

MathWorks
FINANCE CONFERENCE 2023

Application Development from Design to Deployment, a Performance Analysis App

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Team and business activities

Amundi Convexity Solutions at a glance

8 Portfolio
Managers

2 Financial
Engineers

2 Investment
Specialists

€9.5bn AuM*

VOLATILITY

€ 1.0bn

PROTECTIVE OVERLAY

€ 8.0bn**

CONVERTIBLE BONDS

€ 594Mn

Source: Amundi, assets under management as of 30/06/2023. Given for indicative purposes only. *AuM include open ended funds, segregated mandates and pockets.
**Corresponds to a mix between client portfolio AuM and long notional exposure (for overlay strategies)

Context and problematic

Context and problematic

What is a good insurance or protection program?

Definition 1: Protective overlay

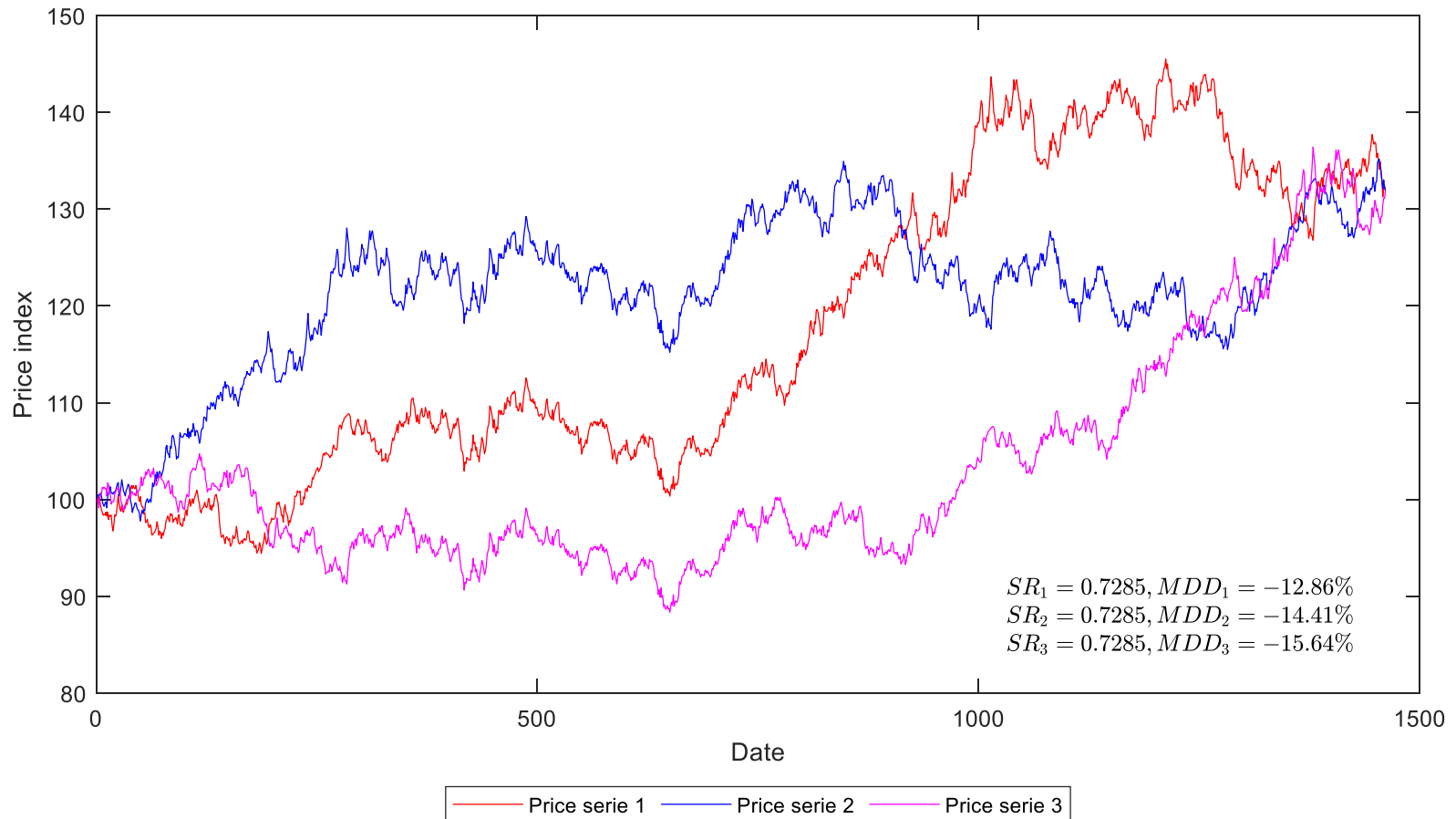
Protective overlays are investment solutions designed to reduce downside risks of a target portfolio without altering its asset allocation.

Challenge 1: How to assess the efficiency of a protection program?

- The efficiency of a protection program represents its ability to generate benefits during market downturn compare to its costs during stable market configuration.
- Standard performance measures only provide an overall information and thus failed to properly isolate the performances during these key periods.

Context and problematic

Conventional performance measures fail to properly assess downside risk



*Price series are generated using the same data generation process $\mathcal{N}(5\%, 10\%)$, **Price series are built using a pseudo bootstrap process.

