Plain Vanilla Swap VaR Calculator

User Manual

with historical time series

English

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1 Introduction

1.0 What Is the Swap VaR Calculator?

The Plain Vanilla Swap VaR Calculator is a web-based tool for valuing interest rate swaps and measuring their risk on the basis of **historical interest rate time series**. The tool provides:

- **valuation** of an interest rate swap (present value) with the current yield curve,
- **risk metrics** (DV01, modified duration, convexity),
- **Value at Risk (VaR)** with a covariance matrix estimated from the data,
- a **cash flow table** with discount factors and forward rates,
- a **CSV export** including covariance and correlation matrices,
- built-in **sample data** (EUR swap curve and EUR government bonds).

1.0 Who Is This Tool For?

- Risk managers at banks and financial institutions
- Treasury departments
- Finance students
- Financial analysts and controllers

1.0 System Requirements

- Modern web browser (Chrome, Firefox, Safari, Edge) with JavaScript enabled
- No installation required; all calculations run locally in the browser

1.0 Related Calculator

The **Forward Swap VaR Calculator** uses the same methodology for swaps with a forward start. With forward start = 0 it is equivalent to this calculator. It has its own sample data and reads only maturities in years (`Y`) with a decimal point.

2 Quick Start

2.0 Step 1: Enter Swap Parameters

Notional, fixed rate, term and payment frequency.

2.0 Step 2: Provide Interest Rate Data

- choose your own time series file with “Choose file…” and click “Load time series”, or
- under “… or use sample data” select a data set and click “Load”.

2.0 Step 3: Click “Calculate”

The results appear on the right; optionally use “CSV export (incl. matrices)”.

Tip

To try it out: keep the default settings, load the sample data “EUR swap curve” and calculate. Result: present value −17,384.30 EUR, DV01 −475.49 EUR, modified duration −4.75, VaR (99%, 1 day) 4,817.78 EUR.

3 User Interface

3.0.0 Left Side: Input Area

- Swap parameters
- Historical time series: choose file, load time series, sample data, notes on CSV import
- Status message and display of the loaded yield curve
- VaR parameters, buttons “Calculate” and “CSV export (incl. matrices)”

3.0.0 Right Side: Results Area

- Key figures: present value, DV01, modified duration and convexity (both on notional), Value at Risk, number of payments
- Information on the VaR method
- Yield curve chart and table of the current yield curve
- Swap cash flow details
- Statistical parameters (observations, average volatility and correlation)

4 Step-by-Step Guide

4.1 Entering Swap Parameters

Field	Entry	Default
Notional (EUR)	with or without separators	1000000
Fixed rate (% p.a.)	point or comma	3.5
Term (years)	decimals allowed, e.g. 7.5	5
Payment frequency	annually, semi-annually, quarterly	annually

The number of payments is term × frequency (rounded down). The calculator values the swap from the perspective of the **fixed rate payer**: it pays the fixed rate and receives the floating rate (forward rates from the yield curve).

4.2 Loading Time Series

1. Click "Choose file…" and select the CSV file on your computer.
2. Click "Load time series".
3. The status message shows the maturities, period, number of days and the current yield curve applied (last row of the file).

Storage location: The CSV file must be saved **locally on your computer** (or on a drive/USB stick connected to it). "Choose file" always opens your own computer – the calculator cannot access files on a website or server directly. Please download online files first. The file is processed only in your browser and is not uploaded.

4.3 Using Sample Data

Without a file of your own you can use the built-in sample data (251 trading days each, 14 Nov 2025 – 30 Oct 2026, market-like synthetic data):

- **EUR swap curve (zero-coupon)** – default,
- **EUR government bonds, Bund (zero-coupon)**.

"Load" transfers the data set directly into the calculator, "As CSV" saves it as a file (e.g. to view in Excel or as a template for your own data).

4.4 Time Series File Format

- **Header row:** first column `Date`, then the maturities with unit: `Y` = years, `M` = months (`3M` = 0.25 years); a number without unit = years.
- **Rates:** zero-coupon rates (continuous) in percent, e.g. `2.85`.
- **Data rows:** one trading day per row, chronologically ascending (oldest row first), at least **251 complete rows**. The **last row** is the current yield curve.
- **Maturities:** the curve should cover the swap term; beyond it the curve is extended flat.
- **Delimiter:** comma or semicolon. Decimal separator point; with semicolon a decimal comma is also accepted (European Excel export). Encoding UTF-8.

Example:

```
Date,0.25Y,0.5Y,1Y,2Y,3Y,5Y,7Y,10Y
2025-11-14,1.9710,2.0200,1.9833,2.0735,2.1209,2.2940,2.4377,2.6712
...
2026-10-30,2.5916,2.7609,2.9267,3.0352,3.0246,3.0753,3.1377,3.2451
```

Data sources for your own time series: Deutsche Bundesbank (term structure), ECB (euro area yield curves), Bloomberg/Refinitiv (swap curves). Par yields should first be converted into zero-coupon rates.

4.5 Setting VaR Parameters

Confidence level: 95%, 99% (default) or 99.9%. At 99%, the calculated loss is not exceeded in 99 out of 100 cases.

Time horizon (days): holding period h; the 1-day VaR is scaled by $\sqrt{h}$ (e.g. 10 days: factor 3.16). Default: 1 day.

No volatility needs to be entered – it is estimated from the time series.

5 Interpreting Results

5.1 Present Value

Green = positive, red = negative.

- **Positive:** the swap is in the money for the fixed rate payer (forward rates above the fixed rate).
- **Negative:** the fixed rate is above market level; on unwind the fixed rate payer would have to pay.
- **Zero:** the fixed rate equals the par swap rate (typical at inception).

