1. (i)From the alpha vs price plot and v vs exp(-α\*v)\*ψ(v) plot, I think alpha = 1.5 is a good choice when I compare the result from FFT with BS model.

图示, 工程绘图

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图表, 折线图

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(ii) From the n vs price plot, I think the n=14 i.e N=2^14 is a good choose since the running time is not too long and n from 10 to 15 all have similar result.

From the B vs price plot, I choose to set B to be 150 since they all have very close result.

The price is 21.26887

图表, 散点图

描述已自动生成

图表, 折线图, 散点图

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(iii)

When K=260, the n still could choose 14, N=2^10 by plot n vs price.

When K=260, the B should be increase to 700 by plot B vs price. The price is not stable at small B.

The price is 16.7391

图表

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图表, 散点图

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(B) (i)

Price from K=100 to K=200 are [1] 50.6408799 40.7959153 31.2377849 22.4276489 14.9940815 9.3683660 5.5483462 3.1598539 1.7573445 0.9631986 0.5240890

Implied volatilities are 0.3019497 0.2961735 0.2927067 0.2920052 0.2941674 0.2984345 0.3044104 0.3110051 0.3179951 0.3248425 0.3314583

图表, 折线图, 散点图

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图表, 折线图, 散点图

描述已自动生成

(ii)

Price from expT=1/12 to expT=24/12 are 5.322599 7.597951 9.368366 10.877338 12.219825 13.444817 14.581532 15.649026 16.660510 17.625557 18.551337 19.443368 20.305991 21.142680 21.956260 22.749060 23.523021 24.279782 25.020734 25.747075 26.459837 27.159924 27.848124 28.525137

Implied volatilities are 0.2993974 0.2988752 0.2984345 0.2980754 0.2977964 0.2975943 0.2974645 0.2974018 0.2974002 0.2974538 0.2975569 0.2977038 0.2978895 0.2981094 0.2983591 0.2986348 0.2989330 0.2992506 0.2995850 0.2999335 0.3002940 0.3006646 0.3010435 0.3014292

图表, 散点图

描述已自动生成

图表, 散点图

描述已自动生成

(iii)

Change sigma

图表, 散点图

描述已自动生成

Sigma and implied volatility has negative correlation.

Change nu

图表, 散点图

描述已自动生成

Nu and implied volatility has positive correlation.

Change kappa

图表, 散点图

描述已自动生成

Kappa and implied volatility has positive correlation.

Change rho

图表, 折线图

描述已自动生成

Rho and implied volatility has positive correlation.

Change theta

图表, 折线图, 散点图

描述已自动生成

Theta and implied volatility has positive correlation.

图表, 散点图

描述已自动生成

I plot the implied volatility from 1 month to 24 months with different parameters. These parameters in Heston model seems change the shape of implied volatility a lot.