Context and problematic

Standalone protection representation

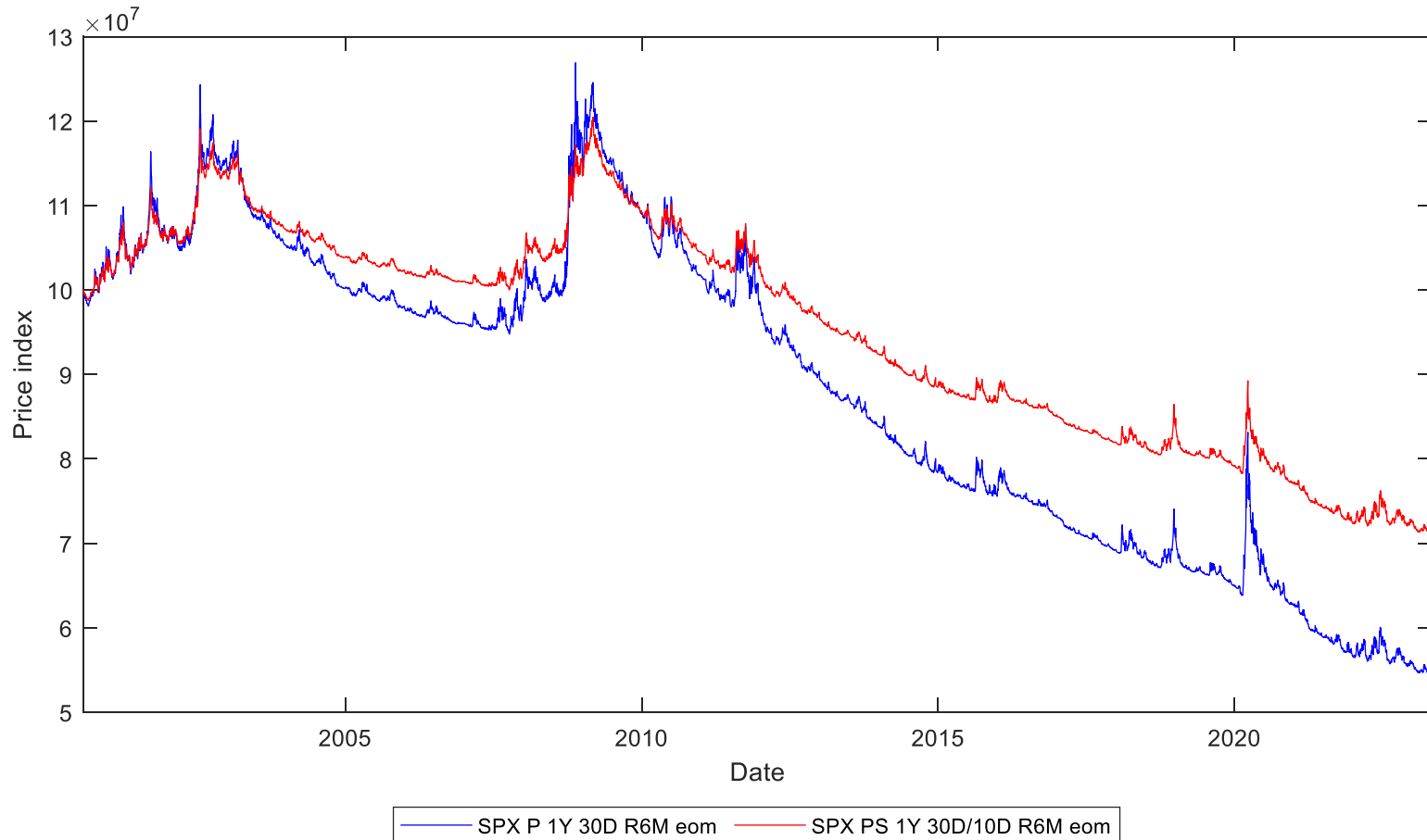


Illustration of protection marked to market.

Performance analysis framework

Performance analysis framework

Framework enhancement

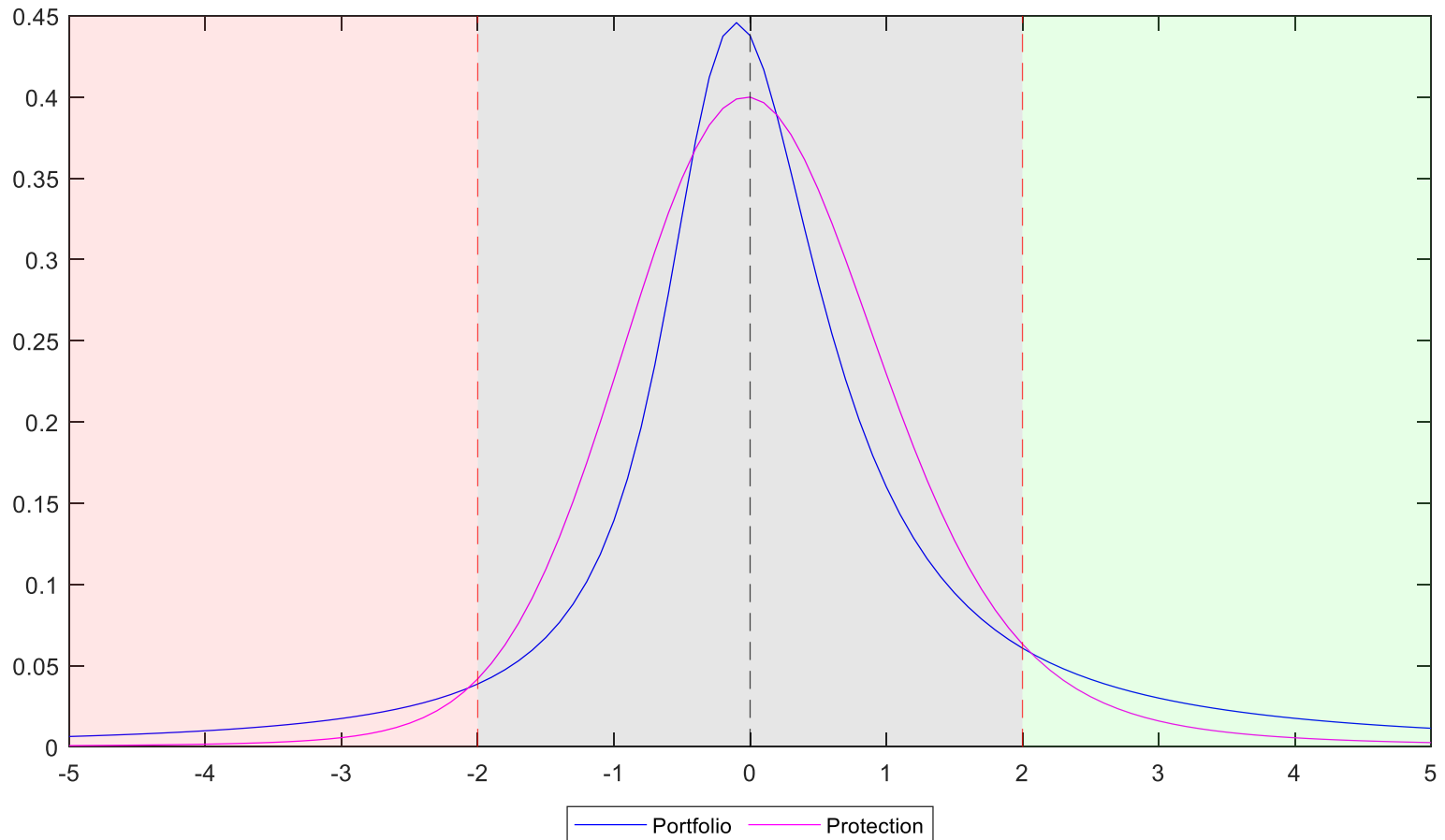
Solution 1: Conditional performance measures

