T.RowePrice

Retirement Income Calculator Methodology

T. Rowe Price Retirement Income Calculator overview

The T. Rowe Price Retirement Income Calculator (the Tool) provides an estimated probability of success in reaching your retirement goal (i.e., not running out of money in retirement) and whether you are in the retirement Confidence Zone for achieving your retirement goal. We refer to the estimated probability of success in reaching your retirement goal in this document as your Confidence Score. The Confidence Score is shown as a percentage in the Tool. The Tool will estimate whether you are Above, In, or Below the Confidence Zone, to indicate the probability of meeting your retirement goal based on the assumptions and analysis described below.

Clients can get started by accessing the Tool at https://www.troweprice.com/ric. If you choose to log in as a T. Rowe Price Guest or are logged in as a T. Rowe Price Client when you use the Tool, we will pre-fill fields we already know about you, as well as save your Profile and Input information (described below) from your session and pre-fill it for you when you return to use the Tool again in the future. (After the first use, you will confirm the accuracy of these pre-filled information fields as you progress through the Tool.)

After completing the Tool Profile and Inputs, users will receive a retirement Confidence Score based on Monte Carlo statistical projections. On the results screen, users can update certain inputs and see the impact of these changes to their probability of success.

This Tool does not include recommendations for portfolio allocations, account types, individual securities or other investment products. The results are not intended to be personalized investment advice and are for educational purposes only. Users seeking more comprehensive retirement planning, advice, and financial planning (including other goals) are encouraged to consider services offered by T. Rowe Price Advisory Services, Inc., a registered investment adviser.

Data and assumptions about you

In order to determine your Confidence Score, we use data and assumptions about you, as follows.

Profile, Inputs, and assumptions

The Profile and Input information, coupled with the assumptions of the Tool, form the basis of the Tool's calculations for the probability of success of meeting the retirement goal.

Profile Information: For each planning partner, the Tool asks you to provide: gender (used for life expectancy), current age, marital status, and state of residence (used for federal and state tax calculations).

Other Input Information: Other data you provide is relevant to our retirement planning calculations, including: employment status; annual employment, retirement, or other income; retirement balance and savings amounts in tax-deferred qualified accounts (e.g., 401(k) and taxable accounts); and your intended investment allocation approach. You can also include anticipated retirement cash income, such as the proceeds from a sale of a business or real estate, to fund retirement.

Results Screen Play Zone Inputs: You can use the Play Zone on the results screen to alter inputs and see the impact on your Confidence Score; for example: retirement age(s), retirement living expenses, amounts you are saving for retirement, or other income you anticipate receiving in retirement.

General assumptions

Income, Contributions, and Retirement Expenses: We assume that your employment income and contributions will increase at a rate to keep pace with inflation (assumed to be 3% based on historic inflation rates) and will stop at retirement. This Tool does not take into account current retirement plan and Internal Revenue Service (IRS) limits for contributions or distributions. Prior to any optional modification(s) you make on the results screen, the Tool assumes annual retirement living expenses based on your current standard of living. Retirement cash flow needs are calculated by adjusting for expenses not applicable after you no longer receive employment income, such as: federal and state employment income taxes, payroll taxes, and assumed savings amounts for a future retirement. While the specific amount may vary due to the interaction of these assumptions and your specific situation, in general the Tool assumes approximately 60-85% of your pre-retirement income is needed to maintain your standard of living during retirement.

Time Horizons and Life Expectancy: Prior to any optional modification(s) you make on the results screen, the Tool assumes a retirement age of 65, or if you are already 65, your next birthday. If you have a planning partner, the Tool has additional default retirement assumptions displayed to you and that can be adjusted on the results screen.

The Tool assumes life expectancy based on your age and gender inputs. We use estimates from the Society of Actuaries, non-smoker data. For males under the age of 71, we assume retirement lasts until age 92. For females under the age of 72, we assume retirement lasts until age 94. For those above those current ages, the mortality assumption is increased in 1-year increments.

