

Package ‘R4GoodPersonalFinances’

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Title Make Optimal Financial Decisions

Version 1.0.0

Description Make optimal decisions for your personal or household finances. Use tools and methods that are selected carefully to align with academic consensus, bridging the gap between theoretical knowledge and practical application. They help you find your own personalized optimal discretionary spending or optimal asset allocation, and prepare you for retirement or financial independence.

The optimal solution to this problems is extremely complex, and we only have a single lifetime to get it right.

Fortunately, we now have the user-friendly tools implemented, that integrate life-cycle models

with single-period net-worth mean-variance optimization models.

Those tools can be used by anyone who wants to see what highly-personalized optimal decisions can look like.

For more details see:

Idzorek T., Kaplan P. (2024, ISBN:9781952927379),

Haghani V., White J. (2023, ISBN:9781119747918).

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<https://r4goodacademy.github.io/R4GoodPersonalFinances/>,
<https://github.com/R4GoodAcademy/R4GoodPersonalFinances>

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R4GoodPersonalFinances-package
<i>R4GoodPersonalFinances: Make Optimal Financial Decisions</i>

Description

Make optimal decisions for your personal or household finances. Use tools and methods that are selected carefully to align with academic consensus, bridging the gap between theoretical knowledge and practical application. They help you find your own personalized optimal discretionary spending or optimal asset allocation, and prepare you for retirement or financial independence. The optimal solution to this problems is extremely complex, and we only have a single lifetime to get it right. Fortunately, we now have the user-friendly tools implemented, that integrate life-cycle models with single-period net-worth mean-variance optimization models. Those tools can be used by anyone who wants to see what highly-personalized optimal decisions can look like. For more details see: Idzorek T., Kaplan P. (2024, ISBN:9781952927379), Haghani V., White J. (2023, ISBN:9781119747918).

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See Also

Useful links:

- <https://www.r4good.academy/>
- <https://r4goodacademy.github.io/R4GoodPersonalFinances/>
- <https://github.com/R4GoodAcademy/R4GoodPersonalFinances>
- Report bugs at <https://github.com/R4GoodAcademy/R4GoodPersonalFinances/issues>

calc_effective_tax_rate

Calculate Effective Tax Rate

Description

Calculate Effective Tax Rate

Usage

```
calc_effective_tax_rate(portfolio, tax_rate_ltcg, tax_rate_ordinary_income)
```

Arguments

portfolio A nested tibble of class Portfolio.
 tax_rate_ltcg A numeric. Tax rate for long-term capital gains.
 tax_rate_ordinary_income
 A numeric. Tax rate for ordinary income.

Value

A portfolio object augmented with nested columns with effective tax rates calculations.

Examples

```
portfolio <- create_portfolio_template()
portfolio$accounts$taxable <- c(10000, 30000)
portfolio <-
  calc_effective_tax_rate(
    portfolio,
    tax_rate_ltcg = 0.20,
    tax_rate_ordinary_income = 0.40
  )
portfolio$aftertax$effective_tax_rate
```

calc_gompertz_joint_parameters

Calculating the Gompertz model parameters for joint survival

Description

Calculating the Gompertz model parameters for joint survival

Usage

```
calc_gompertz_joint_parameters(
  p1 = list(age = NULL, mode = NULL, dispersion = NULL),
  p2 = list(age = NULL, mode = NULL, dispersion = NULL),
  max_age = 120
)
```

Arguments

p1	A list with age, mode and dispersion parameters for the first person (p1).
p2	A list with age, mode and dispersion parameters for the second person (p2).
max_age	A numeric. The maximum age for the Gompertz model.

Value

A list containing:

data	A data frame with survival rates for 'p1', 'p2', 'joint' survival, and the fitted Gompertz model
mode	The mode of the joint Gompertz distribution
dispersion	The dispersion parameter of the joint Gompertz distribution

Examples

```
calc_gompertz_joint_parameters(
  p1 = list(
    age      = 65,
    mode     = 88,
    dispersion = 10.65
  ),
  p2 = list(
    age      = 60,
    mode     = 91,
    dispersion = 8.88
  ),
  max_age = 110
)
```

calc_gompertz_parameters

Calculating Gompertz model parameters

Description

Calculating Gompertz model parameters

Usage

```
calc_gompertz_parameters(
  mortality_rates,
  current_age,
  estimate_max_age = FALSE
)
```

Arguments

mortality_rates A data frame with columns `mortality_rate` and `age`. Usually the output of `read_hmd_life_tables()` function or filtered data from `life_tables` object.

current_age A numeric. Current age.

estimate_max_age A logical. Should the maximum age be estimated?

Value

A list containing:

data The input mortality rates data frame with additional columns like `'survival_rate'` and `'probability_of_death'`

mode The mode of the Gompertz distribution

dispersion The dispersion parameter of the Gompertz distribution

current_age The current age parameter

max_age The maximum age parameter

References

Blanchet, David M., and Paul D. Kaplan. 2013. "Alpha, Beta, and Now... Gamma." *Journal of Retirement* 1 (2): 29-45. doi:10.3905/jor.2013.1.2.029.

Examples

```
mortality_rates <-
  dplyr::filter(
    life_tables,
    country == "USA" &
    sex     == "male" &
    year    == 2022
  )

calc_gompertz_parameters(
  mortality_rates = mortality_rates,
  current_age     = 65
)
```

`calc_gompertz_survival_probability`*Calculating Gompertz survival probability*

Description

Calculating Gompertz survival probability

Usage

```
calc_gompertz_survival_probability(  
  current_age,  
  target_age,  
  mode,  
  dispersion,  
  max_age = NULL  
)
```

Arguments

<code>current_age</code>	Current age
<code>target_age</code>	Target age
<code>mode</code>	Mode of the Gompertz distribution
<code>dispersion</code>	Dispersion of the Gompertz distribution
<code>max_age</code>	Maximum age. Defaults to NULL.

Value

A numeric. The probability of survival from 'current_age' to 'target_age' based on the Gompertz distribution with the given parameters.

Examples

```
calc_gompertz_survival_probability(  
  current_age = 65,  
  target_age = 85,  
  mode = 80,  
  dispersion = 10  
)
```

calc_life_expectancy *Calculate Life Expectancy*

Description

Calculate Life Expectancy

Usage

```
calc_life_expectancy(current_age, mode, dispersion, max_age = 120)
```

Arguments

current_age	A numeric. Current age.
mode	A numeric. Mode of the Gompertz distribution.
dispersion	A numeric. Dispersion of the Gompertz distribution.
max_age	A numeric. Maximum age. Defaults to 120.