Our solution consists of refining the analysis framework with the introduction of two types of conditional performance measures:

1. Conditional distribution analysis;
 - Convexity plot;
 - Quantile asymmetry;
2. Drawdown based performance analysis.
 - Drawdown(up) reduction (benefit(cost));
 - Decay (how long the protection retains its benefit?)

Performance analysis framework

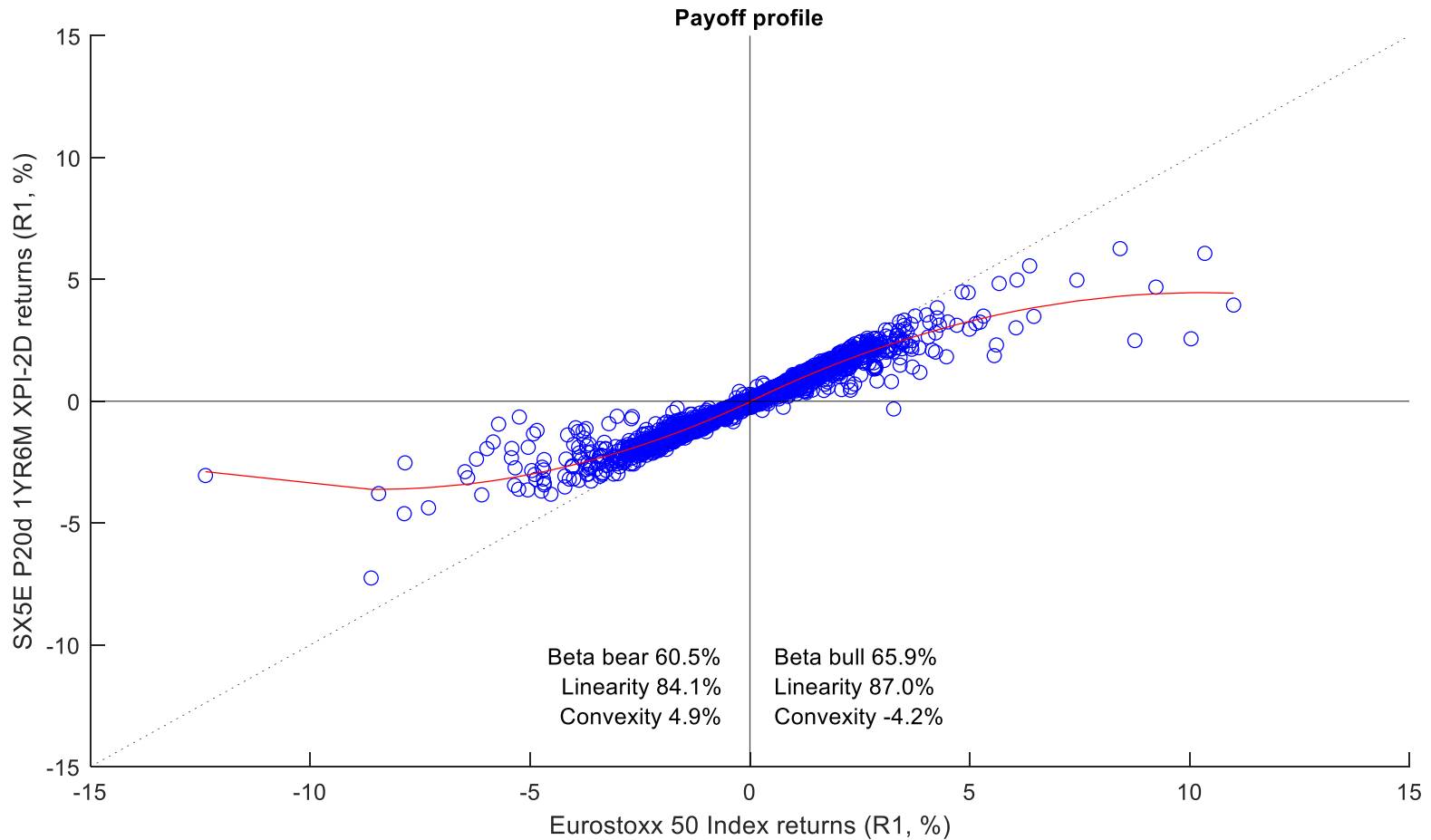
Quantile analysis



*Distribution are illustrative and generated using stable distribution $(\alpha, \beta, \gamma, \Delta) = (1, 0.25, \frac{1}{\sqrt{2}}, 0)$ for the protection and $(\alpha, \beta, \gamma, \Delta) = (1.75, 0.5, \frac{1}{\sqrt{2}}, 0)$ for the protection.

