Financial Engineering Lab (MA374)

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Roll Number - 180123021
Lab - 09

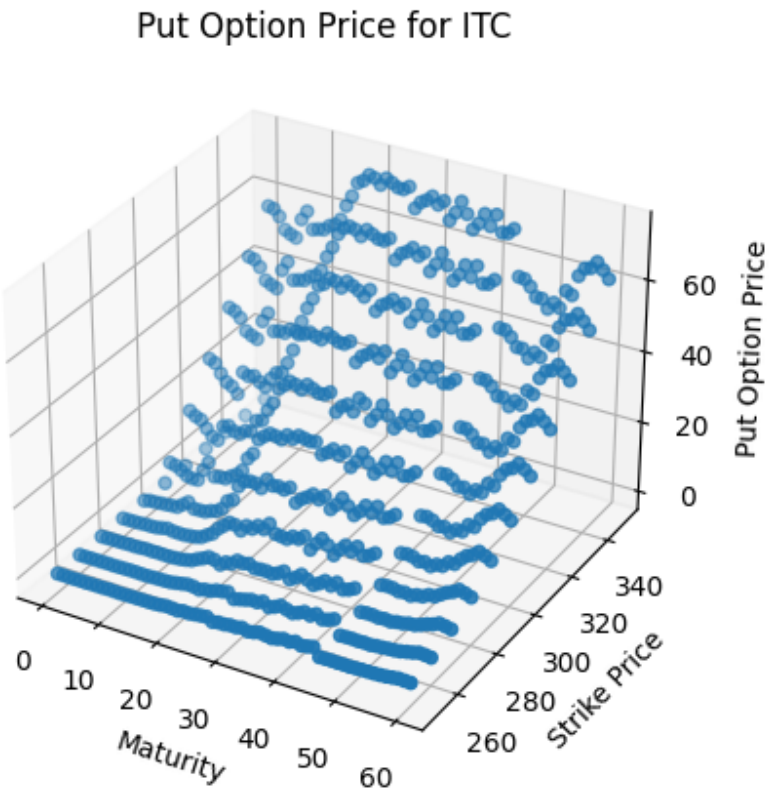
To run the code type **python3 180123021_Kartikeya_Singh_q.py** into the terminal.

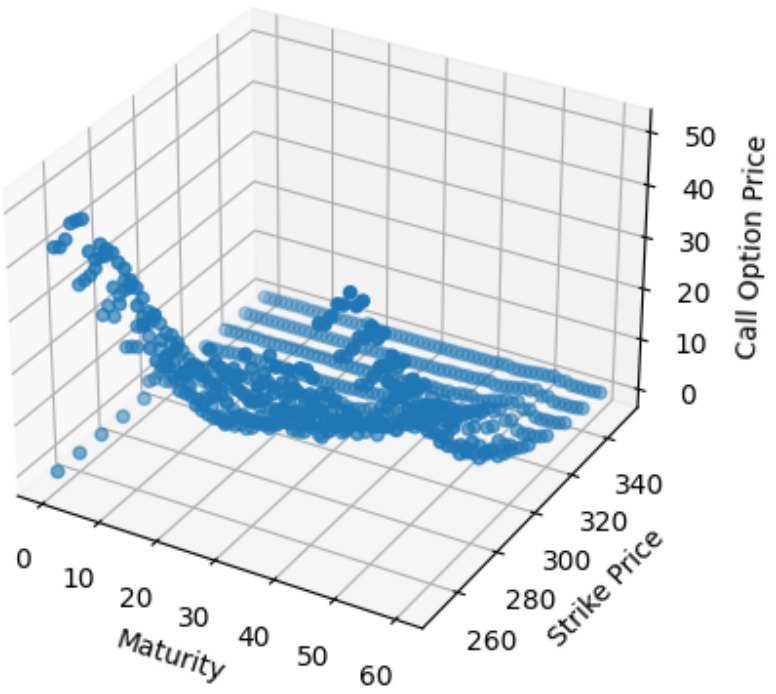
Question 1

The data of option prices is collected for the companies -
['NIFTY', 'CIPLA', 'COALINDIA', 'ICICI', 'ITC']

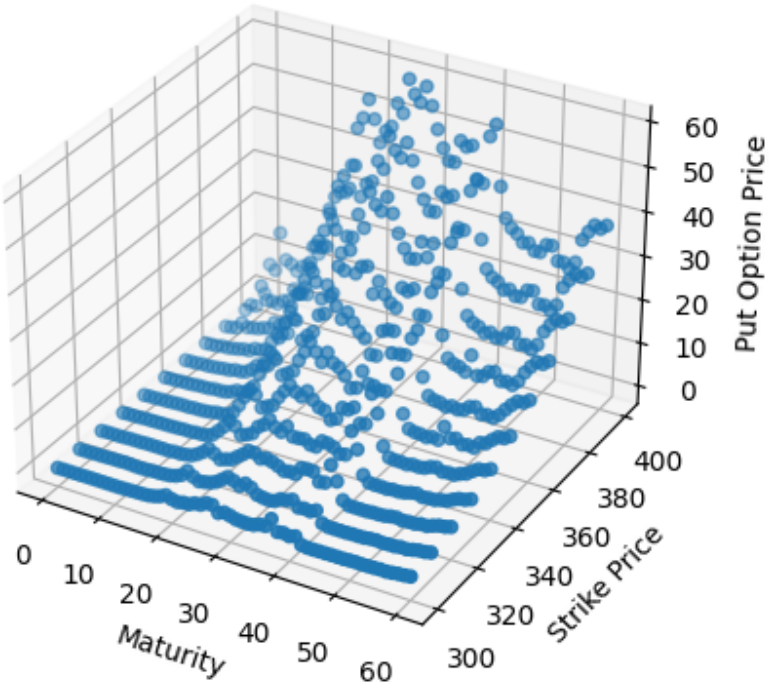
Question 2

The 3-D graphs are -

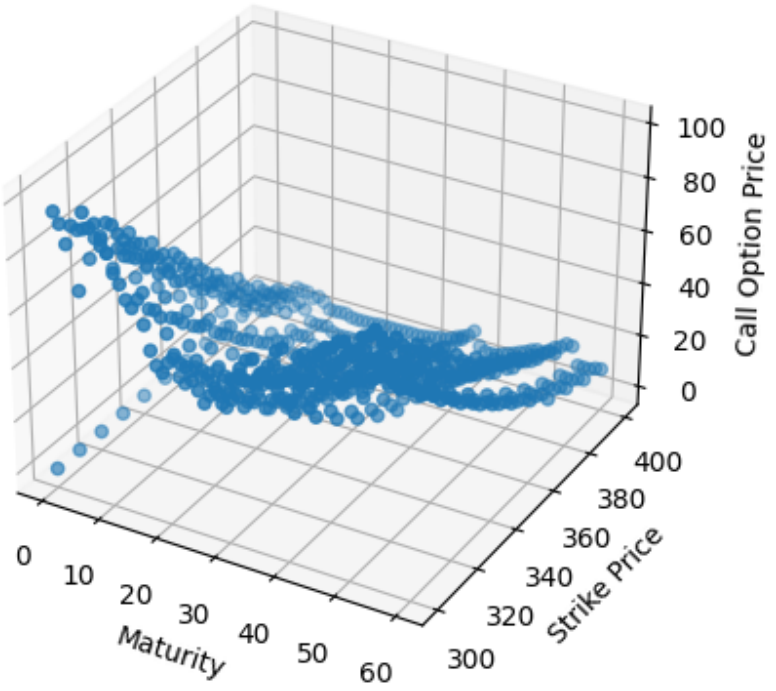


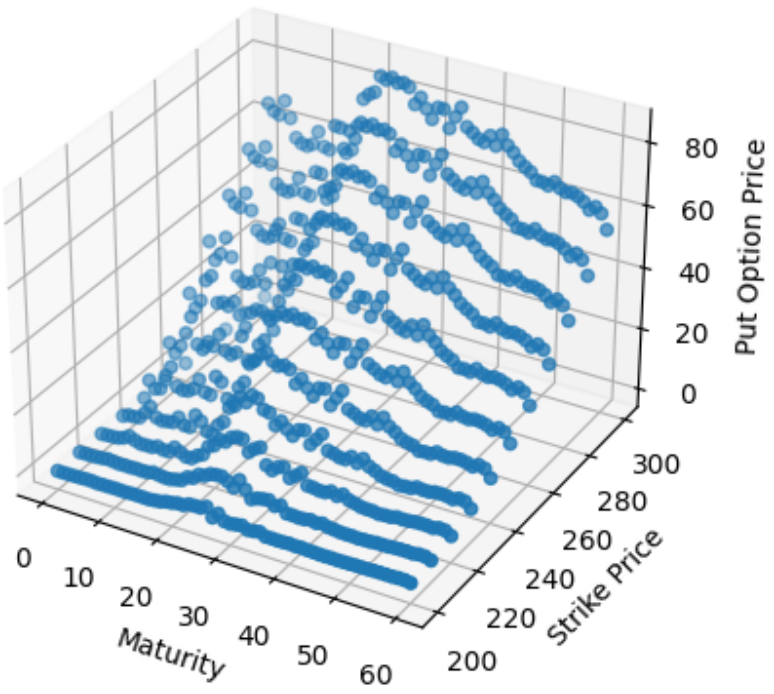

Call Option Price for ITC
Call Option Price
0
10
20
30
40
50
Strike Price
260
280
300
320
340
Maturity
0
10
20
30
40
50
60

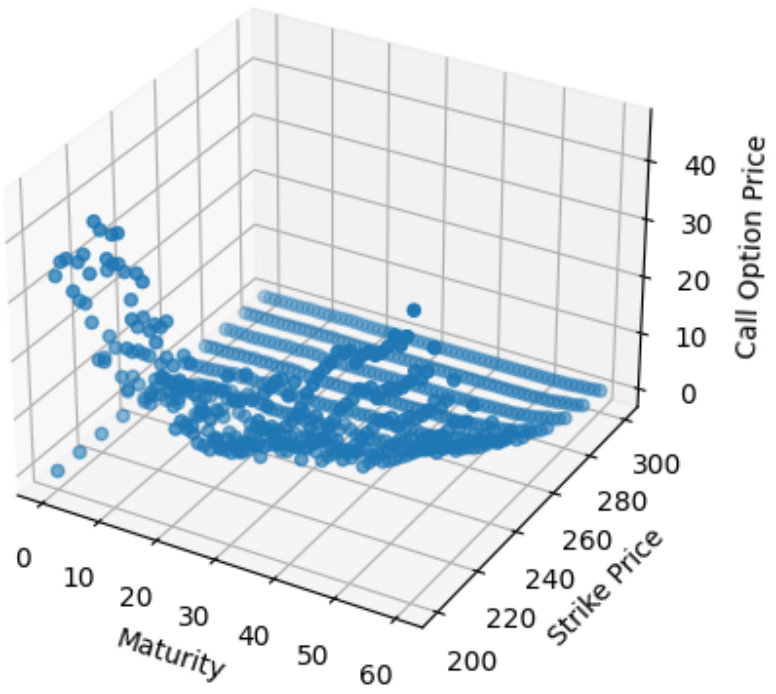
Put Option Price for ICICI

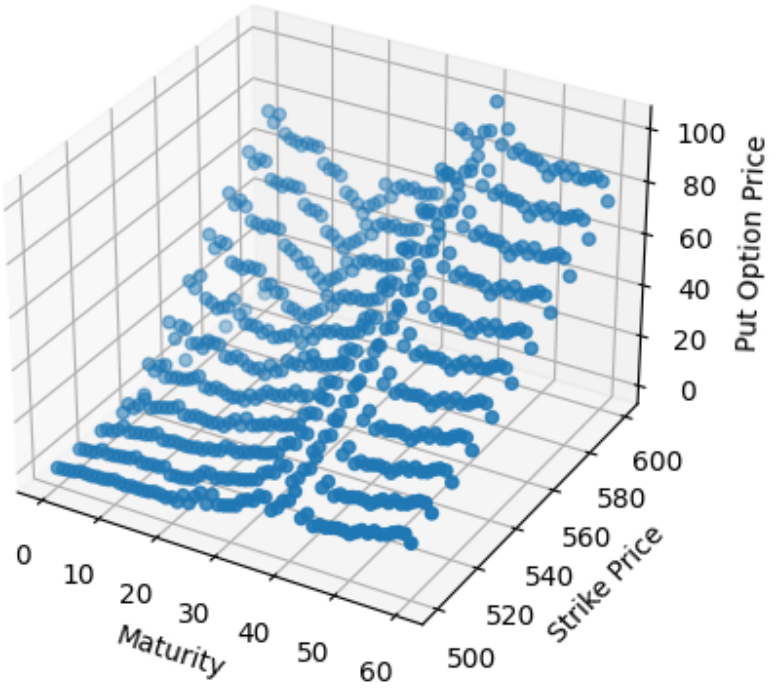


Call Option Price for ICICI

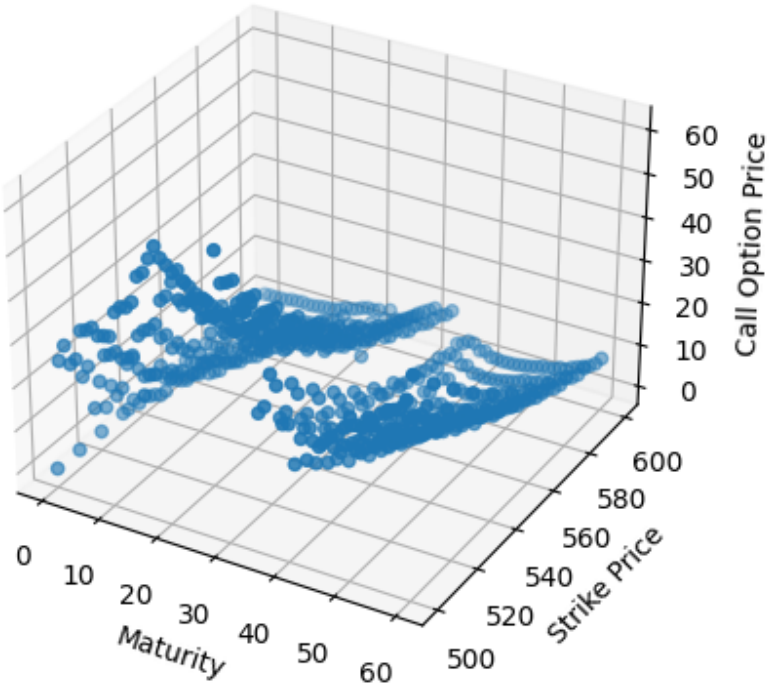


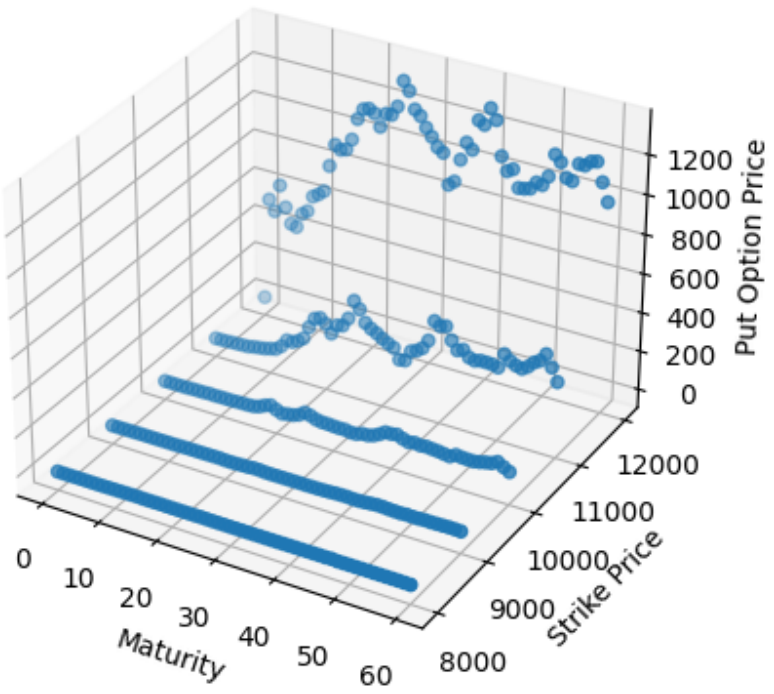

Put Option Price for COALINDIA
Put Option Price
0
20
40
60
80
Strike Price
200
220
240
260
280
300
Maturity
0
10
20
30
40
50
60

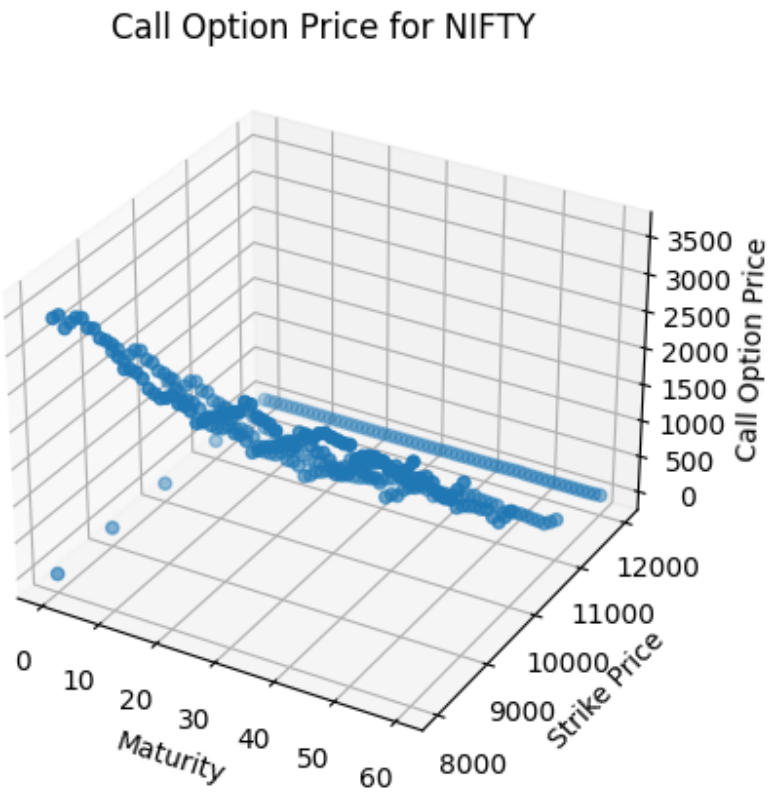

Call Option Price for COALINDIA
Call Option Price
0
10
20
30
40
Strike Price
200
220
240
260
280
300
Maturity
0
10
20
30
40
50
60


