SVI calibration

In financial modelling, calibration refers to the process of adjusting the parameters of a model so that its outputs match observed market prices as closely as possible. In case of the SVI model, its parameterization is as follows:

where is the implied total variance and is the log forward moneyness, are the five parameters used to fit on a given expiry for any . For more details, refer to the seminal paper on SVI model, *Gatheral, Jim, and Antoine Jacquier. "Arbitrage-free SVI volatility surfaces." Quantitative Finance 14.1 (2014): 59-71.*

1). Write an SVI calibrator   
Develop an SVI calibrator to solve for the SVI parameters against the points on an implied volatility smile. To help you get started, we have provided sample code in demo\_svi\_calibrator.txt (some modifications are needed to get it running). Alternatively, you may find sample code on [github](https://github.com/wangys96/SVI-Volatility-Surface-Calibration),

2). Propose quantitative measures to evaluate the quality of the calibrator

The calibrator in 1) may be able to find the SVI parameters such that the “calibration” error is minimized. However, this does not guarantee a satisfactory calibration result. For example, matching an outlier might compromise the fit of the entire curve, and matching the wings might trade off against accurately fitting the near-the-money points

3). Stress data test, 2025-04-08, AAPL.US  
On a typical market turmoil selloff day, where the market trades towards the put wings (downward skewing), verify if the calibrator in 1) can handle this scenario correctly. For example, ensure it does not result in negative volatilities in the right asymptote.

4). Day to day parameter stability  
Utilize real data in data set folder to test the day-to-day stability of the calibrator in 1). Quantify the stability measure and propose improvement methods if it does not perform well. For example, refer to the paper by *Ferhati, Tahar, titled 'Robust Calibration for SVI Model Arbitrage Free,' available at SSRN 3543766 (2020), for guidance on setting appropriate parameter boundaries for the SVI-Quasi-explicit calibrator."*