

Lab08

April 8, 2019

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In [ ]: '''
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MA374 / Lab 08  
Deepak Kumar Gouda / 160123054  
'''
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In [1]: import numpy as np  
        from pandas import read_csv
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In [2]: from scipy.stats import norm
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In [3]: from mpl_toolkits.mplot3d import Axes3D  
        import matplotlib.pyplot as plt
```

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In [4]: %matplotlib inline
```

```
In [5]: def getS0(name='', market='BSE', index=False):  
        fields=['Close']  
        if index:  
            data = read_csv('./Data/'+market.lower()+'.data1.csv', usecols=fields, index_col=0)  
        else:  
            data = read_csv('./Data/'+market+'Data/'+name+'.csv', usecols=fields, index_col=0)  
        return data.iloc[-1]['Close']
```

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In [6]: def getHistoricalVolatility(data):  
        close = np.array(data['Close'])  
        change = np.zeros(len(close)-1)  
        for i in range(1, len(close)):  
            change[i-1] = (close[i]-close[i-1])/close[i-1]  
        historicalVolatility = np.std(change)*(252**0.5)  
        return historicalVolatility
```

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In [7]: def getCall(S, K, r, t, sig):  
        d1 = (np.log(S/K)+t*(r+(sig**2)/2))/(sig*(t**0.5))  
        d2 = d1-sig*(t**0.5)  
        Nd1 = norm.cdf(d1)  
        Nd2 = norm.cdf(d2)  
        C = S*Nd1 - K*np.exp(-r*t)*Nd2  
        return C
```

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In [8]: def getPut(S, K, r, t, sig):
    d1 = (np.log(S/K)+t*(r+(sig**2)/2))/(sig*(t**0.5))
    d2 = d1-sig*(t**0.5)
    Nd1 = norm.cdf(-d1)
    Nd2 = norm.cdf(-d2)
    P = K*np.exp(-r*t)*Nd2 - S*Nd1
    return P

In [9]: def model(name='', market='BSE', index=False, num_fig=0):
    fields=['Close']
    if index:
        data = read_csv('./Data/'+market.lower()+'data1.csv', usecols=fields, index_col=0)
    else:
        data = read_csv('./Data/'+market+'Data/'+name+'.csv', usecols=fields, index_col=0)

    if(index):
        print('\t\t'+market+'Index')
    else:
        print('\t\tStock : '+stock+' Market : '+market)
    #####Q1#####
    lastMonth = data.iloc[len(data)-21:]
    sig = getHistoricalVolatility(lastMonth)
    print("Historical Volatility = ", sig)

    #####Q2#####
    S0 = data.iloc[-1]['Close']
    A = np.arange(0.5, 1.6, 0.1)
    K = S0
    r = 0.05
    t = 126/252

    callPrice = np.zeros(len(A))
    putPrice = np.zeros(len(A))

    for i, a in enumerate(A):
        callPrice[i] = getCall(S0, a*K, r, t, sig)
        putPrice[i] = getPut(S0, a*K, r, t, sig)

    print('Call Price = ', end='')
    print(np.round(callPrice, 2))
    print('Put Price = ', end='')
    print(np.round(putPrice, 2))
    print('\n')

    #####Q3#####
    S0 = data.iloc[-1]['Close']
    A = 1
    K = A*S0

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r = 0.05
t = 126/252
T = 21
start = len(data)-T
volatility = []
callPrices = []
putPrices = []

while(start >= 0):
    monthlyData = data[start:-1]
    sig = getHistoricalVolatility(monthlyData)
    volatility.append(sig)
    C = getCall(S0, K, r, t, sig)
    P = getPut(S0, K, r, t, sig)
    callPrices.append(C)
    putPrices.append(P)
    start = start-T

x = np.arange(1, len(volatility)+1)
y = np.array(volatility)
z_call = np.array(callPrices)
z_put = np.array(putPrices)

fig = plt.figure()
ax = fig.add_subplot(111+num_fig, projection='3d')
ax.scatter(x, y, z_call, c='b', marker='o', label='Call Option')
ax.scatter(x, y, z_put, c='r', marker='o', label='Put Option')

ax.set_xlabel('Time (in number of months)')
ax.set_ylabel('Volatility')
ax.set_zlabel('Option Prices')
ax.legend()
if index:
    plt.title(name+' Market = '+market)
else:
    plt.title('Stock = '+name+' Market = '+market)
plt.show()

```

