Market risk capital requirement calculation based on Solvency 2

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Abstract

The Solvency II framework requires insurers to perform complex and computationally intensive calculations for the Market Risk component of the Solvency Capital Requirement (SCR), which can pose operational challenges, particularly for large and diversified investment portfolios. Traditional spreadsheet-based methods often fall short in scalability, reliability, and transparency.

This thesis focuses specifically on the market risk sub-module of the Standard Formula, beginning with a detailed review of its mathematical and regulatory foundations. The development of the risk shocks, covering interest rate, equity, spread, property, currency, and concentration risk, is traced from the original CEIOPS (now EIOPA) documents through to the final Delegated Regulation.

The core contribution is a modular, open-source Python application that automates the SCR calculation process for the sub-modules of market risk. The tool incorporates robust data validation, externalized regulatory parameters for ease of updates, and automated retrieval of relevant market data from official sources such as EIOPA.

To validate its practical utility, the tool is applied to a synthetic asset portfolio, demonstrating its ability to handle a range of financial instruments, flag data issues, and produce transparent, per-instrument results. By bridging the gap between regulation and implementation, this thesis offers a practical resource for insurance professionals and researchers working on Solvency II market risk compliance.