Stochastic Methods for Finance: Report 5

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I've chosen in https://finance.yahoo.com/ an asset on which there is a book of European style options: Spotify Technology S.A. This is also an asset that does not pay dividends.

1. The company

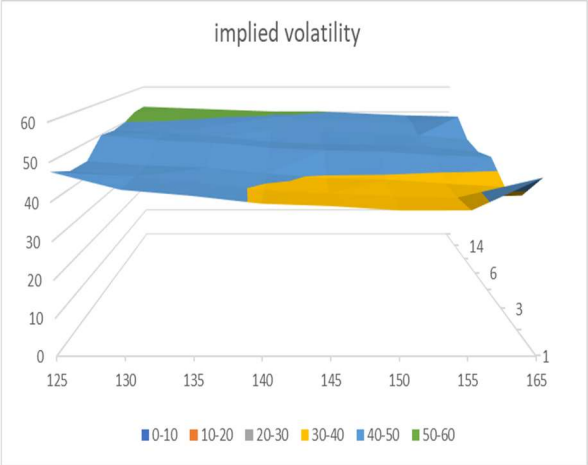
Spotify Technology S.A., together with its subsidiaries, provides audio streaming services worldwide. It operates through two segments, Premium and Ad-Supported. The Premium segment offers unlimited online and offline streaming access to its catalog of music and podcasts without commercial breaks to its subscribers. The Ad-Supported segment provides on-demand 12online access to its catalog of music and unlimited online access to the catalog of podcasts to its subscribers on their computers, tablets, and compatible mobile devices. The company also offers sales, distribution and marketing, contract research and development, and customer support services. Spotify Technology S.A. was incorporated in 2006 and is based in Luxembourg, Luxembourg.

Previous Close	132.17
Open	131.04
Bid	130.66 x 3200
Ask	130.76 x 1200
Volume	619,416
Avg. Volume	1,926,959
Market Cap	25.325B

2. Implied volatility

From Yahoo Finance, I've found the implied volatility for the Call options and considered its surface as function of the time maturity and the strike price. The result of this is the smile effect of the volatility, in fact, volatility surfaces are created combining the volatility smiles with the volatility term structure to produce a table of volatilities that are applicable for valuing an option at any maturity and with any strike price.

So, I've considered S=132.03 and call options with different time and K to construct the surface.

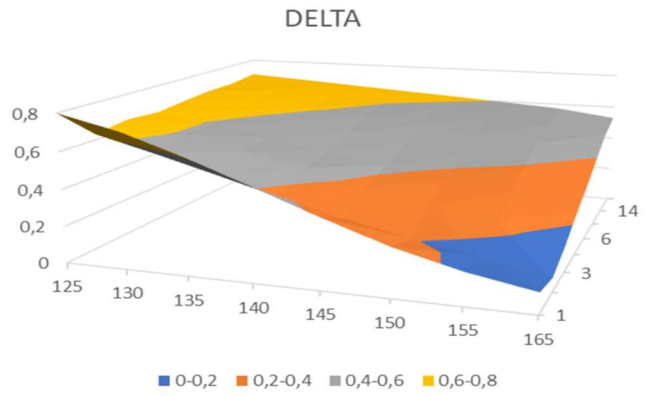


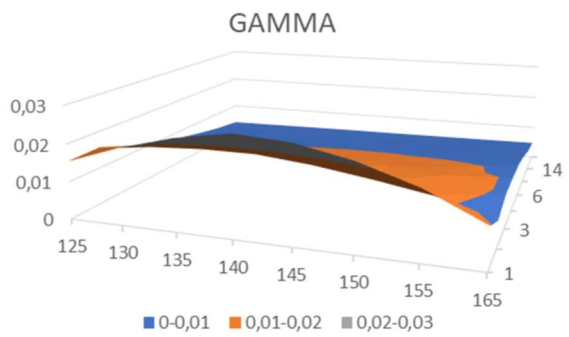
This is the resulting graph with the implied volatilities expressed in percentage.

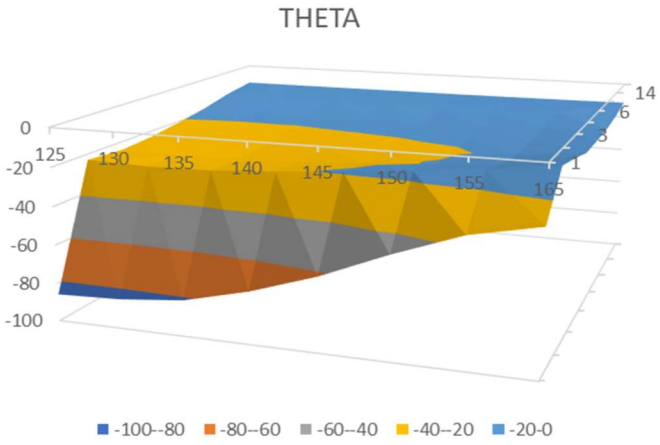
When the skew is prominent, it suggests that the Black Scholes model may not be able to accurately capture the risk related to options with different strikes, and vice versa.

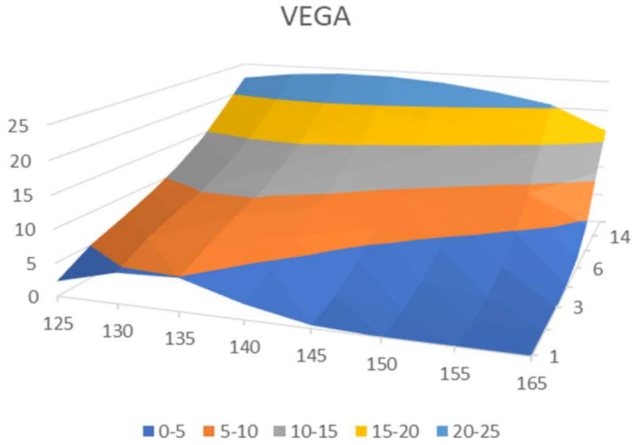
3. Greeks

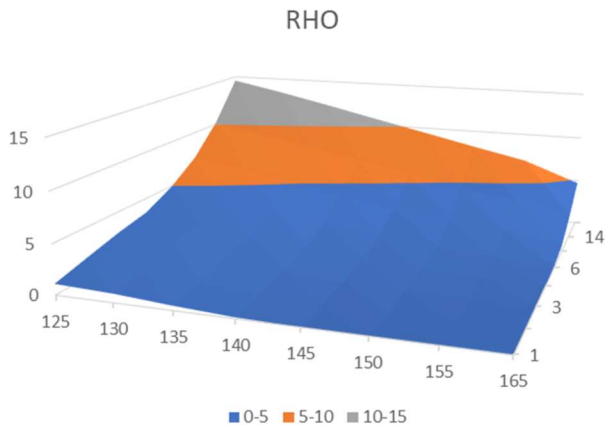
Finally, I've computed the values of the Greeks for the *Spotify*'s call options with the increase of time to maturity. In particular I've chosen S= 132.03, the dividend rate equal 0, I've computed the value of r as inverse formula of $D(0,T)=e^{-rt}$ for every period T and used the implied volatility from the previous table.











Time is expressed in months.

In conclusion we can notice that, as expected, the Greeks became smoother as the time to maturity increases.