Financial Engineering II
Lab Assignment 8

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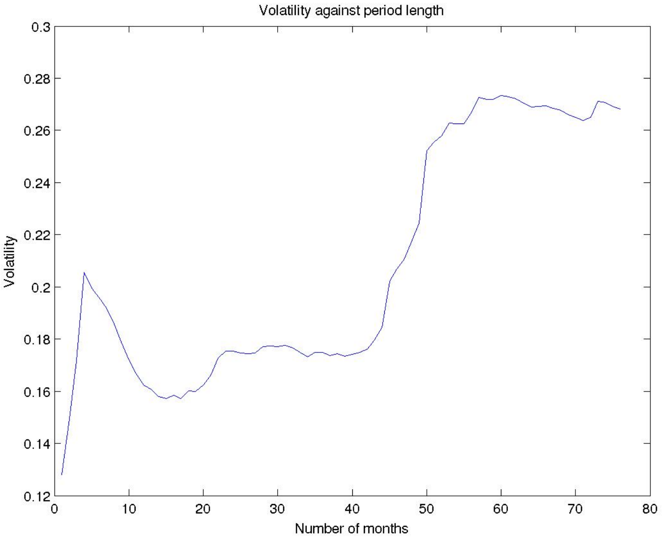
March 22, 2014

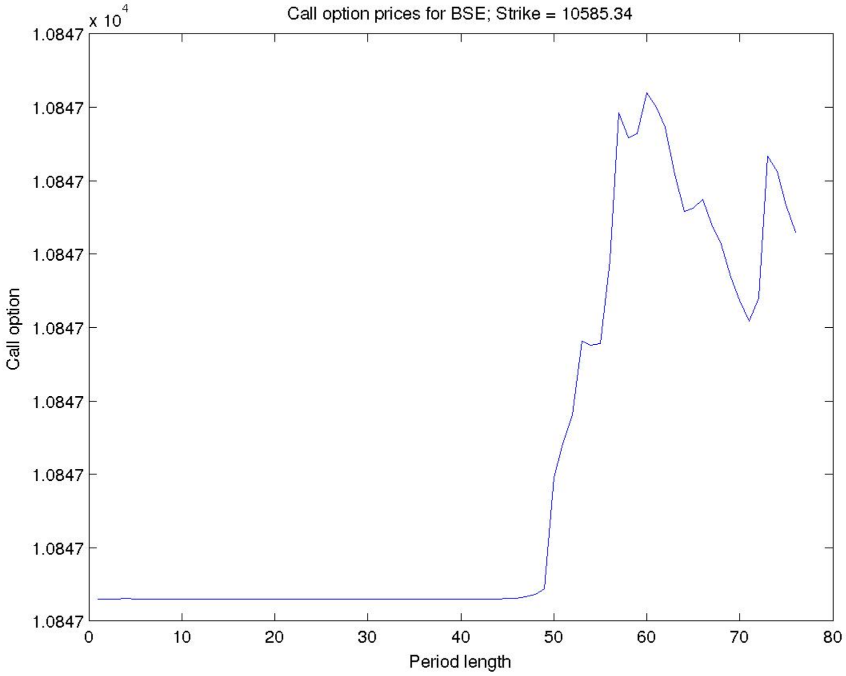
Contents

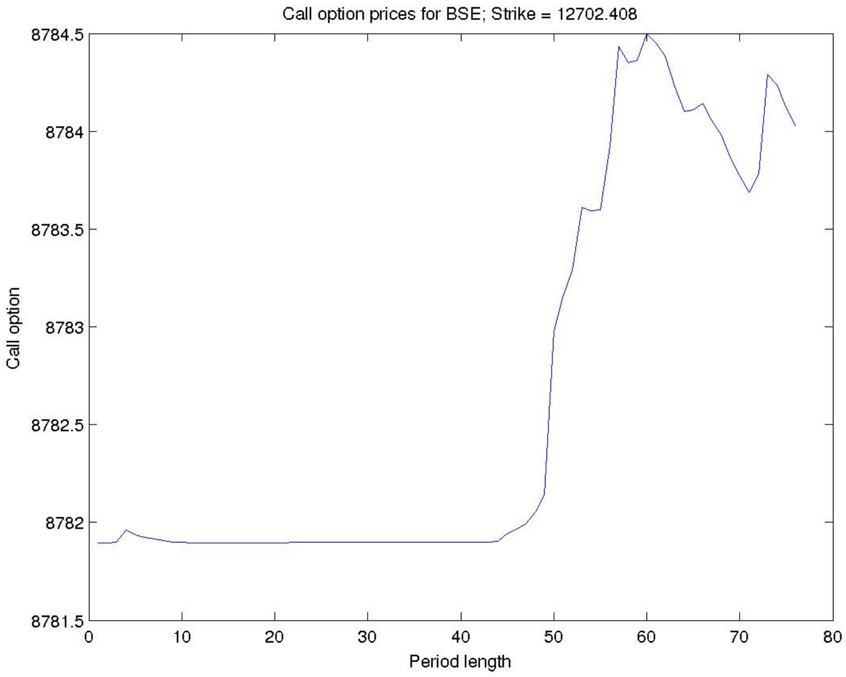
1 Plot of volatility against period length