Put Option Price for CIPLA
Put Option Price
100
80
60
40
20
0
Strike Price
600
580
560
540
520
500
Maturity
0
10
20
30
40
50
60

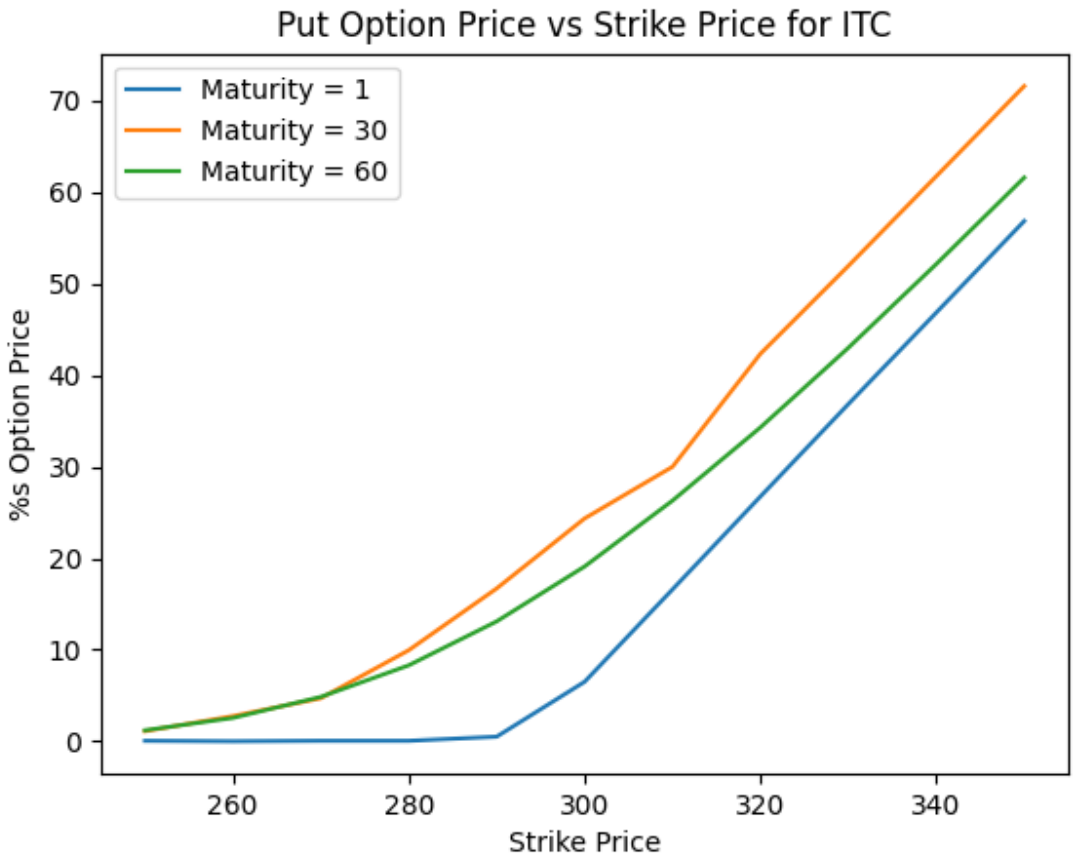
Call Option Price for CIPLA

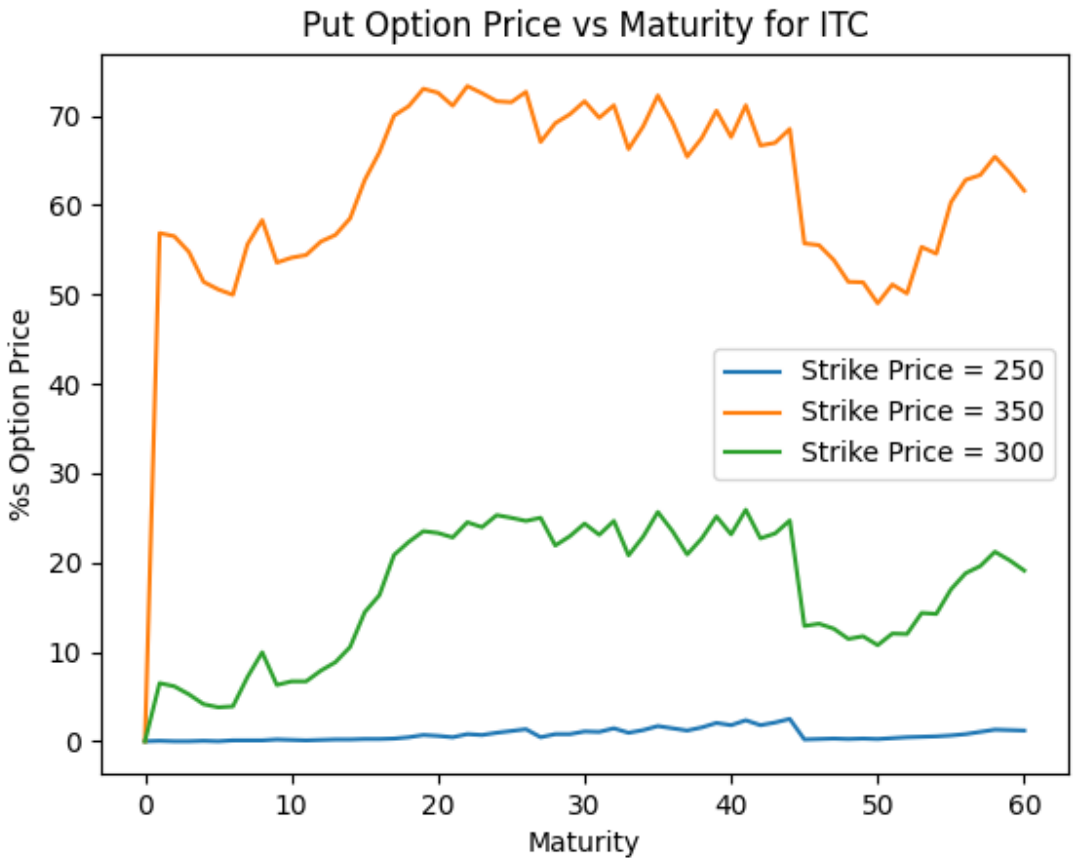


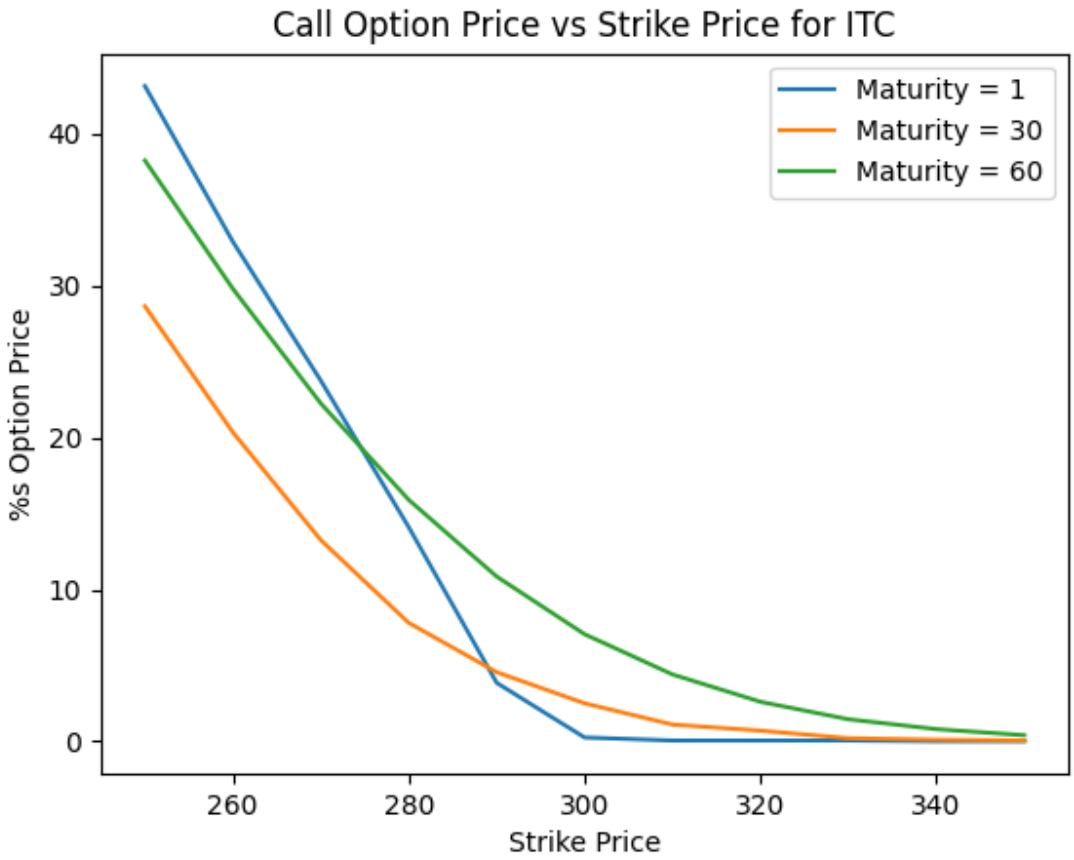

Put Option Price for NIFTY
Put Option Price
1200
1000
800
600
400
200
0
12000
11000
10000
9000
8000
Strike Price
0
10
20
30
40
50
60
Maturity

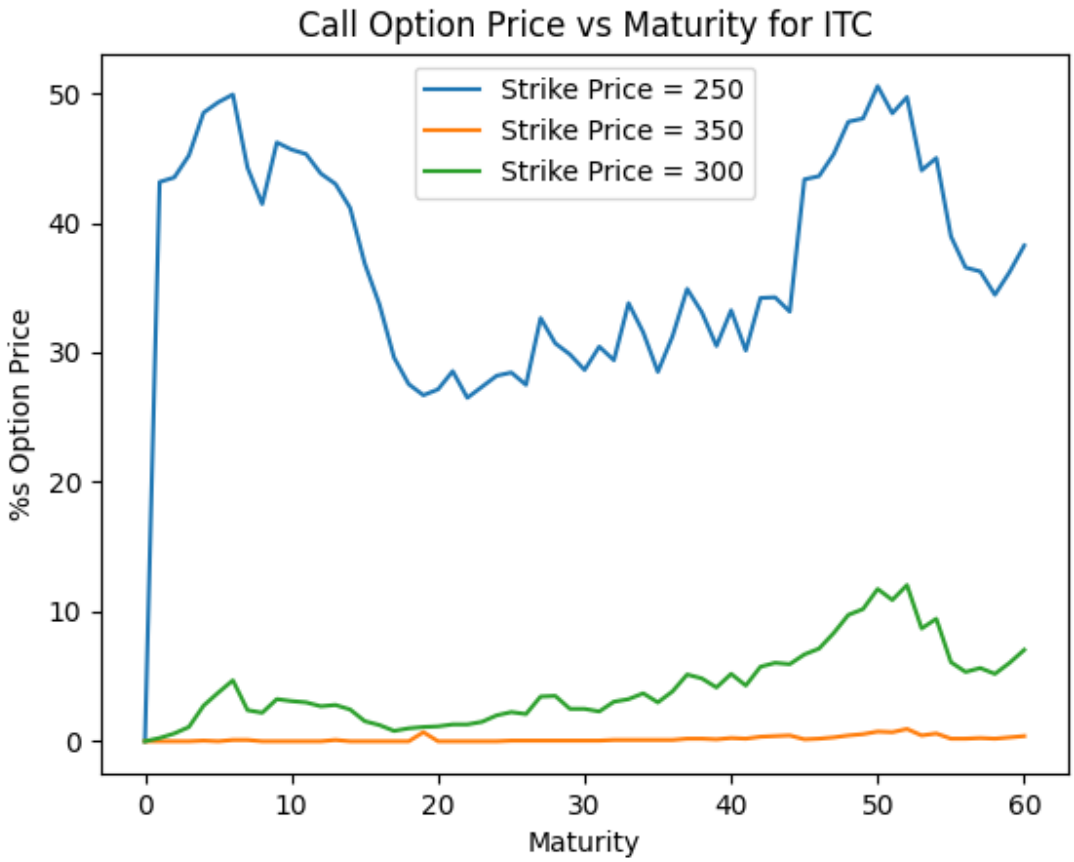


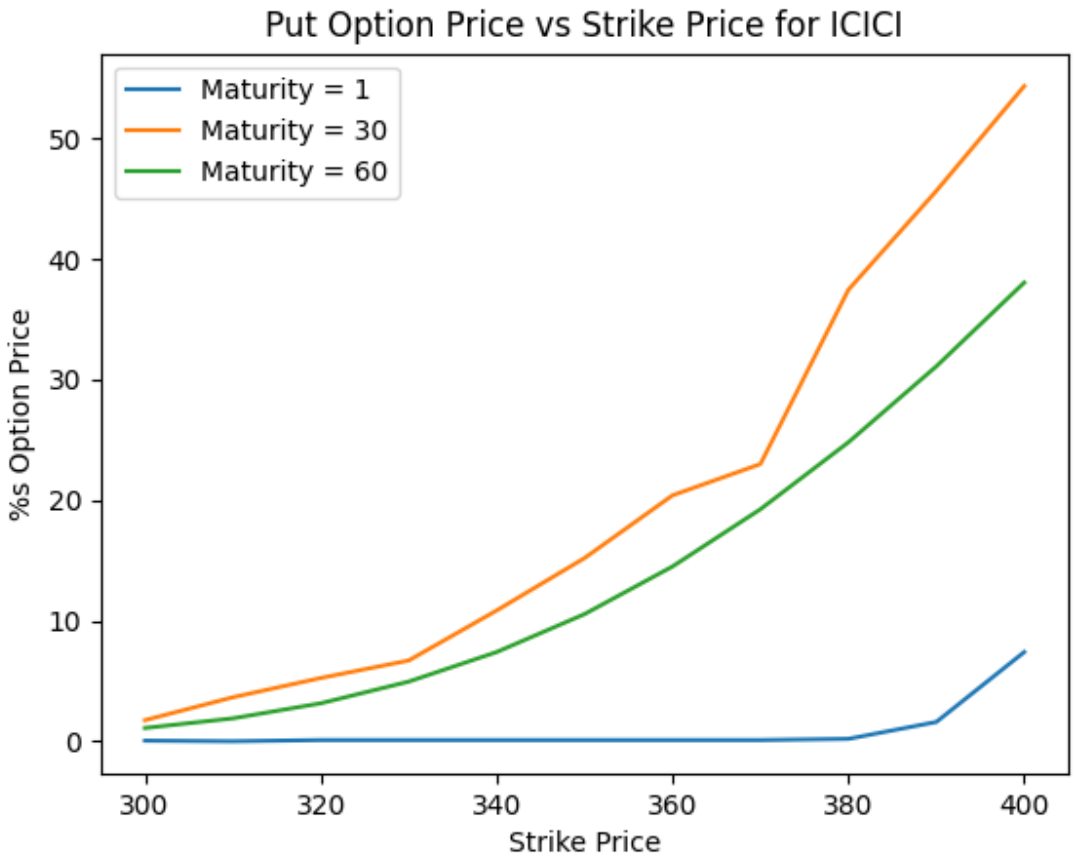
The 2-D graphs are -

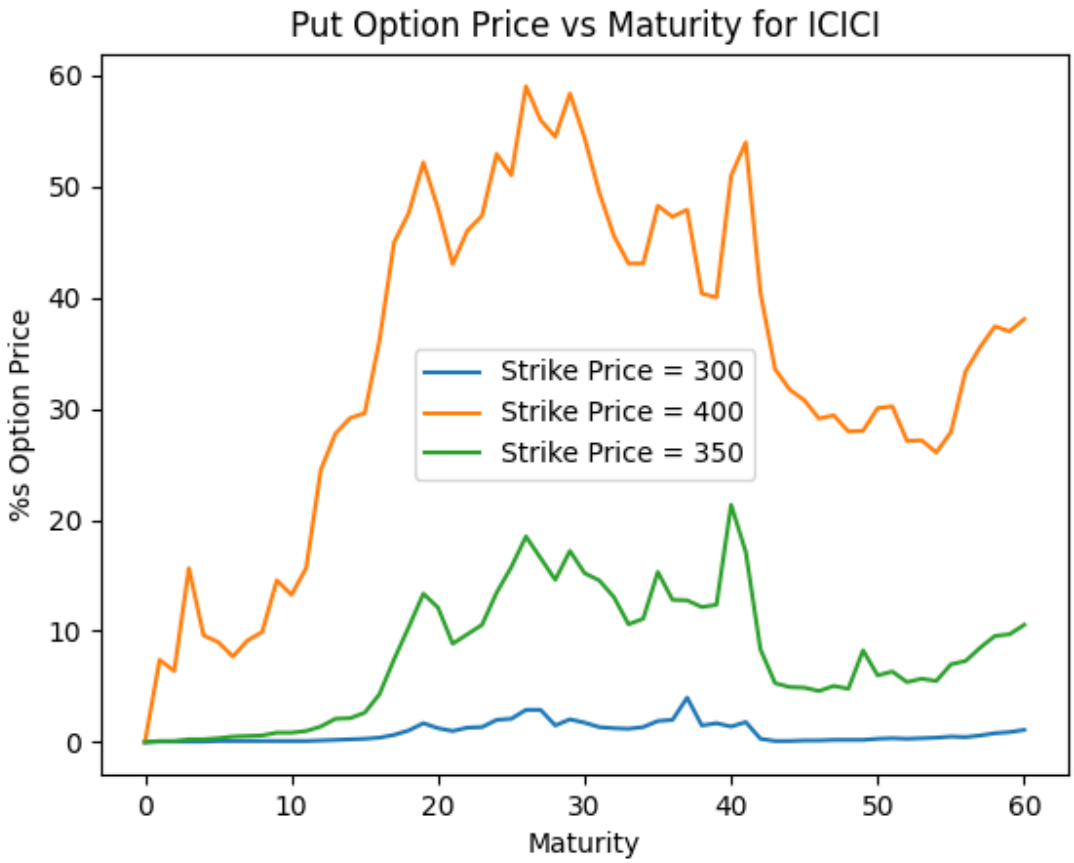

Put Option Price vs Strike Price for ITC
Maturity = 1
Maturity = 30
Maturity = 60
%s Option Price
Strike Price
0
10
20
30
40
50
60
70
260
280
300
320
340

