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Option Pricing and Risk Analysis using Stochastic Models

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Abstract: This project applies stochastic models in quantitative research and analysis to accurately price options and assess associated risks. Leveraging historical financial data, it encompasses data preprocessing, model selection, parameter estimation, option pricing, risk analysis, and sensitivity analysis. Selected models like Black-Scholes-Merton and Heston are calibrated using optimization techniques. Accurate option prices and key option Greeks are calculated based on estimated parameters and underlying asset prices. Risk analysis utilizes Monte Carlo simulation to evaluate metrics such as VaR and ES. Sensitivity analysis explores the impact of changing model parameters. The project emphasizes documentation, resulting in a comprehensive report. It showcases expertise in option valuation, risk assessment, and quantitative analysis, demonstrating proficiency in data preprocessing, model implementation, and advanced quantitative techniques.

Contents

1 Some examples and best-practices

For internal references use label-refs: see section 1. Bibliographic citations can be done with cite: refs. [1–3]. When possible, align equations on the equal sign. The package `amsmath` is already loaded. See (1.1).

$$\begin{aligned} x &= 1\,, \qquad y = 2\,, \\ z &= 3\,. \end{aligned} \tag{1.1}$$

Also, watch out for the punctuation at the end of the equations.

If you want some equations without the tag (number), please use the available starred-environments. For example:

$$x = 1$$

The amsmath package has many features. For example, you can use use `subequations` environment:

$$a = 1 \tag{1.2a}$$
$$b = 2 \tag{1.2b}$$

and it will continue to operate across the text also.

$$c = 3 \tag{1.2c}$$

The references will work as you'd expect: (1.2a), (1.2b) and (1.2c) are all part of (1.2).

A similar solution is available for figures via the `subfigure` package (not loaded by default and not shown here). All figures and tables should be referenced in the text and should be placed at the top of the page where they are first cited or in subsequent pages. Positioning them in the source file after the paragraph where you first reference them usually yield good results. See figure 1 and table 1.

We discourage the use of inline figures (wrapfigure), as they may be difficult to position if the page layout changes.

We suggest not to abbreviate: "section", "appendix", "figure" and "table", but "eq." and "ref." are welcome. Also, please do not use `\emph` or `\it` for latin abbreviaitons: i.e., et al., e.g., vs., etc.

Figure 1. Always give a caption.

x	y	x and y
a	b	a and b
1	2	1 and 2
α	β	α and β

Table 1. We prefer to have borders around the tables.

2 Sections

2.1 And subsequent

2.1.1 Sub-sections

Up to paragraphs. We find that having more levels usually reduces the clarity of the article. Also, we strongly discourage the use of non-numbered sections (e.g. `\subsubsection*`). Please also see the use of "`\texorpdfstring{}{}`" to avoid warnings from the hyperref package when you have math in the section titles

A Some title

Please always give a title also for appendices.

Acknowledgments

This is the most common positions for acknowledgments. A macro is available to maintain the same layout and spelling of the heading.

Note added. This is also a good position for notes added after the paper has been written.

References

[1] Author, *Title*, *J. Abbrev.* **vol** (year) pg.

[2] Author, *Title*, arxiv:1234.5678.

[3] Author, *Title*, Publisher (year).