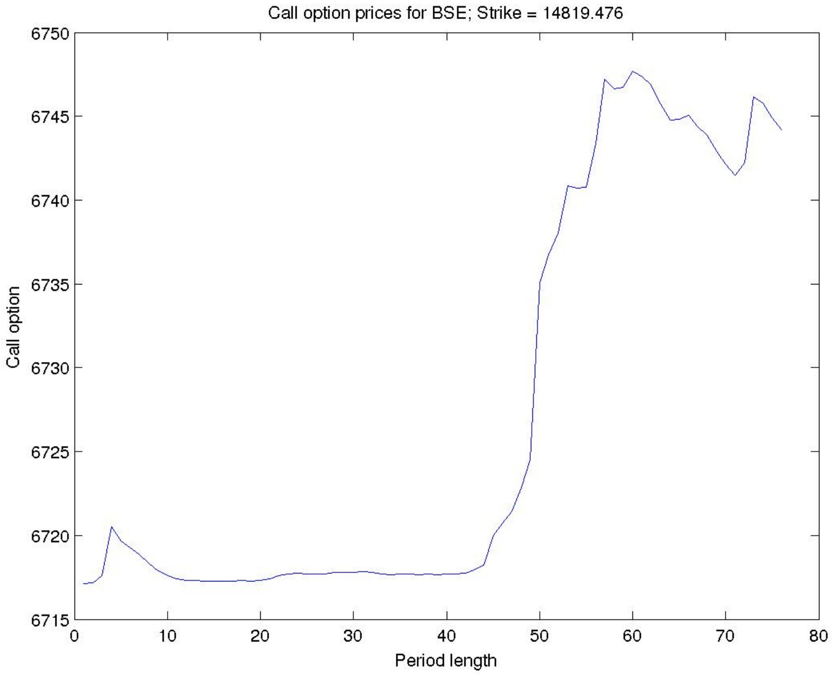


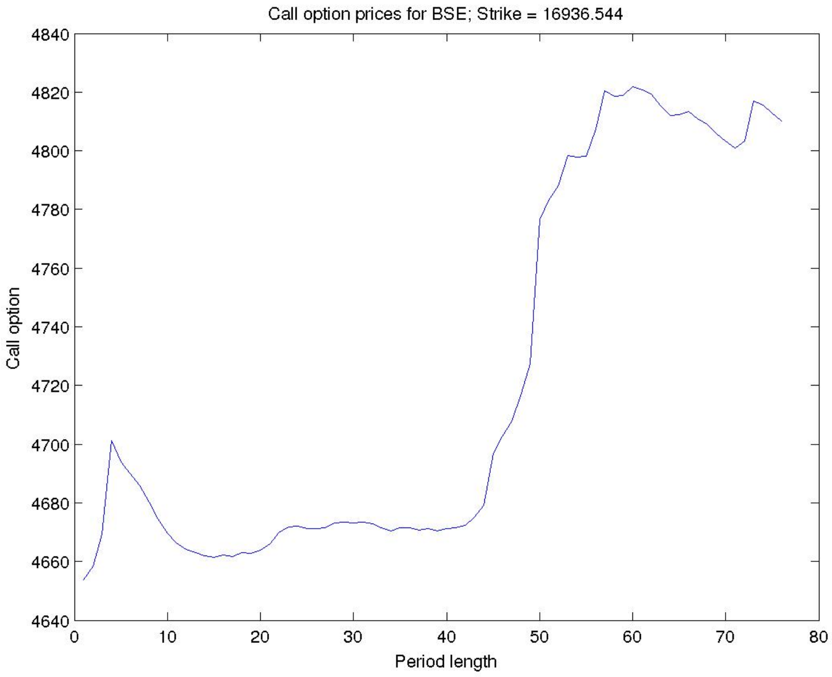
2 Option prices against period length

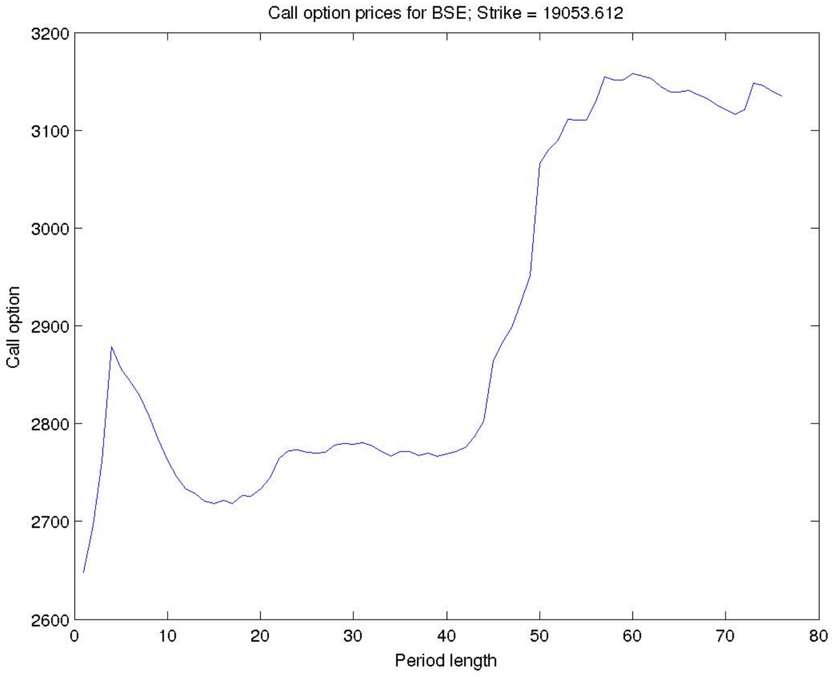
2.1 Call option prices

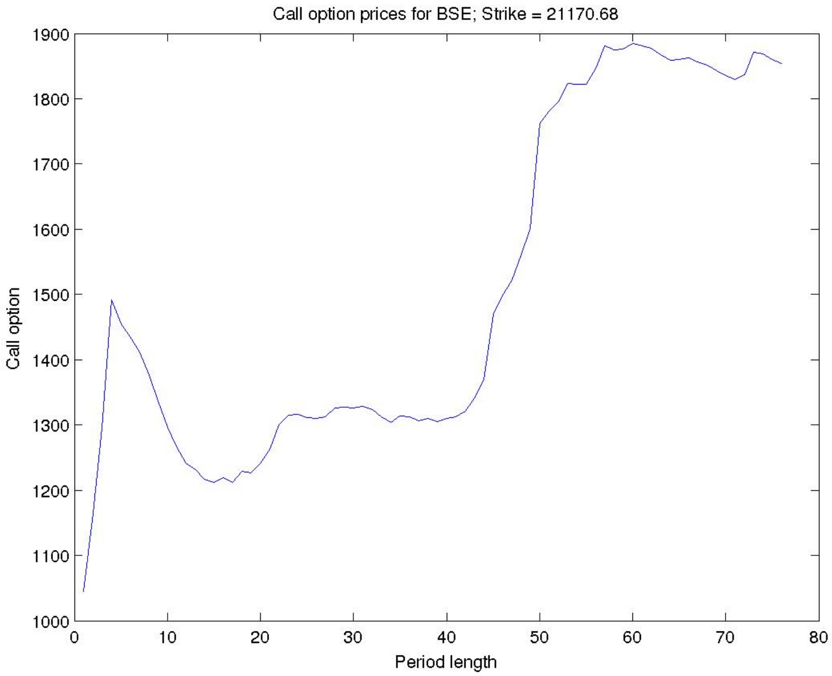


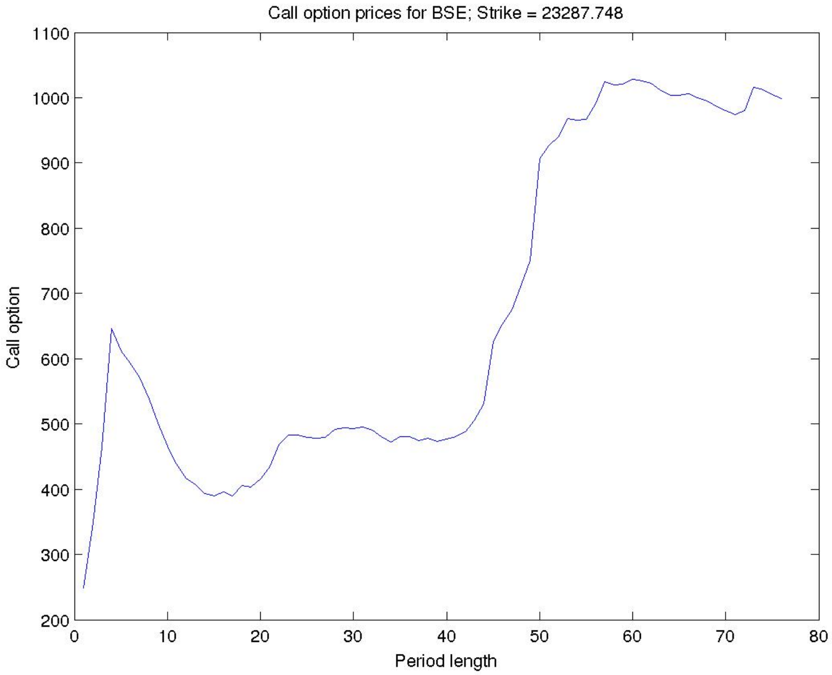

Call option prices for BSE; Strike = 12702.408
