J:r JSON risk portfolio pricing app

Tutorial: valuation and stress testing

FRAME CONSULTING
Financial Risk & Applications

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Introduction

Introduction

In a market risk context, EVE stress testing essentially boils down to evaluating a portfolio under different scenarios, i.e., different sets of parameters. Parameters are typically based on market observations like yield curves or fx prices.

JSON risk portfolio pricing supports this in an easy manner.:

1. Prepare csv or json files* for
   - your portfolio and
   - your parameters (curves, scalars, surfaces).

2. Upload csv or json files, run the calculation and check warnings and errors.

3. Check and export the results .

Portfolio

Curves
Scalars
Surfaces

Web App
https://jsonrisk.de/portfolio_pricing

Portfolio present value
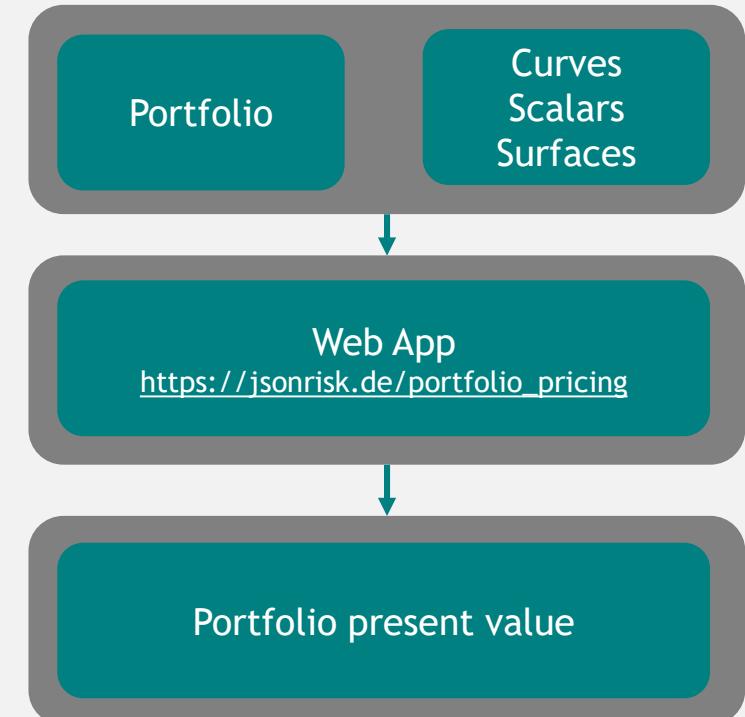
JSON risk portfolio pricing

First look and feel – three tabs
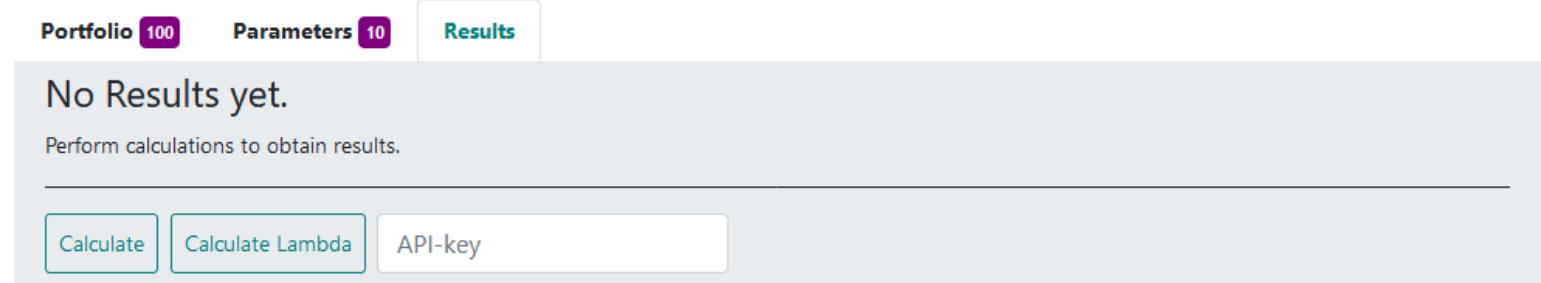
When visiting the website, test portfolio (100 intruments)
and test parameters (10 curves, scalars and surfaces) load automatically.

