

Problem set 5

Due date: Tuesday, October 29th, 11:15 am.

Exercise 1

Build the implied volatility surface of the STOXX50E index using the Andreasen-Huge algorithm. The surface will contain implied vols for strikes from 40% to 200%, matching as closely as you can the market data in the spreadsheet.

First derive the implied vols for the expirations in the spreadsheet, and then for the expirations $T = 1$ and $T = 1.5$. Since the market data (taken by the original Andreasen-Huge paper) refers to March 2010, when interest rates were very close to 0 and the dividend rate was also very low, you can set $r = q = 0$.

Suppose that the stock follows a process

$$dS_t = S_t \sigma(S_t, t) dW_t \quad (1)$$

with

$$\sigma(S_t, t) = \frac{f(S_t, t)}{S_t} \quad (2)$$

and $f(S_t, t)$ is a piecewise-constant function in S_t and t . with this set-up, you have that

$$A C(T + 1) = C(T) \quad (3)$$

where A is the matrix in the paper.

For each expiration, choose the piece-wise function $f(S_t, t)$ so that it takes a number of values v_1, v_2, \dots, v_n equal to the number of market-observed option prices, following the graphical example below (where the red circles represent the observed option prices).