Call option
Period length
8781.5
8782
8782.5
8783
8783.5
8784
8784.5
0
10
20
30
40
50
60
70
80

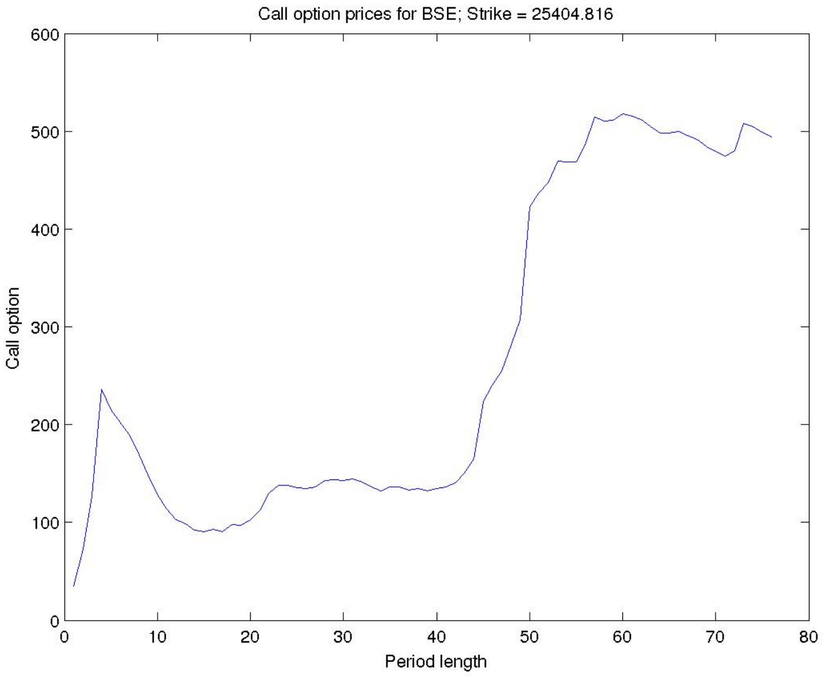

Call option prices for BSE; Strike = 14819.476
Call option
Period length
6715
6720
6725
6730
6735
6740
6745
6750
0
10
20
30
40
50
60
70
80