Portfolio tab

JSON risk portfolio pricing

1. Press Clear.

Portfolio

| Create instrument | Import more (csv) | Import more (json) | Clear | Export json | Export csv | filter portfolio |

2. Press Import (json) or Import (csv) choose file in file explorer.

No Portfolio present.

Import portfolio from file or load test portfolio.

| Create instrument | Import (csv) | Import (json) | Load test portfolio |

3. The portfolio is displayed in the portfolio tab.

Actions			Index	ID	Type	Sub portfolio	Notional	Quantity	Market value	Currency	Maturity	Tenor	Fixed rate
View	Edit	Remove	0	1	bond	bonds	100,000.00		100,000.00	EUR	30.11.2021	1	1.0000%
View	Edit	Remove	1	2	bond	bonds	100,000.00		100,000.00	USD	30.11.2026	3	1.0000%

Remark: The page never uploads anything to our servers. All data is stored in the local browser online. Exception: the optional AWS pricing feature.

JSON risk portfolio pricing

Portfolio (2) – create, view, edit, delete instruments

1. Press Create instrument to add a new instrument to the portfolio.

2. Press View to view an existing instrument. The button Add as new item allows you to create copies of instruments or similar instruments with modifications.

3. Press Edit for changing fields.

4. Press Remove to delete an item from the portfolio.

Portfolio

| Create instrument | Import more (csv) | Import more (json) | Clear | Export json | Export csv | filter portfolio |

| View Edit Remove | **0** | 1 | **bond** | bonds | 100,000.00 | 100,000.00 | EUR | 30.11.2021 | 1 | 1.0000% |

View and edit

```
{
  "id": "new_item",
  "type": "bond",
  "sub_portfolio": "bonds",
  "notional": 10000,
  "quantity": null,
  "market_value": null,
  "currency": "EUR",
  "maturity": "2030-01-01",
  "tenor": 1,
  "fixed_rate": 0.01,
  "float_current_rate": null,
  "float_spread": null,
```

| Add as new item | Cancel |

* the buttons 'create instrument' and 'view' and 'edit' will open a dialog with an editable json representation of the instrument
**detailed information how to fill fields is available on https://jsonrisk.de/01_Documentation.html

You can always store a modified portfolio permanently on your disk by using the export functionality.

Parameters tab

JSON risk portfolio pricing

Parameters (1)

Got market data for upload?

no — yes

Indicative EUR market data is available in the app for testing. Just choose a parameter set in the dropdown box and press load.

Got a prepared or previously stored json parameter set?

yes — no

Upload all parameters in one step with json format.

Build a parameter set with single scalars, curves and surfaces in csv format.
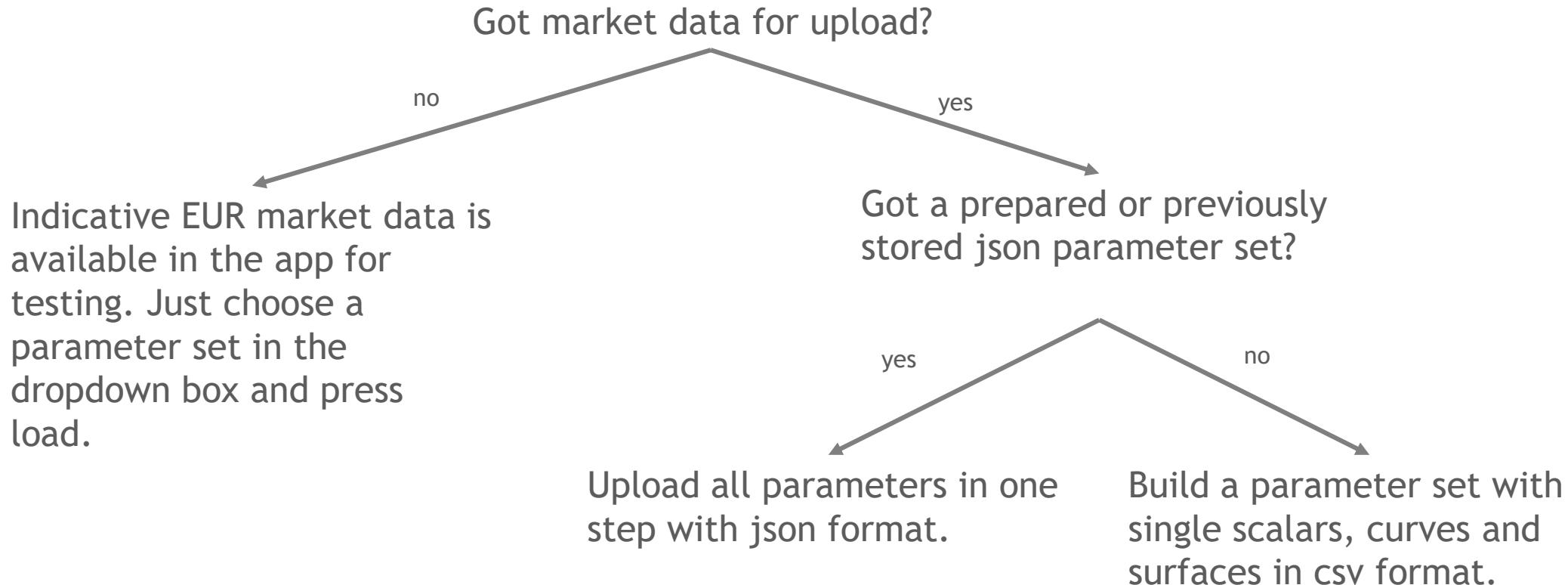
A description of the csv format for scalars, curves and surfaces is in the appendix.