Retirement Income and Withdrawal Assumptions: In order to model retirement income needs and portfolio values in a given year, we start with the income sources you included in the Tool. Next, total outflows are estimated as the expenses used to fund your goals and taxes. The net of the income and outflows represents a withdrawal from, or addition to, the portfolio value. The adjusted portfolio values are then impacted by the Capital Market Assumptions and Monte Carlo analysis described below. The Tool uses the required minimum distribution (RMD) age prescribed by the IRS to determine when RMDs are required for purposes of the analysis. The Tool assumes RMDs will be taken once you reach the age prescribed by the IRS to take RMDs. More specifically, this means that the Tool assumes RMDs for qualified retirement accounts begin at age 73 (72 if you turned 72 before 2023 or 70½ if you turned 70½ before 2020); beginning in 2033, this assumption will change to age 75. For any assets included under the Qualified Retirement Account section, the Tool assumes these assets are subject to RMDs outlined by the IRS for Traditional IRAs. For example, if you include Roth or Inherited retirement account assets under this category, the Tool will not apply the RMD rules associated with those particular account types, but rather use the rules associated with Traditional IRAs. To the extent estimated RMDs and other income sources exceed your assumed or stated retirement income goals, we assume the amounts are reinvested in a taxable account. RMDs are calculated using the uniform lifetime table even if the co-client is a spouse more than 10 years younger than the client.

Taxes: Taxes are calculated using the following assumptions under the Tax Cuts and Jobs Act (TCJA) and pre-TCJA rates, as described. (TCJA is scheduled to sunset in 2026, meaning federal tax rates and brackets could revert to pre-TCJA levels.) For conservative estimates, we assume the sunset of TCJA rates and reversion to prior law for calculations that extend beyond 2026. We calculate taxes each year in retirement, as follows: We first calculate state, then federal taxes on estimated portfolio withdrawals and use the progressive federal and state tax rates each year. We use standard deductions and personal exemptions based upon your marital status for tax calculations and assume taxes are paid annually from the earnings of taxable accounts, if you input such accounts or they become available from 'excess' required minimum distributions. Twenty percent (20%) of annual earnings from taxable account assets, e.g., dividends and capital gains distributions from mutual funds, are assumed to be subject to long-term capital gains. Prior to retirement, we assume a long-term capital gains rate of 15%. During retirement, the long-term capital gains rates applied in each year are based on your income, marital status, and the relevant rates before and after the assumed TCJA sunset in 2026. The long-term capital gains rates apply to both annual earnings from taxable account assets and also to the sale of taxable account assets for funding your retirement goal. Tax-deferred and qualified assets generate taxes at your assumed ordinary income rate when money is withdrawn.

Spending Order of Assets: We assume that your retirement accounts are in tax-deferred qualified retirement accounts based on the percentage that you specify on the Input screen, with the remainder assumed to be in taxable accounts. This Tool does not include assumptions for any inherited retirement account assets, Roth individual retirement accounts or Roth savings in workplace retirement plans. During retirement, we assume all earnings from taxable investments are taxed each year at current tax rates. To provide retirement income, we assume the following spending order of assets in this Tool: 1) cash income (including Social Security and other income sources you have specified); 2) taxable accounts; and 3) tax-deferred accounts.

Social Security: Unless you specify you are not eligible for Social Security on the Input screen, the Tool assumes you will receive estimated Social Security amounts based on your retirement age and current salary, beginning at age 70 (given longevity expectations in this Tool, the maximum single retirement benefit) and then increased annually with a Cost Of Living adjustment keeping pace with inflation (3%). This Tool assumes 85% of the Social Security benefit is taxable income as a conservative estimate.

Intended Investment Allocation: Your Choice of "Conservative," "Moderate," or "Aggressive" Proportions of Stocks and Bonds: As part of the Input screen, we ask your intended investment allocation: "Conservative," "Moderate," or "Aggressive." You also have the option to modify this allocation on the results screen to receive an updated Confidence Score.

The investment allocations are hypothetical for the purposes of illustration and broadly defined with asset classes being composed of 30% equity and 70% bonds for the "Conservative" allocation; 60% equity and 40% bonds for the "Moderate" allocation; and 90% equity and 10% bonds for the "Aggressive" allocation. These allocations are assumed to be rebalanced annually to remain consistent throughout your working years and retirement.