Value

A numeric. Total life expectancy in years.

Examples

```
calc_life_expectancy(  
  current_age = 65,  
  mode       = 80,  
  dispersion  = 10  
)
```

calc_optimal_asset_allocation
 Calculate optimal asset allocation

Description

Calculate optimal asset allocation

Usage

```
calc_optimal_asset_allocation(  
  household,  
  portfolio,  
  current_date = get_current_date()  
)
```

Arguments

household	An R6 object of class Household.
portfolio	A nested tibble of class Portfolio.
current_date	A character. Current date in the format YYYY-MM-DD. By default, it is the output of <code>get_current_date()</code> .

Value

The portfolio with additional nested columns:

- `allocations$optimal` - optimal joint net-worth portfolio allocations
- `allocations$current` - current allocations

Examples

```

older_member <- HouseholdMember$new(
  name      = "older",
  birth_date = "1980-02-15",
  mode      = 80,
  dispersion = 10
)
household <- Household$new()
household$add_member(older_member)

household$expected_income <- list(
  "income" = c(
    "members$older$age <= 65 ~ 7000 * 12"
  )
)
household$expected_spending <- list(
  "spending" = c(
    "TRUE ~ 5000 * 12"
  )
)

portfolio <- create_portfolio_template()
portfolio$accounts$taxable <- c(10000, 30000)

portfolio <-
  portfolio |>
  calc_effective_tax_rate(
    tax_rate_ltcg = 0.20,
    tax_rate_ordinary_income = 0.40
  )

portfolio <-
  calc_optimal_asset_allocation(
    household = household,
    portfolio = portfolio,
    current_date = "2020-07-15"
  )

```

```
portfolio$allocations
```

```
calc_optimal_risky_asset_allocation
```

Calculate optimal risky asset allocation

Description

Calculates the optimal allocation to the risky asset using the Merton Share formula.

Usage

```
calc_optimal_risky_asset_allocation(  
  risky_asset_return_mean,  
  risky_asset_return_sd,  
  safe_asset_return,  
  risk_aversion  
)
```

Arguments

`risky_asset_return_mean` A numeric. The expected (average) yearly return of the risky asset.

`risky_asset_return_sd` A numeric. The standard deviation of the yearly returns of the risky asset.

`safe_asset_return` A numeric. The expected yearly return of the safe asset.

`risk_aversion` A numeric. The risk aversion coefficient.

Details

Can be used to calculate the optimal allocation to the risky asset for vectors of inputs.

Value

A numeric. The optimal allocation to the risky asset. In case of `NaN()` (because of division by zero) the optimal allocation to the risky asset is set to 0.

See Also

- [How to Determine Our Optimal Asset Allocation?](#)
- Haghani V., White J. (2023) "The Missing Billionaires: A Guide to Better Financial Decisions." ISBN:978-1-119-74791-8.

Examples

```
calc_optimal_risky_asset_allocation(
  risky_asset_return_mean = 0.05,
  risky_asset_return_sd   = 0.15,
  safe_asset_return       = 0.02,
  risk_aversion           = 2
)

calc_optimal_risky_asset_allocation(
  risky_asset_return_mean = c(0.05, 0.06),
  risky_asset_return_sd   = c(0.15, 0.16),
  safe_asset_return       = 0.02,
  risk_aversion           = 2
)
```

calc_portfolio_parameters

Calculate Portfolio Parameters

Description

Calculate Portfolio Parameters

Usage

```
calc_portfolio_parameters(portfolio)
```

Arguments

portfolio	A tibble of class Portfolio. Usually created using create_portfolio_template and customised.
-----------	--

Value

A list with the following elements:

- value: The value of the portfolio.
- weights: The weights of assets in the portfolio.
- expected_return: The expected return of the portfolio.
- standard_deviation: The standard deviation of the portfolio.

Examples

```
portfolio <- create_portfolio_template()
portfolio$accounts$taxable <- c(10000, 30000)
calc_portfolio_parameters(portfolio)
```

`calc_purchasing_power` *Calculate purchasing power*

Description

Calculates changes in purchasing power over time, taking into account the real interest rate.

Usage

```
calc_purchasing_power(x, years, real_interest_rate)
```

Arguments

<code>x</code>	A numeric. The initial amount of money.
<code>years</code>	A numeric. The number of years.
<code>real_interest_rate</code>	A numeric. The yearly real interest rate.

Details

The real interest rate is the interest rate after inflation. If negative (e.g. equal to the average yearly inflation rate) it can show diminishing purchasing power over time. If positive, it can show increasing purchasing power over time, and effect of compounding interest on the purchasing power.

Value

A numeric. The purchasing power.

See Also

- [How to Determine Our Optimal Asset Allocation?](#)

Examples

```
calc_purchasing_power(x = 10, years = 30, real_interest_rate = -0.02)
calc_purchasing_power(x = 10, years = 30, real_interest_rate = 0.02)
```

calc_retirement_ruin *Calculating retirement ruin probability*

Description

Calculating retirement ruin probability

Usage

```
calc_retirement_ruin(  
  portfolio_return_mean,  
  portfolio_return_sd,  
  age,  
  gompertz_mode,  
  gompertz_dispersion,  
  portfolio_value,  
  monthly_spendings,  
  yearly_spendings = 12 * monthly_spendings,  
  spending_rate = yearly_spendings/portfolio_value  
)
```

Arguments

portfolio_return_mean	A numeric. Mean of portfolio returns.
portfolio_return_sd	A numeric. Standard deviation of portfolio returns.
age	A numeric. Current age.
gompertz_mode	A numeric. Gompertz mode.
gompertz_dispersion	A numeric. Gompertz dispersion.
portfolio_value	A numeric. Initial portfolio value.
monthly_spendings	A numeric. Monthly spendings.
yearly_spendings	A numeric. Yearly spendings.
spending_rate	A numeric. Spending rate (initial withdrawal rate).

Value

A numeric. The probability of retirement ruin (between 0 and 1), representing the likelihood of running out of money during retirement.

References

Milevsky, M.A. (2020). Retirement Income Recipes in R: From Ruin Probabilities to Intelligent Drawdowns. Use R! Series. doi:[10.1007/9783030514341](https://doi.org/10.1007/9783030514341).