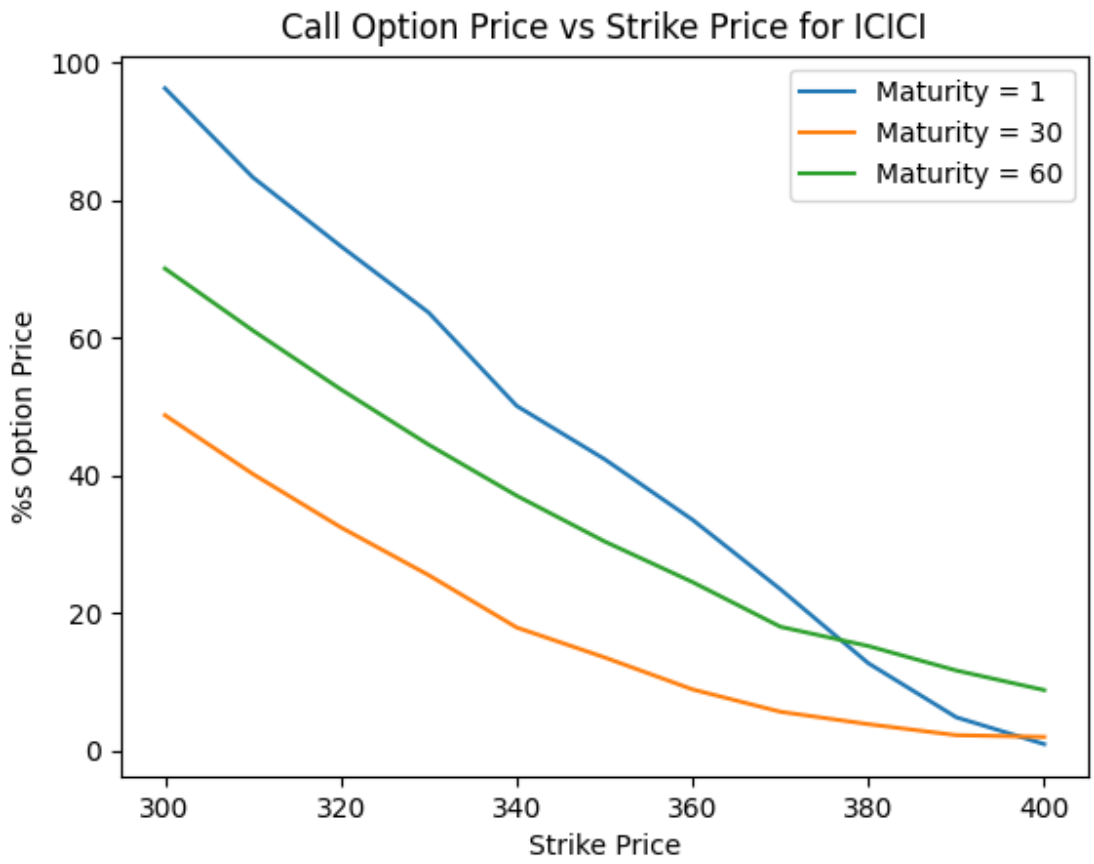

Put Option Price vs Maturity for ITC
%s Option Price
Maturity
Strike Price = 250
Strike Price = 350
Strike Price = 300
0
10
20
30
40
50
60
70

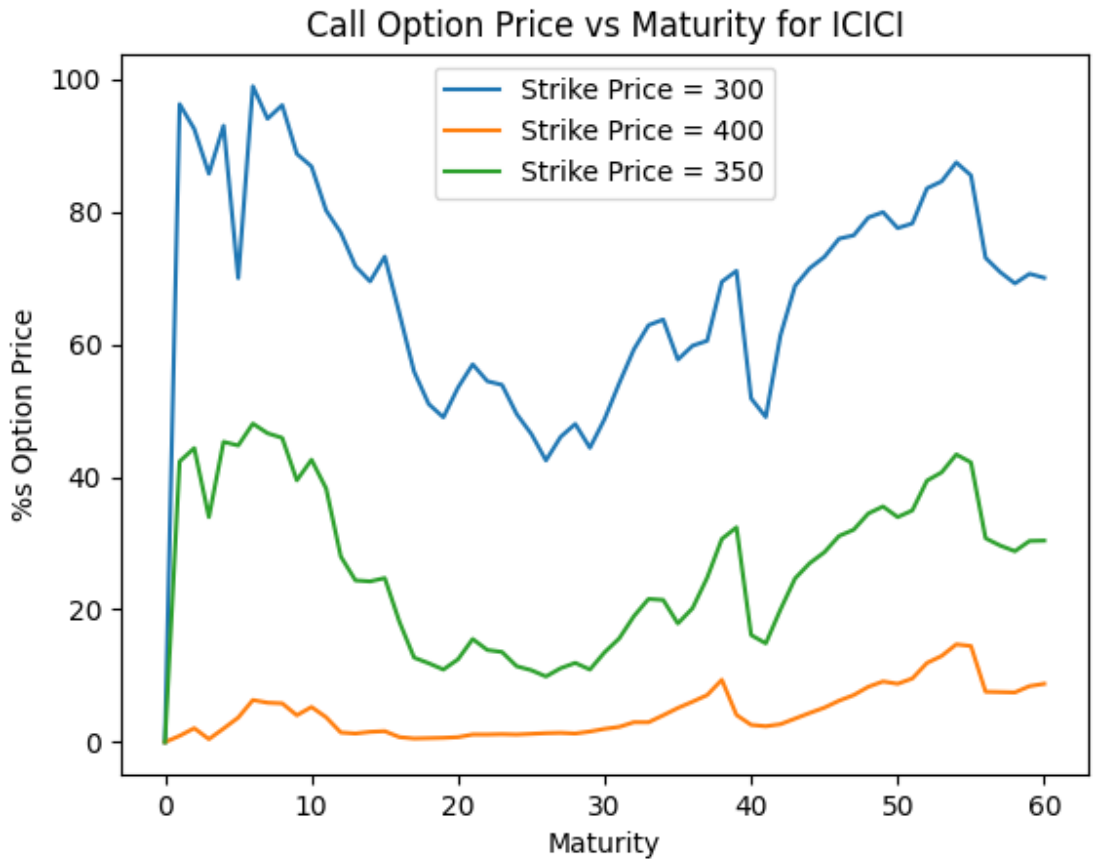

Call Option Price vs Strike Price for ITC
Maturity = 1
Maturity = 30
Maturity = 60
%s Option Price
Strike Price
0
10
20
30
40
260
280
300
320
340

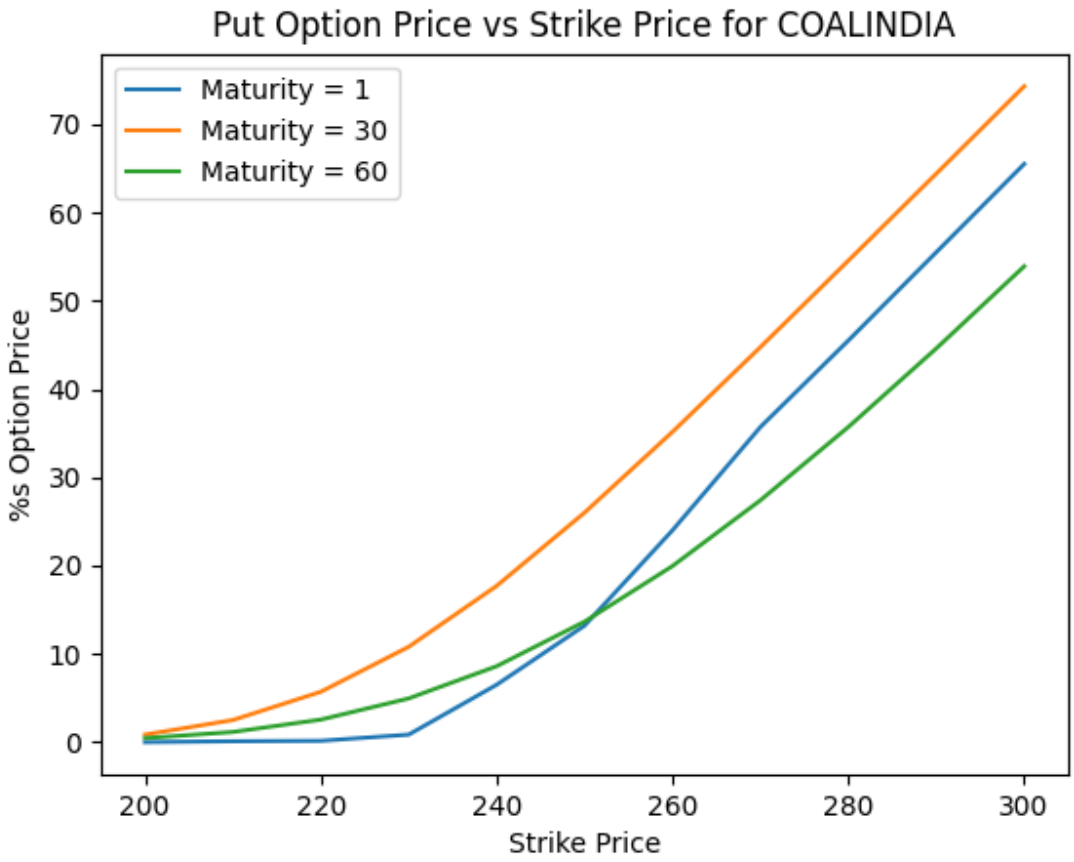

Call Option Price vs Maturity for ITC
Strike Price = 250
Strike Price = 350
Strike Price = 300
%s Option Price
Maturity
0
10
20
30
40
50
60

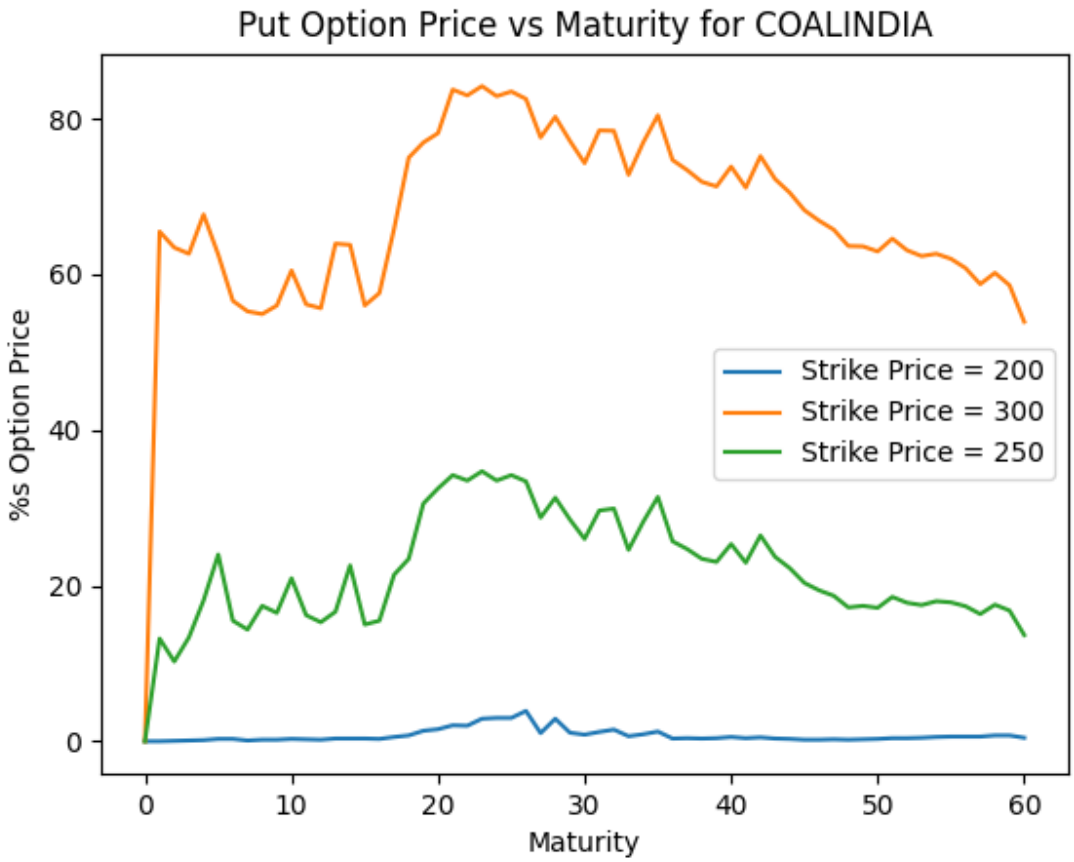

Put Option Price vs Strike Price for ICICI
Maturity = 1
Maturity = 30
Maturity = 60
%s Option Price
0
10
20
30
40
50
300
320
340
360
380
400
Strike Price

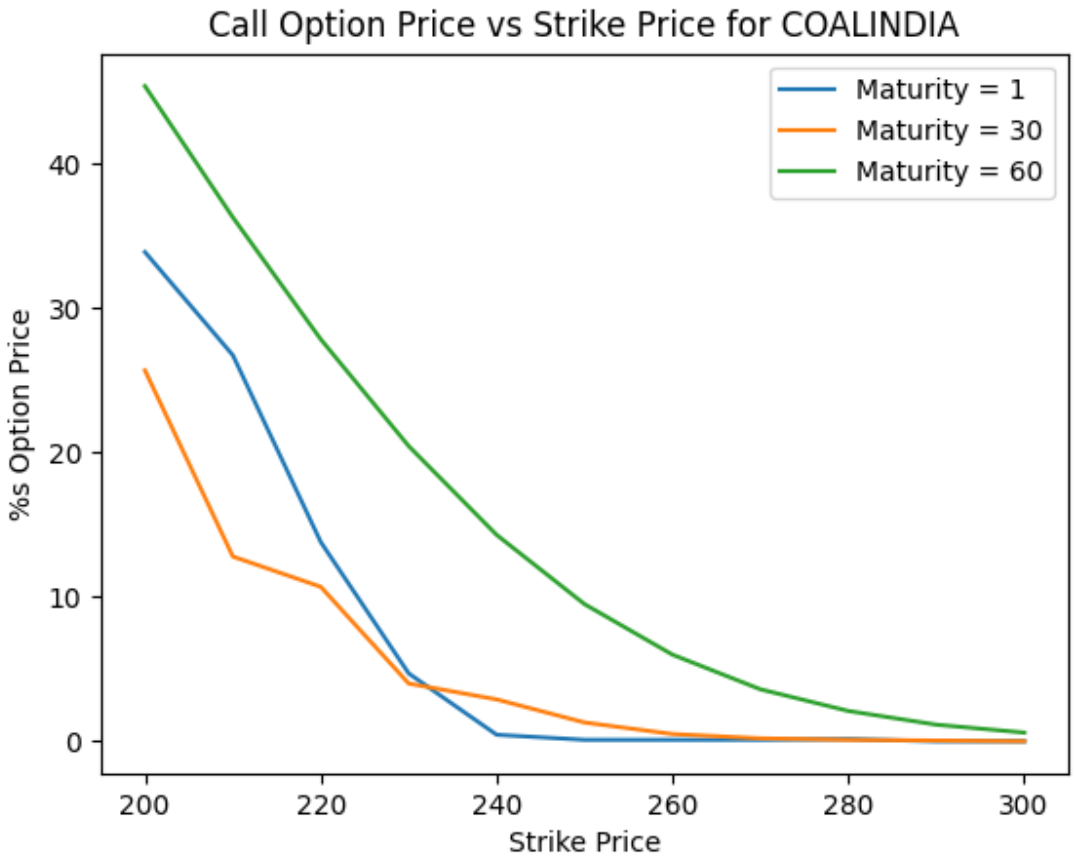

Put Option Price vs Maturity for ICICI
%s Option Price
Maturity
Strike Price = 300
Strike Price = 400
Strike Price = 350
0
10
20
30
40
50
60

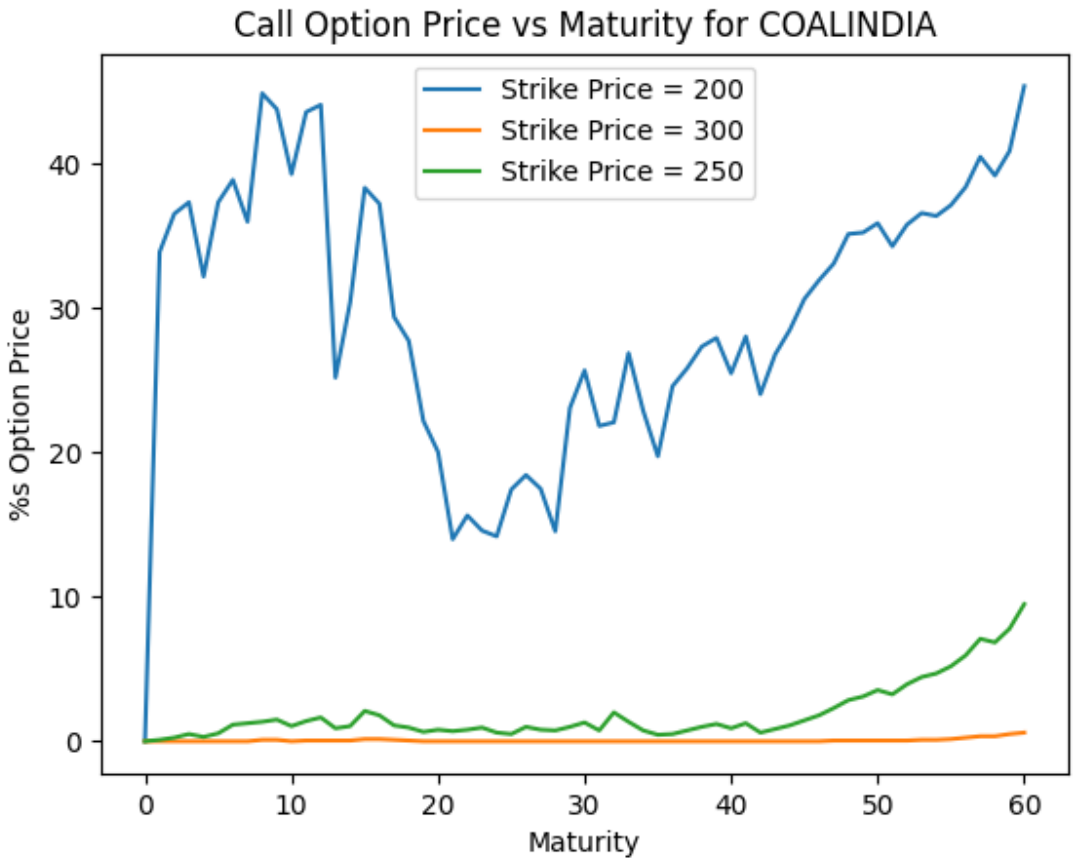

Call Option Price vs Strike Price for ICICI
Maturity = 1
Maturity = 30
Maturity = 60
%s Option Price
Strike Price
100
80
60
40
20
0
300
320
340
360
380
400

