FM_Assignment7_Duo_Zhou

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Loading Data

```
datapath <- "C:/Users/zd000/Desktop/MSCA/Financial Analytics/Assignments/week7/"
optionsData = read.csv(paste(datapath,'OptionsPrices.csv',sep='/'),header=TRUE,row.names=1,sep=",")
dim(optionsData)
```

```
## [1] 209  26
```

```
head(optionsData,10)
```

```
##           Expiry OptRate  UndPr   S1   S2   S3   S4   S5   S6   S7   S8   S9
## 2/26/2007    298  0.0518 1492.0 1465 1470 1475 1480 1485 1490 1495 1500 1505
## 2/27/2007    297  0.0518 1432.4 1405 1410 1415 1420 1425 1430 1435 1440 1445
## 2/28/2007    296  0.0518 1446.3 1420 1425 1430 1435 1440 1445 1450 1455 1460
## 3/1/2007     295  0.0518 1441.9 1415 1420 1425 1430 1435 1440 1445 1450 1455
## 3/2/2007     294  0.0518 1422.3 1395 1400 1405 1410 1415 1420 1425 1430 1435
## 3/5/2007     291  0.0518 1408.3 1385 1390 1395 1400 1405 1410 1415 1420 1425
## 3/6/2007     290  0.0518 1432.4 1405 1410 1415 1420 1425 1430 1435 1440 1445
## 3/7/2007     289  0.0518 1429.8 1405 1410 1415 1420 1425 1430 1435 1440 1445
## 3/8/2007     288  0.0518 1441.5 1415 1420 1425 1430 1435 1440 1445 1450 1455
## 3/9/2007     287  0.0518 1441.7 1415 1420 1425 1430 1435 1440 1445 1450 1455
##             S10  S11       P1       P2       P3       P4       P5       C6
## 2/26/2007 1510 1515 54.30423 56.07166 57.89065 59.76235 61.68784 65.58547
## 2/27/2007 1450 1455 61.95104 63.81159 65.71825 67.67180 69.67278 74.02288
## 2/28/2007 1465 1470 57.80807 59.57165 61.38412 63.24652 65.15989 68.37187
## 3/1/2007  1460 1465 57.69166 59.44031 61.23744 63.08412 64.98139 68.75248
## 3/2/2007  1440 1445 59.91121 61.64433 63.42451 65.25283 67.13038 71.26430
## 3/5/2007  1430 1435 63.42158 65.21900 67.06240 68.95270 70.89081 71.24644
## 3/6/2007  1450 1455 57.00668 58.74649 60.53483 62.37279 64.26142 68.50506
## 3/7/2007  1450 1455 57.24539 58.98721 60.77829 62.61982 64.51289 66.26680
## 3/8/2007  1460 1465 55.02205 56.76158 58.55119 60.39202 62.28519 65.67180
## 3/9/2007  1460 1465 54.46266 56.21081 58.00953 59.85999 61.76325 65.35265
##                C7       C8       C9      C10      C11    P1425
## 2/26/2007 62.82907 60.12979 57.48878 54.90710 52.38579 41.88617
## 2/27/2007 71.32719 68.68091 66.08466 63.53896 61.04441 69.67278
## 2/28/2007 65.59614 62.87461 60.20830 57.59825 55.04550 59.57165
## 3/1/2007  65.95926 63.21990 60.53548 57.90705 55.33568 61.23744
## 3/2/2007  68.44802 65.68434 62.97440 60.31928 57.72015 71.03768
## 3/5/2007  68.48520 65.77451 63.11524 60.50827 57.95451 79.13961
```

```
## 3/6/2007  65.69996 62.94883 60.25274 57.61277 55.03000 64.26142
## 3/7/2007  63.46754 60.72346 58.03569 55.40545 52.83394 64.51289
## 3/8/2007  62.87339 60.13080 57.44512 54.81756 52.24919 58.55119
## 3/9/2007  62.56457 59.83272 57.15818 54.54210 51.98553 58.00953
```

Using the options data from file OptionsPrices.csv used in the workshop calculate the P&L breakdown into delta, gamma and vega components of 1425 December 2007 put for each day between 2/27/2007 and 3/5/2007.

Compare actual P&L for 1425 December 2007 put with the estimated daily P&L for each day between 2/27/2007 and 3/5/2007.

Put the results in a table with columns: actual P&L, estimated P&L, delta P&L, gamma P&L, vega P&L.

