1. Caplet pricing in Different Models

(a). D(0,1.25) = 1/(1+0.0125)^(1.25)=0.9845918

(b). The price is 0.0001839503

(cd). When sigma=0.15\*0.0125=0.001875, the price is 0.0001841228 with bachelier’s formula.

They are similar since I make theta in normal equals theta \* F0 in log-normal model.

The Normal model gives higher put price since normal model allows negative rate which could have high put price.

(e)

0.5%

Price= 2.280965e-14

Delta = -7.738034e-11

Gamma= -0.3076847

Vega= 6.108913e-12

Theta= -4.578833e-13

0.75%

Price = 3.024875e-08

Delta = -6.182526e-05

Gamma= -0.1848989

Vega= 2.874182e-06

Theta= -2.151856e-07

1.0%

Price = 1.241814e-05

Delta = -0.01460106

Gamma= 15.17689

Vega= 0.000362066

Theta= -2.699972e-05

1.25%

Price = 0.0001839503

Delta = -0.1163075

Gamma= 52.20796

Vega= 0.001224038

Theta= -8.950346e-05

Highest gamma: 1.25%

Highest vega: 1.25%

Highest theta: 1.0%

At the high strike, the price increase faster than low strike when forward rate increase.

At the high strike, the price increase faster than low strike when volatility increase. .

At the middle strike, the price decrease slower than low strike when maturely date increase. .

1. Stripping Caplet Volatilities.

（a）

one\_year\_1

[1] 0.0002064998

> one\_year\_2

[1] 0.0004249305

> one\_year\_3

[1] 0.000654551

> one\_year

[1] 0.0008947245

>

> two\_year\_1

[1] 0.00122756

> two\_year\_2

[1] 0.001572981

> two\_year\_3

[1] 0.001930403

> two\_year

[1] 0.002299298

>

> three\_year\_1

[1] 0.002725922

> three\_year\_2

[1] 0.003164353

> three\_year\_3

[1] 0.003614139

> three\_year

[1] 0.00407486

>

> four\_year\_1

[1] 0.004546129

> four\_year\_2

[1] 0.005027585

> four\_year\_3

[1] 0.00551889

> four\_year

[1] 0.006019727

>

> five\_year\_1

[1] 0.006584812

> five\_year\_2

[1] 0.007159746

> five\_year\_3

[1] 0.007744234

> five\_year

[1] 0.008337995

(b)

Difference between Implied volatility and caplet volatility increases with time increase.

图表, 折线图

描述已自动生成

Red line is implied volatility, Green line is caplet volatility