Performance analysis framework

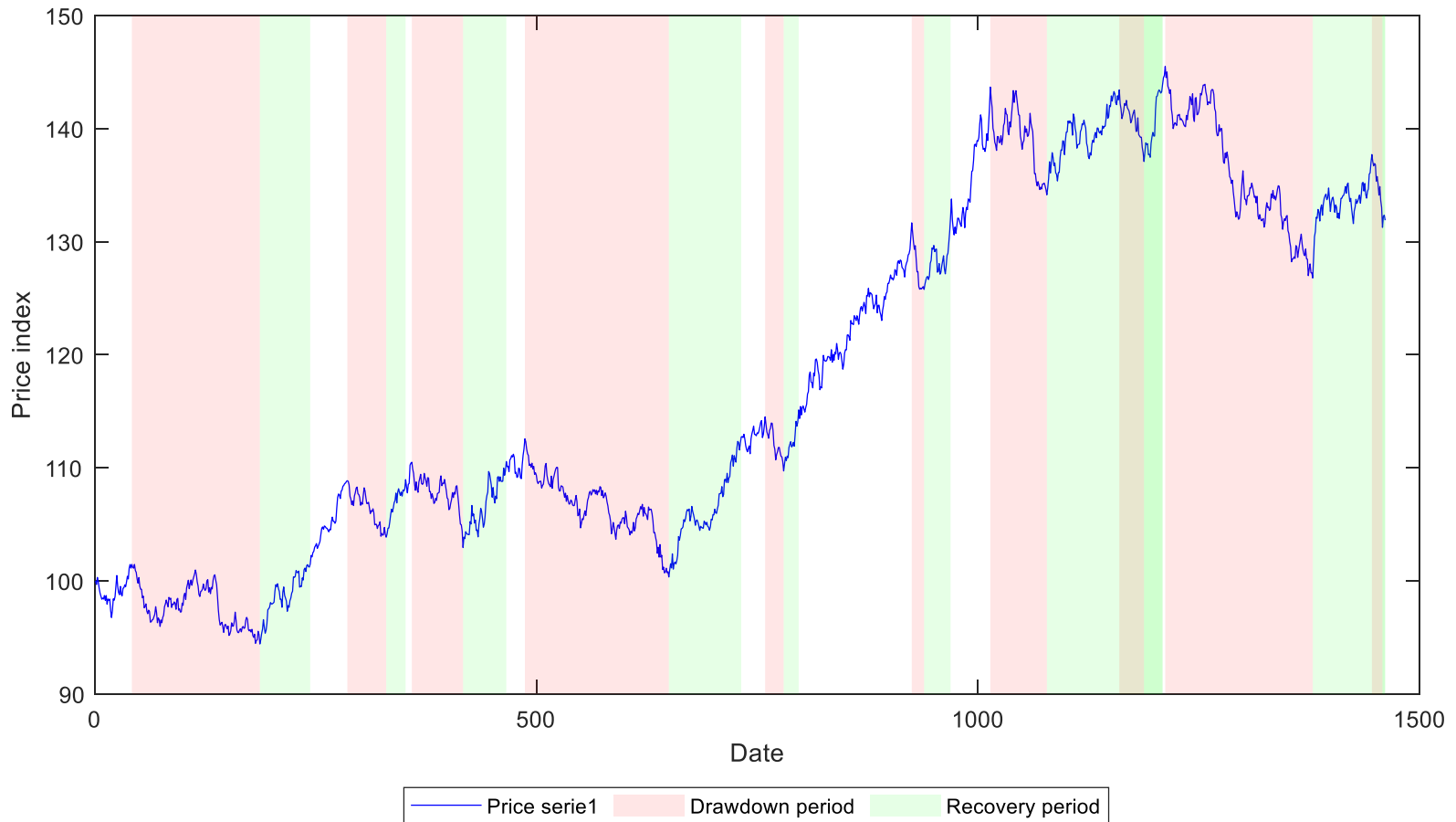
Convexity plot



*R1 represents returns over one day. **Red lines are polynomial estimation conducted over negative and positive returns of the benchmark.

Solutions

Drawdown based performance analysis, drawdown breakdown



*Drawdown and recovery periods are identified by a recursive exclusion algorithm. **Recovery periods can overlap other drawdown and/or recovery periods.