JSON risk portfolio pricing
Parameters (2) – uploading csv parameters

1. Press clear all and enter a valuation date.

2. Press Import new and choose csv file in file explorer. There is a separate button for each of scalars, curves and surfaces. After uploading the parameters are displayed.

After uploading all needed scalars, curves and surfaces, we recommend to export the complete parameter set as a json file.

JSON risk portfolio pricing
Parameters (3) – curve and surface assignment

Built-in automatic curve and surface assignment for an instrument?

no   yes
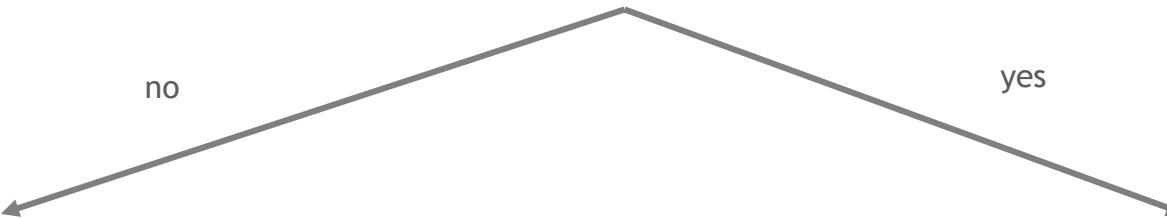
1. Choose the names for discount, forward and spread curves and/or surfaces.
2. Fill for each instrument in the corresponding portfolio upload file the fields if applicable:
   - disc_curve,
   - fwd_curve,
   - spread_curve,
   - surface.
3. Make sure that the names for all relevant instruments and curves match.

1. You have to name the parameters according to the name convention below:
   - disc_curve: instrument.currency + _OIS_DISCOUNT* (e.g. EUR_OIS_DISCOUNT),
   - fwd_curve= instrument.currency + _ + (instrument.float_tenor or instrument.tenor) + _FWD* (e.g. EUR_6M_FWD),
   - spread_curve: left empty,
   - surface = CONST_10BP.
2. Make sure you have all relevant parameters for each instrument.

* EUR is the default currency ** 6M is the default tenor

If a corresponding field in the portfolio upload file is empty for an instrument then the program assigns default parameters automatically, if available.

Results tab

Results

1. Press Calculate to start the calculation* and wait for calculations to finish.

2. As soon as calculations complete, the application displays present values in tabular and graphical format.

3. Inspect the boxes with warnings and errors, if any.

4. Press Export to store results in csv format.

*For more details about the buttons calculate lambda and API-key see appendix.

No Results yet.
Perform calculations to obtain results.