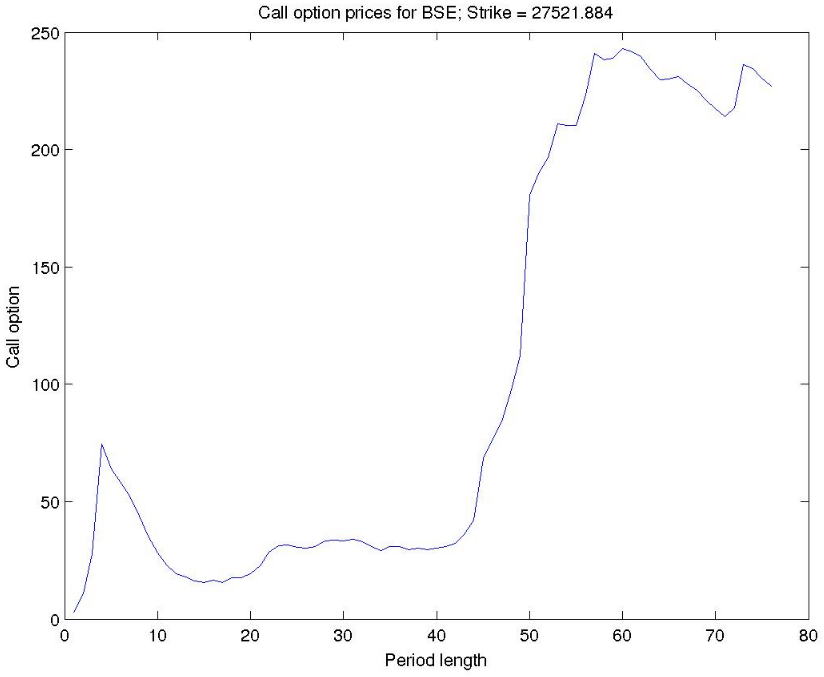

Call option prices for BSE; Strike = 16936.544
Call option
4840
4820
4800
4780
4760
4740
4720
4700
4680
4660
4640
0
10
20
30
40
50
60
70
80
Period length

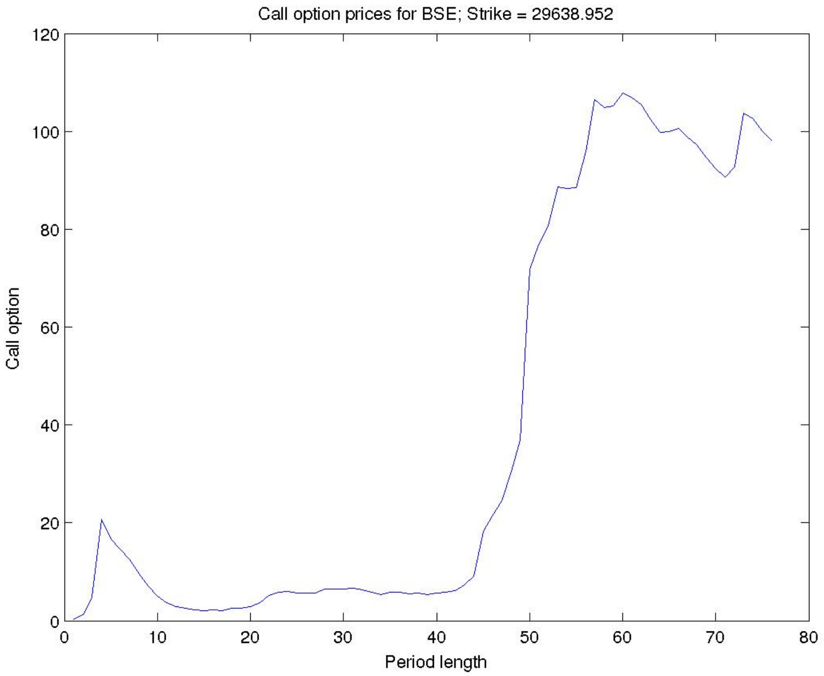

Call option prices for BSE; Strike = 19053.612
Call option
3200
3100
3000
2900
2800
2700
2600
0
10
20
30
40
50
60
70
80
Period length


Call option prices for BSE; Strike = 21170.68
Call option
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
Period length
0
10
20
30
40
50
60
70
80