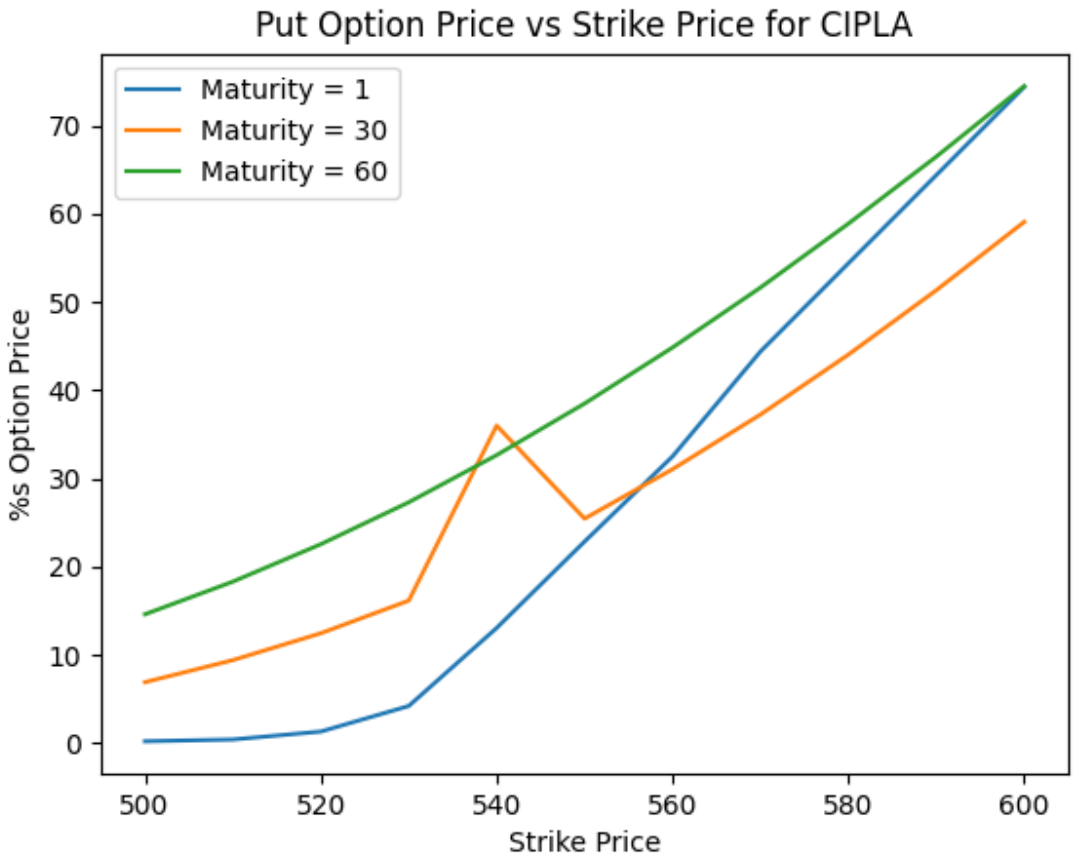

Call Option Price vs Maturity for ICICI
Strike Price = 300
Strike Price = 400
Strike Price = 350
%s Option Price
Maturity
0
20
40
60
80
100
0
10
20
30
40
50
60

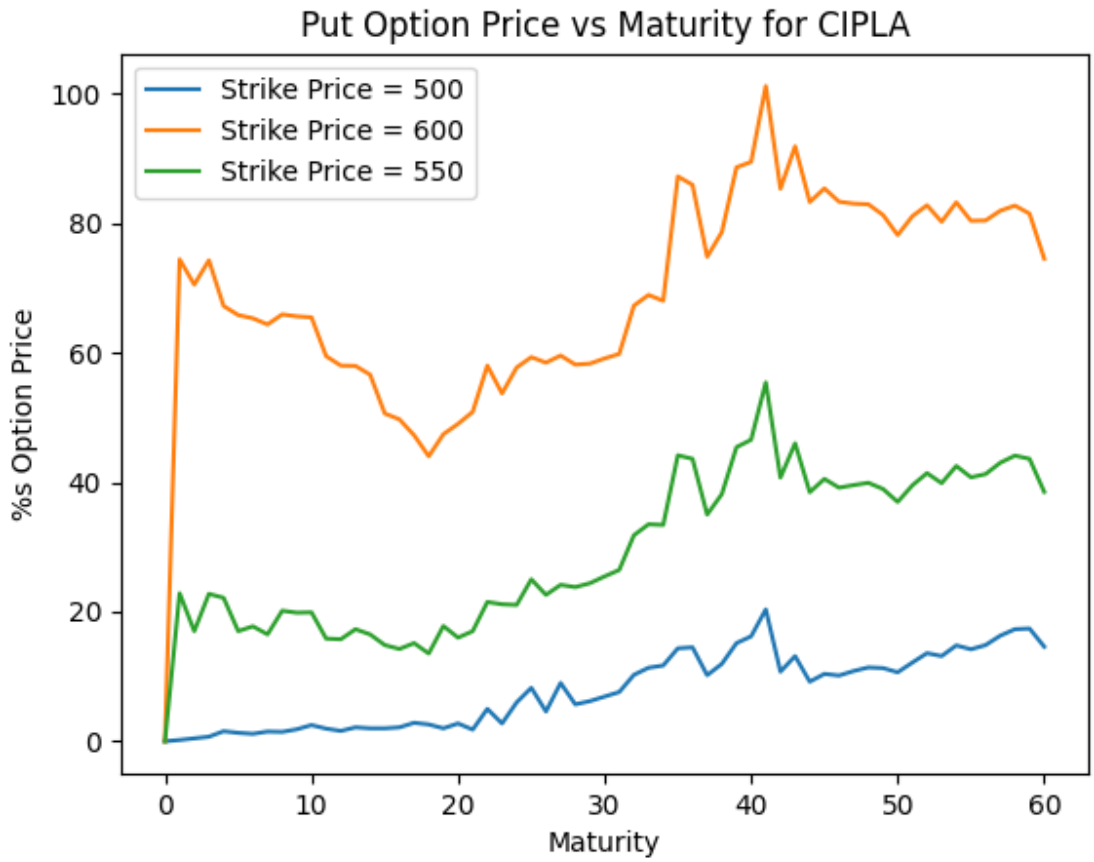

Put Option Price vs Strike Price for COALINDIA
Maturity = 1
Maturity = 30
Maturity = 60
%s Option Price
Strike Price
0
10
20
30
40
50
60
70
200
220
240
260
280
300

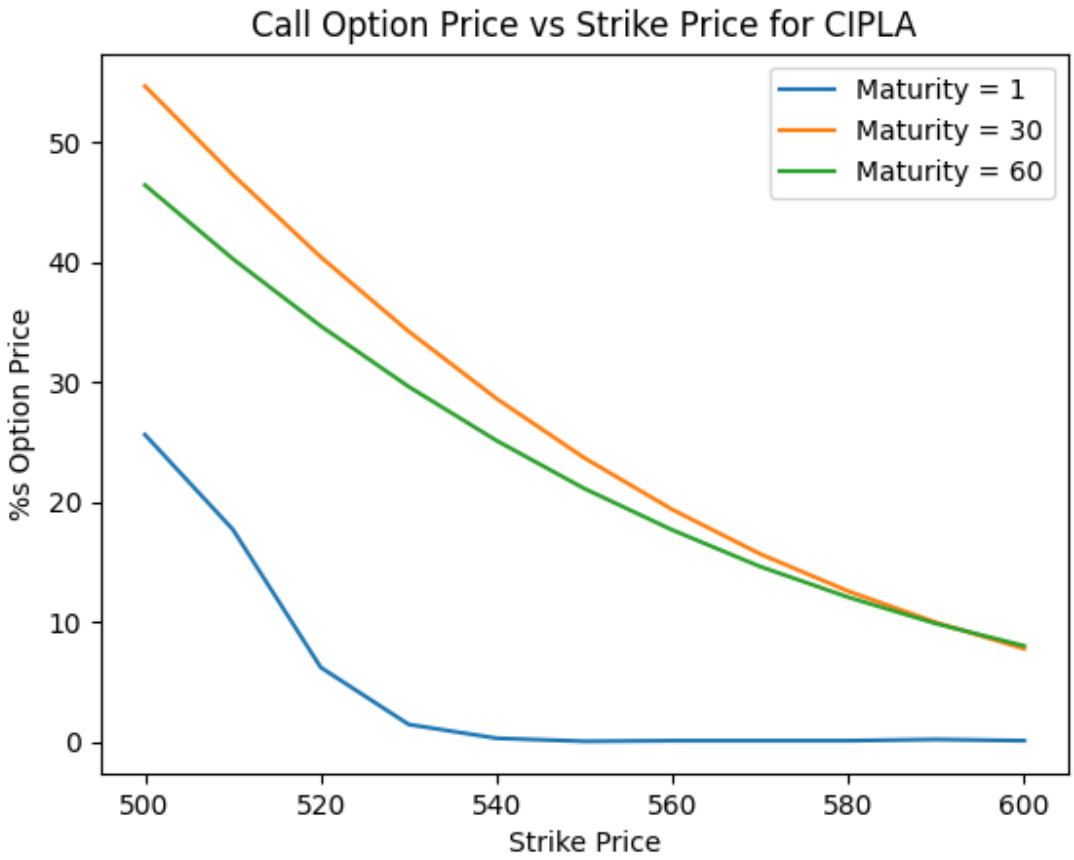

Put Option Price vs Maturity for COALINDIA
%s Option Price
Maturity
Strike Price = 200
Strike Price = 300
Strike Price = 250
0
20
40
60
80
0
10
20
30
40
50
60

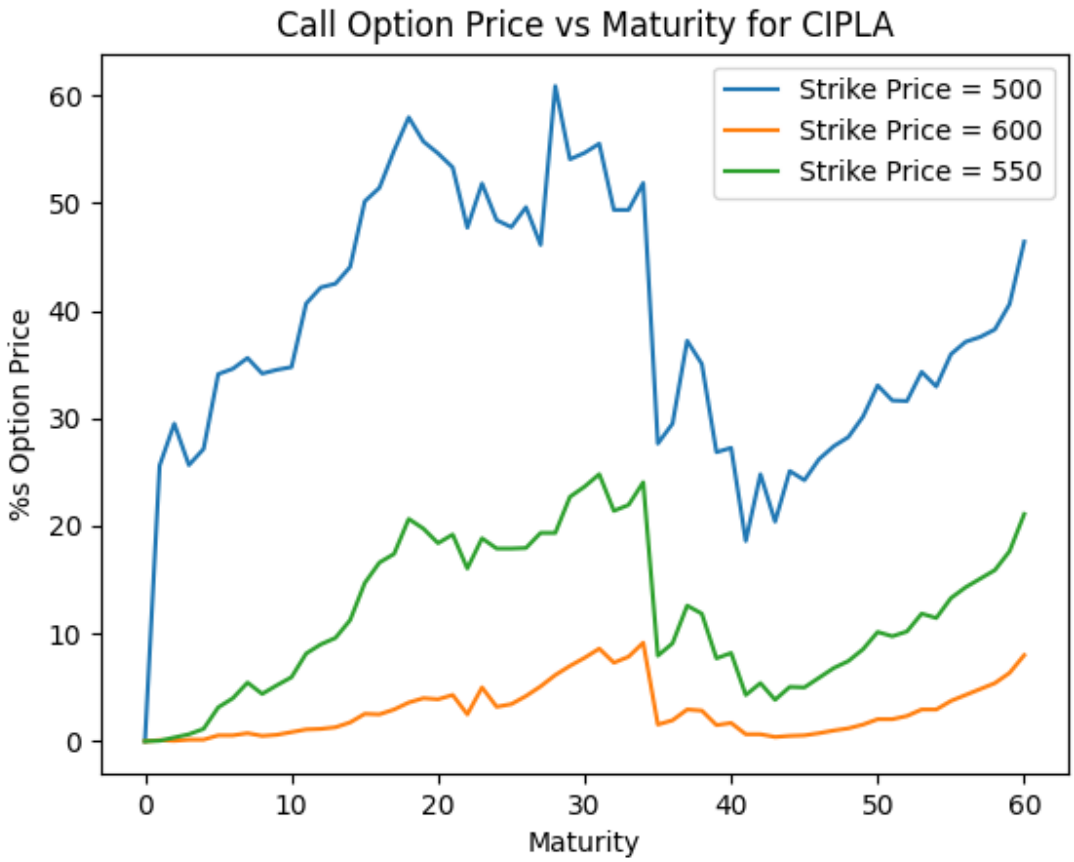

Call Option Price vs Strike Price for COALINDIA
Maturity = 1
Maturity = 30
Maturity = 60
%s Option Price
0
10
20
30
40
200
220
240
260
280
300
Strike Price

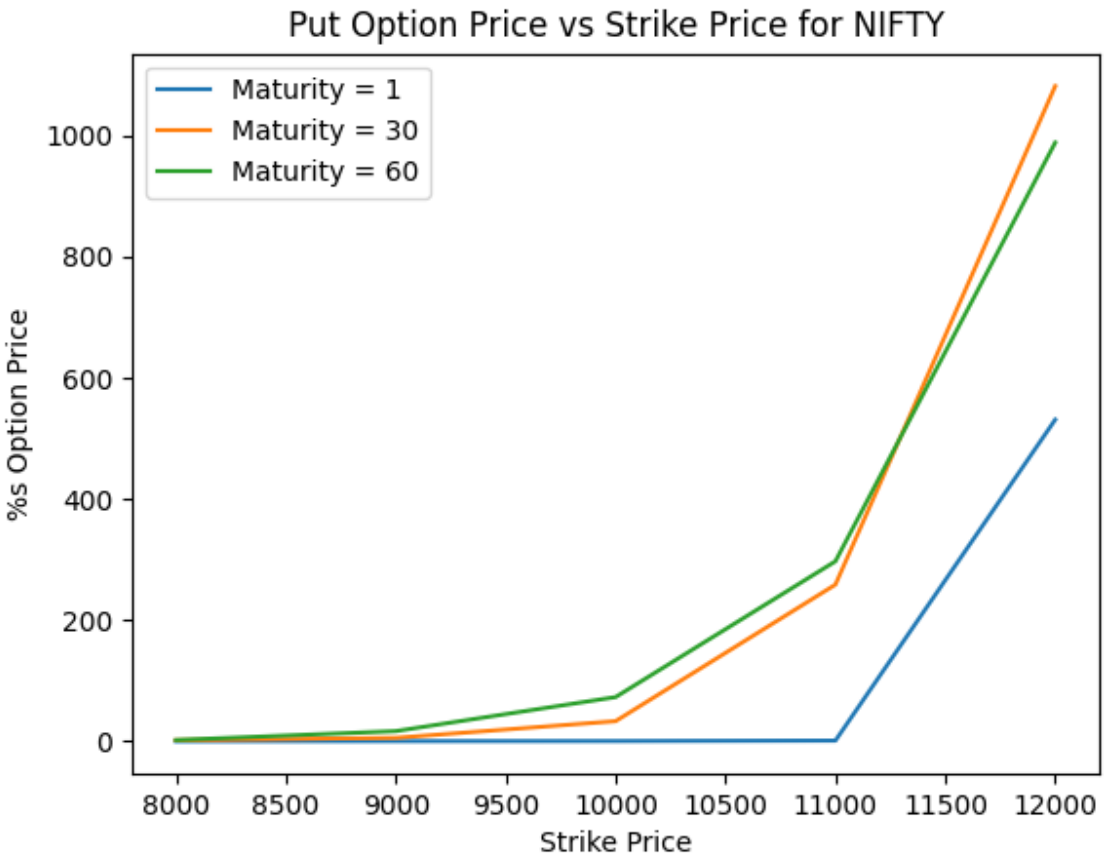

Call Option Price vs Maturity for COALINDIA
Strike Price = 200
Strike Price = 300
Strike Price = 250
%s Option Price
Maturity
0
10
20
30
40
50
60

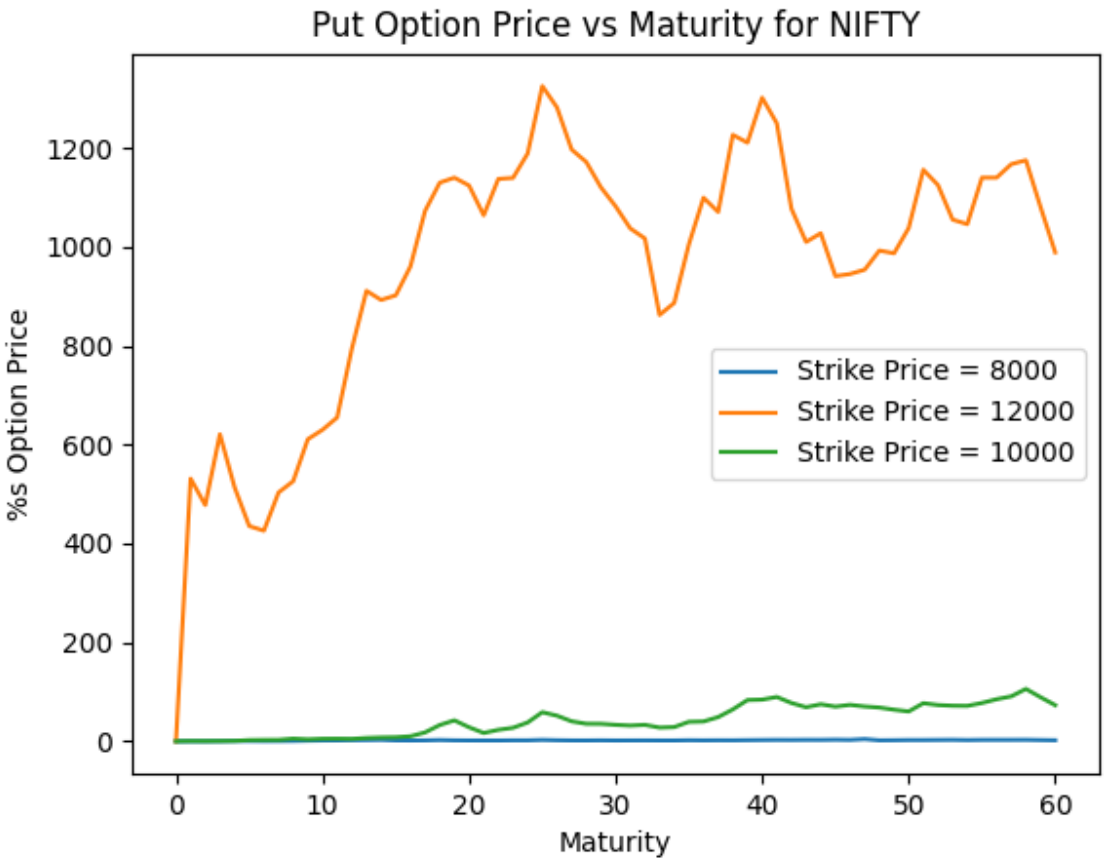

Put Option Price vs Strike Price for CIPLA
Maturity = 1
Maturity = 30
Maturity = 60
%s Option Price
0
10
20
30
40
50
60
70
500
520
540
560
580
600
Strike Price