Calculate | Calculate Lambda | API-key

Calculations completed for 20 of 20 instruments.
Present values for 20 instruments were calculated in 0.21 seconds.

Clear results

P&L and Present Values for each scenario
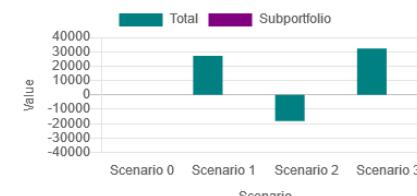
Present values of scenario 0

Choose subportfolio... | P&L | Present Values
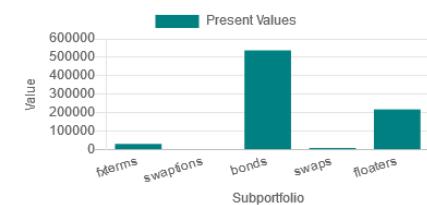
Present value vector by sub-portfolios

Export

Index	Scenario	Total	fxterms	swaptions	bonds	swaps	floaters
0	Scenario 0	791,779.87	29,664.80	0.00	537,630.55	7,353.29	217,131.23
1	Scenario 1	818,905.59	30,568.67	0.19	555,955.15	8,879.42	223,502.16
2	Scenario 2	773,554.64	30,372.09	492.83	519,213.21	1,882.56	221,593.96
3	Scenario 3	824,018.01	29,773.59	0.00	563,532.57	12,464.14	218,247.72

JSON risk portfolio pricing

Example (1) – successful calculation for test portfolio and test parameters

Calculations completed for 100 of 100 instruments.

Present values for 100 instruments were calculated in 7.81 seconds.

Clear results

Warnings **190**   ×

Warning on instrument 100: Assigning default surface CONST_10BP. [repeats 24 times]

Warning on instrument 100: Assigning default forward curve USD_3M_FWD. [repeats 3 times]

Warning on instrument 100: Assigning default discount curve USD_OIS_DISCOUNT. [repeats 15 times]

Warning on instrument 96: Assigning default forward curve EUR_3M_FWD. [repeats 14 times]

Warning on instrument 98: Assigning default discount curve EUR_OIS_DISCOUNT. [repeats 85 times]

Warning on instrument 94: Assigning default forward curve EUR_1M_FWD. [repeats 10 times]

Warning on instrument 87: Assigning default forward curve EUR_6M_FWD. [repeats 39 times]

- Present value were calculated sucessfully for each instrument.

- The warnings box merely informs that default curves and surfaces were assigned automatically.

JSON risk portfolio pricing

Example (2) – calculation fails when there are no parameters for one or more instruments

Calculations completed for 0 of 100 instruments.

Present values for 0 instruments were calculated in 0.11 seconds.

Could not price 100 instruments due to errors. For more details, see errors box below.

Clear results

Warnings 190

Warning on instrument 96: Could not find default surface CONST_10BP in parameters. [repeats 24 times]

Warning on instrument 96: Could not find default forward curve EUR_3M_FWD in parameters. [repeats 14 times]

Warning on instrument 94: Could not find default forward curve EUR_1M_FWD in parameters. [repeats 10 times]

Warning on instrument 96: Could not find default discount curve EUR_OIS_DISCOUNT in parameters. [repeats 85 times]

Warning on instrument 95: Could not find default forward curve EUR_6M_FWD in parameters. [repeats 39 times]

Warning on instrument 100: Could not find default forward curve USD_3M_FWD in parameters. [repeats 3 times]

Warning on instrument 100: Could not find default discount curve USD_OIS_DISCOUNT in parameters. [repeats 15 times]

Errors 100

Error pricing instrument 96: fixed_income.present value: Must provide discount curve when evaluating interest stream [repeats 90 times]

Error pricing instrument 87: callable_fixed_income.present_value: must provide forward curve for calibration [repeats 10 times]

IDs with Errors 100

96, 95, 92, 94, 98, 91, 93, 97, 89, 90, 87, 77, 88, 86, 79, 73, 100, 69, 75, 85, 99, 84, 78, 83, 82, 71, 81, 67, 80, 64, 76, 61, 58, 56, 72, 66, 74, 54, 70, 63, 68, 60, 37, 65, 47, 33, 62, 46, 29, 59, 45, 57, 44, 25, 55, 38, 21, 18, 53, 34, 30, 51, 50, 26, 49, 22, 48, 40, 15, 36, 32, 52, 28, 13, 24, 20, 17, 14, 11, 43, 42, 9, 41, 39, 12, 35, 7, 31, 27, 23, 19, 16, 4, 2, 10, 8, 6, 5, 3, 1

- No instruments were priced.