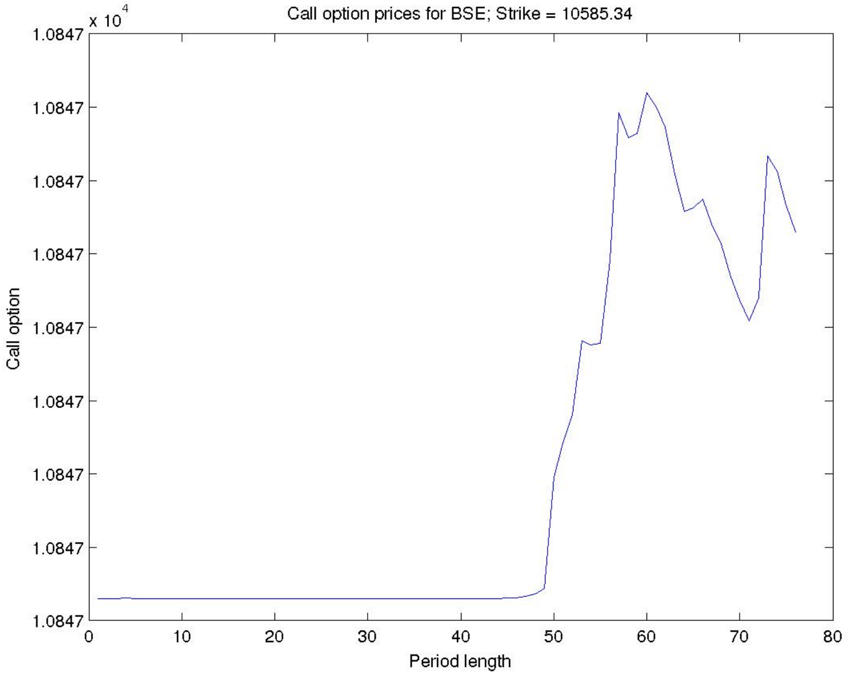

Call option prices for BSE; Strike = 23287.748
Call option
200
300
400
500
600
700
800
900
1000
1100
Period length
0
10
20
30
40
50
60
70
80

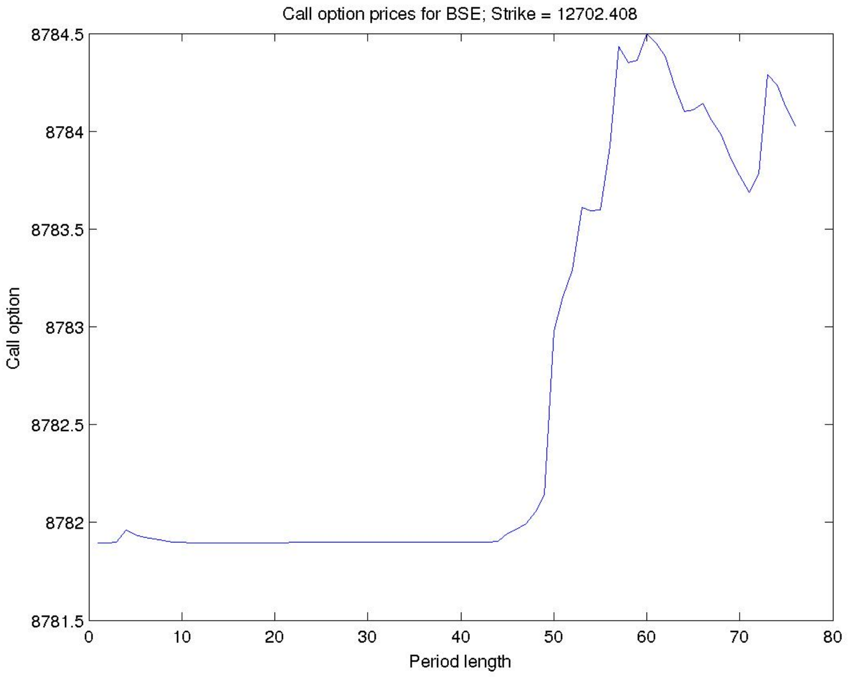

Call option prices for BSE; Strike = 25404.816
Call option
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
Period length


Call option prices for BSE; Strike = 27521.884
Call option
250
200
150
100
50
0
0
10
20
30
40
50
60
70
80
Period length