Examples

```
calc_retirement_ruin(
  age = 65,
  gompertz_mode = 88,
  gompertz_dispersion = 10,
  portfolio_value = 1000000,
  monthly_spendings = 3000,
  portfolio_return_mean = 0.02,
  portfolio_return_sd = 0.15
)
```

```
calc_risk_adjusted_return
```

Calculate risk adjusted return

Description

Calculates the risk adjusted return for portfolio of given allocation to the risky asset.

Usage

```
calc_risk_adjusted_return(
  safe_asset_return,
  risky_asset_return_mean,
  risky_asset_allocation,
  risky_asset_return_sd = NULL,
  risk_aversion = NULL
)
```

Arguments

safe_asset_return A numeric. The expected yearly return of the safe asset.

risky_asset_return_mean A numeric. The expected (average) yearly return of the risky asset.

risky_asset_allocation A numeric. The allocation to the risky asset. Could be a vector. If it is the optimal allocation then parameters **risky_asset_return_sd** and **risk_aversion** can be omitted.

risky_asset_return_sd A numeric. The standard deviation of the yearly returns of the risky asset.

risk_aversion A numeric. The risk aversion coefficient.

Value

A numeric. The risk adjusted return.

See Also

- [How to Determine Our Optimal Asset Allocation?](#)
- Haghani V., White J. (2023) "The Missing Billionaires: A Guide to Better Financial Decisions." ISBN:978-1-119-74791-8.

Examples

```
calc_risk_adjusted_return(  
  safe_asset_return = 0.02,  
  risky_asset_return_mean = 0.04,  
  risky_asset_return_sd = 0.15,  
  risky_asset_allocation = 0.5,  
  risk_aversion = 2  
)  
  
calc_risk_adjusted_return(  
  safe_asset_return = 0.02,  
  risky_asset_return_mean = 0.04,  
  risky_asset_allocation = c(0.25, 0.5, 0.75),  
  risky_asset_return_sd = 0.15,  
  risk_aversion = 2  
)
```

create_portfolio_template

Create Portfolio Template

Description

Creates a template for default portfolio with two asset classes:

- GlobalStocksIndexFund
- InflationProtectedBonds

Usage

```
create_portfolio_template()
```

Details

The template is used as a starting point for creating a portfolio. The asset classes have some reasonable default values of expected returns and standard deviations of returns. The template assumes no correlations between asset classes in the correlations matrix. Please check and update the template assumptions if necessary.

The nested pretax columns contain default values for parameters needed for calculating effective tax rates. The template assumes only capital gains tax is paid. Please customise this template to your individual situation.

The accounts nested columns have zero values for all assets by default in both taxable and tax-advantaged accounts. The template assumes that there is currently no financial wealth allocated to those accounts. Please customise this template to your individual situation.

The weights nested columns define weights of assets in portfolios representative of the household human capital and liabilities. The template assumes equal weights for all assets for both portfolios. Please customise this template to your individual situation.

Value

A nested tibble of class 'Portfolio' with columns:

- name
- expected_return
- standard_deviation
- accounts
 - taxable
 - taxadvantaged
- weights
 - human_capital
 - liabilities
- correlations
- pretax
 - turnover
 - income_qualified
 - capital_gains_long_term
 - income
 - capital_gains
 - cost_basis

See Also

Possible sources of market assumptions:

- <https://elmwealth.com/capital-market-assumptions/>
- <https://www.obligacjeskarbowe.pl/oferta-obligacji/obligacje-10-letnie-edo/>
- <https://www.msci.com/indexes/index/664204>
- (PDF) <https://research.ftserussell.com/Analytics/FactSheets/Home/DownloadSingleIssue?issueName=AWORLDS&is>

Examples

```
portfolio <- create_portfolio_template()
portfolio$accounts$taxable <- c(10000, 30000)
portfolio
```

format_currency	<i>Printing currency values or percentages</i>
-----------------	--

Description

Wrapper functions for printing nicely formatted values.

Usage

```
format_currency(
  x,
  prefix = "",
  suffix = "",
  big.mark = ",",
  accuracy = NULL,
  min_length = NULL,
  ...
)

format_percent(x, accuracy = 0.1, ...)
```

Arguments

x	A numeric vector
prefix, suffix	Symbols to display before and after value.
big.mark	Character used between every 3 digits to separate thousands. The default (NULL) retrieves the setting from the number options .
accuracy	A number to round to. Use (e.g.) 0.01 to show 2 decimal places of precision. If NULL, the default, uses a heuristic that should ensure breaks have the minimum number of digits needed to show the difference between adjacent values. Applied to rescaled data.
min_length	A numeric. Minimum number of characters of the string with the formatted value.
...	Other arguments passed on to base::format() .

Value

A character. Formatted value.
A character. Formatted value.

See Also

`scales::dollar()`
`scales::percent()`

Examples

```
format_currency(2345678, suffix = " PLN")  
format_percent(0.52366)
```

`get_cache_info`*Working with cache*

Description

Get information about the cache
Reset the cache
Set the cache directory

Usage

```
get_cache_info()  
  
reset_cache()  
  
set_cache(path = file.path(getwd(), ".cache"))
```

Arguments

<code>path</code>	The path to the cache directory. Defaults to the <code>`.cache`</code> folder in the current working directory.
-------------------	---

Value

Invisibly returns the path to the cache directory or a list containing:

<code>path</code>	The path to the cache directory.
<code>files</code>	The number of files in the cache.

Examples

```
get_cache_info()  
  
reset_cache()  
  
set_cache()
```

get_current_date	<i>Get current date</i>
------------------	-------------------------

Description

If R4GPF.current_date option is not set, the current system date is used.

Usage

```
get_current_date()
```

Value

A date.

Examples

```
get_current_date()
# Setting custom date using `R4GPF.current_date` option
options(R4GPF.current_date = as.Date("2023-01-01"))
get_current_date()
options(R4GPF.current_date = NULL) # Reset default date#' Working with cache

get_current_date()
```

Household	<i>Household class</i>
-----------	------------------------

Description

The Household class aggregates information about a household and its members.

Value

An object of class Household.

Active bindings

expected_income Set of rules that are used to generate streams of expected income

expected_spending Set of rules that are used to generate streams of expected spending

risk_tolerance Risk tolerance of the household

consumption_impatience_preference Consumption impatience preference of the household - subjective discount rate (ρ). Higher values indicate a stronger preference for consumption today versus in the future.

smooth_consumption_preference Smooth consumption preference of the household - Elasticity of Intertemporal Substitution (EIS) (η). Higher values indicate more flexibility and a lower preference for smooth consumption.