First, Calculate implied volatilites of put with strike 1425 between 2/26/2007 and 3/5/2007

```
# Use europeanoptionimplied vol() over each row of optionsData,
## use as.vector to eliminate dates and multiply by 100 to show in percent
put1425.impliedVolatilities <- as.vector(apply(optionsData[1:6,], 1, function (z)
EuropeanOptionImpliedVolatility("put", value=z[26], underlying=z[3], strike=1425,
dividendYield = z[2], riskFreeRate = z[2], maturity = z[1]/365, volatility = 0.3)))*100
# return head of implied 1425p vols
cbind(row.names(optionsData[1:6,]), put1425.impliedVolatilities)
```

```
##                  put1425.impliedVolatilities
## [1,] "2/26/2007" "13.7652034208984"
## [2,] "2/27/2007" "14.8543608464592"
## [3,] "2/28/2007" "14.0232113170416"
## [4,] "3/1/2007"  "14.0122623728442"
## [5,] "3/2/2007"  "14.2734641332504"
## [6,] "3/5/2007"  "14.6403269375492"
```

Find option premimum and Greeks of 1425 put between 2/26/2007 and 3/5/2007

```
currentPutValue<-matrix(NA, nrow = 6, ncol = 4)
for(i in 1:6){
currentPutValue.temp <- EuropeanOption(type="put",underlying = optionsData[i,3],
strike = 1425, maturity = optionsData[i,1]/365, riskFreeRate = optionsData[i,2],
volatility =put1425.impliedVolatilities[i]/100 , dividendYield = optionsData[i,2])
currentPutValue[i,1]<-as.numeric(currentPutValue.temp[1])
currentPutValue[i,2]<-as.numeric(currentPutValue.temp[2])
currentPutValue[i,3]<-as.numeric(currentPutValue.temp[3])
currentPutValue[i,4]<-as.numeric(currentPutValue.temp[4])
}
colnames(currentPutValue)<-c('value','delta','gamma','vega')
rownames(currentPutValue)<-row.names(optionsData[1:6,])
# Return the value and greeks
currentPutValue
```

```
##              value      delta       gamma     vega
## 2/26/2007 41.88617 -0.3192287 0.001877508 469.7047
```

```
## 2/27/2007 69.67282 -0.4390288 0.001981668 491.4471
## 2/28/2007 59.57164 -0.4107088 0.002060517 490.1616
## 3/1/2007  61.23743 -0.4198390 0.002080639 489.8957
## 3/2/2007  71.03771 -0.4607314 0.002097565 487.8443
## 3/5/2007  79.13961 -0.4892711 0.002078716 481.2111
```

Calculate the daily breakdown of 1425-put P&L between 2/27/07 and 3/05/07 into delta gama and vega buckets First find estimated delta, gamma and vega P&L using forula on slide 15 for this week and then sum them up to get total estimated P&L. The actual P&L is calculated by taking the difference between consecutive daily P1425 premimum.

```
PNL.daily<-matrix(NA, nrow = 5, ncol = 5)

for(i in 1:5){
# delta pnl= delta* change in price
PNL.daily[i,3]<-currentPutValue[i,2]*(optionsData[i+1,3]-optionsData[i,3])
# gamma pnl= (1/2) * gamma * (change in price)^2
PNL.daily[i,4]<-.5*currentPutValue[i,3]*(optionsData[i+1,3]-optionsData[i,3])^2
# vega pnl= (vega/100) * change in implied volatility
PNL.daily[i,5]<-currentPutValue[i,4]/100*
  (put1425.impliedVolatilities[i+1]-put1425.impliedVolatilities[i])

# Calculate the sum of the greek pnls
PNL.daily[i,2]<-PNL.daily[i,3]+PNL.daily[i,4]+PNL.daily[i,5]
# Calculate the actual put pnl
PNL.daily[i,1]<-optionsData[i+1,26]-optionsData[i,26]
}
colnames(PNL.daily)<-c('actual P&L', 'estimated P&L', 'delta P&L', 'gamma P&L',
                       'vega P&L')
rownames(PNL.daily)<-row.names(optionsData[2:6,])
PNL.daily
```

```
##           actual P&L estimated P&L delta P&L  gamma P&L    vega P&L
## 2/27/2007  27.786615     27.476457 19.026029 3.33460488  5.11582328
## 2/28/2007 -10.101134     -9.995722 -6.102501 0.19143908 -4.08466035
## 3/1/2007    1.665789      1.773397  1.807119 0.01994581 -0.05366752
## 3/2/2007    9.800244      9.908110  8.228845 0.39964920  1.27961624
## 3/5/2007    8.101930      8.445520  6.450240 0.20556140  1.78971911
```