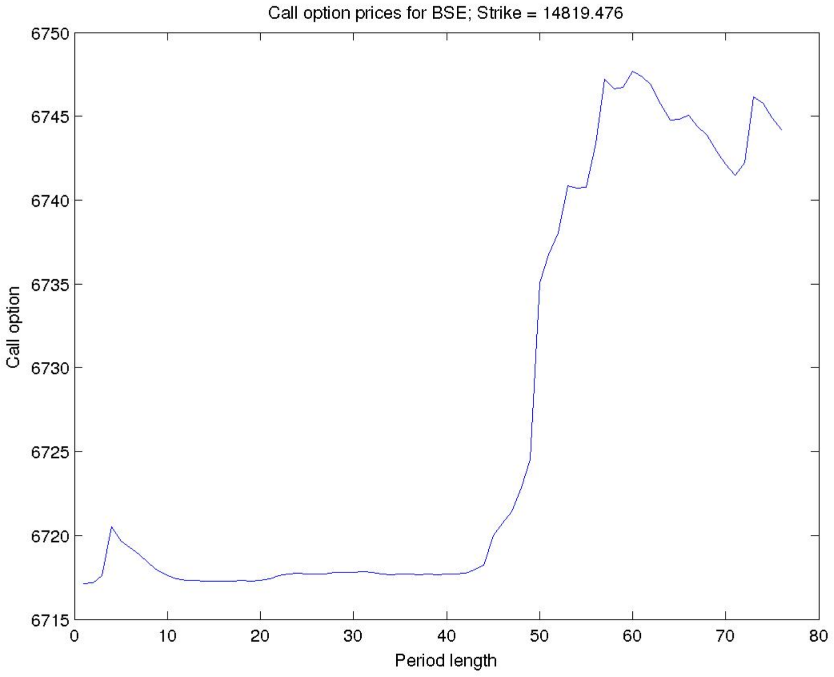


2.2 Put option prices

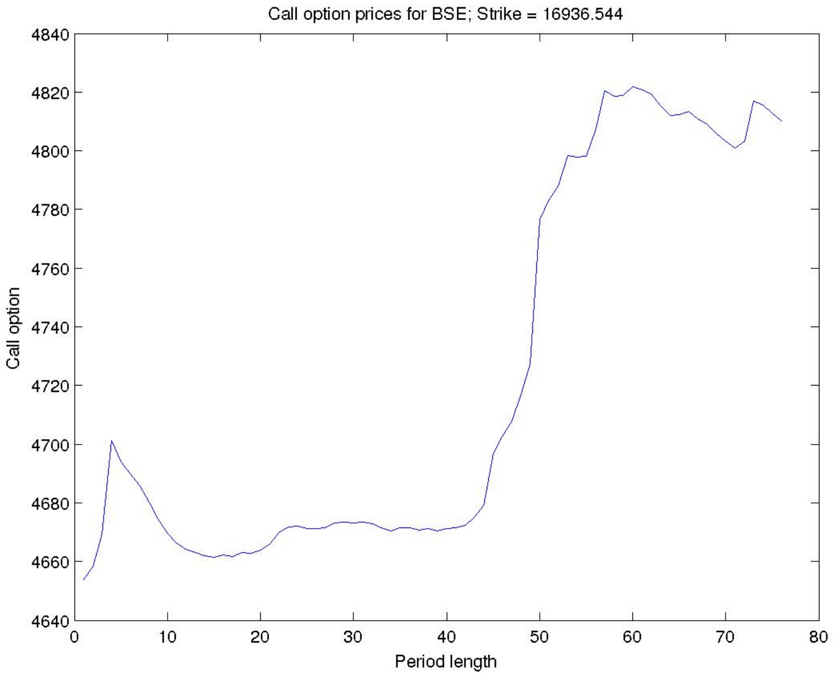


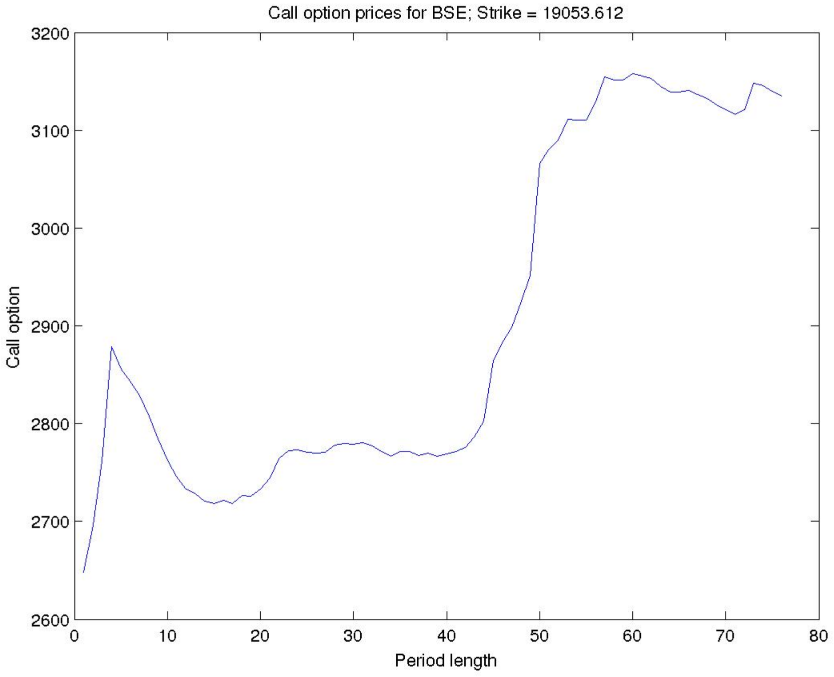


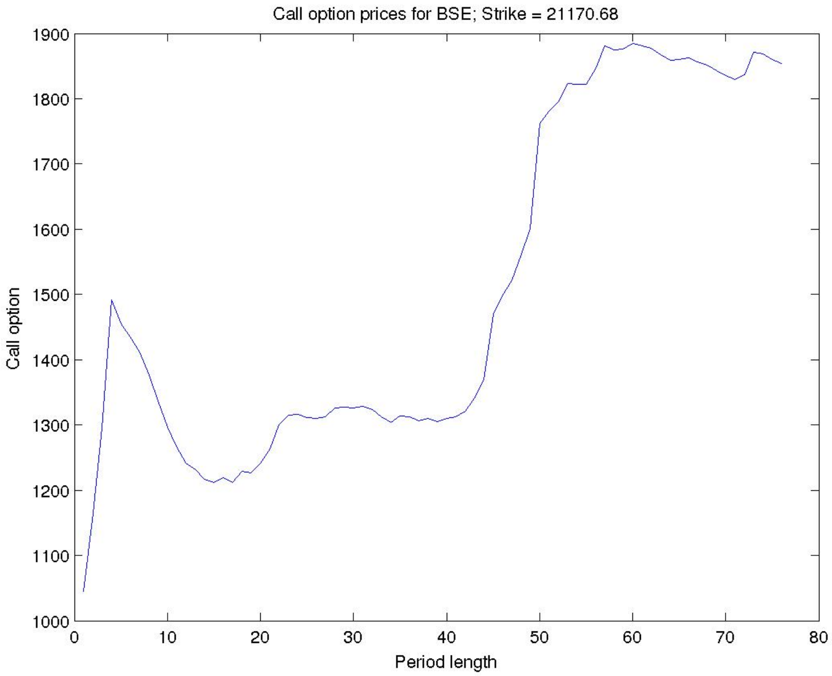
Call option prices for BSE; Strike = 12702.408