These allocations are also assumed to be well-balanced and well-diversified both across asset classes and within their sub-asset components—as shown in the sub-asset class assumptions below. While the hypothetical allocations are informed by T. Rowe Price's perspective on portfolio construction, it is important to note that the sub-asset class components do not represent any specific securities or investment advice, and this tool is for educational purposes only. The hypothetical allocations are solely for the purpose of functionally illustrating the overall impact of the "Conservative," "Moderate," or "Aggressive" selection at the asset class level—i.e., stocks and bond mixture—in conjunction with the other factors considered in the analysis (for example, retirement expenses).

Hypothetical investment style / allocation components: "consevative" / "moderate" / "aggressive" stocks and bonds

(Table 1)

Asset class	Sub-asset class	Conservative	Moderate	Aggressive
Equity		**30%**	**60%**	**90%**
	Large-Cap Equity	21%	37%	56%
	Small-Mid Cap Equity	0%	5%	7%
	Developed Markets Equity	9%	14%	21%
	Emerging Markets Equity	0%	4%	6%
Bonds		**69%**	**39%**	**9%**
	Investment Grade Bonds	40%	28%	9%
	High Yield Bonds	2%	1%	0%
	Developed Markets Bonds (Hedged)	17%	9%	0%
	Emerging Markets Bonds	1%	1%	0%
	Short Term TIPS	9%	0%	0%
Cash		**1%**	**1%**	**1%**
	Cash	1%	1%	1%

To understand how your choice of hypothetical investment allocation impacts the overall analysis in the Tool, see the return and correlation assumptions provided in Tables 2 and 3.

Monte Carlo analysis

The Tool uses Monte Carlo analysis to generate 1,000 hypothetical market scenarios so that users can analyze hypothetical outcomes for the retirement goal scenario (e.g., retirement age, savings, expenses, etc.) they input into the Tool, coupled with our methodology and assumptions (described in this document). Monte Carlo analysis provides ranges of potential future outcomes based on a probability model.

Probability of Success/Probability of Failure: The percentage of trials of your hypothetical retirement and market scenarios that were successful. The Monte Carlo simulation runs your scenario 1,000 times, so for example, if 600 of those runs are successful (i.e., all your goals are funded and you have at least $1 of assets remaining at the end), then the Probability of Success would be 60%, and the Probability of Failure would be 40%.

Confidence Score and Confidence Zone Ranges: As noted, the Tool will provide a retirement Confidence Score (estimated probability of success in funding all goals) based on Monte Carlo analysis. On the results screen, users can update various inputs and see the impacts to the Confidence Score.

To put the Confidence Score in context, the Tool provides ranges of potential outcomes called the Confidence Zone. The Confidence Zone ranges are determined by the age of the client or, if two clients are included, the age of the older client.

- For clients ages 44 and younger, the Confidence Zone is 70% to 95%.
- For clients ages 45 and over, the Confidence Zone is 80% to 95%.

Caculating hypothetical future values

The Tool uses Monte Carlo analysis to generate 1,000 hypothetical market scenarios so that users can analyze hypothetical outcomes for an assumed portfolio of up to nine asset classes under a broad range of market conditions. Monte Carlo analysis provides ranges of potential future outcomes based on a probability model. Our Monte Carlo analysis creates potential simulated portfolio values by using portfolio returns created randomly from the rates of return and other assumptions for each asset class shown below:

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(Table 2) Asset class assumptions