Solutions

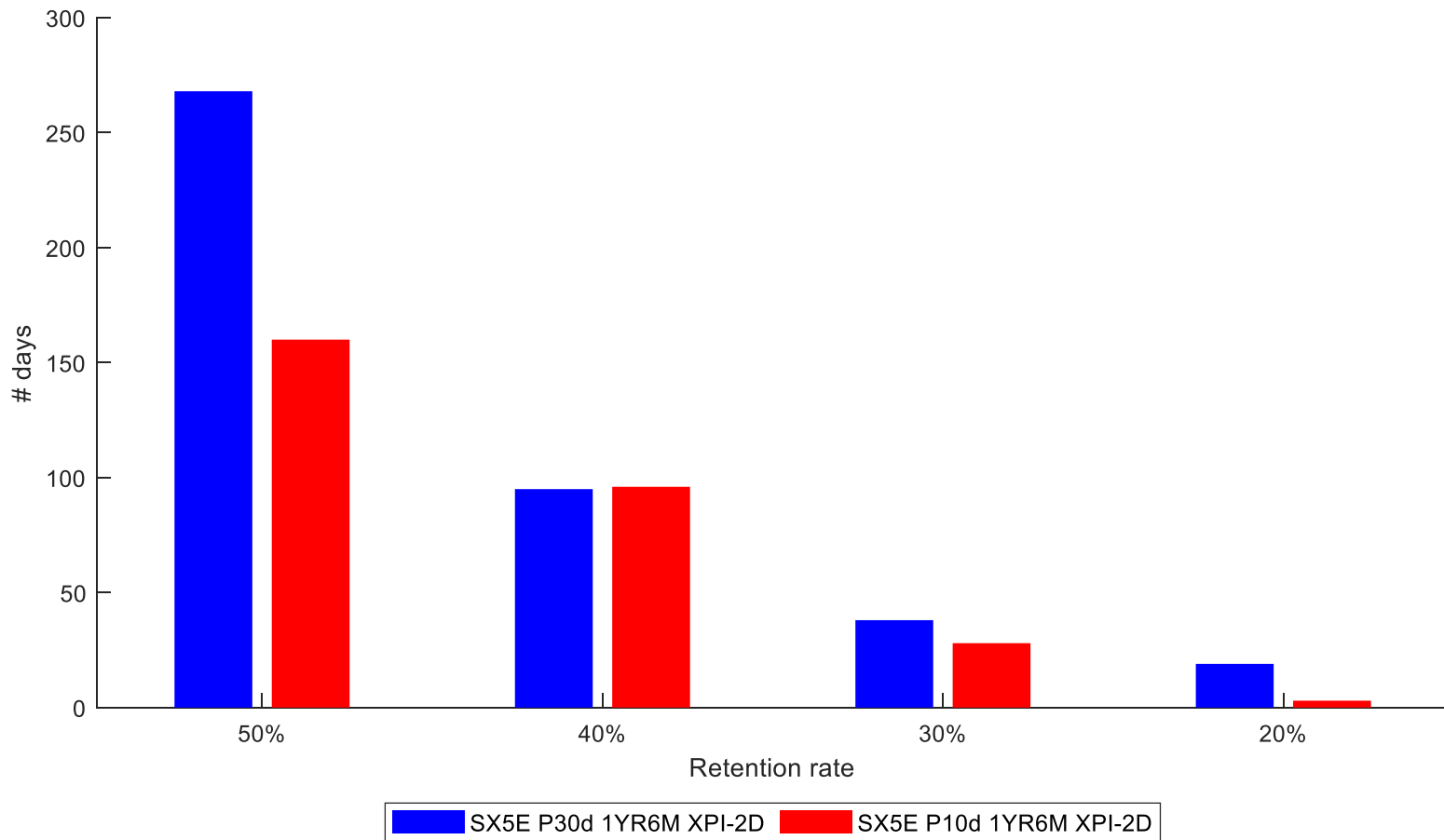
Drawdown based performance analysis, drawdown table

Rank	Start date	Valley date	Recovery date	Time to valley (# days)	Time to recover (# days)	Loss	Recover
1	16-Jul-07	9-Mar-09	27-Feb-15	430	1559	-58,58%	141,87%
2	19-Feb-20	18-Mar-20	10-Mar-21	20	255	-38,24%	63,35%
3	18-Feb-11	12-Sep-11	17-May-13	146	439	-33,26%	50,30%
4	13-Apr-15	11-Feb-16	4-May-17	218	320	-28,37%	40,47%
5	16-Nov-21	29-Sep-22	31-Jan-23	227	88	-23,70%	27,39%
6	19-Mar-12	1-Jun-12	7-Sep-12	54	70	-18,86%	23,43%
7	1-Nov-17	27-Dec-18	3-Jul-19	301	134	-18,27%	23,25%
8	15-Apr-10	7-May-10	18-Jan-11	16	182	-16,08%	20,05%
9	27-Oct-11	24-Nov-11	26-Jan-12	20	45	-15,33%	18,16%
10	19-Jun-14	16-Oct-14	22-Jan-15	85	70	-12,96%	16,06%
11	21-Jul-20	30-Oct-20	9-Nov-20	73	6	-12,92%	15,22%
12	21-Apr-16	27-Jun-16	7-Sep-16	47	52	-12,77%	14,81%
13	8-Jan-10	5-Feb-10	15-Apr-10	20	49	-12,70%	14,60%
14	9-May-06	13-Jun-06	20-Sep-06	25	71	-11,65%	13,20%
15	28-May-13	24-Jun-13	9-Aug-13	19	34	-11,21%	12,68%

*The table displays all the drawdowns with a loss higher than 10%.

