MF796 Homework2
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Problem Set#2

1. Option Pricing via FFT Techniques

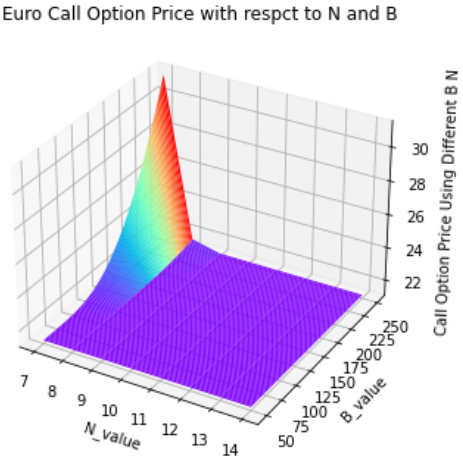
(a) Exploring FFT Technique Parameters

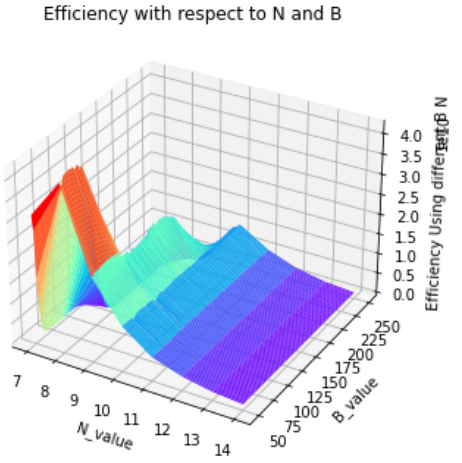
(i) Here're some results of the prices using different alpha:

Alpha	0.01	0.05	0.1	0.5	1	5	20
Price	25.4065	21.2688	21.2688	21.2688	21.2688	21.2688	21.2688

By choosing N=14 and B=250, wo can see that the call prices are stable starting from alpha = 0.05 to alpha = 20.

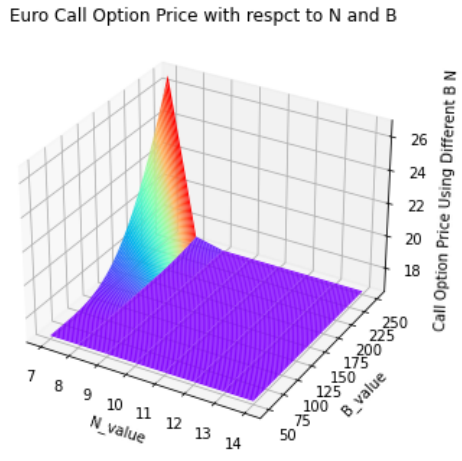
(ii) Changing the N and B values and setting alpha as **1**, we can create a 3-D plot to depict their relations:

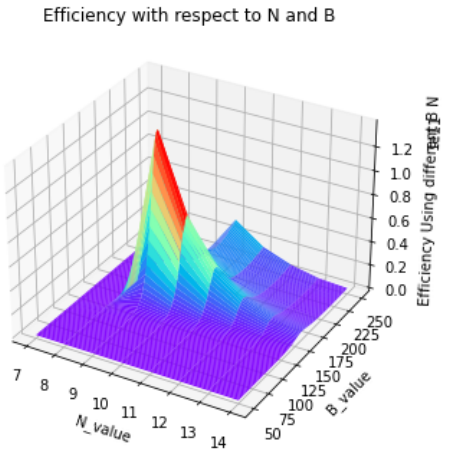




From the plot we can conclude that, the call option prices tend to be stable when Ns in the range from 9 to 14, B in the range from 75 to 250. And according to the efficiency plot, we can get that N=9 , B= 100

(iii) Holding all others constant as above, change strike price to 260, and repeat what we do in (ii), we can also get the plot below:

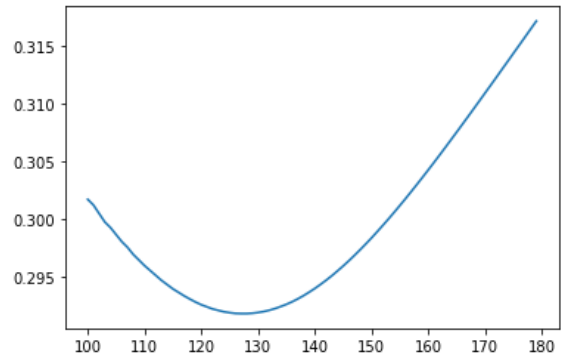




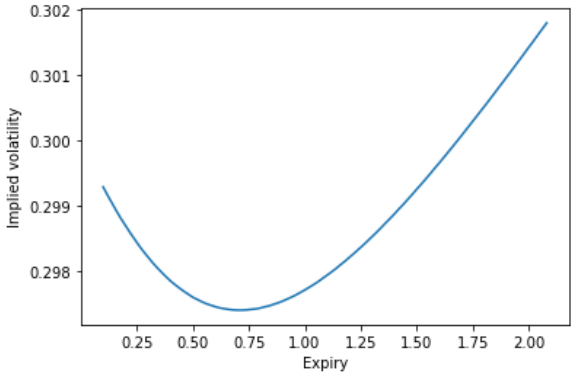
From the plot above, we can conclude that the value plot is really similar to the former one. Then the best value is N = 9 and B = 200, there's a bit of different but not so hugely from the above one.

(b) Exploring Heston Parameters

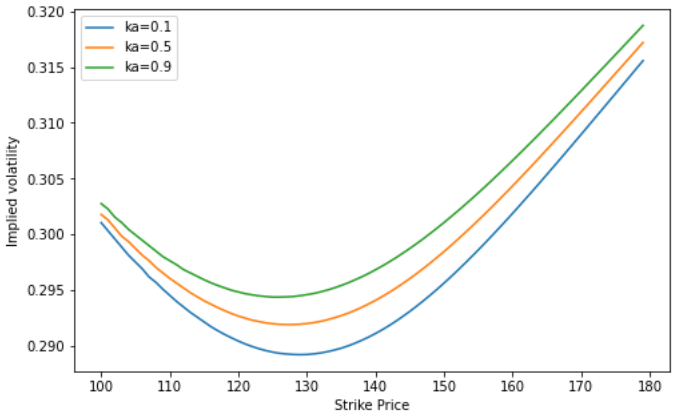
(i) The plot shown below**:**



(ii) Setting strike price as 150, I plot the curve of expiry and the implied volatility:



(iii) First, changing kappa value, we get the plots below:



