



1. Introduction

This appendix provides modeling details and assumptions used by AIDA (Income Discovery's retirement income analytics engine) in the blog post analysis, including details of asset allocations, return expectations, and annuity payout rates. It also provides the data underlying the figures in the blog post. Figures presented in the blog post are provided as a sample and do not guarantee future investment returns, results, or cash flows. Results may vary with each use and over time.

2. Monte Carlo Simulations

AIDA evaluates plans under Monte Carlo simulation (simulation) which refers to the mathematical technique of evaluating the level of risk and uncertainty of any decision through multiple future possibilities with each possibility represented by a scenario path.

A scenario path represents a multi-year sequence of projected annual inflation and asset class returns. AIDA analyzes multiple plans through the same set of scenario paths so the performance of those plans can be directly compared to measure risk and identify efficient alternatives.

Simulations are done using scenario paths taken from a forward-looking random walk type assumption set. Simulations are designed to provide a more realistic assessment of how investments may perform by looking at a wide variety of potential market scenarios that take fluctuating market returns into account. Instead of basing the calculations on an average rate of return, a minimum of 1,000 hypothetical scenario paths were analyzed to show what may happen to the assets over the plan horizon.

Each simulation includes up and down markets and inflation of various lengths, intensities, and combinations. These simulations will determine the number of retirees out of 1,000 that produced the full income over the planning horizon.

3. Safe Income

Safe Income, an important measure for many clients uncertain how much they can safely spend in retirement, is the maximum base desired income reward that is achievable, in addition to non-discretionary line-item expenses and associated taxes and fees, without dropping confidence below 90%. It is the amount of retirement income with a 90% probability of success for the 90th



percentile lifespan. Safe income consists of Social Security benefits, pension payments, lifetime income payments, withdrawals from investments and any other incoming cash flows.

The safe income analysis is done using a Monte Carlo simulation where 1,000 hypothetical, future retirement scenarios are analyzed. The probability of success is determined by dividing the number of scenario paths that generated full desired income over the complete planning horizon by the total number of scenario paths. The income amount that results in investments outlasting 900 out of the 1,000 hypothetical scenarios is determined to be the safe income.

4. Optimization Metrics

The framework used by AIDA is built on the thesis that using only the existing paradigm of average expected return and standard deviation of a portfolio, a paradigm conceived to accomplish accumulation goals, is insufficient in evaluating decumulation and distribution strategies.

The framework uses the following metrics when comparing different plans:

Income (reward): The specified level of spending and additional expenses for a retirement income plan. Income is the total outflows of the plan, including the base desired income, non-discretionary line-item expenses, state and federal taxes, Medicare premiums, and fees. Income is sourced from withdrawals from SWP and all available cash flows such as Social Security, pensions, lifetime income products, and any other incoming cash flows.

Confidence (risk): Probability that the plan successfully delivers the full income over the complete planning horizon. It is the percentage¹ of scenario paths that generated full pre-tax income over the complete planning horizon. This risk metric is presented as a frequency, the number of retirees out of 1,000 that received full income, a presentation format that is better understood and acted upon by the clients.

Cumulative Shortfall for Underfunded Retiree (risk): For each year of a scenario path where the full income was not received, the shortfall as a percentage of pre-tax income is measured and this shortfall percentage is accumulated across all years for each scenario path and called cumulative shortfall. Then all scenario paths are sorted based on cumulative shortfall to select the 98th percentile scenario path. That scenario path represents the near-worst case plan

¹ All confidence percentages higher than 98% are rounded down to 98%.



performance which, for presentation purposes, is called the *Underfunded Retiree*. Two metrics are observed on the chosen scenario path: number of years where full income was not received and cumulative shortfall dollars, i.e. the total gap between the pre-tax income and the generated income over those years.

Average Legacy (reward): For each scenario path, terminal portfolio value (TPV) is determined as SWP balance and the liquid contract values of all non-annuitized lifetime income products at the end of the planning horizon. If a scenario path has intermediate years of shortfall followed by full income generation (e.g. due to cash flows beginning after the shortfall), the TPV is reduced by expected income taxes due by heirs and cumulative shortfall to determine net legacy. The *Average Legacy* is the post-tax TPV for the scenario path having the median net legacy across all scenario paths.

Each income level is associated with certain risks as captured in confidence and cumulative shortfall for the underfunded retiree and impact on the average legacy goal. Higher reward of income will generally lead to higher risk and lower legacy for a given plan. Unique plans may be able to provide different levels of income at the same level of confidence.

5. Capital Market Assumptions

The case study in the blog post was generated using generic sample capital market assumptions to model hypothetical performance based on asset classes that may represent a client's investments. Advisory fees were also included in all portfolios in this analysis.

Inflation and portfolio returns for 1,000 hypothetical scenarios were generated. The return for each class is specified as an annual long-term compounded return and variation of the return.