- Default USD discount curve is missing for 15 instruments in USD.
- Default EUR discount curve is missing for 85 instruments in EUR.
- Default forward curves for different tenors and currencies are missing.
- A volatility surface is needed and none found for 24 instruments.

- As default discount and forward curves as well as surfaces couldn't be assigned, pricing obviously fails for the whole portfolio.

Appendix

Appendix (1) – parameter examples for multi scenario calculations – csv format*

Scalars (4 scenarios)

FX rate scalars represent the value of 1 EUR in the foreign currency.

Comma separated example

```
name,USD,GBP
Scenario 1,1.31,1.20
Scenario 2,1.33,1.19
Scenario 3,1.34,1.22
Scenario 4,1.35,1.21
```

Multiple scalars per file supported.
Curve (4 scenarios, 6 terms)

Interest rate curves represent zero coupon rates in the convention Act/365 with annual compounding.

Semicolon separated example

```
EUR_OIS_DISCOUNT;30D;60D;180D;1Y;3Y;5Y
Scenario 1;-0.00383;-0.00358;-0.00325;-0.00389;-0.00325;-0.00377
Scenario 2;-0.00388;-0.00378;-0.00370;-0.00378;-0.00381;-0.00390
Scenario 3;-0.00387;-0.00319;-0.00308;-0.00355;-0.00323;-0.00332
Scenario 4;-0.00374;-0.00395;-0.00347;-0.00334;-0.00324;-0.00311
```

Surface (4 scenarios, 2 expiries, 5 terms)

Volatility surfaces represent bachelier volatilities in basis points (so-called basis point volatilities).

- Comma, semicolon or tab separated formats supported
- Must use points as decimal separator
- Time labels may be (d)ays, (m)onths or (y)ears, uppercase or lowercase

Tab separated example

SURF	30D	60D	180D	1Y	3Y
3M	0.00300	0.00348	0.00422	0.00435	0.00478
3M	0.00383	0.00422	0.00497	0.00472	0.00481
3M	0.00428	0.00450	0.00523	0.00570	0.00580
3M	0.00451	0.00548	0.00608	0.00666	0.00624
1Y	0.00478	0.00561	0.00627	0.00761	0.00693
1Y	0.00537	0.00580	0.00688	0.00841	0.00734
1Y	0.00566	0.00659	0.00712	0.00867	0.00775
1Y	0.00630	0.00697	0.00781	0.00931	0.00860

*To get examples for json format, just download a parameter set on the parameters tab.

Each parameter in a set must have the same count of scenarios or only one scenario.

Appendix (1) – parameter examples for multi scenario calculations – csv format*

- Without AWS lambda, all calculations happen in the browser and performance depends on the power of your local machine.

- With AWS lambda, users can leverage the computing power of up to 1,000 computing instances in the cloud.

- Calculation with AWS lambda requires an API key. If you are interested in the AWS lamba calculation feature, feel free to contact us.

AWS* lambda functions

jsonrisk.de/portfolio_pricing

calculation request →

calculation results ←

lambda-function

(program code)