Solutions

Protection decay

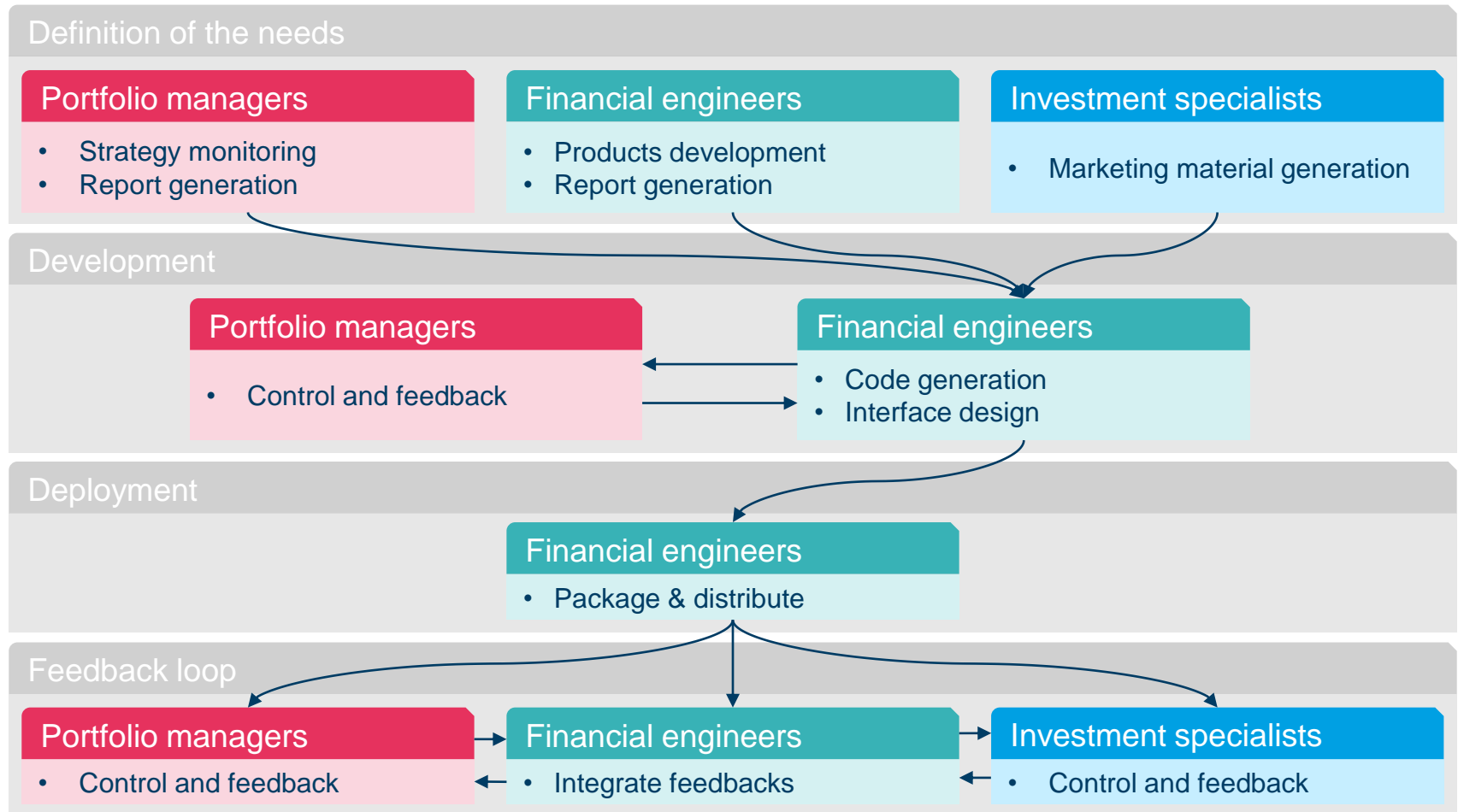


*Retention rate corresponds to the number of days that the protection is able to retain x% of its gain obtained during drawdown.

Implementation

Implementation

Development flow chart



Implementation

Why MATLAB?

The MATLAB ecosystem

1. Long MATLAB programming history in the team (proprietary tools: volatility surfaces calibration, option pricing, option based simulation tools...);
2. Various built-in features for code efficiency;
 - *Code analyzer* (live warning and errors visualization)
 - *Run and Time* (code execution breakdown)
3. Continuous development;
 - *Arguments block* (effortless function inputs management)
 - *MATLAB Test App* (run and visualize unit test)
4. Reactive and qualitative support;
5. Two-way integration with other languages.

Implementation

Application design

Challenge 2: How to centralize and share the performance analysis library?

1. Different types of end users with different expectations;
2. Non standardized solutions requiring high degree of flexibility.

