Assignment 6: Take Home Messages

1. Certificate Pricing

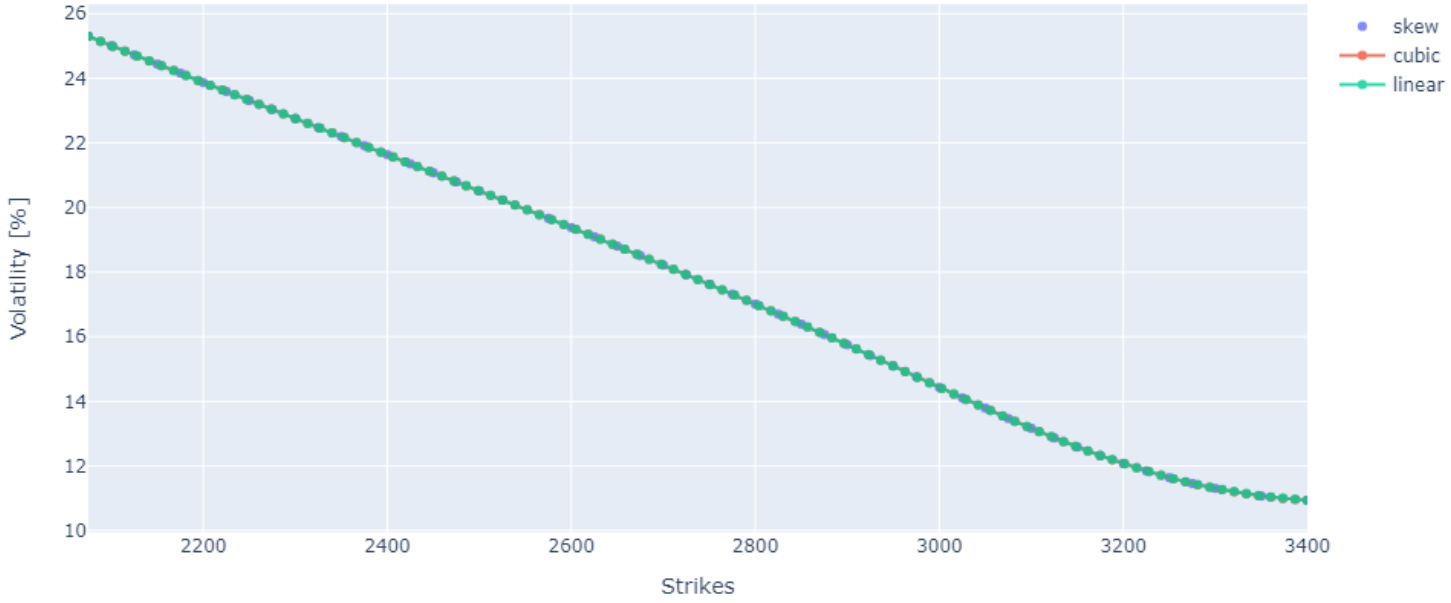
Identify the criteria to set Montecarlo number of simulations (weights = 1/8).

Participation coefficient in percentage, elapsed time in seconds

NSim	MC Type	IC-	IC+	|IC|	elapsed [sec]
1E+4	plain	327.722	338.074	20.705	0.033
	antithetic	331.971	335.057	6.173	0.048
1E+5	plain	333.493	336.780	6.573	0.070
	antithetic	334.242	335.220	1.954	0.101
1E+6	plain	334.256	335.292	2.071	0.406
	antithetic	334.610	334.917	0.614	0.629
1E+7	plain	334.686	335.013	0.655	4.499
	antithetic	334.790	334.887	0.194	7.252

2. Pricing Digital Option

1. Plot the volatility smirk



2. Choose the strike interpolation function:
   - x Linear ?
   - ✓ Cubic Spline ?

2. Pricing Digital Option

3. What is the relation between vega Black closed formula ν and the price difference between call spread limit and digital Black closed formula?