Asset class	Long-term compound annual rate of return	Annualized volatility (standard deviation)	Index	Index data start date
Large-Cap Equity	8.04%	18.00%	S&P 500	January 1940
Small/Mid-Cap Equity	8.72%	20.00%	Russell 2500	February 1979
Developed Markets Equity	7.70%	20.00%	MSCI EAFE	February 1970
Emerging Markets Equity	7.73%	25.00%	MSCI Emerging Markets	February 1988
Investment Grade Bonds	5.30%	6.50%	Bloomberg U.S. Aggregate Bond	February 1976
High Yield Bonds	6.33%	12.00%	Bloomberg U.S. Corporate High Yield	August 1983
Developed Markets Bonds (Hedged)	5.36%	5.50%	Bloomberg Global Aggregate ex U.S.	February 1990
Emerging Markets Bonds	5.83%	10.00%	J.P. Morgan Emerging Markets Bond Global	February 1994
Short-Term TIPS	4.40%	4.50%	Bloomberg TIPS 1-5	September 1976*
Cash	3.96%	3.00%	IA SBBI US 30 Day TBill	January 1926

*The start date for the representative index is March 2005. A Multi-Asset model is used for returns before this date.

The methodology underlying our long-term return, risk and correlation assumptions accounts for historical data for each asset class and includes the full range of available history at the time of the analysis. The historical look-back considers multiple time horizons and rolling periods to capture returns, volatility and correlations across a wide range of economic and market environments. The look-back analysis is used as a basis for the projected returns shown in Table 2. These assumptions are not guarantees of future market conditions or results. These returns do not reflect taxes, fees and expenses, or the effects of inflation. Other investments not considered may have characteristics similar or superior to those being analyzed.

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(Table 3) Correlation coefficient assumptions

The Monte Carlo analysis also takes into account the assumed correlation among the asset classes. The correlation values can range from -1.0 to 1.0; the closer the value is to 1.0, the higher the tendency that the assets have to move in the same direction. The closer the value is to -1.0, the higher the tendency that the assets have to move in the opposite direction. A correlation of 0 indicates the assets move independently. Building a portfolio using assets with low or negative correlation can affect the risk and return potential of the portfolio. This is due to the assumed correlation among the asset classes.

Asset Class	Large-Cap Equity	Small/Mid-Cap Equity	Developed Markets Equity	Emerging Markets Equity	Investment Grade Bonds	High Yield Bonds	Developed Markets Bonds (Hedged)	Emerging Markets Bonds	Short-Term TIPS	Cash
Large-Cap Equity	1.00	0.80	0.70	0.50	0.40	0.60	0.20	0.40	0.00	0.10
Small/Mid-Cap Equity	0.80	1.00	0.60	0.60	0.30	0.70	0.10	0.60	0.00	0.00
Developed Markets Equity	0.70	0.60	1.00	0.70	0.20	0.40	0.40	0.50	0.00	0.00
Emerging Markets Equity	0.50	0.60	0.70	1.00	0.00	0.40	0.10	0.60	0.00	0.00
Investment Grade Bonds	0.40	0.30	0.20	0.00	1.00	0.60	0.70	0.20	0.30	0.20
High Yield Bonds	0.60	0.70	0.40	0.40	0.60	1.00	0.40	0.60	0.10	0.00
Developed Markets Bonds (Hedged)	0.20	0.10	0.40	0.10	0.70	0.40	1.00	0.30	0.10	0.10
Emerging Markets Bonds	0.40	0.60	0.50	0.60	0.20	0.60	0.30	1.00	0.10	0.00
Short-Term TIPS	0.00	0.00	0.00	0.00	0.30	0.10	0.10	0.10	1.00	0.30
Cash	0.10	0.00	0.00	0.00	0.20	0.00	0.10	0.00	0.30	1.00

Risks inherent in investing

Based on your specific circumstances, you must decide the appropriate balance between the potential risks and potential returns of your investment decisions. The Tool does not and cannot adequately understand or assess the appropriate risk/return balance for you. In the real world, investment returns can (and often do) vary widely from year to year. The Tool will ask you how you plan to allocate your investments among stocks and bonds (conservative, moderate or aggressive, as described in the 'Intended Asset Allocation' section).

Investing in bonds involves inflation risk, interest rate risk, and credit risk. Interest rate risk is the possibility that bond prices will decrease because of an interest rate increase. When interest rates rise, bond prices fall. When interest rates fall, bond prices rise. Credit risk is the risk that a company will not be able to pay its debts, including the interest on its bonds.

