

Retirement Simulator: what the model assumes

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The simulator is built for one situation, the day you stop working. From that day you live off your portfolio, plus your pension once it starts, and the simulator tells you how much you can spend each year and how likely it is that the money lasts as long as you do. This note lists what the model assumes, so you know what to enter and how to read the result.

The situation it models

From the first year there is no salary and no new savings. Your spending comes from the portfolio, and from your pension once it starts. If you're still working and saving, use the Savings Goal calculator for the years until you stop, then come back here with the amount you expect to have on that day.

What you enter

The table below lists each input and what the model takes it to mean.

Input	What the model takes it to mean
Portfolio	The invested money you will live off, in today's euros. Leave out your home and the cash you keep aside.
Age and sex	Your age today in whole years. Sex is only used for life expectancy.
Withdrawal rate	The share of today's portfolio you take out each year when Flexibility is 0%. The amount stays the same every year in today's euros. The hint under the slider shows the first withdrawal your current settings really produce.
Pension (net, per year)	What reaches your bank account in a year, after tax and social contributions, in today's euros. The model keeps it constant after inflation. Take the figure from your own pension estimate and convert it to net.
Pension starts at age	The pension is added to your spending from that age, and before it the portfolio carries everything. If you're already past that age, the pension is paid from the first year.
Flexibility	At 0% you take the same withdrawal every year. At 100% the withdrawal is recalculated every year from what is left. In between, the two are blended in that proportion.
Real return (average)	The average yearly return of your portfolio after inflation and after fees. It is an arithmetic average, so money compounds a little more slowly, and the hint under the slider shows by how much.
Volatility	How far a single year typically ends from the average. Technically it is the standard deviation of the yearly log return, the way volatility is usually quoted for funds and indices, and the same definition as in the Savings Goal calculator.
Risk aversion	How much more a bad year hurts you than a good year pleases you, from 1 (low) to 10 (very high). It only changes the Safe Income Equivalent.
Safety net floor	The yearly income you could count on from outside the portfolio if it ran dry, state support for example.
Spending floor and cap	From the second year, how far your total spending may fall or rise from one year to the next.

How a year works

Each year starts with your withdrawal, and what is left stays invested until the next one. Ages are counted in whole years and every scenario runs from today to your 100th birthday, so the last year of spending is the year you are 99.

All amounts are in today's euros. A return of 3% means 3% above inflation, and a pension of 30k means 30k of today's purchasing power in every year.

There is no tax in the model, so what you withdraw counts as money you can spend. That is close to reality for a Luxembourg resident who holds accumulating funds for more than six months, because those gains are normally tax free, and it is the reason you enter your pension net.

Returns

Each year gets a random return, drawn independently of the years before it, with the average and the volatility you set. The returns follow a lognormal distribution, the usual choice for money that compounds, which means a year can never lose more than 100%. With a 3% average and 10% volatility, money compounds at about 2.5% a year in the typical scenario, because the ups and downs drag compounding below the average.

The model knows nothing about market history, so it has no crashes that come in series, no recoveries that follow them and no change in your portfolio mix over time. It runs 5,000 scenarios, so the numbers move a little when you roll new ones. The safe income moves by less than 1% and the failure risk by up to about one point, while the median wealth at 95 can move by a few percent, and by more when volatility is high.

The spending rule

In the fixed part you take the withdrawal rate times your starting portfolio, and that amount stays the same every year in today's euros, whatever the markets do.

The flexible part is recalculated at the start of every year. It is the level amount that would use up what is left exactly by your 100th birthday if every remaining year earned the typical compounded return, so after a good year you spend more and after a bad year you spend less.

Flexibility blends the two, and 70% means 30% of the fixed amount plus 70% of the flexible one. From the second year the spending floor and the cap limit how far total spending can move from the year before, and the arrival of your pension doesn't count as a jump.

When the portfolio runs out

A scenario fails in the year the portfolio can't pay the withdrawal the rule asks for. In that year you spend what is left, and afterwards you live on your pension. Whenever that leaves you below the safety net floor, the difference is added as outside money, and it never comes from the portfolio.

Failure risk is the share of scenarios that fail while you're still alive. A scenario that fails at 97 counts for less than one that fails at 80, in proportion to the chance of being alive at that age, which comes from a standard population life table for your sex. At 100% flexibility the portfolio can only run out if the spending floor forces it. With the default floor of 80% the failure risk is then close to zero and the cost shows up as lower spending instead, while a floor close to 100% brings the failure risk back.

The three numbers at the top

Here is what each of the three headline numbers measures.

- **Median wealth at 95.** The portfolio at the start of the year you are 95, in the middle scenario, with half of the scenarios above it and half below. It shows what the money does, whether or not you're alive at 95.
- **Failure risk.** The chance that the portfolio runs out while you're alive, as described above.
- **Safe income equivalent.** The steady yearly income, free of any risk, that would be worth the same to you as this plan. Every year of every scenario is scored with a standard utility curve set by your risk aversion, each year counts in proportion to the chance of being alive, and the average score is turned back into euros. The higher your risk aversion, the more the bad scenarios weigh. Spending below the safety net floor counts as the floor, with a minimum of 1k a year, so that one disastrous year can't pull the number to zero.

For readers who want the formula, the curve is $u(c) = c^{1-g} / (1-g)$, where c is the year's spending and g your risk aversion, and $u(c) = \log(c)$ when g is 1.

The charts

The first two charts show, for every age, where the 5,000 scenarios sit. The wide band runs from the 10th to the 90th percentile and holds 8 scenarios in 10, the narrow band runs from the 25th to the 75th and holds the middle half, and the line is the median. The first point is today, and the bands don't take life expectancy into account.

The last chart shows how the safe income varies from one scenario to the next. Its markers are the headline number, the median scenario, the worst 5% and a risk-free benchmark, which is the safe income you'd get by spreading the portfolio evenly until 100 at a 0% real return, plus your pension.

What the model leaves out

The list below names what the model leaves out on purpose, so you can judge how much each point matters in your case.

- Work income and new savings, because the simulation starts the day you stop working.
- Tax, beyond entering your pension net.
- What it costs to keep building pension rights if you stop before your pension starts, voluntary contributions for example. Count that cost inside your yearly spending.
- A partner. The model follows one life.
- Spending needs that change with age, one-off expenses, property, inheritance and care costs.
- Any link between one year's return and the next.

A note on what this document is

This note describes a financial education tool, not investment advice. The simulator shows how a withdrawal plan behaves under the assumptions above. It doesn't know your full situation, it recommends no product and no allocation, and its results are an illustration rather than a forecast. The decisions stay with you and your written plan, and anything tax-specific should be confirmed with a qualified tax adviser.