Methods

Public methods:

- `Household$get_members()`
- `Household$add_member()`
- `Household$set_member()`
- `Household$set_lifespan()`
- `Household$get_lifespan()`
- `Household$calc_survival()`
- `Household$get_min_age()`
- `Household$clone()`

Method `get_members()`: Getting members of the household

Usage:

`Household$get_members()`

Method `add_member()`: Adding a member to the household It will fail if a member with the same name already exists.

Usage:

`Household$add_member(household_member)`

Arguments:

`household_member` A `HouseholdMember` object.

Method `set_member()`: Setting a member of the household If a member already exists, it will be overwritten.

Usage:

`Household$set_member(member)`

Arguments:

`member` A `HouseholdMember` object.

Method `set_lifespan()`: Setting an arbitrary lifespan of the household

Usage:

`Household$set_lifespan(value)`

Arguments:

`value` A number of years.

Method `get_lifespan()`: Getting a lifespan of the household If not set, it will be calculated based on the members' lifespans.

Usage:

`Household$get_lifespan(current_date = get_current_date())`

Arguments:

`current_date` A date in the format "YYYY-MM-DD".

Method `calc_survival()`: Calculating a survival rate of the household based on its members' parameters of the Gompertz model.

Usage:

```
Household$calc_survival(current_date = get_current_date())
```

Arguments:

`current_date` A date in the format "YYYY-MM-DD".

Method `get_min_age()`: Calculating a minimum age of the household members.

Usage:

```
Household$get_min_age(current_date = get_current_date())
```

Arguments:

`current_date` A date in the format "YYYY-MM-DD".

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
Household$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

Examples

```
household <- Household$new()
household$risk_tolerance
household$consumption_impatience_preference
household$smooth_consumption_preference
```

HouseholdMember	<i>HouseholdMember class</i>
-----------------	------------------------------

Description

The `HouseholdMember` class aggregates information about a single member of a household.

Value

An object of class `HouseholdMember`.

Active bindings

`max_age` The maximum age of the household member

`mode` The Gompertz mode parameter

`dispersion` The Gompertz dispersion parameter

Methods

Public methods:

- `HouseholdMember$new()`
- `HouseholdMember$get_name()`
- `HouseholdMember$get_birth_date()`
- `HouseholdMember$calc_age()`
- `HouseholdMember$get_lifespan()`
- `HouseholdMember$calc_life_expectancy()`
- `HouseholdMember$calc_survival_probability()`
- `HouseholdMember$get_events()`
- `HouseholdMember$set_event()`
- `HouseholdMember$clone()`

Method `new()`: Creating a new object of class `HouseholdMember`

Usage:

```
HouseholdMember$new(name, birth_date, mode = NULL, dispersion = NULL)
```

Arguments:

`name` The name of the member.

`birth_date` The birth date of the household member in the format YYYY-MM-DD.

`mode` The Gompertz mode parameter.

`dispersion` The Gompertz dispersion parameter.

Method `get_name()`: Getting the name of the household member

Usage:

```
HouseholdMember$get_name()
```

Method `get_birth_date()`: Getting the birth date of the household member

Usage:

```
HouseholdMember$get_birth_date()
```

Method `calc_age()`: Calculating the age of the household member

Usage:

```
HouseholdMember$calc_age(current_date = get_current_date())
```

Arguments:

`current_date` A date in the format "YYYY-MM-DD".

Method `get_lifespan()`: Calculating a lifespan of the household member

Usage:

```
HouseholdMember$get_lifespan(current_date = get_current_date())
```

Arguments:

`current_date` A date in the format "YYYY-MM-DD".

Method `calc_life_expectancy()`: Calculating a life expectancy of the household member

Usage:

```
HouseholdMember$calc_life_expectancy(current_date = get_current_date())
```

Arguments:

`current_date` A date in the format "YYYY-MM-DD".

Method `calc_survival_probability()`: Calculating a survival probability of the household member

Usage:

```
HouseholdMember$calc_survival_probability(
  target_age,
  current_date = get_current_date()
)
```

Arguments:

`target_age` Target age (numeric, in years).

`current_date` A date in the format "YYYY-MM-DD".

Method `get_events()`: Getting the events related to the household member

Usage:

```
HouseholdMember$get_events()
```

Method `set_event()`: Setting an event related to the household member

Usage:

```
HouseholdMember$set_event(event, start_age, end_age = Inf, years = Inf)
```

Arguments:

`event` The name of the event.

`start_age` The age of the household member when the event starts.

`end_age` The age of the household member when the event ends.

`years` The number of years the event lasts.

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
HouseholdMember$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

Examples

```
member <- HouseholdMember$new(
  name      = "Isabela",
  birth_date = "1980-07-15",
  mode      = 91,
  dispersion = 8.88
)
member$calc_age()
member$calc_life_expectancy()
```

 life_tables

HMD life tables

Description

A data frame based on: HMD. Human Mortality Database. Max Planck Institute for Demographic Research (Germany), University of California, Berkeley (USA), and French Institute for Demographic Studies (France). Available at www.mortality.org.

Usage

```
life_tables
```

Format

```
life_tables:
```

A data frame with 6 columns:

country Country name

sex Sex: "male", "female", "both"

year Year

age Age

mortality_rate Mortality rate

life_expectancy Life expectancy

Source

<https://www.mortality.org>

 plot_expected_allocation

Plot expected allocation over household life cycle

Description

Plot expected allocation over household life cycle

Usage

```
plot_expected_allocation(
  scenario,
  accounts = c("all", "taxable", "taxadvantaged")
)
```

Arguments

- scenario A tibble with nested columns - the result of `simulate_scenario()`. Data for a single scenario.
- accounts A character. Plot allocation for specified types of accounts.

Value

A `ggplot2::ggplot()` object.