```

In [10]: stock_name=['ABB', 'AXISBANK', 'BALMLAWRIE', 'BHARTIARTL',
                    'CUMMINSIND', 'EMAMILTD', 'GODREJIND',
                    'HDFCBANK', 'HEROMOTOCO', 'HINDUNILVR',
                    'INFY', 'IOC', 'ITC', 'LUPIN', 'M&M',
                    'MAHABANK', 'NTPC', 'SBIN', 'SHREECEM', 'TCS']

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In [11]: market_name = ['BSE', 'NSE']

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In [12]: model('', 'BSE', index=True)
         model('', 'NSE', index=True)

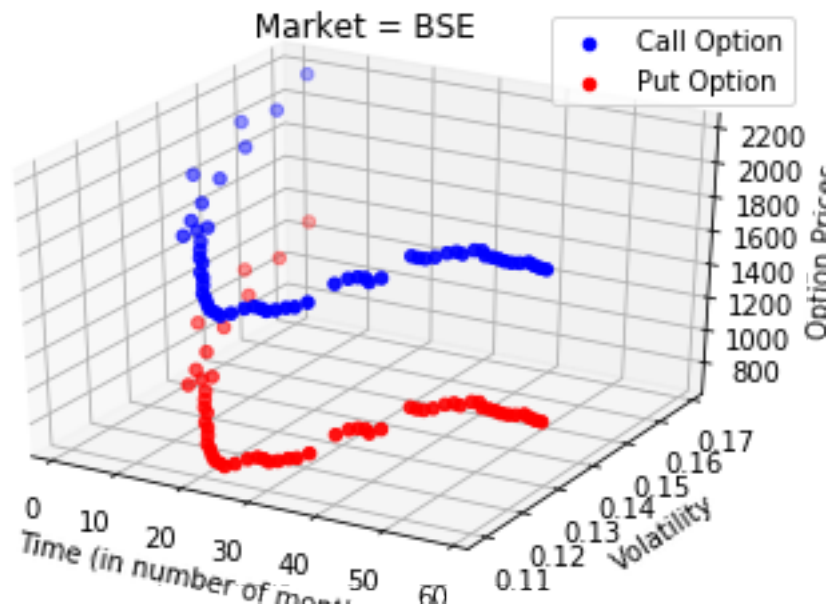
```

BSEIndex

Historical Volatility = 0.15047750489169973

Call Price = [1.847943e+04 1.496165e+04 1.144400e+04 7.937370e+03 4.599660e+03
1.998200e+03 6.061700e+02 1.276300e+02 1.932000e+01 2.210000e+00