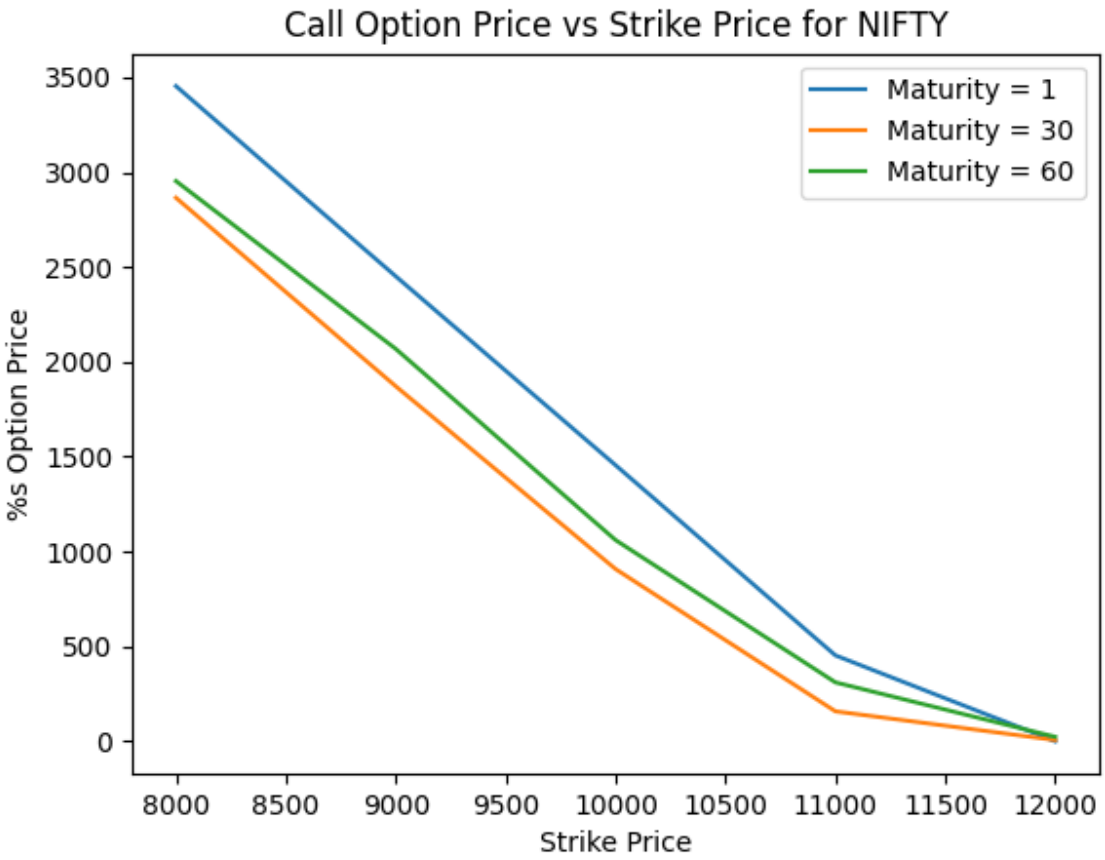

Put Option Price vs Maturity for CIPLA
Strike Price = 500
Strike Price = 600
Strike Price = 550
%s Option Price
Maturity
0
20
40
60
80
100
0
10
20
30
40
50
60

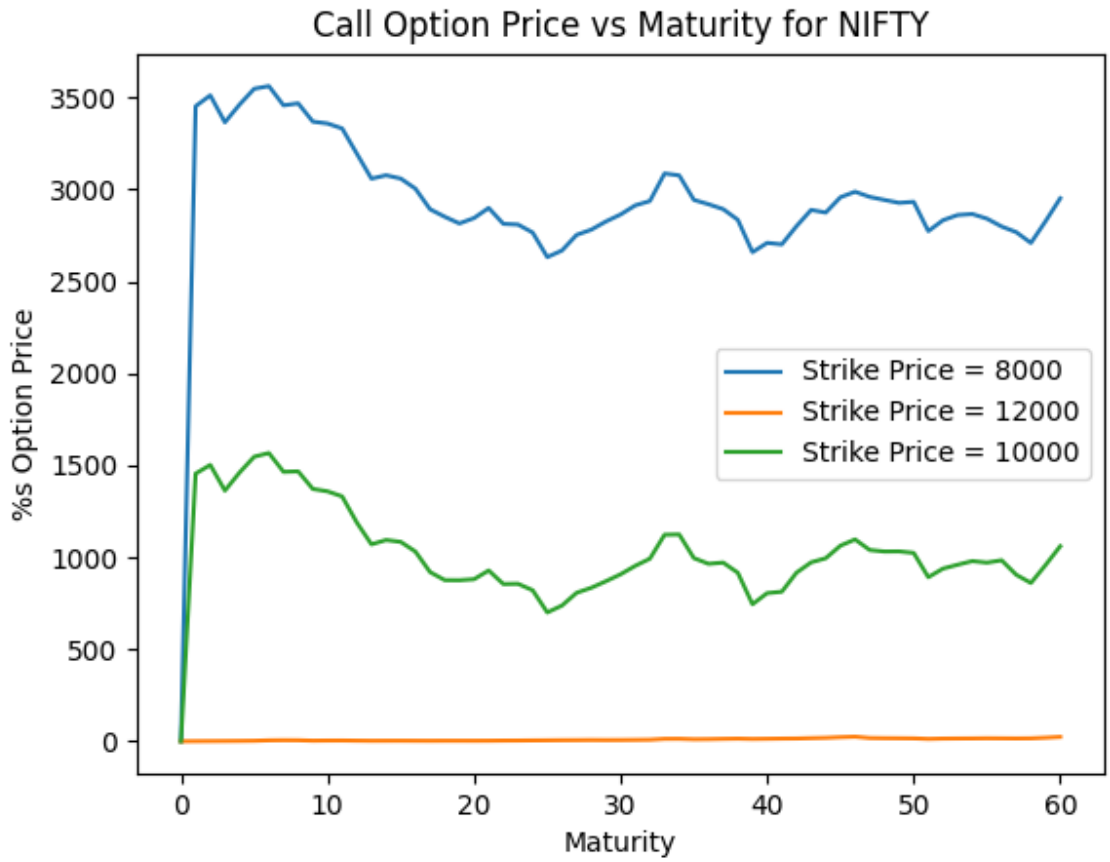

Call Option Price vs Strike Price for CIPLA
Maturity = 1
Maturity = 30
Maturity = 60
%s Option Price
0
10
20
30
40
50
500
520
540
560
580
600
Strike Price


Call Option Price vs Maturity for CIPLA
Strike Price = 500
Strike Price = 600
Strike Price = 550
%s Option Price
Maturity
0
10
20
30
40
50
60


Put Option Price vs Strike Price for NIFTY
Maturity = 1
Maturity = 30
Maturity = 60
%s Option Price
0
200
400
600
800
1000
8000
8500
9000
9500
10000
10500
11000
11500
12000
Strike Price

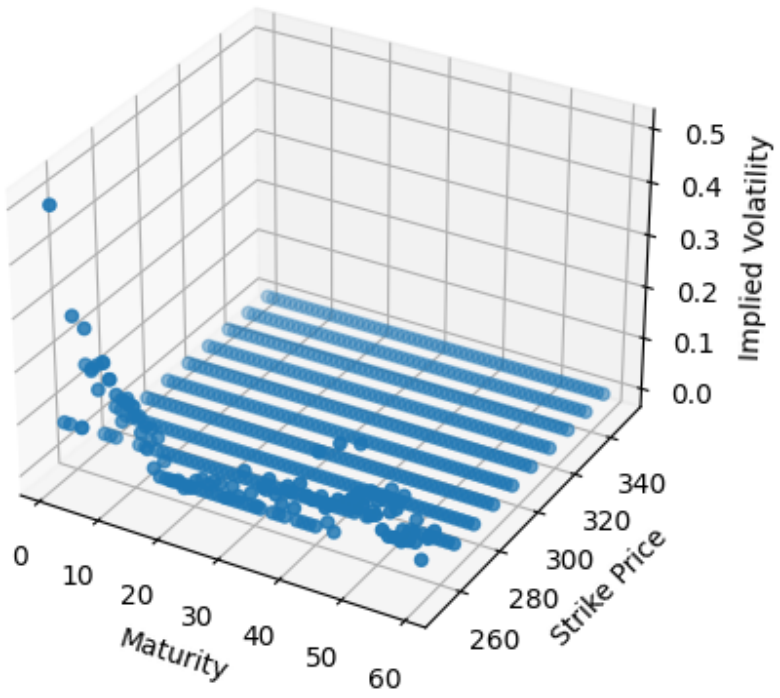

Put Option Price vs Maturity for NIFTY
%s Option Price
Maturity
0
200
400
600
800
1000
1200
0
10
20
30
40
50
60
Strike Price = 8000
Strike Price = 12000
Strike Price = 10000

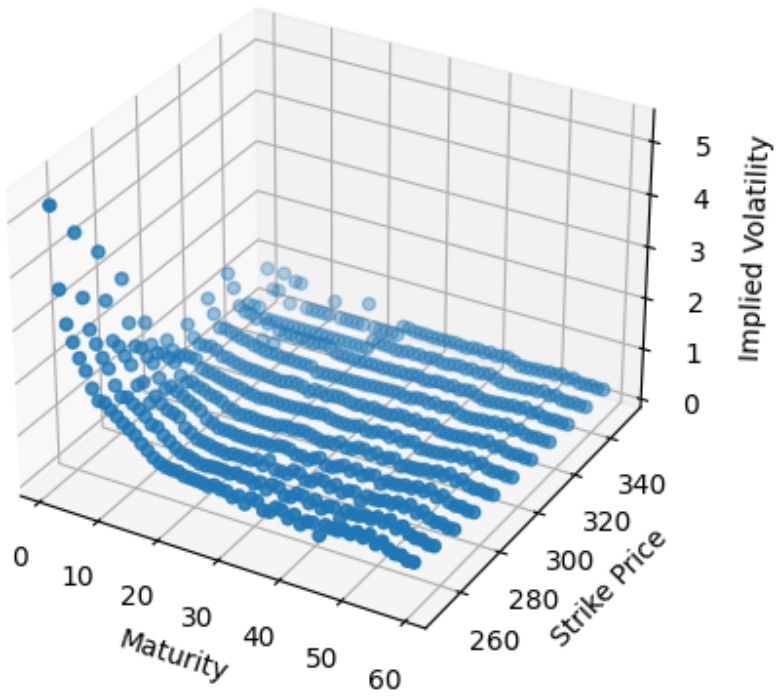

Call Option Price vs Strike Price for NIFTY
Maturity = 1
Maturity = 30
Maturity = 60
%s Option Price
Strike Price
3500
3000
2500
2000
1500
1000
500
0
8000
8500
9000
9500
10000
10500
11000
11500
12000

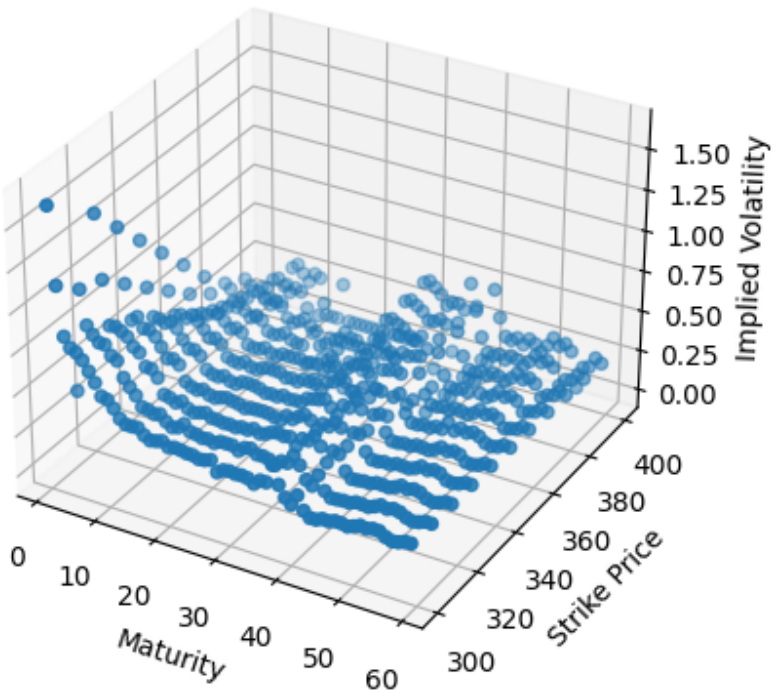


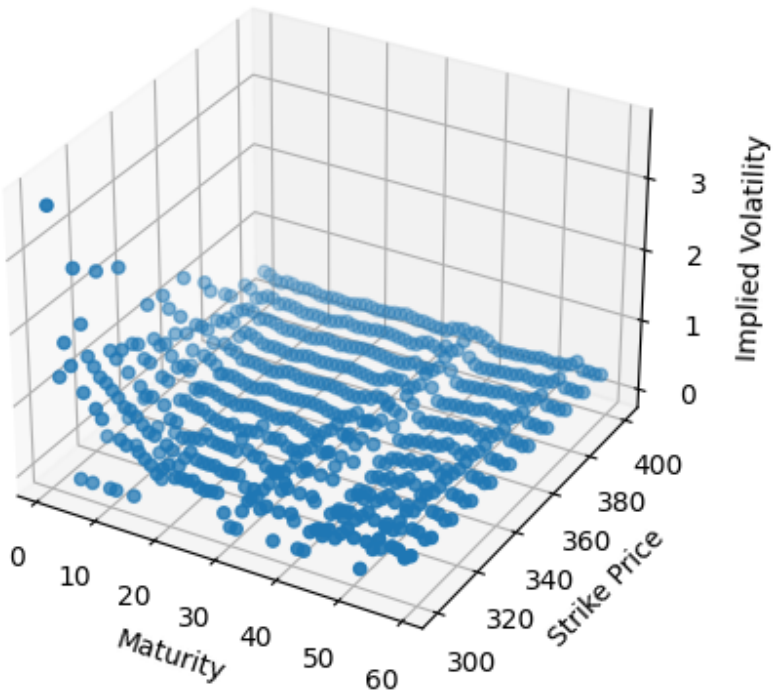
Question 3

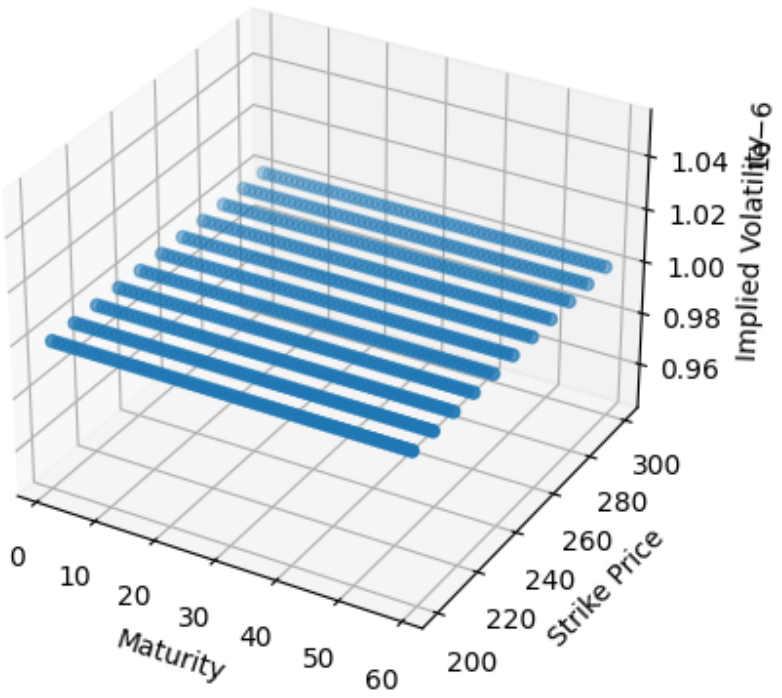
The bisection method is used to calculate the implied volatility. The implied volatility is varied against strike price and maturity. The 3-D graphs are -

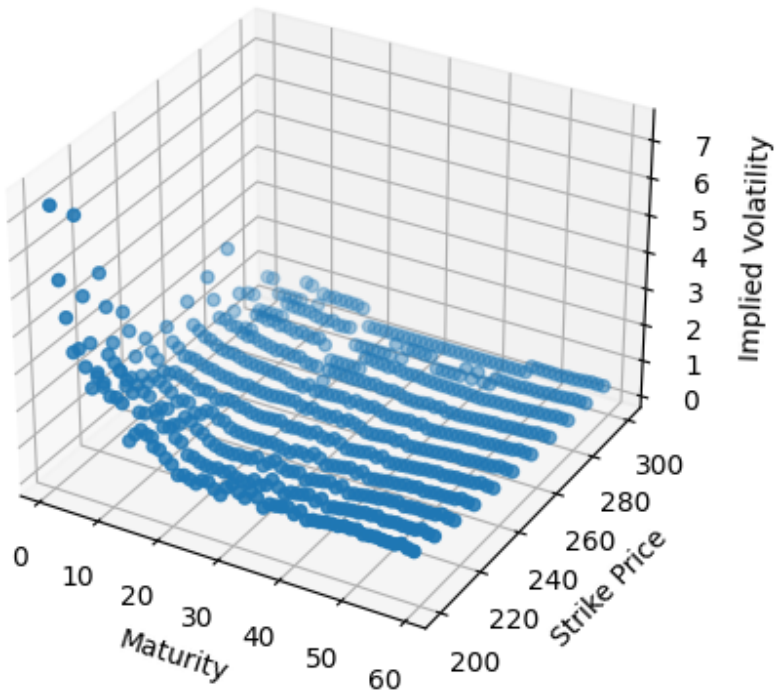

Put Implied Volatility for ITC
Implied Volatility
0.0
0.1
0.2
0.3
0.4
0.5
Strike Price
260
280
300
320
340
Maturity
0
10
20
30
40
50
60

