

Rain Dog's Investment Forecast Methodology

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- Rain Dog's proprietary Investment Forecast Model (IFM) consists of six elements: capital markets model, federal tax model, investment strategies component, investor behavior component, Personal Utility Function, and goal optimization model.
- Rain Dog's IFM allows for personalized investment forecasting, planning, and goal optimization.
- Personalized investment forecasting is most useful to investors whose risk tolerance is especially low or high; whose risk capacity is especially low or high; whose savings rate is especially low or high; who plan to retire earlier or later than the general population; or who have less common financial assets such as a pension or trust.

Introduction

Investment planners use a variety of methods to create recommendations for their clients. These methods range from informal to formal and include detailed stock picking, market timing, application of widely accepted rules of thumb, selection of model portfolios, and other methods.

Rain Dog uses a **forecasting approach** to support investment planning for our clients, which we call the Investment Forecast Model (IFM).

The main purpose of the IFM is to provide a quantitatively rigorous basis for determining personally optimal decisions about savings rates, investment returns, investment risks, investment glide paths, federal tax strategies, timing of

retirement, and spending levels both near-term and throughout retirement.

The IFM provides for defining an investor-specific *utility function* (aka score) that is tuned to each investor's circumstances and goals and that supports optimal planning for each individual investor.

The IFM includes consideration of several elements that we believe are necessary to fully support client recommendations:

- Capital markets
- Federal taxes
- Investment strategies
- Investor behavior, and
- Investor preferences

As shown in Figure 1, each of these factors is addressed by an element of the IFM. Each of these factors is summarized in this section and then is described in more detail in the sections that follow.

The Rain Dog **Capital Markets Model (CMM)** simulates the behavior of investments in different asset classes over time, including stocks, bonds, personal real estate, cash, inflation, and many other asset classes.

Rain Dog's **Federal Tax Model (FTM)** accounts for the effect that federal taxes have on investment performance and after-tax income. It applies federal tax rules to investment decisions, and it includes the ability to account for rising or falling tax rates over time.

Rain Dog's **Investor Behavior Component** models the effects of investor decisions including social security start age and pre-retirement savings rate. It can model investors making rational changes in behavior in response to market

conditions, such as spending more when the market is up and spending less when the market is down.

Rain Dog's **Personal Utility Function** captures investor preferences, including investor's desires for spending at different levels, risk tolerance, and other factors. The utility function captures nuances of each investor's goals, and it supports computational optimization of investor goals.

Rain Dog's **Investment Strategies Component** draws from both the CMM and the FTM and includes the ability to model the consequences of portfolio conversion strategies, withdrawal strategies, buffer and cash-management strategies, Roth conversion strategies, rebalancing frequencies, personalized investment glide paths, and other investment strategies.



Figure 1

Finally, Rain Dog's **Goal Optimization Model** takes in input about Investor Preferences and optimizes for the individual investor's utility

function computationally. [This functionality is under development and will be available in 2H2024.]

The following sections describe each element of the IFM in more detail.

Capital Markets Model

Rain Dog's CMM models dependencies and interactions among asset classes with statistical rigor.

Asset classes. Investors' current assets are analyzed based on more than 40 standard asset classes. Future investment performance of the current investment is modeled based on the classification of current assets based on these standard asset classes.

Future asset class performance. To model future performance of asset classes, the return and volatility of the asset classes are calculated from the historical data of relevant indexes or related index funds from 1990-2023. Some data is calculated based on the period from 1972-2023, including correlations among asset classes and inflation.

Return distributions. Asset class returns do not tend to be "normally distributed," i.e., they do not look like perfect bell curves. Most asset classes show significant amounts of skew (the top of the bell curve is to the left or right of the middle), and kurtosis (the tails of the bell curve are fatter than a standard normal bell curve). Consequently, our CMM uses empirically based probability distributions for all asset classes rather than standard normal distributions.

Number of asset classes. Some investment planning tools model all investments using a small

number of asset classes. For example, a tool might model all stocks based on the S&P 500, including small cap stocks and international stocks. The CMM uses enough asset classes to support fine-tuning in evaluating investment alternatives.

The asset classes used in Rain Dog's CMM are listed in Table 1 on the next page.

Dependencies. Some investment planning and forecasting tools model asset class returns as though they are "stochastically independent random variables," meaning those tools assume that the returns of one asset class are not affected by the returns of other asset classes. This is not a valid assumption, and the CMM accounts for statistical dependencies among asset classes.

Future returns. While past performance is not a guarantee of future performance, we strongly believe that empirical data is nonetheless the least-worst indicator of future performance.

Annuities. The CMM accounts for the role that fixed annuities can play in retirement planning, including conversion of investment assets to annuities at varying points in time and with varying rates.

Initial market conditions. The CMM models asset class returns through a combination of statistically random returns and regime-based returns in which recent market performance can, optionally, be factored into the first several years of forecasted market returns.

We do not consider regime-based starting forecasts to be definitive; rather we believe they provide additional perspective that adds to the perspective provided by returns that are independent of initial market conditions.