Examples

```

older_member <- HouseholdMember$new(
  name      = "older",
  birth_date = "2000-02-15",
  mode      = 80,
  dispersion = 10
)
household <- Household$new()
household$add_member(older_member)

household$expected_income <- list(
  "income" = c(
    "members$older$age <= 65 ~ 10000 * 12"
  )
)
household$expected_spending <- list(
  "spending" = c(
    "TRUE ~ 5000 * 12"
  )
)

portfolio <- create_portfolio_template()
portfolio$accounts$taxable <- c(10000, 30000)
portfolio$weights$human_capital <- c(0.2, 0.8)
portfolio$weights$liabilities <- c(0.1, 0.9)
portfolio <-
  portfolio |>
  calc_effective_tax_rate(
    tax_rate_ltcg      = 0.20,
    tax_rate_ordinary_income = 0.40
  )

scenario <-
  simulate_scenario(
    household = household,
    portfolio = portfolio,
    current_date = "2020-07-15"
  )

plot_expected_allocation(scenario)

```

plot_expected_capital *Plot expected capital over household life cycle*

Description

Plots financial capital, human capital, total capital, and liabilities.

Usage

```
plot_expected_capital(scenario)
```

Arguments

scenario A tibble with nested columns - the result of `simulate_scenario()`. Data for a single scenario.

Value

A `ggplot2::ggplot()` object.

Examples

```
older_member <- HouseholdMember$new(
  name      = "older",
  birth_date = "2000-02-15",
  mode      = 80,
  dispersion = 10
)
household <- Household$new()
household$add_member(older_member)

household$expected_income <- list(
  "income" = c(
    "members$older$age <= 65 ~ 10000 * 12"
  )
)
household$expected_spending <- list(
  "spending" = c(
    "TRUE ~ 5000 * 12"
  )
)

portfolio <- create_portfolio_template()
portfolio$accounts$taxable <- c(10000, 30000)
portfolio$weights$human_capital <- c(0.2, 0.8)
portfolio$weights$liabilities <- c(0.1, 0.9)
portfolio <-
  portfolio |>
  calc_effective_tax_rate(
    tax_rate_ltcg      = 0.20,
```

```

    tax_rate_ordinary_income = 0.40
  )

scenario <-
  simulate_scenario(
    household = household,
    portfolio = portfolio,
    current_date = "2020-07-15"
  )

plot_expected_capital(scenario)

```

plot_future_income	<i>Plot future income structure over household life cycle</i>
--------------------	---

Description

Plot future income structure over household life cycle

Usage

```

plot_future_income(
  scenario,
  period = c("yearly", "monthly"),
  y_limits = c(NA, NA)
)

```

Arguments

scenario	A tibble with nested columns - the result of <code>simulate_scenario()</code> . Data for a single scenario.
period	A character. The amounts can be shown as yearly values (default) or averaged per month values.
y_limits	A numeric vector of two values. Y-axis limits.

Value

A `ggplot2::ggplot()` object.

Examples

```

older_member <- HouseholdMember$new(
  name      = "older",
  birth_date = "1980-02-15",
  mode      = 80,
  dispersion = 10
)

```

```

household <- Household$new()
household$add_member(older_member)

household$expected_income <- list(
  "income" = c(
    "members$older$age <= 65 ~ 7000 * 12",
    "members$older$age > 65 ~ 3000 * 12"
  )
)
household$expected_spending <- list(
  "spending" = c(
    "TRUE ~ 5000 * 12"
  )
)

portfolio <- create_portfolio_template()
portfolio$accounts$taxable <- c(10000, 30000)
portfolio <-
  portfolio |>
  calc_effective_tax_rate(
    tax_rate_ltcg = 0.20,
    tax_rate_ordinary_income = 0.40
  )

scenario <-
  simulate_scenario(
    household = household,
    portfolio = portfolio,
    current_date = "2020-07-15"
  )

plot_future_income(scenario, "monthly")

```

plot_future_spending *Plot future spending structure over household life cycle*

Description

Plot future spending structure over household life cycle, including discretionary and non-discretionary spending. You can also plot discretionary and non-discretionary spending separately, to see structure of non-discretionary spending and possible levels of discretionary spending over time based on Monte Carlo simulations.

Usage

```

plot_future_spending(
  scenario,
  period = c("yearly", "monthly"),
  type = c("both", "discretionary", "non-discretionary"),

```

```

    discretionary_spending_position = c("bottom", "top"),
    y_limits = c(NA, NA)
  )

```

Arguments

scenario	A tibble with nested columns - the result of <code>simulate_scenario()</code> . Data for a single scenario.
period	A character. The amounts can be shown as yearly values (default) or averaged per month values.
type	A character. Type of spending to plot: discretionary, non-discretionary, or both (default).
discretionary_spending_position	A character. Position of discretionary spending in plot. Bottom is the default.
y_limits	A numeric vector of two values. Y-axis limits.

Value

A `ggplot2::ggplot()` object

Examples

```

older_member <- HouseholdMember$new(
  name      = "older",
  birth_date = "1980-02-15",
  mode      = 80,
  dispersion = 10
)
household <- Household$new()
household$add_member(older_member)

household$expected_income <- list(
  "income" = c(
    "members$older$age <= 65 ~ 9000 * 12"
  )
)
household$expected_spending <- list(
  "spending" = c(
    "members$older$age <= 65 ~ 5000 * 12",
    "TRUE ~ 4000 * 12"
  )
)

portfolio <- create_portfolio_template()
portfolio$accounts$taxable <- c(10000, 30000)
portfolio <-
  portfolio |>
  calc_effective_tax_rate(
    tax_rate_ltcg = 0.20,
    tax_rate_ordinary_income = 0.40
  )

```

```

    )

scenario <-
  simulate_scenario(
    household = household,
    portfolio = portfolio,
    # monte_carlo_samples = 100,
    current_date = "2020-07-15"
  )

plot_future_spending(scenario, "monthly")
plot_future_spending(
  scenario,
  "monthly",
  discretionary_spending_position = "top"
)
plot_future_spending(scenario, "monthly", "non-discretionary")
# If Monte Carlo samples are present:
# plot_future_spending(scenario, "monthly", "discretionary")

```

plot_gompertz_calibration

Plotting the results of Gompertz model calibration

Description

Plotting the results of Gompertz model calibration

Usage

```
plot_gompertz_calibration(params, mode, dispersion, max_age)
```

Arguments

params	A list returned by <code>calc_gompertz_parameters()</code> function.
mode	A numeric. The mode of the Gompertz model.
dispersion	A numeric. The dispersion of the Gompertz model.
max_age	A numeric. The maximum age of the Gompertz model.

Value

A `ggplot2::ggplot()` object showing the comparison between actual survival rates from life tables and the fitted Gompertz model.