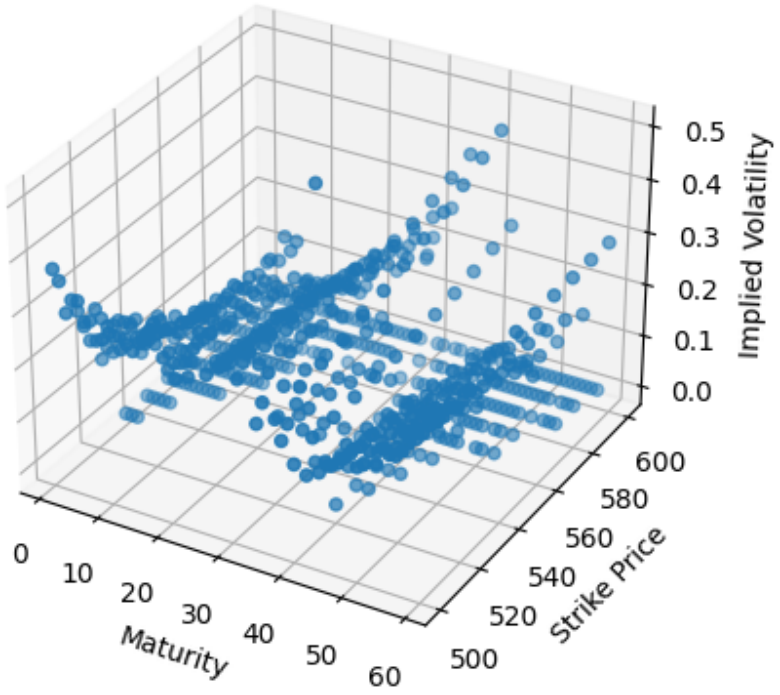

Call Implied Volatility for ITC
Implied Volatility
0
1
2
3
4
5
Strike Price
260
280
300
320
340
Maturity
0
10
20
30
40
50
60

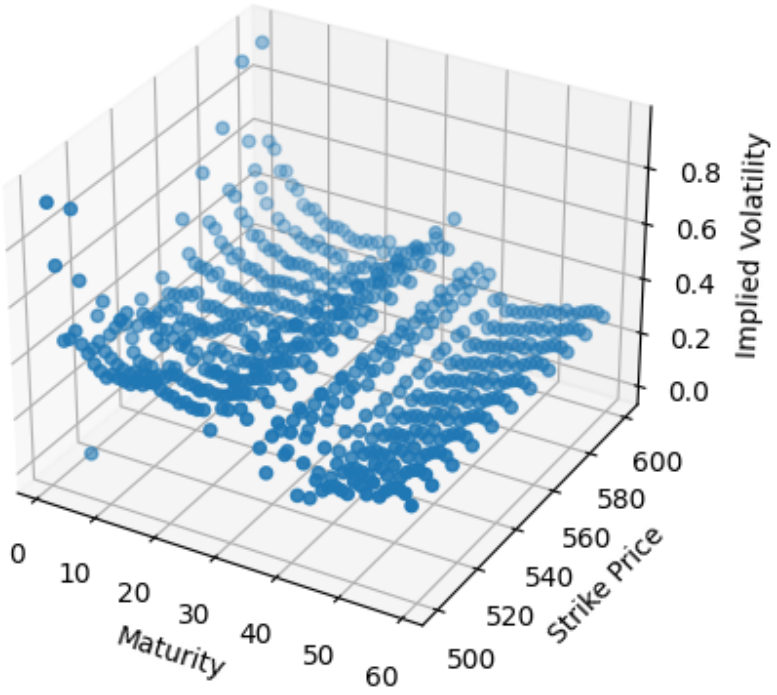

Put Implied Volatility for ICICI
Implied Volatility
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Strike Price
400
380
360
340
320
300
Maturity
0
10
20
30
40
50
60

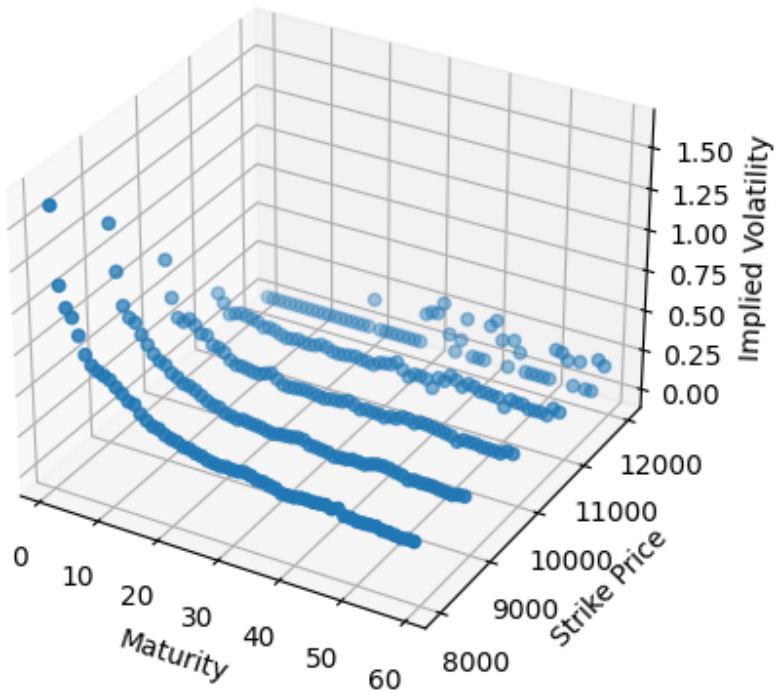

Call Implied Volatility for ICICI
Implied Volatility
0
1
2
3
Strike Price
300
320
340
360
380
400
Maturity
0
10
20
30
40
50
60

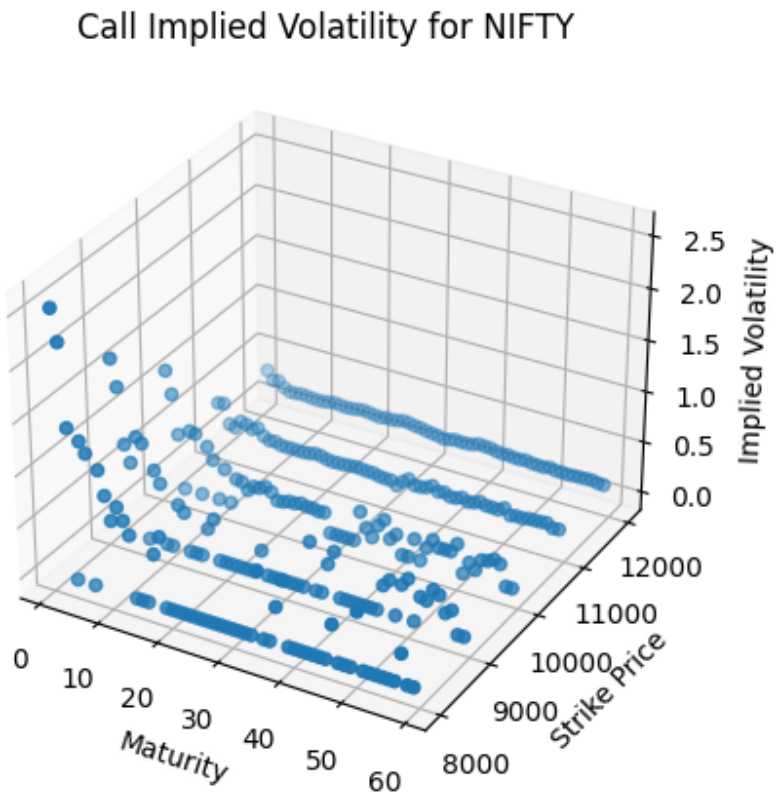

Put Implied Volatility for COALINDIA
Implied Volatility
1e−6
1.04
1.02
1.00
0.98
0.96
Strike Price
300
280
260
240
220
200
Maturity
0
10
20
30
40
50
60


Call Implied Volatility for COALINDIA
Implied Volatility
0
1
2
3
4
5
6
7
Strike Price
200
220
240
260
280
300
Maturity
0
10
20
30
40
50
60

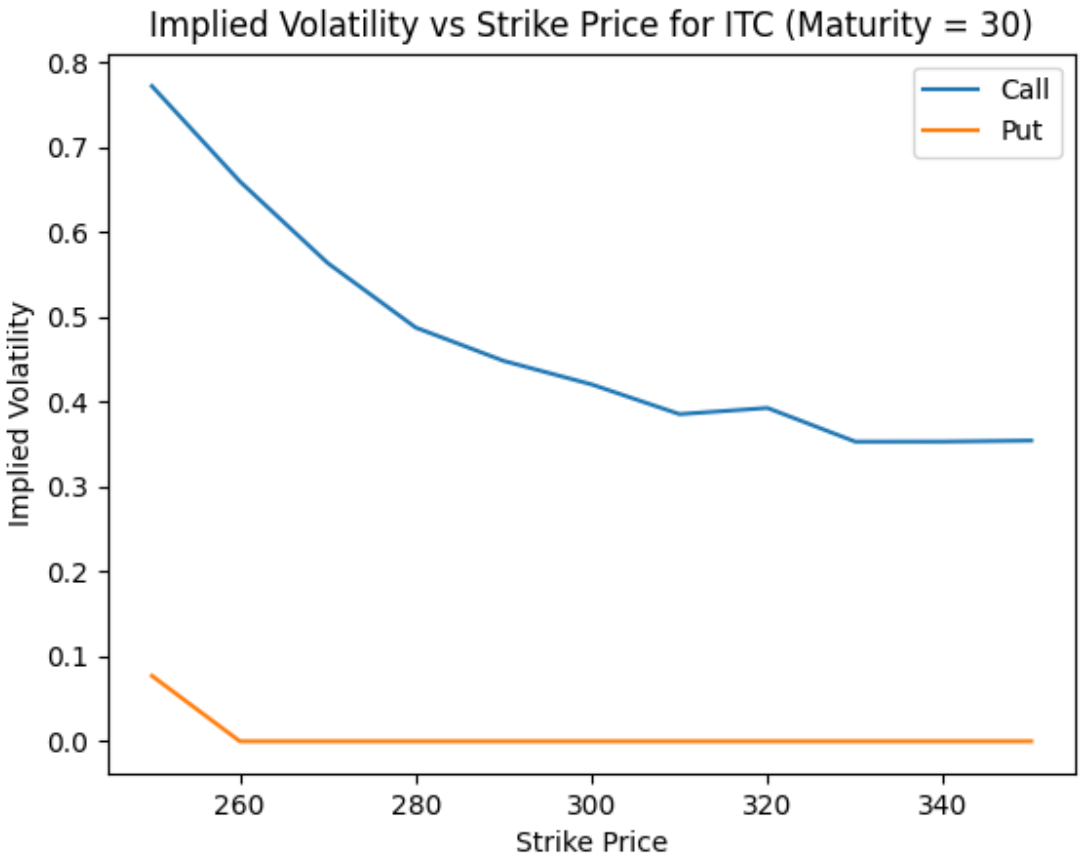

Put Implied Volatility for CIPLA
Implied Volatility
0.0
0.1
0.2
0.3
0.4
0.5
Strike Price
500
520
540
560
580
600
Maturity
0
10
20
30
40
50
60

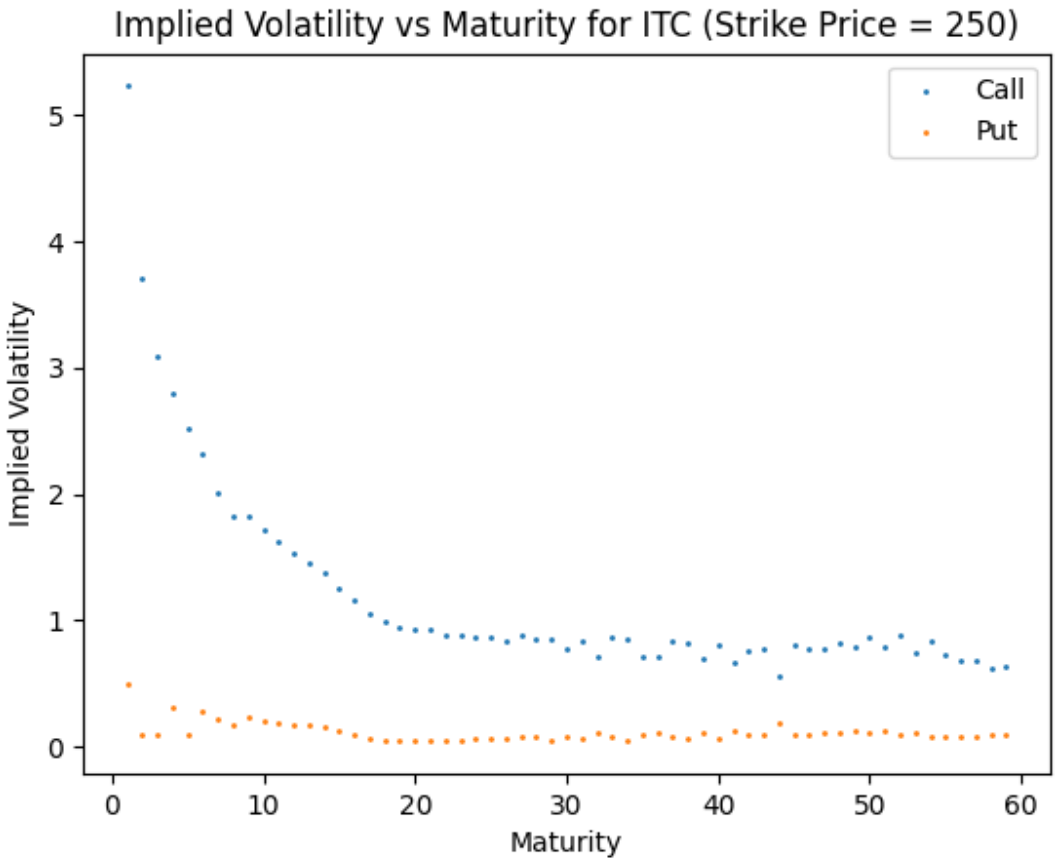

Call Implied Volatility for CIPLA
Implied Volatility
0.0
0.2
0.4
0.6
0.8
Strike Price
500
520
540
560
580
600
Maturity
0
10
20
30
40
50
60

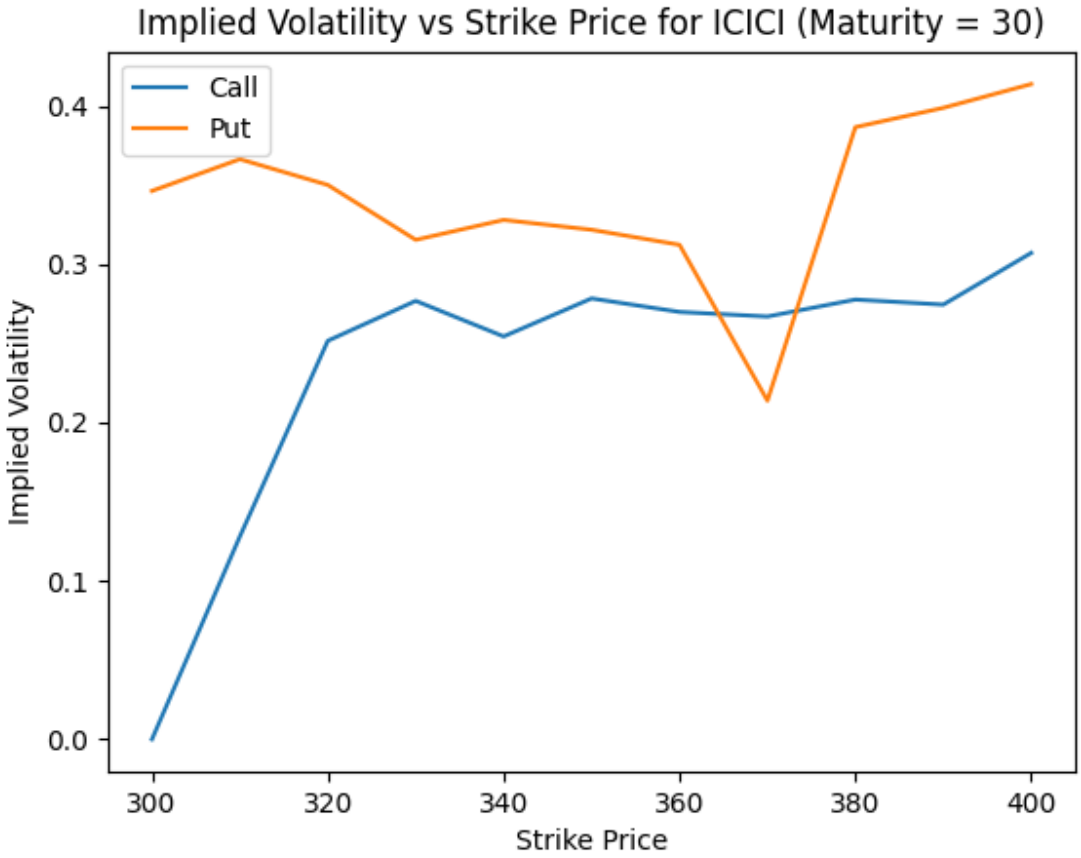

Put Implied Volatility for NIFTY
Implied Volatility
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Strike Price
12000
11000
10000
9000
8000
Maturity
0
10
20
30
40
50
60