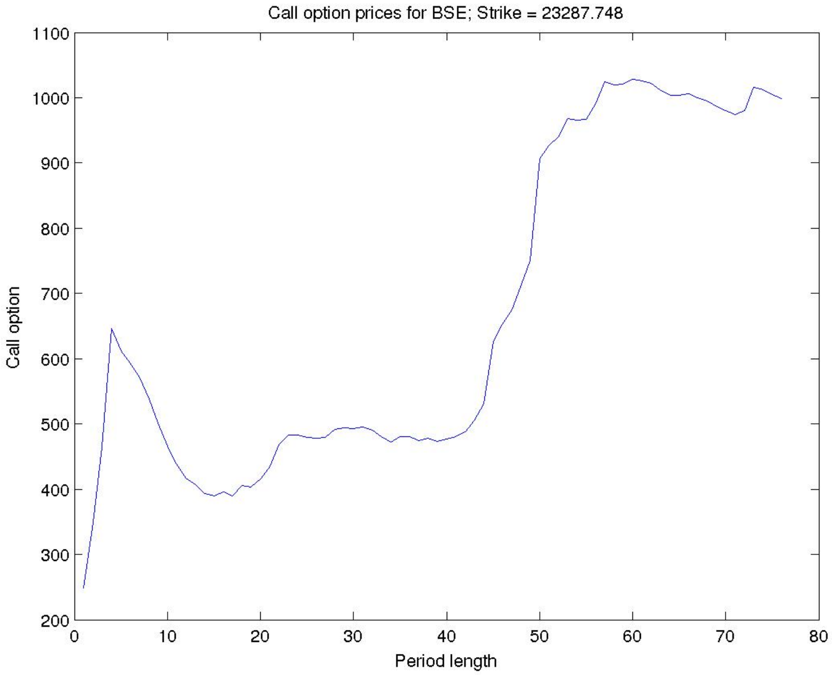


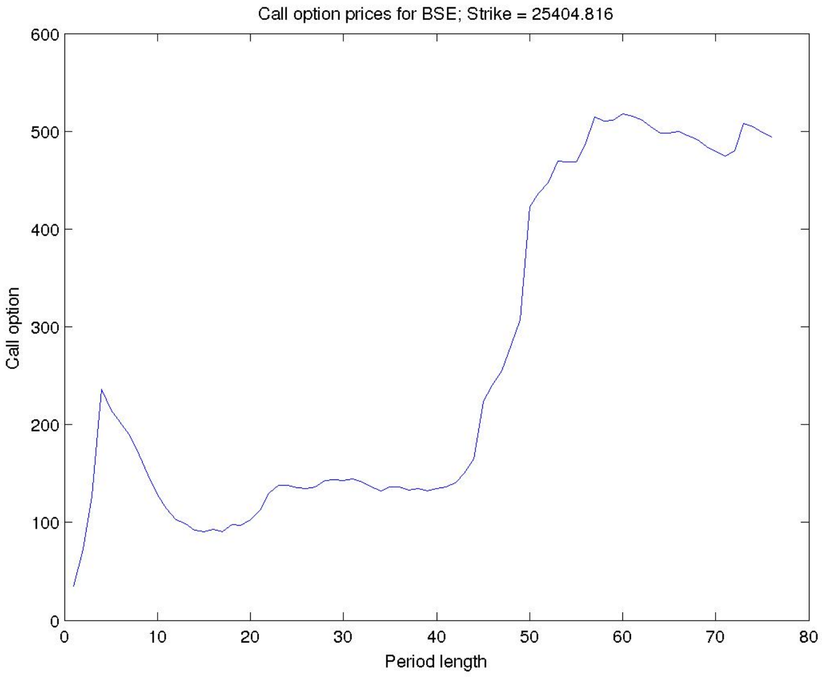
Call option prices for BSE; Strike = 14819.476

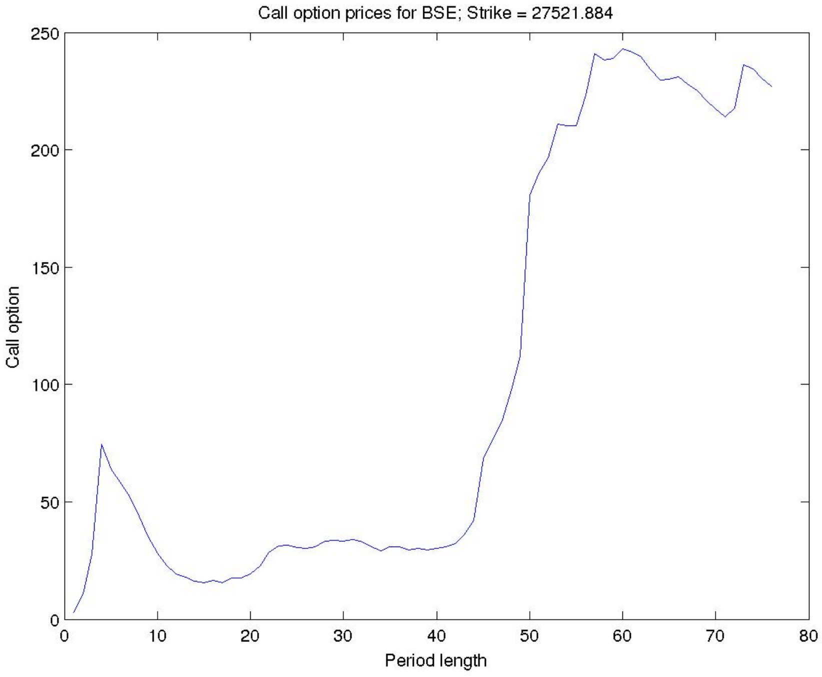

Call option prices for BSE; Strike = 16936.544
Call option
4840
4820
4800
4780
4760
4740
4720
4700
4680
4660
4640
0
10
20
30
40
50
60
70
80
Period length