2.000000e-01]

Put Price = [0.000000e+00 0.000000e+00 1.300000e-01 1.128000e+01 1.913500e+02
1.107670e+03 3.233420e+03 6.272660e+03 9.682130e+03 1.318280e+04
1.669857e+04]

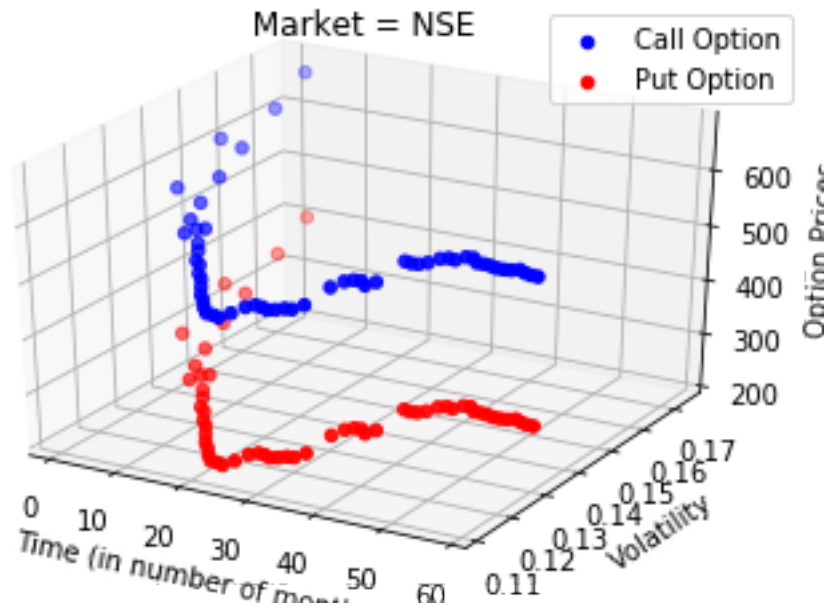


NSEIndex

Historical Volatility = 0.14973524282252496

Call Price = [5.56537e+03 4.50594e+03 3.44654e+03 2.39033e+03 1.38426e+03 5.99610e+02
1.80670e+02 3.76200e+01 5.61000e+00 6.30000e-01 6.00000e-02]

Put Price = [0.00000e+00 0.00000e+00 4.00000e-02 3.27000e+00 5.66300e+01 3.31410e+02
9.71910e+02 1.88829e+03 2.91572e+03 3.97017e+03 5.02903e+03]



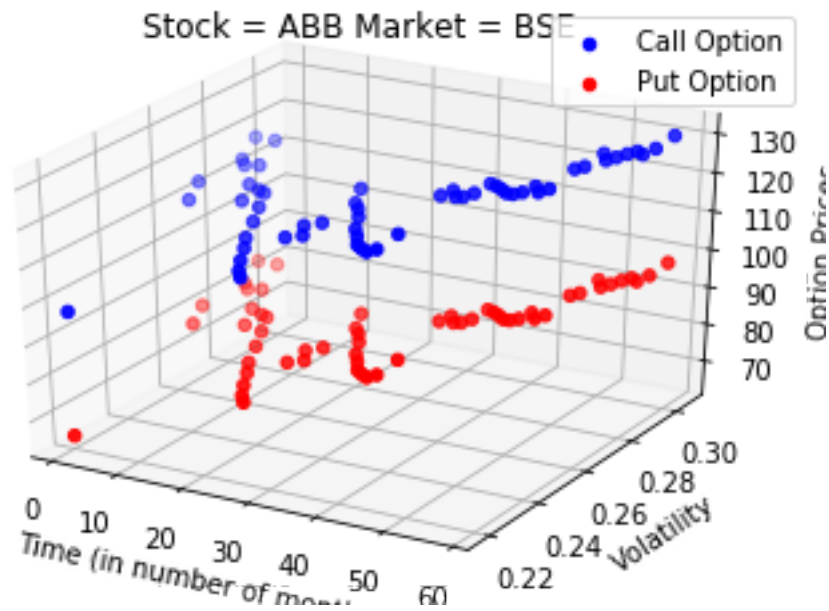
```
In [13]: for i, market in enumerate(market_name):
         for j, stock in enumerate(stock_name):
             model(stock, market, num_fig=0)