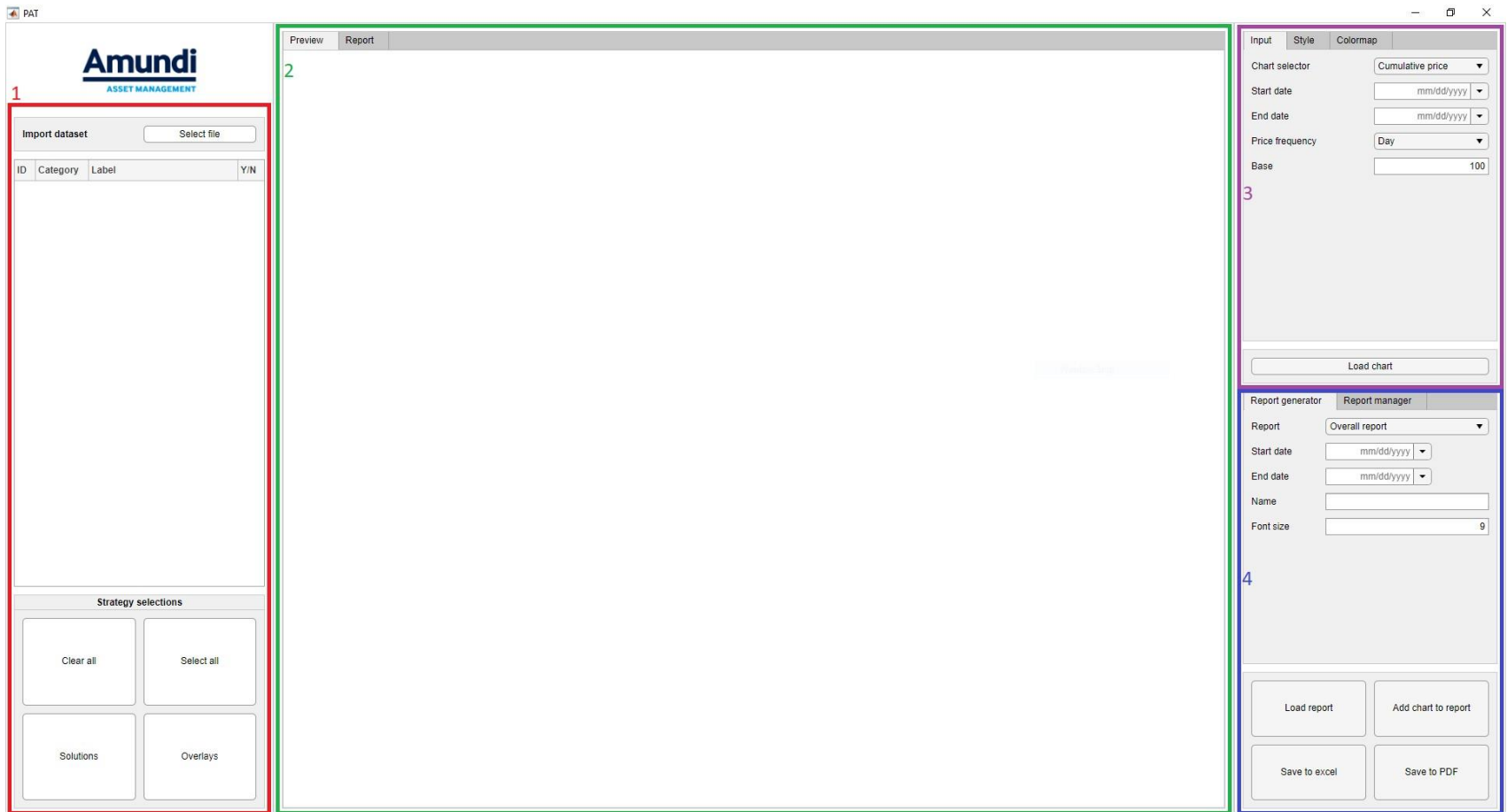
Solution 2: MATLAB App Designer

MATLAB App Designer provides a rich environment with various features to reduce the workflow:

- Auto-Reflow (automatic App dimension in response of screen size, orientation and platform);
- Grid layout with dynamic component resizing (fixe, proportional or fit);
- Clear and clean hierarchy between components (component browser);

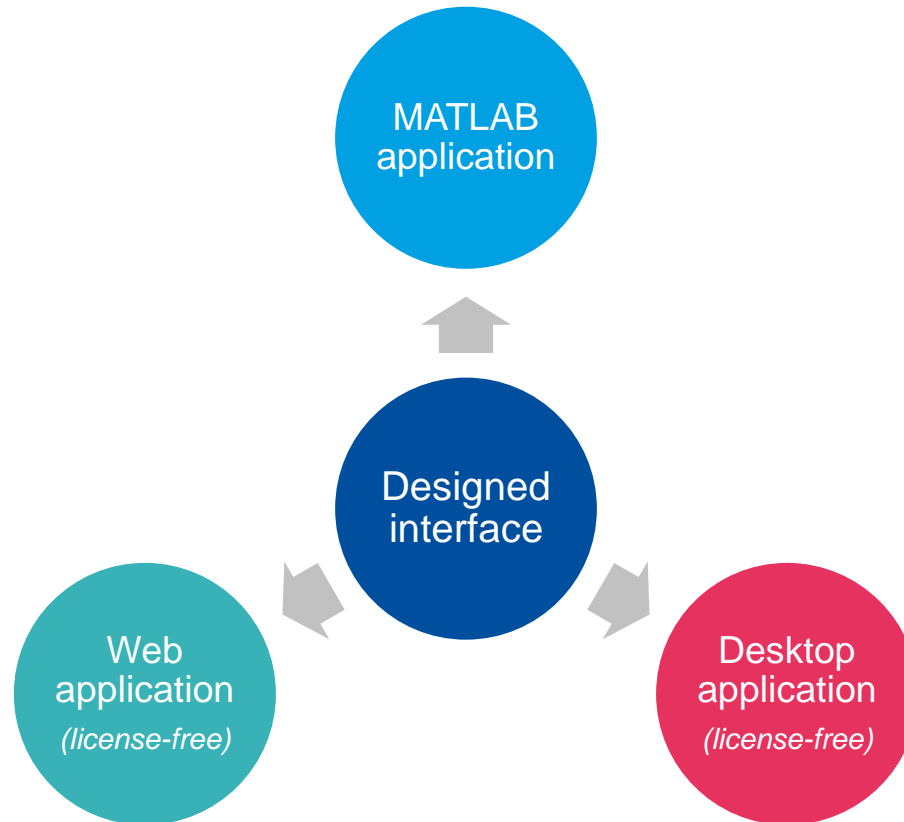
Implementation

One week to generate a UI with the main features



Implementation

Application distribution



Live demonstration

Questions

Appendix

Implementation

User interface – Preview panel

The screenshot displays the Amundi Asset Management software interface, divided into three main sections: a left sidebar, a central preview panel, and a right configuration panel.

Left Sidebar:

- Amundi ASSET MANAGEMENT logo.
- Import your data from an excel file.
- Import dataset: Select file.
- Table with columns: ID, Category, Label, Y/N.
- Select strategies to review.
- Strategy selections: Clear all, Select all, Solutions, Overlays.