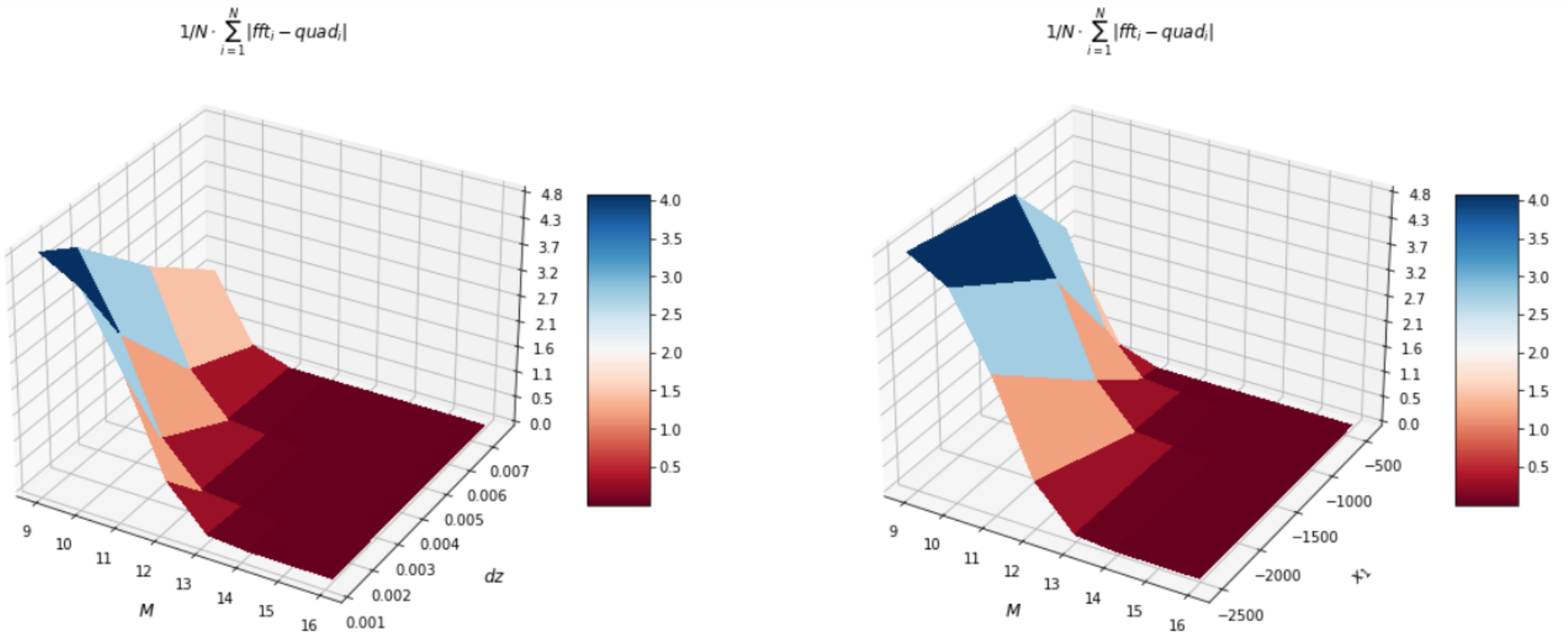
$$\Delta C \approx -\nu^{Black} \cdot \frac{\partial \sigma^{mkt}}{\partial k}$$

Where σ^{mkt} stands for volatility market skew and k denotes the strikes.

Positive if negative skew!

3. FFT Parameters

Identify the criteria to set the two degrees of freedom M, dz or x_1.