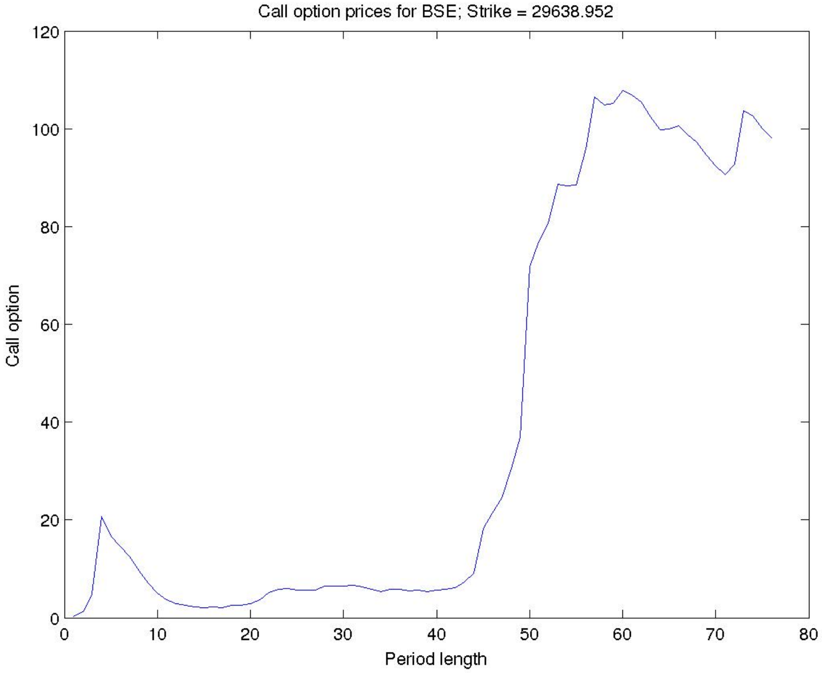

Call option prices for BSE; Strike = 19053.612
Call option
3200
3100
3000
2900
2800
2700
2600
0
10
20
30
40
50
60
70
80
Period length


Call option prices for BSE; Strike = 21170.68
Call option
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
0
10
20
30
40
50
60
70
80
Period length


Call option prices for BSE; Strike = 23287.748
Call option
1100
1000
900
800
700
600
500
400
300
200
0
10
20
30
40
50
60
70
80
Period length


Call option prices for BSE; Strike = 25404.816
Call option
0
100
200
300
400
500
600
0
10
20
30
40
50
60
70
80
Period length


Call option prices for BSE; Strike = 27521.884
Call option
0
50
100
150
200
250
0
10
20
30
40
50
60
70
80
Period length



3 Code

4 Function to compute Option price in BSM

```
function [ call, put ] = bsmoptionprice( price, strike, rate,
   time, period, volatility )
%BSMCALL Compute option prices
%   bsmoptionprice( price, strike, rate, time, period, volatility
    )
%   price = starting price of asset
%   strike = strike price; may be a vector
%   rate = risk-free rate
%   time = time at which option price is to be calculated
%   period = time to expiration of the option
%   volatility = annualised asset price volatility

d1 = (log(price./strike) + (rate + volatility*volatility*0.5)*(
   period - time) )/(volatility * sqrt(period - time) );
d2 = (log(price./strike) + (rate - volatility*volatility*0.5)*(
   period - time) )/(volatility * sqrt(period - time) );
```

```
call = normcdf(d1)*price - (normcdf(d2)*exp(-rate*(period-time)))
   .*strike;
put = (normcdf(-d2)*exp(-rate*(period-time))).*strike - normcdf(-
   d1)*price;

end
```

5 Driver program

```
format short; clear all; clc;

bse = csvread('bsedata_daily.csv');
nse = csvread('nsedata_daily.csv');


% assuming that a month has 26 trading days
daysInAMonth = 26;

months = 76;

% other parameters
rate = 0.05;
s0 = bse(1);
K = s0 * (0.5:0.1:1.5);
v = zeros(1, months);

% estimate historical volatility
for i=1:months
    v(i) = sqrt(252) * std((bse(2:i*daysInAMonth) - bse(1:i*
       daysInAMonth-1)) ...
         ./(bse(1:i*daysInAMonth-1)));
end
h = figure;
plot(v)
title('Volatility␣against␣period␣length')
xlabel('Number␣of␣months')
ylabel('Volatility')
saveas(h, 'volatility', 'jpg')

calldata = zeros(months, length(K));
```

```
putdata = zeros(months, length(K));

for i=1:months
    for j=1:length(K)
        [calldata(i, j), putdata(i, j)] = bsmoptionprice(s0, K(j)
            , rate, 0, 0.5, v(i));
    end
end

for i=1:length(K)
    h = figure;
    plot(calldata(:, i));
    title(['Call␣option␣prices␣for␣BSE;␣Strike␣=␣' num2str(K(i))
        ]);
    xlabel('Period␣length')
    ylabel('Call␣option')
    saveas(h, ['call_strike' num2str(i)], 'jpg')
    figure
    plot(putdata(:, i));
    title(['Put␣option␣prices␣for␣BSE;␣Strike␣=␣' num2str(K(i))])
        ;
    xlabel('Period␣length')
    ylabel('Put␣option')
    saveas(h, ['put_strike' num2str(i)], 'jpg')
end
```