Examples

```
mortality_rates <-  
  dplyr::filter(  
    life_tables,  
    country == "USA" &  
    sex      == "female" &  
    year     == 2022  
  )  
  
params <- calc_gompertz_parameters(  
  mortality_rates = mortality_rates,  
  current_age     = 65  
)  
  
plot_gompertz_calibration(params = params)
```

plot_joint_survival	<i>Plotting the results of Gompertz model calibration for joint survival</i>
---------------------	--

Description

Plotting the results of Gompertz model calibration for joint survival

Usage

```
plot_joint_survival(params, include_gompertz = FALSE)
```

Arguments

params	A list returned by <code>calc_gompertz_joint_parameters()</code> function.
include_gompertz	A logical. Should the Gompertz survival curve be included in the plot?

Value

A `ggplot2::ggplot()` object showing the survival probabilities for two individuals and their joint survival probability.

Examples

```
params <- calc_gompertz_joint_parameters(  
  p1 = list(  
    age      = 65,  
    mode     = 88,  
    dispersion = 10.65  
  ),  
  p2 = list(  
    age      = 60,  
    mode     = 91,  
  )  
)
```

```

      dispersion = 8.88
    ),
    max_age = 110
  )

plot_joint_survival(params = params, include_gompertz = TRUE)

```

plot_life_expectancy *Plot life expectancy of household members*

Description

Probability of dying at a given age is plotted for each member of a household. Also for each member the life expectancy is shown as dashed vertical line.

Usage

```
plot_life_expectancy(household)
```

Arguments

household An R6 object of class Household.

Value

A ggplot object.

Examples

```

hm1 <-
  HouseholdMember$new(
    name      = "member1",
    birth_date = "1955-01-01",
    mode      = 88,
    dispersion = 10.65
  )
hm2 <-
  HouseholdMember$new(
    name      = "member2",
    birth_date = "1965-01-01",
    mode      = 91,
    dispersion = 8.88
  )
household <- Household$new()
household$add_member(hm1)
household$add_member(hm2)

plot_life_expectancy(household = household)

```

`plot_optimal_portfolio`*Plot optimal portfolio allocations*

Description

The function plots current versus optimal portfolio allocations for each asset class and for taxable and tax-advantaged accounts.

Usage

```
plot_optimal_portfolio(portfolio)
```

Arguments

`portfolio` A nested tibble of class `Portfolio`.

Value

A `ggplot2::ggplot()` object.

Examples

```
older_member <- HouseholdMember$new(
  name      = "older",
  birth_date = "1980-02-15",
  mode      = 80,
  dispersion = 10
)
household <- Household$new()
household$add_member(older_member)

household$expected_income <- list(
  "income" = c(
    "members$older$age <= 65 ~ 7000 * 12"
  )
)
household$expected_spending <- list(
  "spending" = c(
    "TRUE ~ 5000 * 12"
  )
)

portfolio <- create_portfolio_template()
portfolio$accounts$taxable <- c(10000, 30000)
portfolio$accounts$taxadvantaged <- c(0, 20000)
portfolio <-
  portfolio |>
  calc_effective_tax_rate(
```

```

    tax_rate_ltcg = 0.20,
    tax_rate_ordinary_income = 0.40
  )

portfolio <-
  calc_optimal_asset_allocation(
    household = household,
    portfolio = portfolio,
    current_date = "2020-07-15"
  )

plot_optimal_portfolio(portfolio)

```

plot_purchasing_power *Plotting changes to the purchasing power over time*

Description

Plots the effect of real interest rates (positive or negative) on the purchasing power of savings over the span of 50 years (default).

Usage

```

plot_purchasing_power(
  x,
  real_interest_rate,
  years = 50,
  legend_title = "Real interest rate",
  seed = NA
)

```

Arguments

x	A numeric. The initial amount of money.
real_interest_rate	A numeric. The yearly real interest rate.
years	A numeric. The number of years.
legend_title	A character.
seed	A numeric. Seed passed to <code>geom_label_repel()</code> .

Value

A `ggplot2::ggplot()` object.

See Also

- [How to Determine Our Optimal Asset Allocation?](#)

Examples

```
plot_purchasing_power(
  x = 10,
  real_interest_rate = seq(-0.02, 0.04, by = 0.02)
)
```

plot_retirement_ruin *Plotting retirement ruin*

Description

Plotting retirement ruin

Usage

```
plot_retirement_ruin(
  portfolio_return_mean,
  portfolio_return_sd,
  age,
  gompertz_mode,
  gompertz_dispersion,
  portfolio_value,
  monthly_spendings = NULL
)
```

Arguments

portfolio_return_mean	A numeric. Mean of portfolio returns.
portfolio_return_sd	A numeric. Standard deviation of portfolio returns.
age	A numeric. Current age.
gompertz_mode	A numeric. Gompertz mode.
gompertz_dispersion	A numeric. Gompertz dispersion.
portfolio_value	A numeric. Initial portfolio value.
monthly_spendings	A numeric. Monthly spendings.

Value

A `ggplot2::ggplot()` object showing the probability of retirement ruin for different monthly spending levels. If a specific 'monthly_spendings' value is provided, it will be highlighted on the plot with annotations.

Examples

```
plot_retirement_ruin(
  portfolio_return_mean = 0.034,
  portfolio_return_sd   = 0.15,
  age                   = 65,
  gompertz_mode         = 88,
  gompertz_dispersion   = 10,
  portfolio_value       = 1000000,
  monthly_spendings     = 3000
)
```

```
plot_risk_adjusted_returns
```

Plotting risk adjusted returns

Description

Plots the risk adjusted returns for portfolios of various allocations to the risky asset.

Usage

```
plot_risk_adjusted_returns(
  safe_asset_return,
  risky_asset_return_mean,
  risky_asset_return_sd,
  risk_aversion = 2,
  current_risky_asset_allocation = NULL
)
```

Arguments

`safe_asset_return`
A numeric. The expected yearly return of the safe asset.

`risky_asset_return_mean`
A numeric. The expected (average) yearly return of the risky asset.

`risky_asset_return_sd`
A numeric. The standard deviation of the yearly returns of the risky asset.

`risk_aversion` A numeric. The risk aversion coefficient.

`current_risky_asset_allocation`
A numeric. The current allocation to the risky asset. For comparison with the optimal allocation.

Value

A `ggplot2::ggplot()` object.

See Also

- [How to Determine Our Optimal Asset Allocation?](#)
- Haghani V., White J. (2023) "The Missing Billionaires: A Guide to Better Financial Decisions." ISBN:978-1-119-74791-8.