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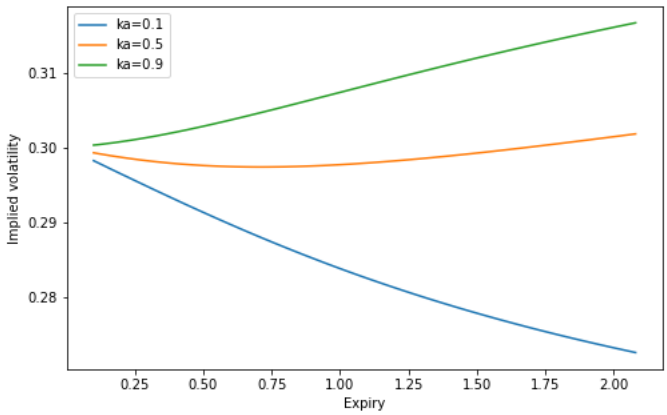
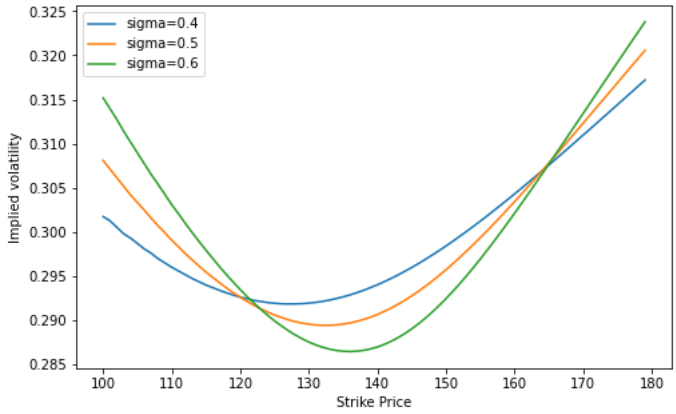
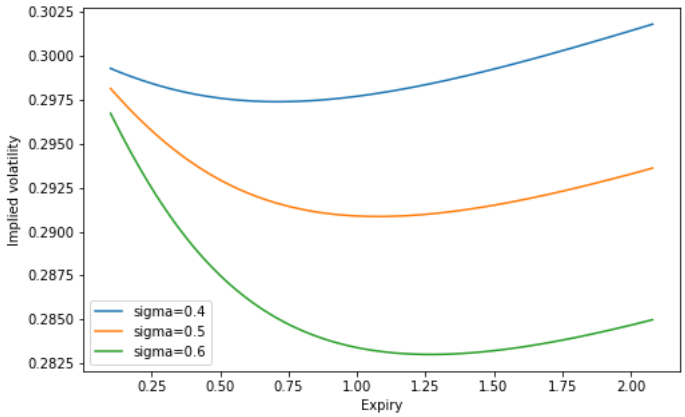


By increasing the kappa value, both the skew and term structure are increasing, while the term structure has been influenced more significantly, it seems that this structure turns from smile to a skew.

Second, changing sigma value we can get the plot below:





By increasing the sigma value, the term structure apparently decreases. However, it's hard to describe the skew structure trend. In other words, skew structure tends to have a inverse-peak curve as the sigma increasing.

Third, changing the rho value we can get the plots below:

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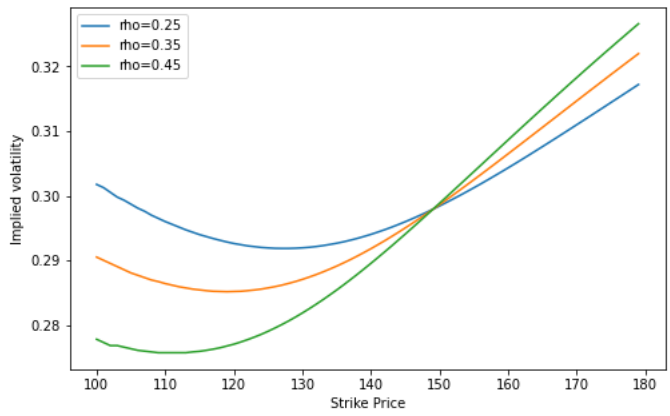
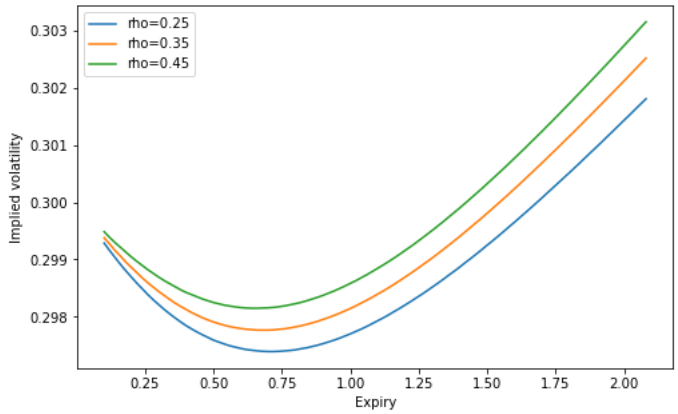
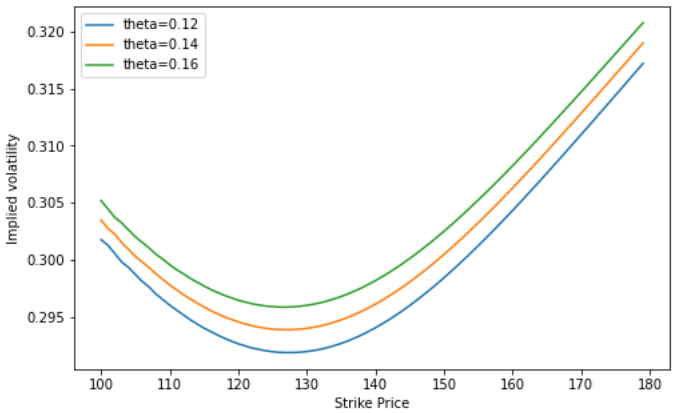