Investing in stocks involves volatility risk, market risk, business risk, and industry risk. The prices of most stocks fluctuate. Volatility risk is the chance that the value of a stock will fall. Market risk is the chance that the prices of all stocks will fall due to conditions in the economic environment. Business risk is the chance that a specific company's stock will fall because of issues affecting it. Industry risk is the chance that a set of factors particular to an industry group will adversely affect stock prices within the industry.

Tool limitations

While the Tool results have been designed with reasonable assumptions and methods, the estimates provide projections only and have certain limitations.

- All results use simplifying assumptions that may not completely or accurately reflect your specific circumstances. The Tool results are dependent on information you provide, including your income, retirement savings and other Inputs, and the assumptions described in this document. The results may vary with each use and over time.
- Failure of the assumptions to accurately project actual market conditions or tax rates may result in over- or understatement of projected retirement income.
- The salary growth rate assumption (3%) may not match your circumstances and may result in over- or understatement of retirement savings and income projections.
- Given the wide variability in personal work histories, the Social Security estimates provided are based on your current salary and not guaranteed to represent your actual situation or be your maximum possible benefit.
- At certain salary levels, the failure to incorporate IRS or plan contribution limits may also result in overstated retirement savings and income projections.
- No investment plan or portfolio allocation eliminates risk or guarantees investment results.

IMPORTANT: The projections or other information generated by the Tool regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. The simulations are based on assumptions. There can be no assurance that the projected or simulated results will be achieved or sustained. The simulations present only a range of possible outcomes. Actual results will vary with each use of the Tool or over time, depending on changes to your inputs or periodic updates to the underlying assumptions, and such results may be better or worse than the results shown. Clients should be aware that the potential for loss (or gain) may be greater than demonstrated in the simulations.

No legal, tax, accounting, or investment advice

The information provided in this Tool is for general and educational purposes only, and is not intended to provide legal, tax, accounting or investment advice or recommendations. This Tool allows you to explore hypothetical future scenarios to test your retirement savings strategy. The assumptions and methodology are not tailored to the needs of any specific investor. Results are intended as an aid, are not guaranteed, and should not be your only source of information when making financial decisions. Before making decisions with legal, tax or accounting ramifications, including modifying any existing investment or retirement plan based on the results of this Tool, you should consult the appropriate professionals for advice that is specific to your situation. Other T. Rowe Price educational tools or advisory services use different assumptions and methods and may yield different results.

Index Definitions

S&P 500 Index: A market cap-weighted index of 500 widely held stocks often used as a proxy for the overall stock market. Performance is reported on a total return basis.

Russell 2500 Index: Tracks the performance of domestic small- and mid-cap stocks as defined by Russell. The index includes the 2,500 smallest companies in the broad Russell 3000 Index.

MSCI EAFE Index: A free-float adjusted market capitalization index that is designed to measure developed market equity performance, excluding the United States and Canada.

MSCI Emerging Markets Index: A capitalization-weighted index of stocks from 26 emerging market countries that only includes securities that may be traded by foreign investors.

Bloomberg U.S. Aggregate Bond Index: An unmanaged index that tracks domestic investment-grade bonds, including corporate, government, and mortgage-backed securities.

Bloomberg Global Aggregate ex USD Bond USD Hedged Index: An unmanaged index that tracks an international basket of bonds that contains government, corporate, agency, and mortgage-related bonds, hedged to U.S. dollars.

J.P. Morgan Emerging Markets Bond Index Global: Tracks U.S. dollar government bonds of 31 foreign countries.

Credit Suisse High Yield Index: An index that tracks the performance of domestic non-investment grade corporate bonds.

Bloomberg U.S. 1–5 Year U.S. Treasury TIPS Index: An index that tracks the performance of inflation protected obligations of the U.S. Treasury with maturities of 1 to 5 years.

IA SBBI US 30 Day TBill Index: The index measures the performance of a single issue of outstanding Treasury Bill which matures closest to, but not beyond, one month from the rebalancing date. The issue is purchased at the beginning of the month and held for a full month; at the end of the month that issue is sold and rolled into a newly selected issue. The index is calculated by Morningstar and the raw data is from The Wall Street Journal.

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