Implementation_Black_Scholes

Sarah-Katharina Umek

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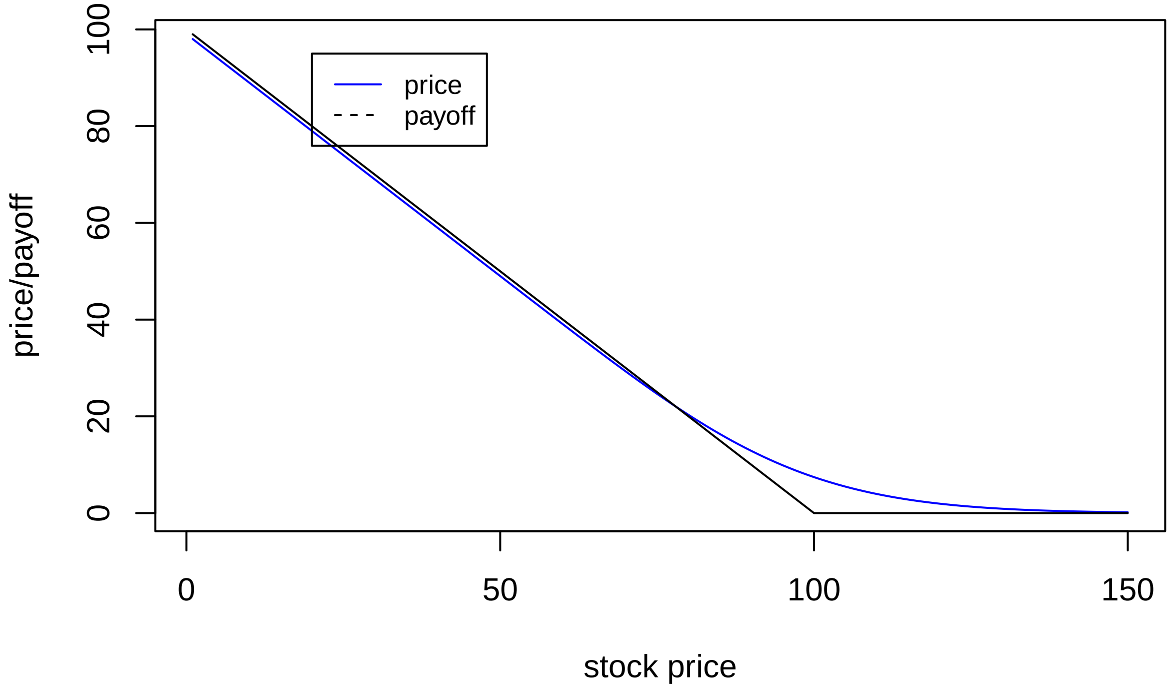
Code to calculate the price of European options, according to Black Scholes.

```r
# S = price, K = Strike, sigma = volatility, interest rate = r
code_put <- function(S, K, sigma, r, theta){
  d_1 <- (log(S / K) + (r + 0.5 * sigma^{2}) * theta) / (sigma * sqrt(theta))
  d_2 <- d_1-sigma*sqrt(theta)
  return(c("price (p)" = exp(-r * theta) * K * pnorm(-d_2) - S * pnorm(-d_1),
           "payoff" = max( K - S, 0)))
}
```

```r
code_call <- function(S, K, sigma, r, theta,expo){
 d_1 <-  (log(S / K) + (r + 0.5 * sigma^{2}) * theta) / (sigma * sqrt(theta))
 d_2 <- d_1 - sigma * sqrt(theta)
 call <- S * pnorm(d_1) - K * exp(-r * theta) * pnorm(d_2)
 delta <- pnorm(d_1) * expo * S
 bankaccount <- -K * pnorm(d_2) * exp(-r * theta) * expo
 hedging_portfolio <- delta + bankaccount
 #value of call position and hedging portfolio is calculated for the sale of 100 calls
 return(c(call * expo, hedging_portfolio))
}
```

```r
p <- sapply(seq(1 , 150), function(x){code_put(x, 100, 0.2, 0.01, 1)})
plot(p[1,], col = 'blue', type = 'l', ylab = "price/payoff", xlab = "stock price")
legend(20, 95, legend = c("price", "payoff"),
       col = c("blue", "black"), lty = (1:2), cex = 0.8)
lines(p[2,] ,col='black')
```


price
payoff
price/payoff
0
20
40
60
80
100
0
50
100
150
stock price