How to control tails in out-of-the money values? L^1, L^2 or L^∞ error criteria…

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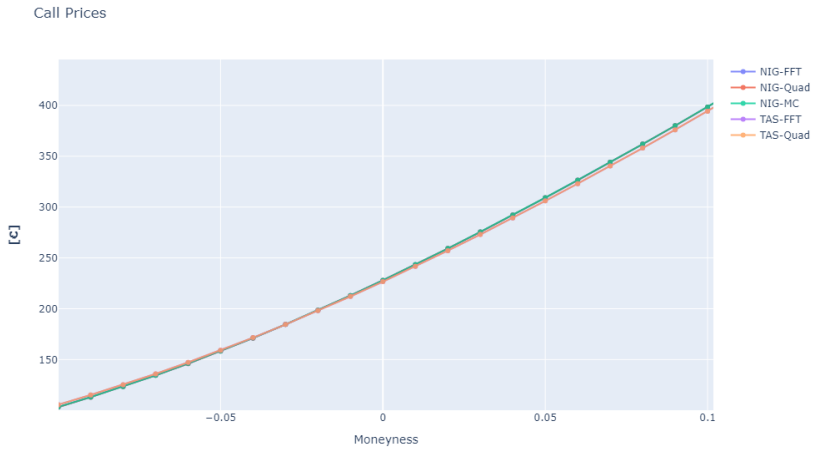
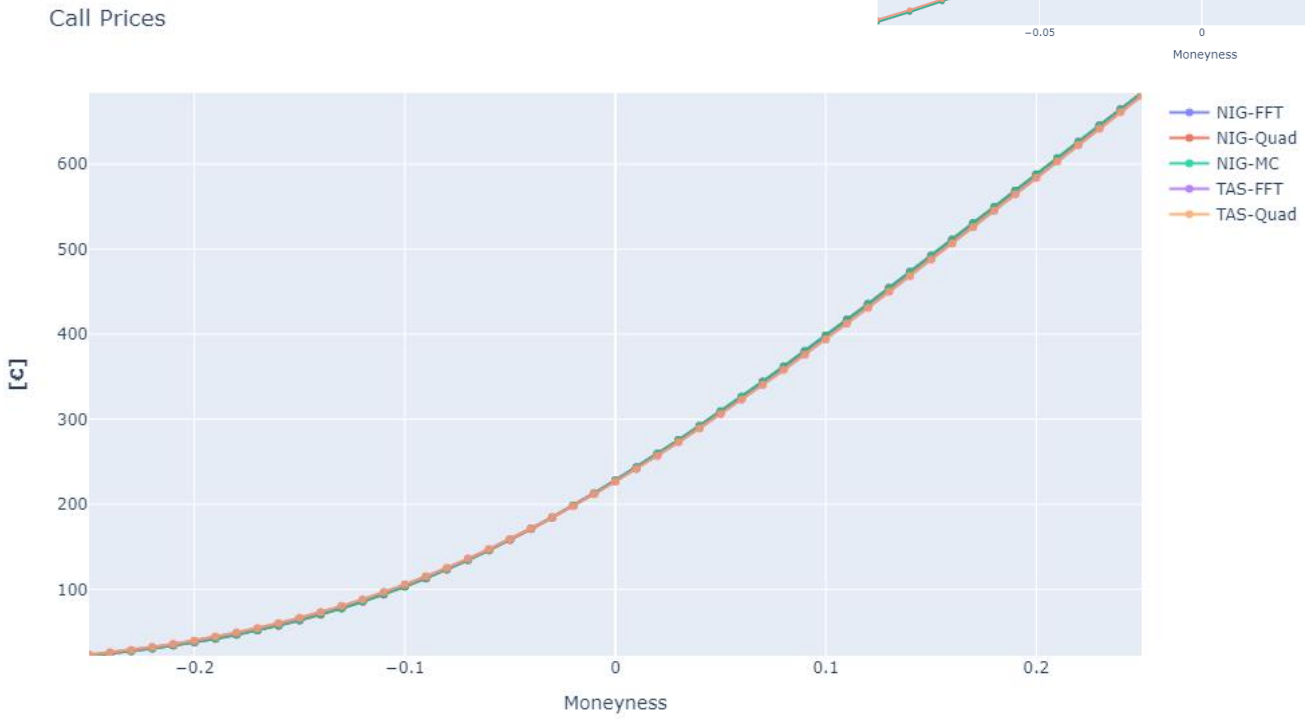
3. Tempered Alpha Stable Process





4. Case study: volatility surface calibration

```
dist = @(p) sum((price_call_model(p)-price_call_market).^2);
A=[1,0,0
    0,1,0];
b=[0
    0];
X = fmincon(dist,initial_values,A,b,[],[],[],[],@(p) constraint(p,alpha));
```

```
function [c, ceq]=constraint(p,alpha)
% function that represents the constraint in the Least Squares Calibration
%p1=sigma
%p2 k, p3 eta
c= [-(1-alpha)./(p(2).*p(1).*p(1))-p(3)];
ceq=[];

end
```

4. Case study: volatility surface calibration

Consider different level of α parameter in normal mean-variance mixture and run a grid search in order to select the best mean squared error vs elapsed execution time:

α	MSE	Elapsed [sec]
0.2500	0.1598	50.2
0.3333	0.3692	66.4
0.5000	1.1154	61.9
0.6667	1.9993	109.0
0.7500	2.6824	121.4