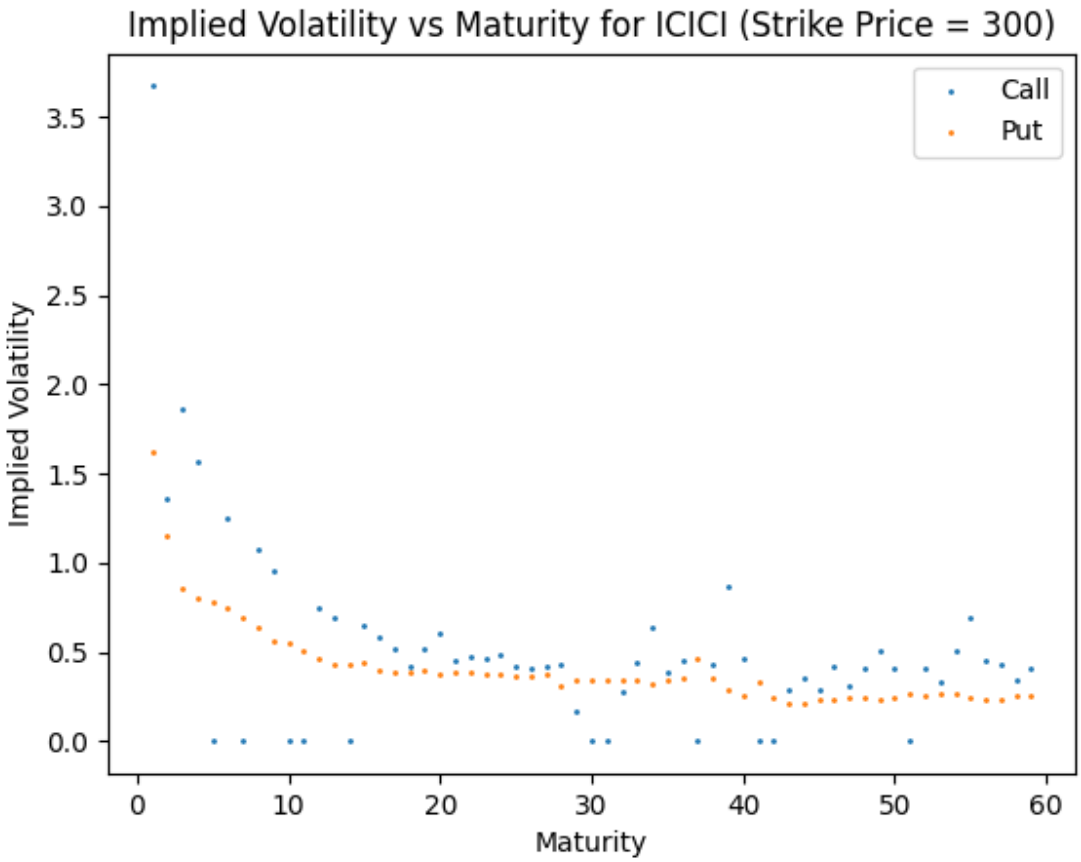


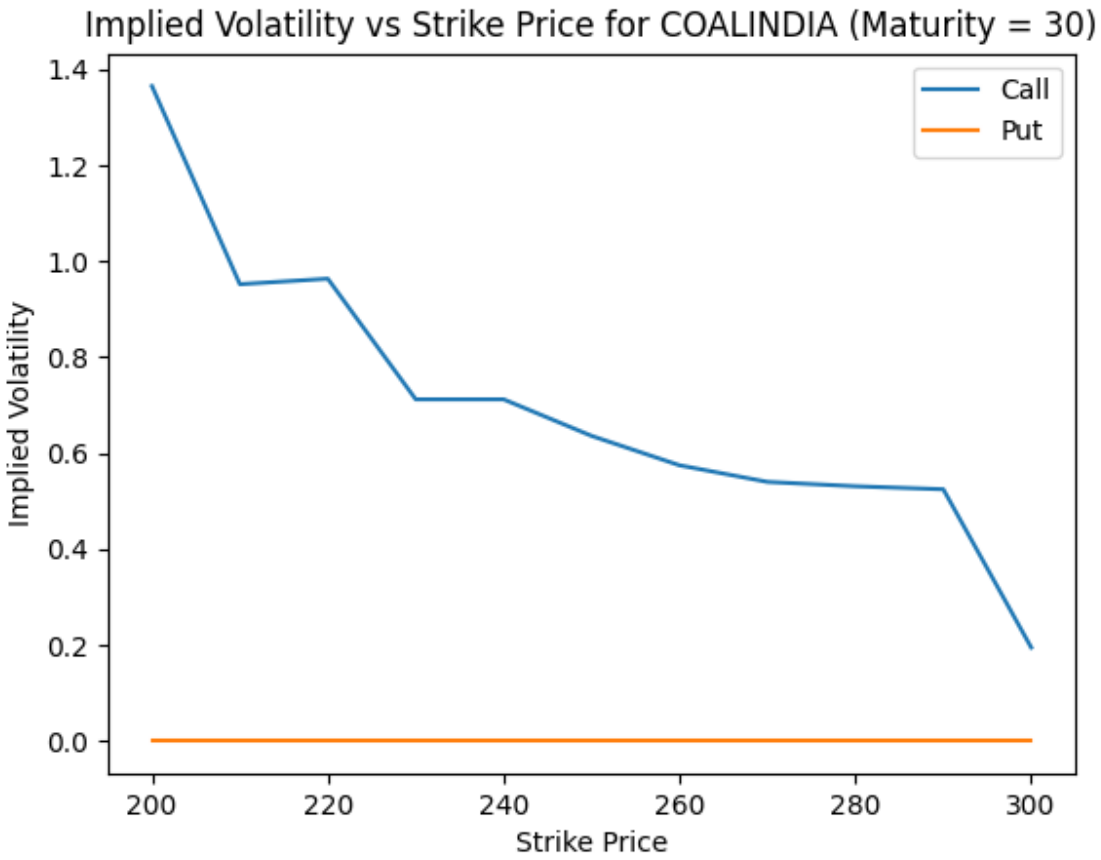
The 2-D graphs are -

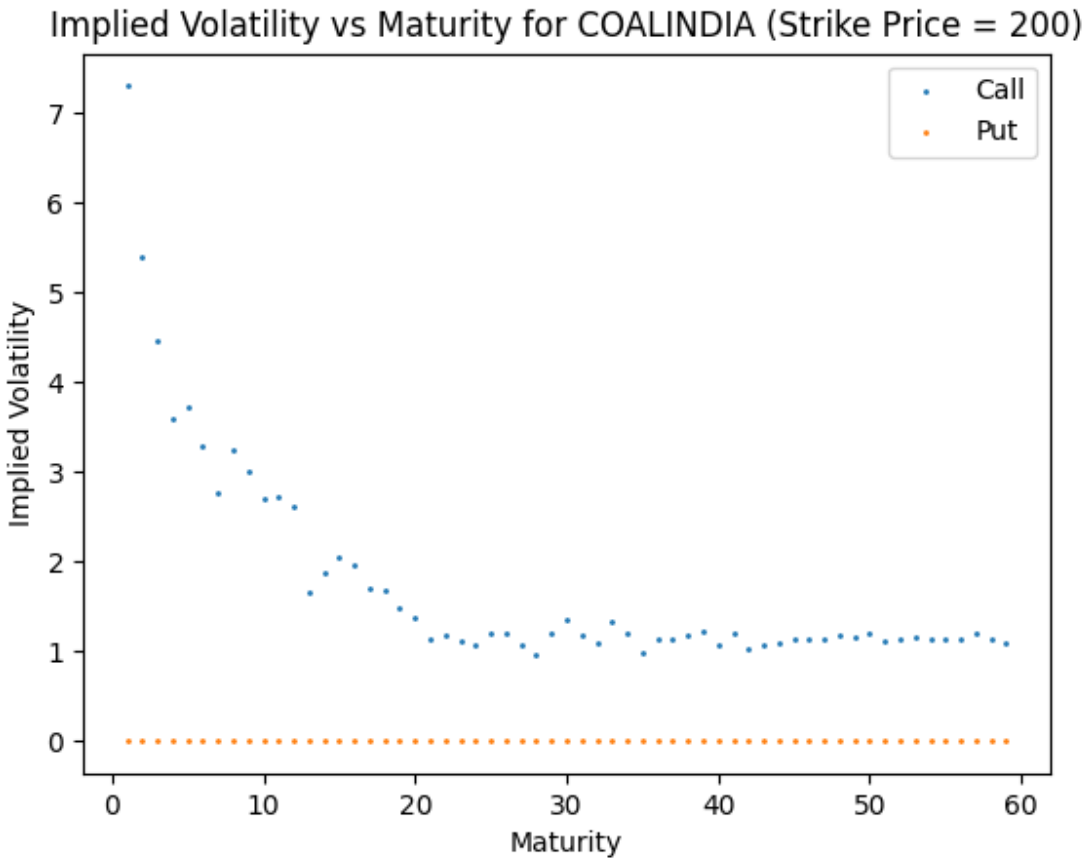

Implied Volatility vs Strike Price for ITC (Maturity = 30)
Call
Put
Implied Volatility
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
260
280
300
320
340
Strike Price

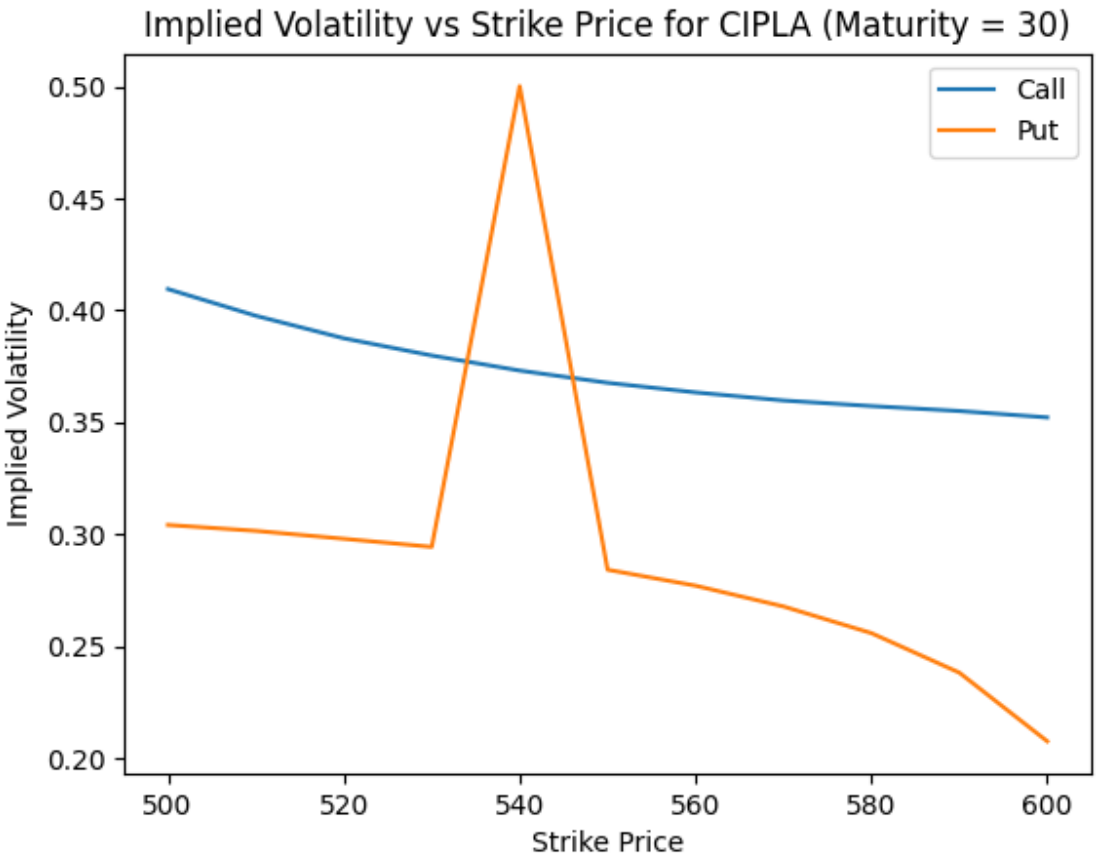

Implied Volatility vs Maturity for ITC (Strike Price = 250)
Call
Put
Implied Volatility
Maturity
0
1
2
3
4
5
0
10
20
30
40
50
60

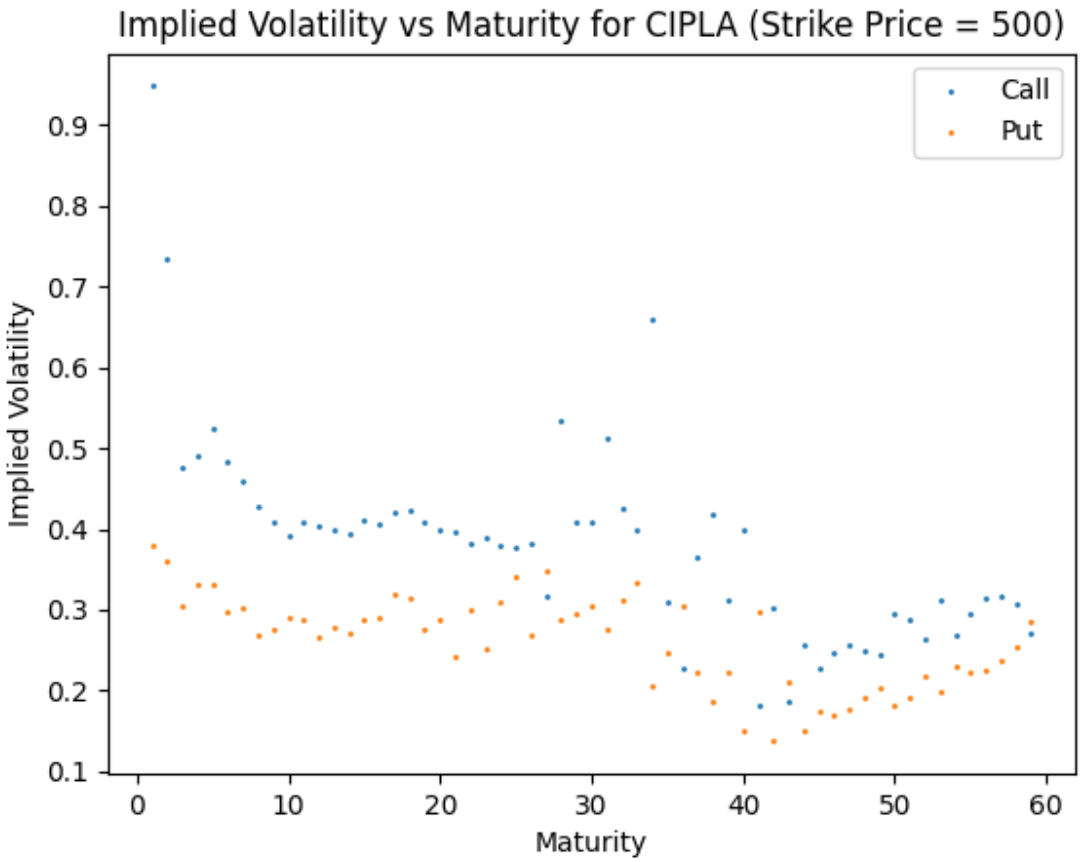

Implied Volatility vs Strike Price for ICICI (Maturity = 30)
Call
Put
Implied Volatility
0.0
0.1
0.2
0.3
0.4
300
320
340
360
380
400
Strike Price

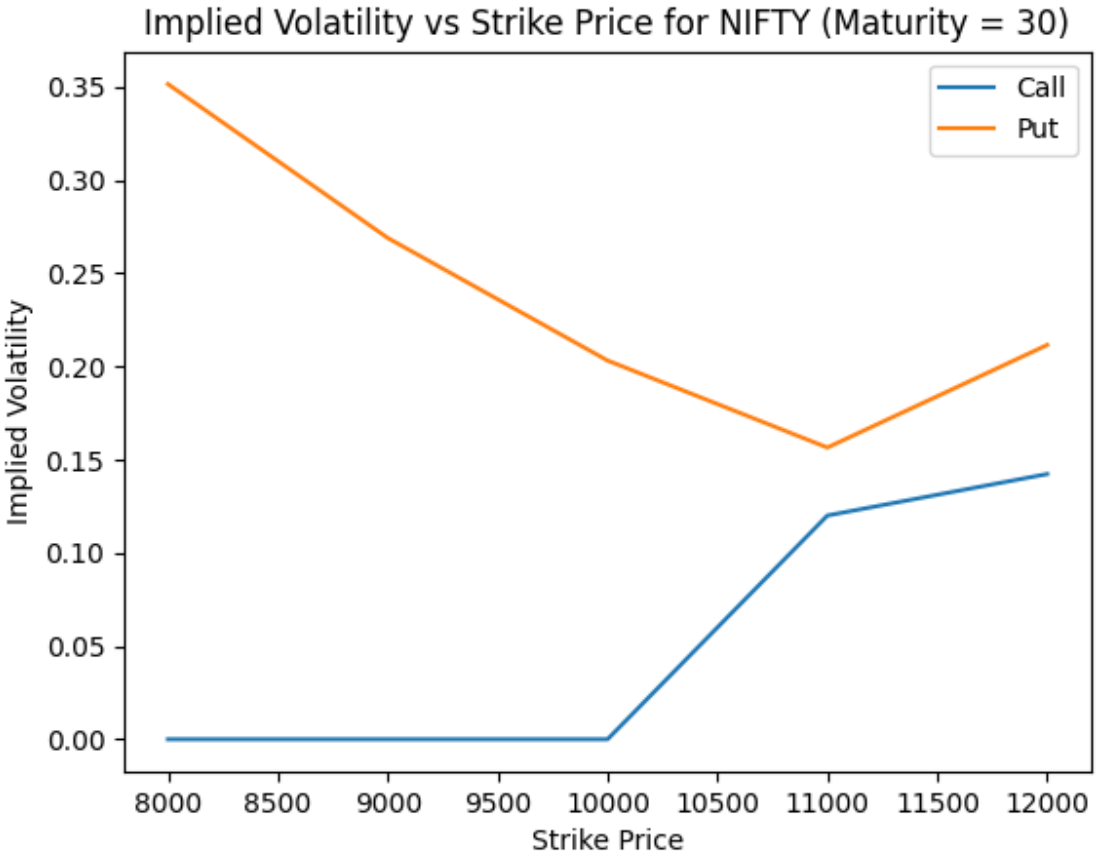

Implied Volatility vs Maturity for ICICI (Strike Price = 300)
Call
Put
Implied Volatility
Maturity
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
0
10
20
30
40
50
60