Table 1 Asset classes used in Rain Dog's Capital Markets Model

US Stocks - Total Market	Sector – Utilities
US Stocks - Large Cap Blend	US Bonds - Total Market
US Stocks - Large Cap Value	Treasuries - Short Term
US Stocks - Large Cap Growth	Treasuries - Intermediate Term
US Stocks - Mid Cap Blend	Treasuries - 10-year
US Stocks - Mid Cap Value	Treasuries - Long Term
US Stocks - Mid Cap Growth	Treasuries - TIPS
US Stocks - Small Cap Blend	GNMA
US Stocks - Small Cap Value	Corporate Bonds - Total Market
US Stocks - Small Cap Growth	Corporate Bonds - Short-Term Investment Grade
International Stocks – Total Market	Corporate Bonds - Long-Term Investment Grade
International Stocks – Europe	Corporate Bonds - High Yield
International Stocks - Developed, ex-US	Global Bonds - USD Hedged
International Stocks - Small Cap, ex-US	Global Bonds - Unhedged
International Stocks - Emerging Markets	Tax Exempt Bonds - Short-Term
Sector - Communication	Tax Exempt Bonds - Intermediate-Term
Sector - Consumer Discretionary	Tax Exempt Bonds - Long-Term
Sector - Consumer Staples	Tax Exempt Bonds - High Yield
Sector - Energy	REIT
Sector - Financials	Gold
Sector - Health Care	Commodities
Sector - Industrials	Cash - Money Market and equivalent (M2)
Sector - IT	Cash - Checking account and equivalent (M1)
Sector - Materials	

Inflation. The CMM performs its computations in real dollars (aka current-year dollars) based on the report date. Asset class returns are adjusted to account for this.

Calculations in real dollars are affected by the inflation assumption. Rain Dog's base inflation assumption is 3.9%, which is the average from

1972-2023. This assumption can be changed selectively.

The CMM models year-to-year variations in inflation, similar to how it models asset class returns. This assumption can be changed selectively.

Personal real estate. Growth in personal real estate is modeled based on historical appreciation of each property, historical inflation, and historical REIT performance. Information about current and past real estate values for specific properties is drawn from public sources including tax records and Zillow.

Federal Tax Model

Rain Dog's FTM accounts for the effect on investments of federal income taxes, federal capital gains taxes, net investment income tax (NIIT), and required minimum distributions.

Tax consequences of asset locations. The FTM accounts for federal tax consequences of keeping assets in different locations (e.g., 401K, Roth, taxable).

Tax consequences of portfolio changes. The FTM calculates tax and asset-growth implications of making portfolio changes over different time periods. This includes the effect of rebalancing assets at different periodicities and in different tax statuses.

Planned changes in federal taxes in 2026. The FTM models the currently planned increase in taxes in 2026 when the Trump tax cuts expire.

Changes in federal taxes after 2026. The FTM can selectively model changes in federal taxes after 2026, including the timing of tax changes and the amount of increase or decrease per tax bracket.

State and local tax assumptions. The FTM does not account for state taxes or local taxes in its calculations.

Simplified assumptions. The FTM estimates federal taxes based on current laws with simplified deduction, exemption, and tax bracket parameters for the current year. It accounts for future-year tax consequences as described above.

Investor Behavior Component

Rain Dog's Investor Behavior Component models the effects of investor decisions over the course of working years and retirement years. Rain Dog's Investor Behavior modeling accounts for the following factors:

- Savings rate, including whether savings is in taxable, tax-deferred, or tax-free locations, and including changes in saving rate over time.
- Social security start ages, including interactions between spouses' starting ages.
- Spending less during market down cycles in retirement.
- Spending more during market up cycles in retirement.

Personal Utility Function

Rain Dog's Personal Utility Function supports a nuanced expression of each investor's personal preferences and goals.

Spending levels. The Personal Utility Function captures the full nuance of investor spending preferences including spending before retirement, at the beginning of retirement, and throughout retirement.

The Personal Utility Function has investors define Essential-level spending, Comfort-level spending, Luxury-level spending, and maximum spending.

Changes in spending levels over time. The Personal Utility Function allows investors to set spending levels that remain constant, that increase or decrease over time, or that change year-by-year.

Legacy. Investors can define the level of legacy they would like to leave.

Full capture of nuanced investor preferences. The Personal Utility Function allows virtually any investor goal to be captured. Some examples include:

- Desired income levels for specific life phases, such as early retirement years vs. later retirement years
- Probability of different levels of income throughout retirement
- Preparedness to fund college, a vacation home, or long-term care
- Probability of different levels of legacy assets
- Degree of investment volatility
- Taxation rate on retirement income
- Desirability of expected case outcomes for income and legacy assets
- Desirability of worst-case outcomes for income and legacy assets
- Taxability of legacy assets

These are just a few examples. The types of goals that can be expressed in the Personal Utility Function are effectively unlimited.

