# Week 7 Assignment

*Matthew Dunne*

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## Week 7: Homework Assignment

*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.*

```
datapath<-"C:/Users/mjdun/Desktop/Financial Analytics/Week 7"
optionsData = read.csv(paste(datapath,'OptionsPrices.csv',sep='/'),header=TRUE,row.names=1,sep=",")
dim(optionsData)
```

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

```
suppressWarnings(library(RQuantLib))
```

*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.*

First get the actual P&L's.

```
#calculate actual P&L for 2/27/2007 3/5/2007
#subset to relevant data
PNL_Dates<-optionsData[1:6,26]
actual.PNL<-c()
for (i in 2:length(PNL_Dates)){
  days_PNL<-PNL_Dates[i]-PNL_Dates[i-1]
  actual.PNL<-c(actual.PNL, days_PNL)
}
actual.PNL
```

```
## [1]  27.786615 -10.101134   1.665789   9.800244   8.101930
```

You need to calculate the implied volatilities in order to find the estimated values and the Greeks.

```
put1425.impliedVolatilities<-function(dataRow){
  myExpiry<-dataRow[1]/365
  myRate<-dataRow[2]
  myUnderlying<-dataRow[3]
  myValue<-dataRow[26]
  impVolPuts<-EuropeanOptionImpliedVolatility("put",
                                              value=myValue,
                                              underlying=myUnderlying,
                                              strike=1425,
                                              dividendYield=myRate,
                                              riskFreeRate=myRate,
                                              maturity=myExpiry,
                                              volatility=.3)
}
put1425.impliedVolatilities<-as.vector(apply(as.matrix(optionsData),1,
                                              function(z) put1425.impliedVolatilities(z)))*100
put1425.impliedVolatilities[1:6]
```

```
## [1] 13.76520 14.85436 14.02321 14.01226 14.27346 14.64033
```

Then get the premiums and Greeks.

```
#first 6 rows, columns for (expiration, rate, underlying, and value of 1425 put)
PremiumandGreek_Dates<-optionsData[1:6,c(1,2,3,26)]
#add the relevant implied volatilities
PremiumandGreek_Dates<-cbind(PremiumandGreek_Dates, impliedVol=(put1425.impliedVolatilities[1:6]/100))
premiums_and_Greeks<-function(dataRow){
  myExpiry<-dataRow[1]/365
  myRate<-dataRow[2]
  myUnderlying<-dataRow[3]
  #fourth column because you've subsetted
  myValue<-dataRow[4]
  myVolatility<-dataRow[5]
  put_premium<-EuropeanOption(type="put",
                              underlying = myUnderlying,
                              strike = 1425,
                              dividendYield = myRate,
                              riskFreeRate = myRate,
                              maturity = myExpiry,
                              volatility = myVolatility)
  prems_and_Greeks<-c(put_premium$value, put_premium$delta, put_premium$gamma, put_premium$vega)
  return(prems_and_Greeks)
}
```

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

```
#to do all rows at once
prems_and_Greeks<-as.vector(apply(as.matrix(PremiumandGreek_Dates),1,
                                  function(z) premiums_and_Greeks(z)))
#make it into a matrix
myMatrix <- matrix(unlist(prems_and_Greeks), nrow = 6, ncol = 4, byrow = TRUE)

#the first column is values, but you need the difference in those values
estimated_values<-myMatrix[,1]
estimated.PNL<-c()
for (i in 2:length(estimated_values)){
   days_est_PNL<-estimated_values[i]-estimated_values[i-1]
   estimated.PNL<-c(estimated.PNL, days_est_PNL)
}
#make it into a table. Remember to take the first row from the Greeks to make the dimensions match
est_and_actual<-as.table(cbind(actual.PNL, estimated.PNL,
                               myMatrix[-1,2], myMatrix[-1,3], myMatrix[-1,4]))
#rename columns
colnames(est_and_actual)<-c("actual P&L", "estimated P&L", "delta P&L", "gamma P&L", "vega P&L")
est_and_actual
```

```
##      actual P&L estimated P&L     delta P&L     gamma P&L      vega P&L
## A  27.786615400  27.786653550  -0.439028814   0.001981668 491.447111343
## B -10.101134440 -10.101180713  -0.410708811   0.002060517 490.161583386
## C   1.665789220   1.665791816  -0.419839015   0.002080639 489.895719358
## D   9.800244220   9.800278282  -0.460731415   0.002097565 487.844252914
## E   8.101930290   8.101895832  -0.489271121   0.002078716 481.211143752
```

Estimated P&L’s are very close to actual P&L’s as we would expect.