5.2 DV01

Change in value for a 1 basis point rise in rates (with reversed sign). A **negative** DV01 means the present value **increases** when rates rise – typical for the fixed rate payer. Example: DV01 = −475 EUR ⇒ gain of approx. 4,750 EUR at +10 bp.

5.3 Modified Duration and Convexity

Both figures are relative to the **notional** (tile "Modified duration (on notional)"). Modified duration is DV01 × 10,000 / notional. It indicates by roughly what percentage of the notional the present value changes when rates rise by 1 percentage point (with reversed sign). Example: duration −4.75 on 1m EUR ⇒ gain of about 47,500 EUR at +1 percentage point. For the fixed rate payer it is negative.

Relating it to the notional is common for swaps, because the present value is often close to zero; a duration relative to the present value would then be very large and of little meaning.

Convexity measures the curvature of the value–rate relationship, also relative to the notional. The calculator shows both values with a true minus sign, e.g. −4.75 and −23.14.

5.4 Value at Risk (VaR)

Example: VaR = 4,817.78 EUR at 99%, 1 day means: with 99% probability the daily loss will not exceed 4,817.78 EUR; on about 2–3 days per year it may be higher.

Method: variance-covariance approach with the covariance matrix of the daily log returns of the discount factors; sensitivities are the full derivatives of the present value with respect to the discount factors, i.e. both the fixed *and* the floating leg are captured. The tile label shows the selected confidence level, e.g. "Value at Risk (99.9%)". Details: see the mathematical documentation.

5.5 Yield Curve and Cash Flow Details

- **Chart and table:** current yield curve with term, rate (% and decimal) and discount factor.
- **Cash flow table:** for each payment the time, discount factor, forward rate, fixed, floating and net cash flow, and present value. Amounts are shown without a currency symbol (unit € in the column header); negative amounts are red with a minus sign.

5.6 Statistical Parameters

- **Observations:** number of daily returns (with 251 days: 250).
- **Average volatility:** daily fluctuation of the discount factor returns.
- **Average correlation:** between adjacent payment dates; undefined for a single payment (shown as "–").

6 Sample Results

Default settings (1m EUR, 3.5%, 5 years), 99%, 1 day:

Data	Frequency	Present value	DV01	Duration	VaR
EUR swap curve	annual	−17,384.30	−475.49	−4.75	4,817.78
EUR swap curve	semi-annual	−18,642.20	−471.81	−4.72	4,775.83
EUR Bund	annual	−17,854.60	−475.70	−4.76	4,828.78

All amounts in EUR; duration on notional. The present value is negative because the fixed rate (3.5%) is above the par swap rate (approx. 3.12%).

7 CSV Export

"CSV export (incl. matrices)" is available after a calculation. The file (semicolon-separated)

`Swap_VaR_Historical_[timestamp].csv`

contains:

1. Swap parameters and number of payments
2. Valuation (present value)
3. Risk metrics (DV01, modified duration and convexity on notional, VaR, confidence level, time horizon)
4. VaR methodology (observations, average volatility and correlation)
5. Yield curve (grid points)
6. Cash flow details
7. Sensitivities w and covariance and correlation matrix of the discount factor returns (labelled with the maturity, e.g. `DF(t=1.00)`)

In Excel: Data → From Text/CSV, encoding UTF-8, delimiter semicolon.

8 Frequently Asked Questions

Q: Is my data stored or uploaded?
A: No. All calculations are performed locally in the browser.

Q: Can I load files directly from the website?
A: No, only files from your own computer. Download online files first or use the built-in sample data.

Q: Why zero-coupon rates and not swap rates/yields?
A: The calculator discounts with DF $= e^{-rt}$, which matches continuous zero-coupon rates. Par swap rates or yields lead to slightly different values.

Q: How many maturities do I need?
A: 6–10 grid points covering the swap term are recommended (e.g. 3M to 10Y).

Q: Can I use other currencies?
A: Yes, the tool is currency-neutral (amounts are labelled EUR). Load the appropriate curve, e.g. USD SOFR or CHF SARON.

Q: How accurate is the VaR?
A: The variance-covariance approach is a linear approximation under a normal distribution assumption: good for small to medium rate moves, less accurate for extreme market moves.

Q: How do I value a forward swap?
A: With the Forward Swap VaR Calculator. It has its own sample data; time series files there must use maturities in years (`Y`, no months) and a decimal point. You can save this calculator's sample data with "As CSV" and load it there.

9 Troubleshooting

9.0.0 "invalid header row (maturities)"

The first row must contain `Date` and maturities with a number, e.g. `Date,1Y,2Y,5Y`.

9.0.0 "only ... complete data rows found, at least 251 required"

The file has too few days or rows with empty or non-numeric values. If the decimal separator is a comma, the semicolon must be used as delimiter.

9.0.0 "Please load a time series first!"

Load a file or the sample data before calculating.

9.0.0 Implausible results

Check that rates are in percent (not decimal), rows are sorted chronologically ascending and the last row is the current curve.

9.0.0 Chart not displayed

Reload the page (F5), use an up-to-date browser, check the JavaScript console (F12).

9.0 Best Practices

✓ Use current, complete time series and document data sources
✓ Recalculate regularly and archive CSV exports
✓ Complement VaR with scenario and stress tests

✗ Do not use par yields unchecked as zero-coupon rates
✗ Do not rely on VaR alone or use it as a stop-loss

9.0 Contact and Support

For the mathematical foundations see the "Mathematical Documentation" of the Swap VaR Calculator. Feedback and improvement suggestions are welcome – your input helps us improve the tool!