Investment Strategies Component

Rain Dog's Investment Strategies Component draws input from the CMM, FTM, Investor Behavior, and Personal Utility Function. It models the effects of different investment strategies, including:

- Asset allocation (allocation of investments to asset classes).
- Asset location (positioning of investments in taxable, tax-deferred, and tax-free locations).
- Tax consequences of changes in asset allocation, including changes arising from rebalancing.
- Withdrawal strategies, including defining $x\%$ per year, manner in which $x\%$ is calculated (e.g., average of past 3 years' investment balances vs. lowest of past 3 years' balances), limits on minimum and maximum withdrawals, and limits on year-to-year fluctuations in income.
- Buffer and cash-management strategies, including the size of the buffer, conditions for funding the buffer, limits on funding the buffer, and type of assets in the buffer.
- Roth conversion strategies, including defined time periods for conversion, percentage of tax-deferred assets to convert, and optimizing conversions for tax efficiency.
- Personalized investment glide paths.
- Advisor fees.

Goal Optimization Model

The Goal Optimization Model computationally evaluates and scores thousands of planning options, and it ranks the best strategies.

The Goal Optimization Model uses the individual investor's utility function, so the scoring is personalized and unique to each investor.

This functionality is under development and will be available in 2H2024.

Monte Carlo Simulation

Rain Dog's IFM uses Monte Carlo simulations to analyze how different factors interact with one another in a statistically rigorous way. These factors include:

- CMM factors (market volatility, rates of return, rates of inflation, and so on)
- FTM factors (tax consequences of different investment decisions, and so on)
- Investor behavior factors (savings rate, social security start ages, and so on)
- Investor preferences (desired income levels, withdrawal rates, and so on)
- Investment strategy (asset allocation, rebalancing, glide paths, advisor fees, use of cash buffer, and so on)

In a Monte Carlo simulation, each factor that varies is assigned a "probability distribution," and then hundreds or thousands of trials are run in which each factor is allowed to vary according to its probability distribution. The Monte Carlo simulation computes the interactions among the factors in ways defined by the simulation.

Rain Dog uses Monte Carlo simulation to forecast or estimate numerous factors including the aggregate rate of return of a portfolio, income levels at different times, asset levels at different times, and overall risk of success or failure. This information is then used to provide insight into planning. For example:

- What do average income and legacy assets look like in the "nominal" (50/50) outcome, i.e., the expected case?
- How likely is it that retirement income will average \$100,000 or higher?
- How bad will average income be in the 10% likely case?

As with any kind of forecasting, a Monte Carlo simulation cannot perfectly predict the future, i.e., there is no guarantee of future performance.

Role of Advisor Judgment

Some advisors and tools allow for insertion of subjective judgments into their forecasts. It is common for investment advisors to assume inflation will be lower than it has been in the past, returns of specific asset classes will be higher—or lower—and so on.

Each of these assumptions might seem reasonable. Indeed, the intent behind making adjustments to the forecast is to improve the accuracy of the forecast. However, putting a subjective thumb on the scale of intermediate steps in a forecast tends to have the opposite effect: each insertion of subjective judgment tends to add error to the forecast.

Moreover, subjective adjustments tend to be motivated by bias in a single direction: such as a

general concern that the pure empirically based forecasts are too optimistic or too pessimistic.

Errors from these subjective adjustments accumulate, and collectively they create an inaccurate forecast.

For sake of overall accuracy, each step in a multi-step forecasting process must use the most neutral data available, which means avoiding subjective assumptions and judgments. It means sticking to unfiltered empirical data as much as possible.

If an advisor or client believes an empirically based forecast is too optimistic or too pessimistic, the correct way to address a concern is to keep each step in the forecasting process free from subjectivity, but to use a statistically less likely or more likely output of the forecast. If the advisor or client is concerned about a forecast being too optimistic, the nominal plan could be based on a 60% or 70% likely forecast rather than the 50/50 forecast. This approach allows for accommodation

of a desire to be more cautious while also preserving the integrity and accuracy of the forecast.

Conclusions

Investment advisory clients are not one-size-fits-all, and Rain Dog's investment forecast methodology has been designed to address the wide range of needs of different investors.

Investors exhibit differences in risk tolerance, risk capacity, expectations about near and long-term performance of capital markets and federal taxes, investor behavior, and investor preferences.

Rain Dog's investment forecast methodology has been designed to account for these variations and to support the creation of investment strategies that satisfy investors' needs, goals, and preferences in a truly personalized way.



[Learn more about Rain Dog | raindogllc.com](https://raindogllc.com)

Important: While we have taken extensive measures to ensure the accuracy of Rain Dog's Investment Forecast Model, the projections and other information generated by Rain Dog 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 best use of the results is for sake of comparing alternative approaches.

All investing involves risk, including the possible loss of principal. Portfolio management strategies such as diversification, asset allocation, and rebalancing do not ensure a profit or guarantee against loss. There is no guarantee that any investment strategy will achieve its objectives. Rain Dog LLC is not a law firm and does not provide legal advice to clients.

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