Examples

```
plot_risk_adjusted_returns(
  safe_asset_return      = 0.02,
  risky_asset_return_mean = 0.04,
  risky_asset_return_sd   = 0.15,
  risk_aversion          = 2,
  current_risky_asset_allocation = 0.8
)
```

plot_scenarios

*Plot scenarios metrics***Description**

The plot allows to compare metrics for multiple scenarios.

If scenarios are simulated without Monte Carlo samples, so they are based only on expected returns of portfolio, two metrics are available for each scenario:

- constant discretionary spending - certainty equivalent constant level of consumption that would result in the same lifetime utility as a given series of future consumption in a given scenario (the higher, the better).
- utility of discretionary spending - normalized to minimum and maximum values of constant discretionary spending (the higher, the better).

If scenarios are simulated with additional Monte Carlo samples, there are four more metrics available per scenario:

- constant discretionary spending (for Monte Carlo samples),
- normalized median utility of discretionary spending (for Monte Carlo samples),
- median of missing funds that need additional income or additional savings at the expense of non-discretionary spending, (of yearly averages of Monte Carlo samples),
- median of discretionary spending (of yearly averages of Monte Carlo samples).

Usage

```
plot_scenarios(scenarios, period = c("yearly", "monthly"))
```

Arguments

scenarios	A tibble with nested columns - the result of simulate_scenarios() .
period	A character. The amounts can be shown as yearly values (default) or averaged per month values.

Value

A `ggplot2::ggplot()` object.

Examples

```

older_member <- HouseholdMember$new(
  name      = "older",
  birth_date = "1980-02-15",
  mode      = 80,
  dispersion = 10
)
household <- Household$new()
household$add_member(older_member)

household$expected_income <- list(
  "income" = c(
    "is_not_on('older', 'retirement') ~ 7000 * 12"
  )
)
household$expected_spending <- list(
  "spending" = c(
    "TRUE ~ 4000 * 12"
  )
)

portfolio <- create_portfolio_template()
portfolio$accounts$taxable <- c(100000, 300000)
portfolio <-
  portfolio |>
  calc_effective_tax_rate(
    tax_rate_ltcg = 0.20,
    tax_rate_ordinary_income = 0.40
  )

start_ages <- c(60, 65, 75)
scenarios_parameters <-
  tibble::tibble(
    member      = "older",
    event       = "retirement",
    start_age   = start_ages,
    years       = Inf,
    end_age     = Inf
  ) |>
  dplyr::mutate(scenario_id = start_age) |>
  tidyr::nest(events = ~scenario_id)

scenarios <-
  simulate_scenarios(
    scenarios_parameters = scenarios_parameters,
    household            = household,
    portfolio            = portfolio,
    maxeval              = 100,

```

```

      current_date      = "2020-07-15"
    )

plot_scenarios(scenarios, "monthly")

```

plot_survival	<i>Plot survival of household members</i>
---------------	---

Description

Plot survival probabilities for each household members and for the entire household when at least one member is alive. The household joint survival probability is also approximated by a Gompertz model.

Usage

```
plot_survival(household, current_date = get_current_date())
```

Arguments

household	An R6 object of class Household.
current_date	A character. Current date in the format YYYY-MM-DD. By default, it is the output of get_current_date() .

Value

A ggplot object.

Examples

```

hm1 <-
  HouseholdMember$new(
    name      = "member1",
    birth_date = "1955-01-01",
    mode      = 88,
    dispersion = 10.65
  )
hm2 <-
  HouseholdMember$new(
    name      = "member2",
    birth_date = "1965-01-01",
    mode      = 91,
    dispersion = 8.88
  )
hm3 <-
  HouseholdMember$new(
    name      = "member3",
    birth_date = "1975-01-01",

```

```

      mode      = 88,
      dispersion = 7.77
    )
    household <- Household$new()
    household$add_member(hm1)
    household$add_member(hm2)
    household$add_member(hm3)

    plot_survival(
      household = household,
      current_date = "2020-01-01"
    )

```

read_hmd_life_tables *Reading HMD life tables*

Description

Reading HMD life tables

Usage

```

read_hmd_life_tables(
  path = getwd(),
  files = c("mltper_1x1.txt", "fltper_1x1.txt", "bltper_1x1.txt")
)

```

Arguments

path	A character. Path to the folder with life tables.
files	A character. Names of files with life tables.

Value

A data frame containing mortality data with columns:

sex	Character - sex ('male', 'female', or 'both')
year	Integer - the year of the data
age	Integer - age
mortality_rate	Numeric - mortality rate
life_expectancy	Numeric - life expectancy

References

HMD. Human Mortality Database. Max Planck Institute for Demographic Research (Germany), University of California, Berkeley (USA), and French Institute for Demographic Studies (France). Available at www.mortality.org

Examples

```
## Not run:
# Download 'txt' files
# ("mltper_1x1.txt", "fltper_1x1.txt", "bltper_1x1.txt")
# for a given country to the working directory
# from https://www.mortality.org after registration.

read_hmd_life_tables(path = getwd())

## End(Not run)
```

run_app

*Run a package app***Description**

Run a package app

Usage

```
run_app(
  which = c("risk-adjusted-returns", "purchasing-power", "retirement-ruin"),
  res = 120,
  shinylive = FALSE
)
```

Arguments

which	A character. The name of the app to run. Currently available: • risk-adjusted-returns - Plotting risk-adjusted returns for various allocations to the risky asset allows you to find the optimal allocation. • purchasing-power - Plotting the effect of real interest rates (positive or negative) on the purchasing power of savings over time. • retirement-ruin - Plotting the probability of retirement ruin.
res	A numeric. The initial resolution of the plots.
shinylive	A logical. Whether to use shinylive for the app.

Value

A `shiny::shinyApp()` object if shinylive is TRUE. Runs the app if shinylive is FALSE with `shiny::runApp()`.

Examples

```
run_app("risk-adjusted-returns")
run_app("purchasing-power")
run_app("retirement-ruin")
```

simulate_scenario	<i>Simulate a scenario of household lifetime finances</i>
-------------------	---

Description

The function simulates a scenario of household lifetime finances and returns a tibble with nested columns. By default no Monte Carlo samples are generated, and only single sample based on portfolio expected returns are returned with column `sample=0`. If the additional Monte Carlo samples are generated, they have consecutive IDs starting from 1 in the `sample` column.