By increasing rho, the skew structure tends to shift downsides and the term structure shifts down as well. The term structure still keep a smile shape while the skew looks like a bit more skew.

Forth, by changing theta we can get the plot below:



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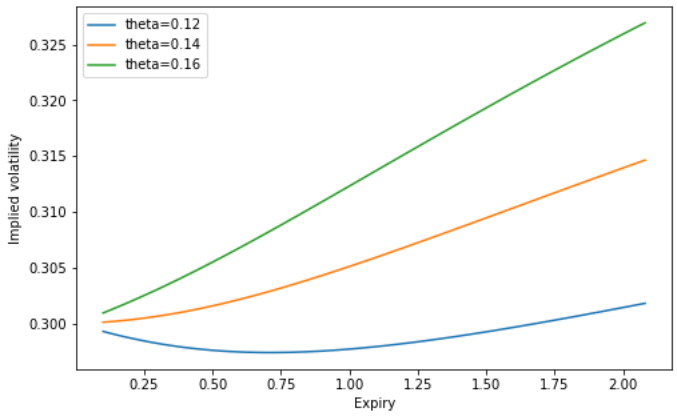
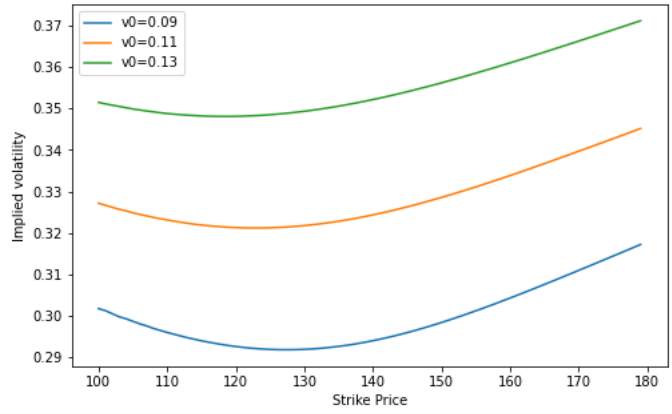
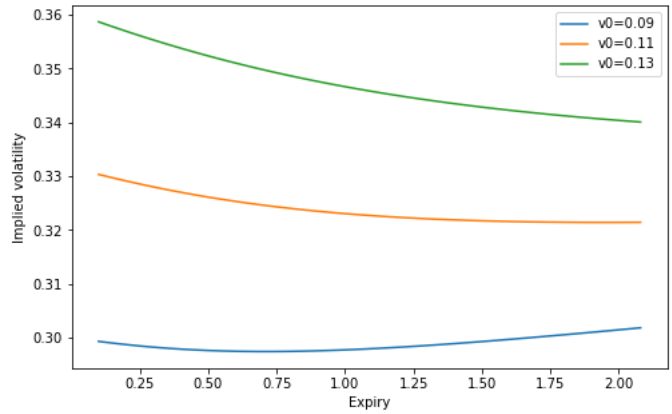


Obviously, increase the theta value, both of the skew and term structure shifts upwards. To be specific, the term structure turns to be steeper.

Finally, we change the V0:





By increasing v0, both of the structures shift upwards with the more steep tendency or slope, and the term structure looks like a bit more ‘skew’.