# Stability Issues in Computational Finance

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Computational Finance today requires a variety of numerical tools for valuation, hedging, risk analysis or asset management. When applying these tools naively (without an appropriate stability analysis), severe numerical problems, e.g., oscillations or massive error amplification, may occur.

Model calibration is a specific source of instability. Many calibration problems in computational finance are ill-posed in the sense of functional analysis. So called regularisation techniques have to be applied to obtain robust results.

In asset allocation, the variance covariance matrix and its eigenvalues play the dominant role how to allocate assets to a portfolio. When the smallest eigenvalues are close to zero (or numerically even negative), again, instabilities can und will appear.

We present examples of different stability and problems and ways to improve the robustness of numerical schemes.
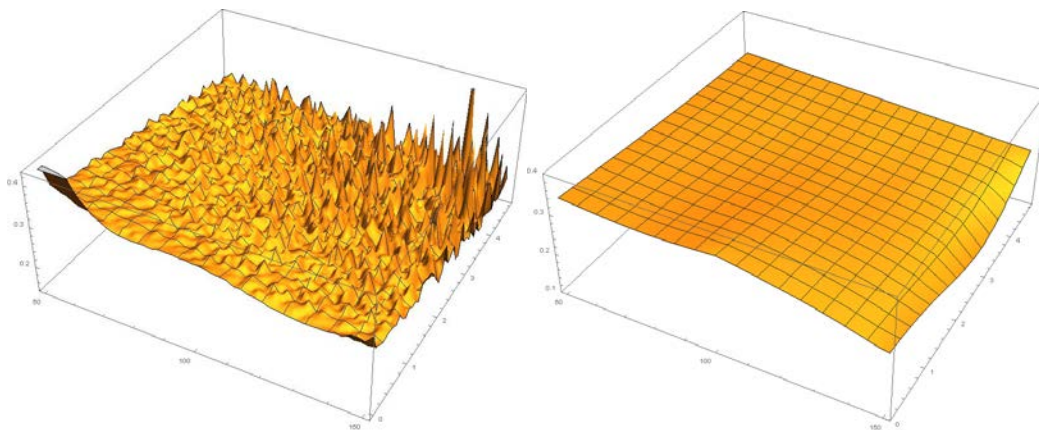
Local volatility.
Left: Naïve application of Dupire's inversion formula.
Right: Stable inversion by regularisation techniques.