horizon Loss	Within Horizon lower CI
Fix Sum stocks	$482	$542	$136	$1,112	-13%	-69%
Fix Sum bonds	$180	$237	$110	$503	-3%	-13%
Fix Sum 50/50	$307	$345	$154	$681	-7%	-39%
Annuity 100% stocks	$272	$296	$141	$491	-1%	-16%
Annuity 100% bonds	$162	$177	$121	$280	0%	-1%
Annuity 50/50	$212	$227	$154	$350	0%	-8%
Future Contribution Annuity 50/50	$244	$253	$164	$374	-1%	-13%

Dollar cost averaging into any asset category dramatically reduces both the median and means along with increasing the lower limits. Within horizon risk is significantly reduced with median loss values down only 1%. As an example, there is only a 5% chance of being down more than -16% in stocks relative to the total amount planned on being invested.

The primary focus of this study is the comparison of the investor who desires a 50/50 mix and makes steady contributions over the 15-year period. The standard asset allocation approach which involves investing contributions into a 50/50 fund has a historical median of $212 and a lower confidence level limit of $154. Considering future contributions, this investor should consider investing 100% in equities for the first few years until a 50% balance is achieved between equities relative to bonds plus future contributions. This results in a mean of $244 and based on the lower limit, actually shows less risk, $164 versus $154. The within horizon loss is slightly higher than the standard annuity as there is a 5% chances of being down -13% or more compared to -8% with the standard annuity as shown in the last column.

Figure 3 shows the different outcomes based on the start date. Overall, using future contributions to determine an asset allocation actually reduces terminal risk while significantly increasing expected wealth along with the opportunity for larger outcomes.

Figure 3
Terminal Wealth After 15 Years per $100 Equity/Bond Investment



B. Monte Carlo Simulation

Although the historical results are informative, they are based on a single return path. To make sure the results are more robust, bootstrapping is employed. Table 3 shows the results.

Table 3
Comparison of Fixed Sums to Steady Contributions per $100 Total Investment.

	Median	Mean	Lower CL	Upper CL	Median Within Horizon Loss	Within Horizon lower CI
Fix Sum stocks	$401	$522	$108	$1,316	-14%	-50%
Fix Sum bonds	$203	$212	$134	$321	-3%	-14%
Fix Sum 50/50	$298	$321	$151	$562	-5%	-23%
Annuity 100% stocks	$256	$290	$113	$579	-5%	-22%
Annuity 100% bonds	$164	$168	$130	$216	-1%	-1%
Annuity 50/50	$211	$218	$137	$323	-1%	-5%
Future Contribution Annuity 50/50	$231	$243	$133	$393	-4%	-16%

Simulation results are similar to the historical results although there are some significant differences, especially with stock returns. Focusing on the 50/50 mix and considering future contributions and allocating assets accordingly again leads to an approximately 10% increase in the mean and median ending wealth values. Unlike the historical results, the lower limit is indeed lower when considering future contributions, but not dramatically. The within horizon risk is much larger with a 5% probability of being down -16% or more as opposed to only -5%

with the standard annuity. Thus, although there is a 10% increase in terminal wealth for very similar end of horizon risk, within horizon risk needs to be considered. This risk is especially relevant for investors that may either stop contributing or change the asset allocation significantly if large losses occur during the time horizon.

Finally, Table 4 displays results assuming the investor starts with 3x the present value of the future contributions. In this case, the difference in terminal wealth is less than 4% and given the higher risk, does not imply that the consideration of future contributions to determine asset allocation is critically important. Thus, if investors do have large investment balances relative to future contributions, they should indeed primarily focus on the risk/return relationship of their actual retirement account balance.

Table 4
Comparison of Fixed Sums to Steady Contributions with $300 initial, $100 additional for Annuity.

	Median	Mean	St. Dev.	Lower CL	Upper CL	Median Within Horizon Loss	Within Horizon lower CI
Annuity 100% stocks	$1,521	$1,902	$1,527	$458	$4,633	-12%	-42%
Annuity 100% bonds	$766	$799	$191	$541	$1,149	-2%	-7%
Annuity 50/50	$1,148	$1,221	$470	$613	$2,091	-4%	-18%
Future Contribution Annuity 50/50	$1,188	$1,274	$525	$599	$2,251	-6%	-24%

CONCLUSION

Investors do not appear to be saving enough to avoid a drastic drop in their standard of living at retirement. In fact, SCEPA research based on 2010 census data show that the median investment savings for 75% of people aged 50-64 is $6,500. Less dire survey results still suggest this value is no more than $100,000. Investors in this situation face difficult choices with only 10-15 years until retirement.

Typical average risk aversion parameters at this stage in life may suggest anywhere from a 40-60% exposure to stocks. However, with little or no accumulated savings at this point, placing future contributions into a 50/50 stock/bond portfolio may not be the optimal choice. At this stage, it would seemingly be expected that investor's future retirement contributions have become a priority. Assuming these contributions are relatively certain results in an interesting dichotomy between those who have significant accumulated savings and those that do not.

Treating future contributions as if they were sitting in a risk-free asset and earning a rate of return equal to any future increase in the value of the contribution, means that investors just starting to save have most all of their projected future retirement balance locked up in future contributions. Thus, this type of investor should seriously consider placing initial contributions in 100% equity or a similar asset class. Eventually, as the accumulated account balance equals future contributions, current contributions can then be directed toward a more varied mix. For those with large account balances relative to future contributions, consideration of this issue is not as critical.

Both historical and Monte Carlo simulation suggests that this type of investment philosophy will result in a 10% increase in the expected account balance at retirement with little increase in terminal wealth, although within horizon risk is magnified. This drawback needs to be seriously considered. Individuals that do not have a history of investing may be more risk-averse and a 100% equity exposure to begin with, even though future contributions will minimize any early losses, may result in the investor leaving the market before more optimal results can be achieved.

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