input portfolio / parameter

user

calculation library
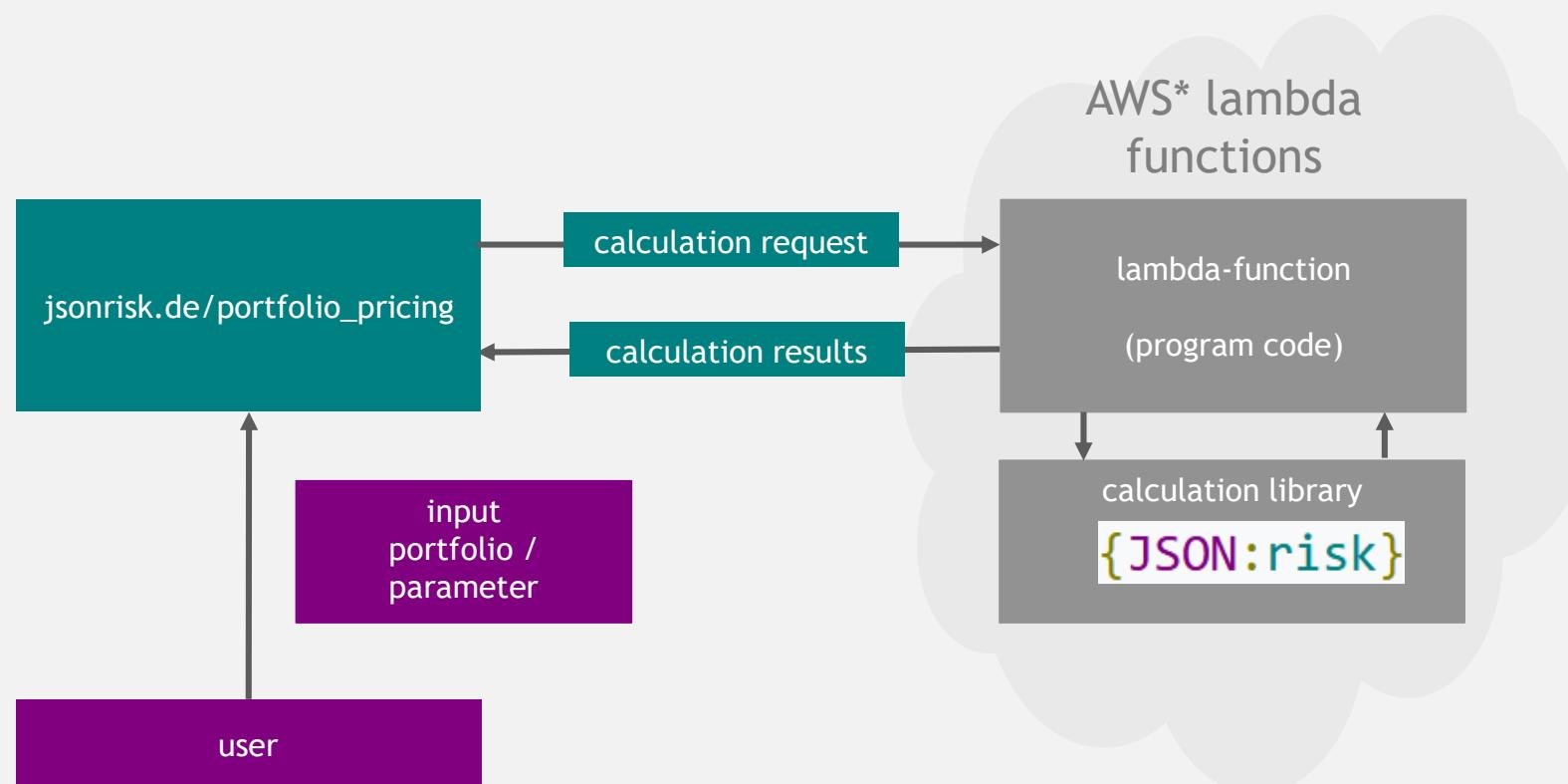
{JSON:risk}

Here, the calculation is performed in the cloud and not locally on your computer.

JSON risk portfolio pricing

More info on JSON risk instruments, parameters and methodology is available on the documentation site under https://jsonrisk.de/01_Documentation.html

- The Instruments guide (https://jsonrisk.de/01_Documentation/01_Instruments.html) summarizes supported instruments and features

- The Instrument fields guide (https://jsonrisk.de/01_Documentation/02_Instrument_fields.html) contains a complete list of JSON fields for describing instrument terms and conditions

- The Data types guide (https://jsonrisk.de/01_Documentation/03_Data_types.html) explains the data types used in the JSON fields

- The Parameters guide (https://jsonrisk.de/01_Documentation/04_Parameters.html) explains how to represent parameters for valuation, e.g., yield curves and surfaces

- The Schedule generation (https://jsonrisk.de/01_Documentation/05_Schedule_generation.html) guide explains how JSON risk generates schedules for interest rate instruments.

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