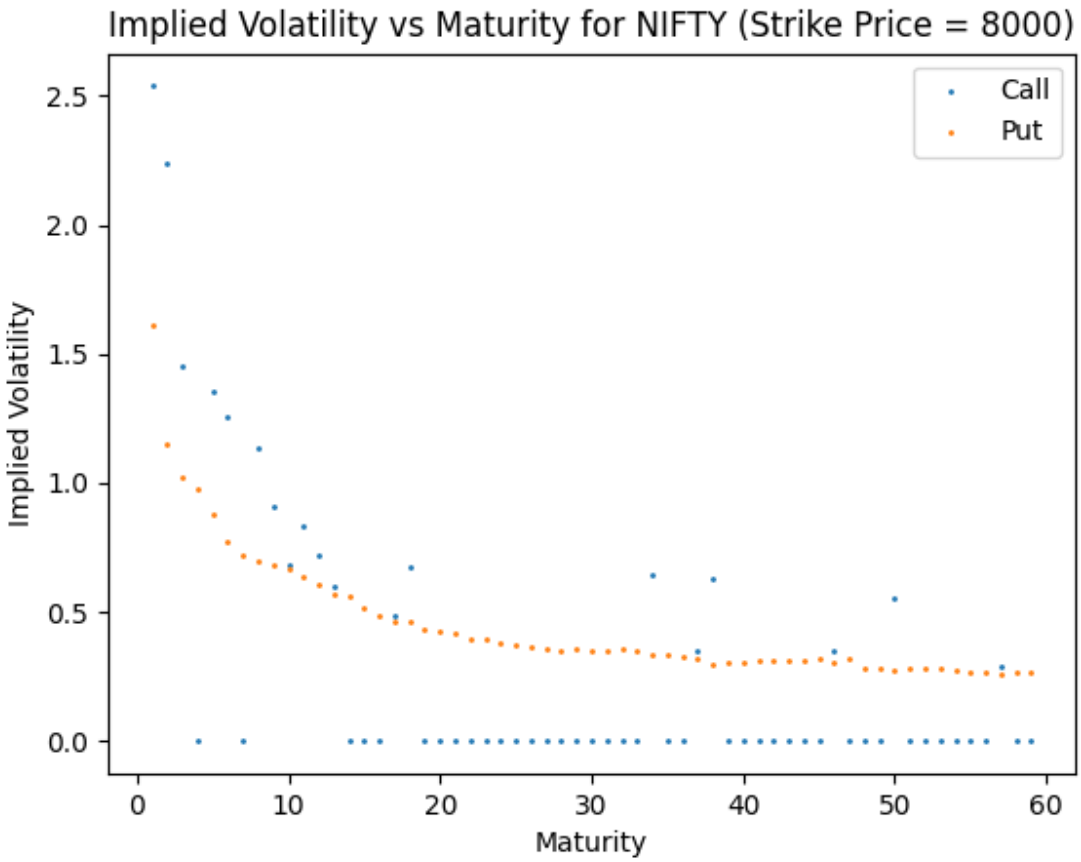

Implied Volatility vs Strike Price for COALINDIA (Maturity = 30)
Call
Put
Implied Volatility
Strike Price
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
200
220
240
260
280
300


Implied Volatility vs Maturity for COALINDIA (Strike Price = 200)
Call
Put
Implied Volatility
Maturity
0
1
2
3
4
5
6
7
0
10
20
30
40
50
60


Implied Volatility vs Strike Price for CIPLA (Maturity = 30)
Call
Put
Implied Volatility
0.50
0.45
0.40
0.35
0.30
0.25
0.20
500
520
540
560
580
600
Strike Price

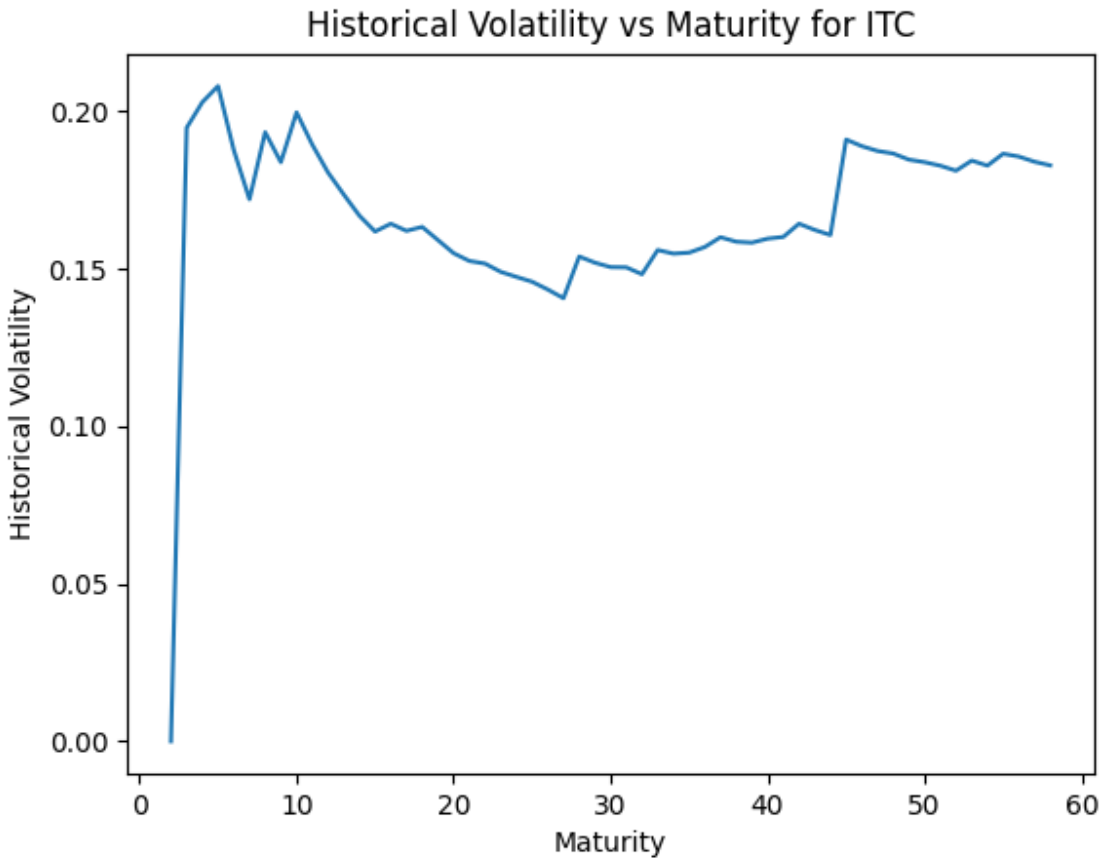

Implied Volatility vs Maturity for CIPLA (Strike Price = 500)
Call
Put
Implied Volatility
Maturity
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0
10
20
30
40
50
60

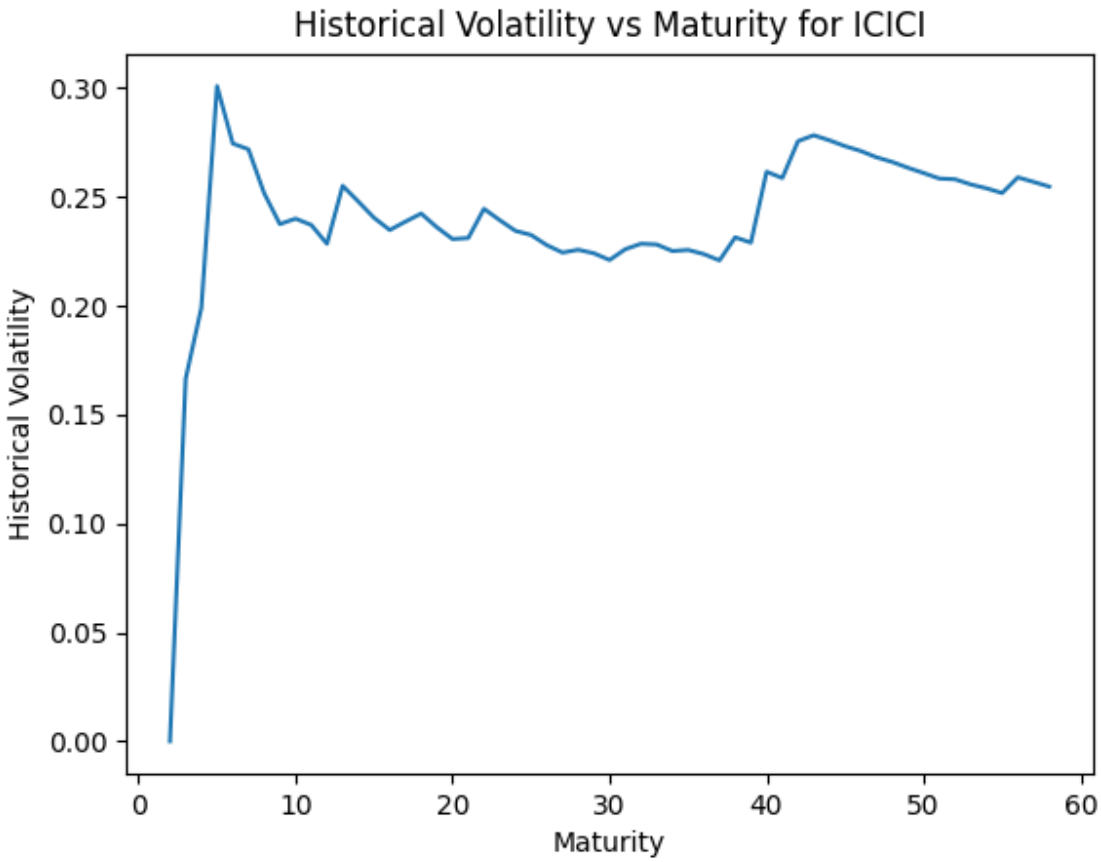

Implied Volatility vs Strike Price for NIFTY (Maturity = 30)
Call
Put
Implied Volatility
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
8000
8500
9000
9500
10000
10500
11000
11500
12000
Strike Price

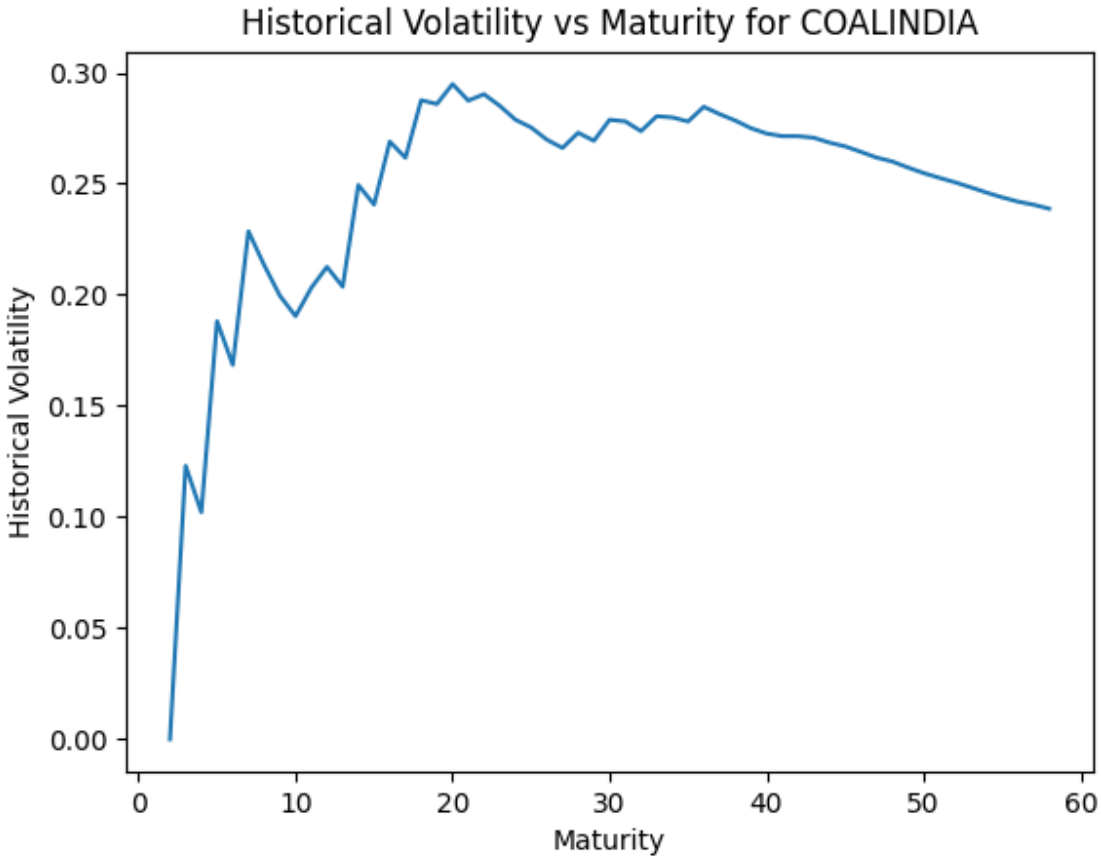


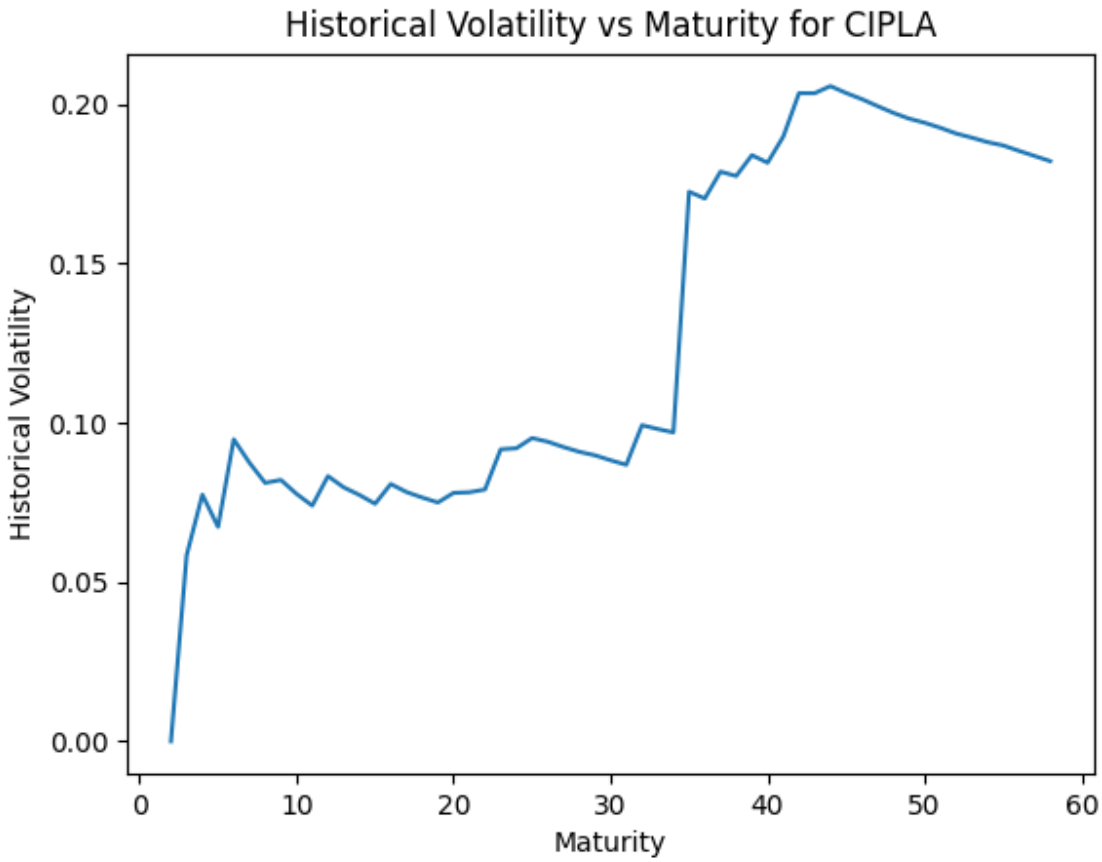
Question 4

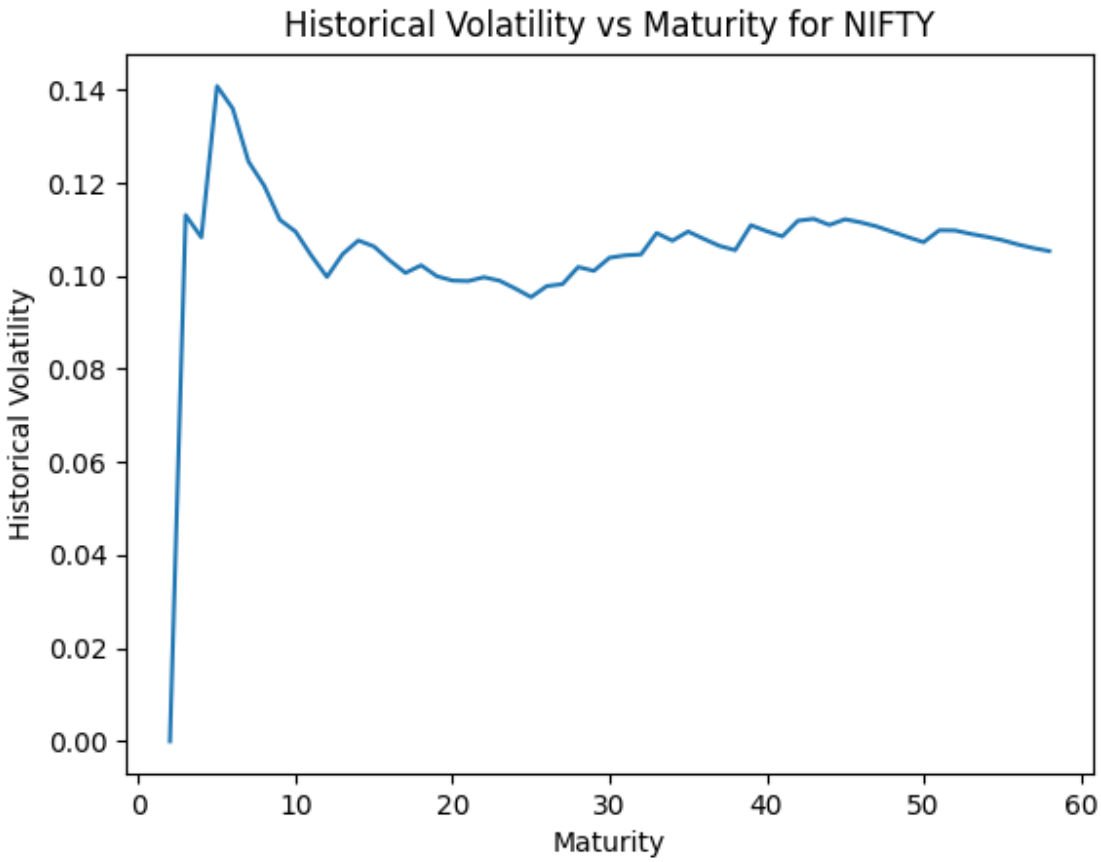
The historical volatility is calculated for various maturities. The variation is -


Historical Volatility vs Maturity for ITC
Historical Volatility
0.00
0.05
0.10
0.15
0.20
0
10
20
30
40
50
60
Maturity


Historical Volatility vs Maturity for ICICI
Historical Volatility
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0
10
20
30
40
50
60
Maturity


Historical Volatility vs Maturity for COALINDIA
Historical Volatility
Maturity
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0
10
20
30
40
50
60


Historical Volatility vs Maturity for CIPLA
Historical Volatility
0.00
0.05
0.10
0.15
0.20
0
10
20
30
40
50
60
Maturity


Historical Volatility vs Maturity for NIFTY
Historical Volatility
Maturity
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0
10
20
30
40
50
60