ID	Category	Label	Y/N
1	Benchmark	Benchmark	<input checked="" type="checkbox"/>
2	Cash	Cash	<input type="checkbox"/>
3	Solution	SX5T Index + P30D1YR6M	<input checked="" type="checkbox"/>
4	Solution	SX5T Index + P20D1YR6M	<input checked="" type="checkbox"/>
5	Solution	SX5T Index + P10D1YR6M	<input checked="" type="checkbox"/>
6	Solution	SX5T Index + PS50/20D1YR6M	<input checked="" type="checkbox"/>
7	Solution	SX5T Index + PS30/10D1YR6M	<input type="checkbox"/>
8	Solution	SX5T Index + P30D6MR6M	<input type="checkbox"/>
9	Solution	SX5T Index + P20D6MR6M	<input type="checkbox"/>
10	Overlay	P30D1YR6M	<input type="checkbox"/>
11	Overlay	P20D1YR6M	<input type="checkbox"/>
12	Overlay	P10D1YR6M	<input type="checkbox"/>
13	Overlay	PS50/20D1YR6M	<input type="checkbox"/>
14	Overlay	PS30/10D1YR6M	<input type="checkbox"/>
15	Overlay	P30D6MR6M	<input type="checkbox"/>
16	Overlay	P20D6MR6M	<input type="checkbox"/>

Central Preview Panel:


- Preview Report tabs.
- Chart title: Cumulative Price Index (base = 100) - day.
- Y-axis: 60 to 240.
- X-axis: 2006 to 2022.
- Legend:
 - Benchmark (black line)
 - SX5T Index + P30D1YR6M (green line)
 - SX5T Index + P20D1YR6M (red line)
 - SX5T Index + P10D1YR6M (orange line)
 - SX5T Index + PS50/20D1YR6M (blue line)

Right Configuration Panel:

- Input 1 | Style 2 | Colormap 3.
- Chart selector: Cumulative price.
- Start date: 31-Dec-2004.
- End date: 19-Jan-2023.
- Price frequency: Day.
- Base: 100.
- Instructions:
 - Select the analysis to run
 - Format the design of the chart
 - Adjust the colormap
- Load chart button.
- Report generator | Report manager.
- Report: Overall report.
- Start date: 31-Dec-2004.
- End date: 19-Jan-2023.
- Name: [empty field]
- Font size: 9.
- Buttons: Load report, Add chart to report, Save to excel, Save to PDF.

Implementation

User interface – Report panel



Import dataset

ID	Category	Label	Y/N
1	Benchmark	Benchmark	<input checked="" type="checkbox"/>
2	Cash	Cash	<input type="checkbox"/>
3	Solution	SX5T Index + P30D1YR6M	<input checked="" type="checkbox"/>
4	Solution	SX5T Index + P20D1YR6M	<input checked="" type="checkbox"/>
5	Solution	SX5T Index + P10D1YR6M	<input checked="" type="checkbox"/>
6	Solution	SX5T Index + PS50/20D1YR6M	<input checked="" type="checkbox"/>
7	Solution	SX5T Index + PS30/10D1YR6M	<input type="checkbox"/>
8	Solution	SX5T Index + P30D6MR6M	<input type="checkbox"/>
9	Solution	SX5T Index + P20D6MR6M	<input type="checkbox"/>
10	Overlay	P30D1YR6M	<input type="checkbox"/>
11	Overlay	P20D1YR6M	<input type="checkbox"/>
12	Overlay	P10D1YR6M	<input type="checkbox"/>
13	Overlay	PS50/20D1YR6M	<input type="checkbox"/>
14	Overlay	PS30/10D1YR6M	<input type="checkbox"/>
15	Overlay	P30D6MR6M	<input type="checkbox"/>
16	Overlay	P20D6MR6M	<input type="checkbox"/>

Strategy selections


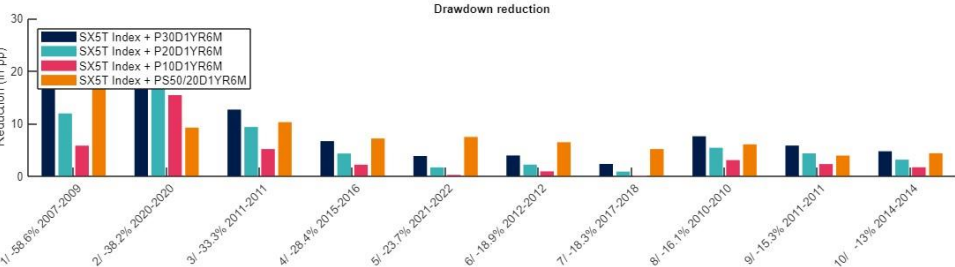
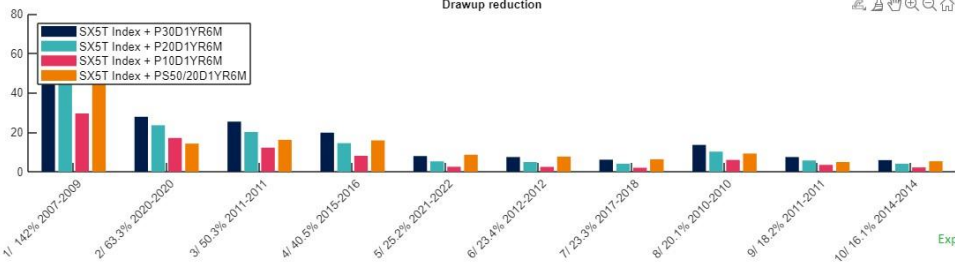
Clear all

Select all

Solutions

Overlays

Preview Report

Input Style Colormap

Chart selector: Drawup reduction

Start date: 31-Dec-2004

End date: 19-Jan-2023

Price frequency: Day

Mode: Top

Level: 10

Output: Absolute

Report generator Report manager

ID	Name	R	C
1	Cumulative Price Index (base = 100)	1	1
2	Drawdown reduction	1	1
3	Drawup reduction	1	1

Manage the report display

Create a customize report