Usage

```
simulate_scenario(
  household,
  portfolio,
  scenario_id = "default",
  current_date = get_current_date(),
  monte_carlo_samples = NULL,
  seeds = NULL,
  use_cache = FALSE,
  debug = FALSE,
  ...
)
```

Arguments

<code>household</code>	An R6 object of class Household.
<code>portfolio</code>	A nested tibble of class Portfolio.
<code>scenario_id</code>	A character. ID of the scenario.
<code>current_date</code>	A character. Current date in the format YYYY-MM-DD. By default, it is the output of <code>get_current_date()</code> .
<code>monte_carlo_samples</code>	An integer. Number of Monte Carlo samples. If NULL (default), no Monte Carlo samples are generated.
<code>seeds</code>	An integer vector. Seeds for the random number generator used to generate random portfolio returns for each Monte Carlo sample. If NULL (default), random seed is generated automatically.
<code>use_cache</code>	A logical. If TRUE, the function uses memoised functions to speed up the simulation. The results are cached in the folder set by <code>set_cache()</code> .
<code>debug</code>	A logical. If TRUE, additional information is printed during the simulation.
<code>...</code>	Additional arguments passed simulation functions.

Value

A tibble with nested columns including:

- scenario_id - (character) ID of the scenario
- sample - (integer) ID of the Monte Carlo sample
- index - (integer) year index starting from 0
- years_left - (integer) years left to the end of the household lifespan
- date - (date) date after index years from the current date
- year - (integer) calendar year
- survival_prob - (double) survival probability of the household
- members - (nested tibble) data of each member in the household
- income - (nested tibble) income streams
- total_income - (double) total income of the household from all income streams
- spending - (nested tibble) non-discretionary spending streams
- nondiscretionary_spending - (double) total non-discretionary spending of the household from all non-discretionary spending streams
- human_capital - (double) human capital of the household
- liabilities - (double) liabilities of the household
- portfolio - (nested tibble) state of investment portfolio
- financial_wealth - (double) financial wealth of the household at the beginning of the year
- net_worth - (double) net worth of the household
- discretionary_spending - (double) optimal discretionary spending of the household
- total_spending - (double) total spending of the household (discretionary + non-discretionary)
- financial_wealth_end - (double) financial wealth of the household at the end of the year
- risk_tolerance - (double) risk tolerance of the household
- smooth_consumption_preference - (double) smooth consumption preference of the household
- consumption_impatience_preference - (double) consumption impatience preference of the household
- time_value_discount - (double) time value discount based on consumption impatience of the household
- discretionary_spending_utility - (double) discretionary spending utility of the household based on the smooth consumption preference
- discretionary_spending_utility_weighted - (double) discretionary spending utility of the household weighted by survival probability and time value discount.

Examples

```

older_member <- HouseholdMember$new(
  name      = "older",
  birth_date = "1980-02-15",
  mode      = 80,
  dispersion = 10
)
household <- Household$new()
household$add_member(older_member)

household$expected_income <- list(
  "income" = c(
    "members$older$age <= 65 ~ 7000 * 12"
  )
)
household$expected_spending <- list(
  "spending" = c(
    "TRUE ~ 5000 * 12"
  )
)

portfolio <- create_portfolio_template()
portfolio$accounts$taxable <- c(10000, 30000)
portfolio <-
  portfolio |>
  calc_effective_tax_rate(
    tax_rate_ltcg = 0.20,
    tax_rate_ordinary_income = 0.40
  )

scenario <-
  simulate_scenario(
    household = household,
    portfolio = portfolio,
    current_date = "2020-07-15"
  )
names(scenario)

```

simulate_scenarios	<i>Simulate multiple scenarios of household lifetime finances</i>
--------------------	---

Description

Simulate multiple scenarios of household lifetime finances

Usage

```
simulate_scenarios(
```

```

    scenarios_parameters,
    household,
    portfolio,
    current_date = get_current_date(),
    monte_carlo_samples = NULL,
    auto_parallel = FALSE,
    use_cache = FALSE,
    debug = FALSE,
    ...
  )

```

Arguments

scenarios_parameters	A tibble with column <code>scenario_id</code> and nested column events. Each scenario has defined one or more events in the tibbles that are stored in as a list in the events column.
household	An R6 object of class <code>Household</code> .
portfolio	A nested tibble of class <code>Portfolio</code> .
current_date	A character. Current date in the format YYYY-MM-DD. By default, it is the output of <code>get_current_date()</code> .
monte_carlo_samples	An integer. Number of Monte Carlo samples. If NULL (default), no Monte Carlo samples are generated.
auto_parallel	A logical. If TRUE, the function automatically detects the number of cores and uses parallel processing to speed up the Monte Carlo simulations. The results are cached in the folder set by <code>set_cache()</code> .
use_cache	A logical. If TRUE, the function uses memoised functions to speed up the simulation. The results are cached in the folder set by <code>set_cache()</code> .
debug	A logical. If TRUE, additional information is printed during the simulation.
...	Additional arguments passed simulation functions.

Value

A tibble with nested columns.

Examples

```

older_member <- HouseholdMember$new(
  name      = "older",
  birth_date = "1980-02-15",
  mode      = 80,
  dispersion = 10
)
household <- Household$new()
household$add_member(older_member)

household$expected_income <- list(

```

```

    "income" = c(
      "members$older$age <= 65 ~ 7000 * 12"
    )
  )
  household$expected_spending <- list(
    "spending" = c(
      "TRUE ~ 5000 * 12"
    )
  )
)

portfolio <- create_portfolio_template()
portfolio$accounts$taxable <- c(10000, 30000)
portfolio <-
  portfolio |>
  calc_effective_tax_rate(
    tax_rate_ltcg = 0.20,
    tax_rate_ordinary_income = 0.40
  )
start_ages <- c(60, 65, 70)
scenarios_parameters <-
  tibble::tibble(
    member      = "older",
    event       = "retirement",
    start_age   = start_ages,
    years       = Inf,
    end_age     = Inf
  ) |>
  dplyr::mutate(scenario_id = start_age) |>
  tidyr::nest(events = -scenario_id)

scenarios_parameters

scenarios <-
  simulate_scenarios(
    scenarios_parameters = scenarios_parameters,
    household           = household,
    portfolio           = portfolio,
    current_date        = "2020-07-15"
  )
scenarios$scenario_id |> unique()

```

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