5.1. Asset Allocations

The following table represents all asset classes and their portfolio allocations for the capital market assumption set used in the analysis:

	Very Conservative	Conservative	Moderate	Moderate Aggressive	Aggressive
U.S. Large Cap	3%	10%	14%	17%	20%
U.S. Small/Mid	0%	1%	3%	9%	17%



Cap					
International Developed	2%	7%	11%	11%	8%
International Emerging	0%	0%	3%	6%	10%
U.S. Corp Bonds - Core	12%	10%	5%	3%	1%
U.S. Corp Bonds - Long Duration	9%	7%	4%	2%	0%
U.S. Corp Bonds - High Yield	0%	0%	8%	7%	3%
International Debt Developed	14%	12%	8%	4%	1%
International Debt Emerging	0%	0%	7%	6%	3%
U.S. Treasuries	30%	24%	11%	5%	1%
TIPS	30%	24%	11%	5%	1%
Real Estate	0%	3%	8%	9%	11%
Hedge Funds	0%	0%	3%	7%	14%
Commodities	0%	0%	1%	3%	5%
Infrastructure	0%	2%	3%	3%	0%
Private Equity	0%	0%	0%	3%	5%

5.2. Return Expectations

The estimated nominal return expectations for each asset class used in the analysis are as follows:



Name	Mean Cap Appcn ² , %	Standard Deviation, %	Income Return, %	Cap Gain Distribution, %
Inflation	2.16%	1.66%	0%	0%
U.S. Large Cap	4.67%	14.89%	2.5%	25%
U.S. Small/Mid Cap	5.22%	18.30%	2.5%	30%
International Developed	4.63%	16.43%	3.0%	25%
International Emerging	6.28%	21.51%	2.5%	35%
U.S. Corp Bonds - Core	0.10%	5.27%	3.5%	70%
U.S. Corp Bonds - Long Duration	(0.38%)	9.74%	4.0%	50%
U.S. Corp Bonds - High Yield	0.19%	9.17%	5.5%	55%
International Debt Developed	(0.21%)	6.84%	2.5%	45%
International Debt Emerging	0.48%	10.27%	5.5%	65%
U.S. Treasuries	(0.14%)	1.74%	2.4%	90%
TIPS	1.76%	5.87%	1.0%	30%
Real Estate	5.62%	15.51%	1.0%	40%
Hedge Funds	2.80%	7.53%	3.0%	25%

² Long term compounded (geometric mean) capital appreciation or geometric mean of the inflation for the inflation row



Commodities	0.16%	16.55%	4.0%	60%
Infrastructure	2.98%	13.38%	4.5%	55%
Private Equity	6.95%	19.36%	3.5%	25%

The estimated nominal return figures only represent our assumptions and should not be viewed as predictions or guarantees of future performance.

6. Annuities

The case study considered a purchase of a fixed indexed annuity (FIA) to increase safe income and to maximize after-tax legacy. The annuity evaluated had the following attributes (payout rate kept constant):

FIA: 7.0% payout rate with a lifetime rider, 3 years deferral period (payout start date in 2025), 1.0% rider fee, U.S. Large Cap asset class representing the index, 5.0% interest cap, 8.0% rollup rate, 10 years guaranteed period, 2.0% immediate credit enhancement, and 100% survivor benefit.

7. Plan Details

The case study assumed annual withdrawals to meet a retiree's desired income needs. Monthly sources of income such as Social Security and pensions were converted into annual amounts for evaluation. Withdrawals were made after accounting for fixed incoming cash flow sources and required minimum distributions. For any Roth conversions, the analysis assumed the disbursement was made from the qualified account in December when the tax situation for the calendar year is known. Once the disbursement was made, the money is assumed to be held in cash until January, at which point it is converted to the Roth account.

8. Taxes

The analysis considered post-tax income needs. Federal and state taxes were calculated using 2022 tax brackets. Tax brackets are adjusted for inflation and use current legislation passed by



Congress. Tax brackets do include the expiration of the current brackets and reversion to previous laws. No assumption is made on whether laws may be passed in the future to make the current temporary brackets permanent.

Tax rates and other tax laws may change in the future. Taxes were applied to all incoming cash flows, such as pensions. The analysis differentiated between non-qualified, qualified and Roth accounts. The analysis assumed that non-qualified accounts were populated with post-tax dollars and are subject to income distributions and capital gains. Capital gains and losses are separately tracked. A maximum capital loss of \$3,000 is applied against taxable income in any year and excess is carried forward for future years to be applied against future capital gains or ordinary taxable income. Bracket-based taxes were calculated on ordinary taxable income and the tax rate applied to capital gains was dependent on filing status and taxable income.

In non-qualified accounts, part of the capital gain is assumed distributed every year and is thus added to the taxable income in addition to the income return. Additional capital gains are assumed to remain as unrealized capital gains until a sale is made. Assets held in non-qualified accounts have a cost basis, which is the amount of the original investment in purchase of those assets. Cost basis is used to determine capital gains or losses when the assets are sold. Withdrawals are first made from the income returns and distributed capital gains, and if those do not meet the necessary annual retirement need, then a sale of holdings is made to generate the remaining amount.

Qualified accounts, such as 401(k) plans or Traditional IRAs, were assumed to be populated with pre-tax dollars. Taxes are due when withdrawals are made from the account, including taxes on required minimum distributions. The analysis assumed that Roth accounts incur no tax liability for capital gains, interest or dividends. It was also assumed that the assets in these accounts were held for the required 5-year holding period before withdrawals are made. Taxes on all transactions made in the month of January to December of a year are paid in January of the following year.