```

Stock : ABB Market : BSE

Historical Volatility = 0.22043505289266346

Call Price = [6.8244e+02 5.5254e+02 4.2302e+02 2.9704e+02 1.8468e+02 9.9210e+01
4.5800e+01 1.8350e+01 6.4900e+00 2.0600e+00 6.0000e-01]

Put Price = [0.0000e+00 1.0000e-02 4.0000e-01 4.3300e+00 2.1880e+01 6.6330e+01
1.4283e+02 2.4528e+02 3.6334e+02 4.8882e+02 6.1727e+02]

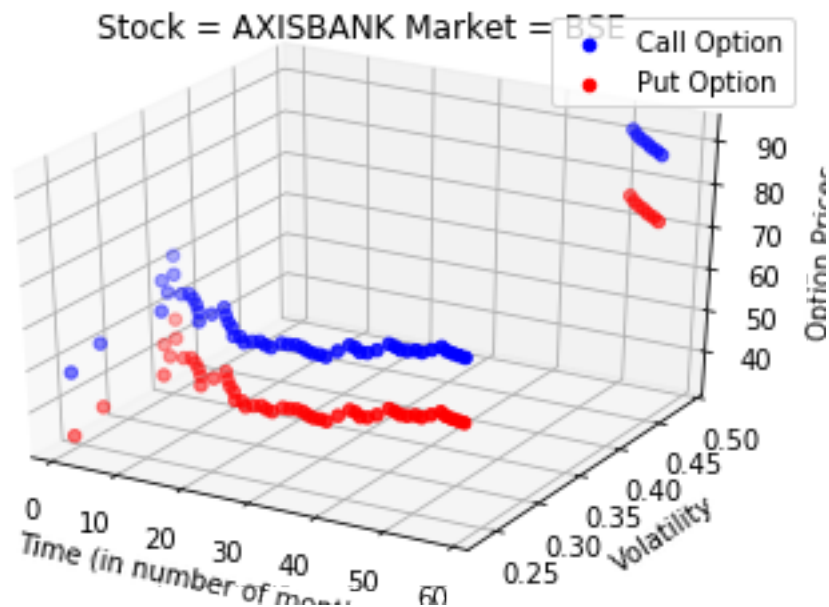


Stock : AXISBANK Market : BSE

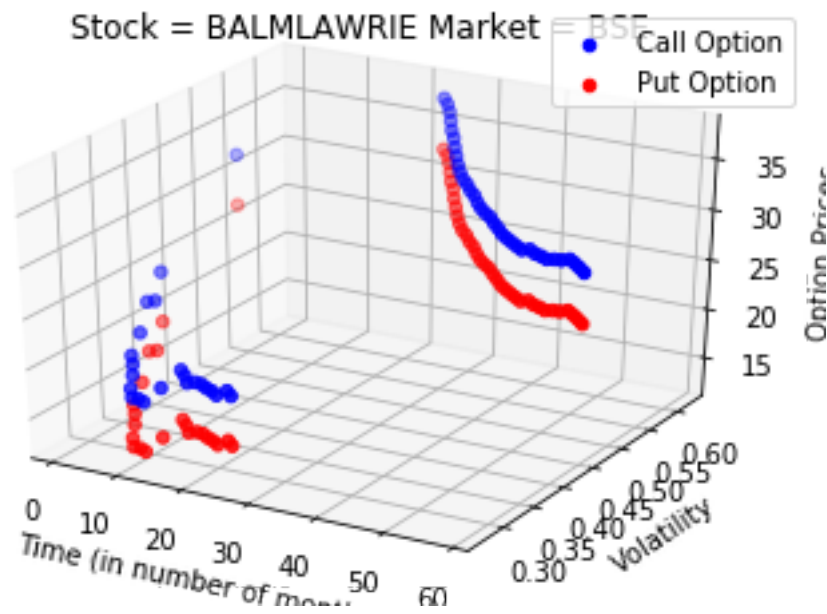
Historical Volatility = 0.2319184707177017

Call Price = [317.55 257.11 196.93 138.75 87.28 48.12 23.2 9.87 3.77 1.31 0.42]

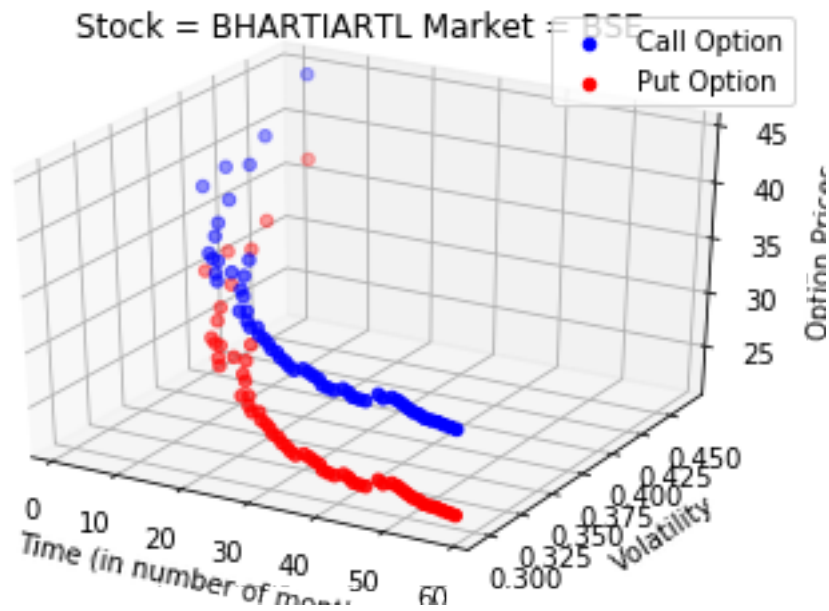
Put Price = [0.0000e+00 1.0000e-02 2.8000e-01 2.5500e+00 1.1530e+01 3.2820e+01 6.8340e+01 1.1547e+02 1.6981e+02 2.2781e+02 2.8737e+02]



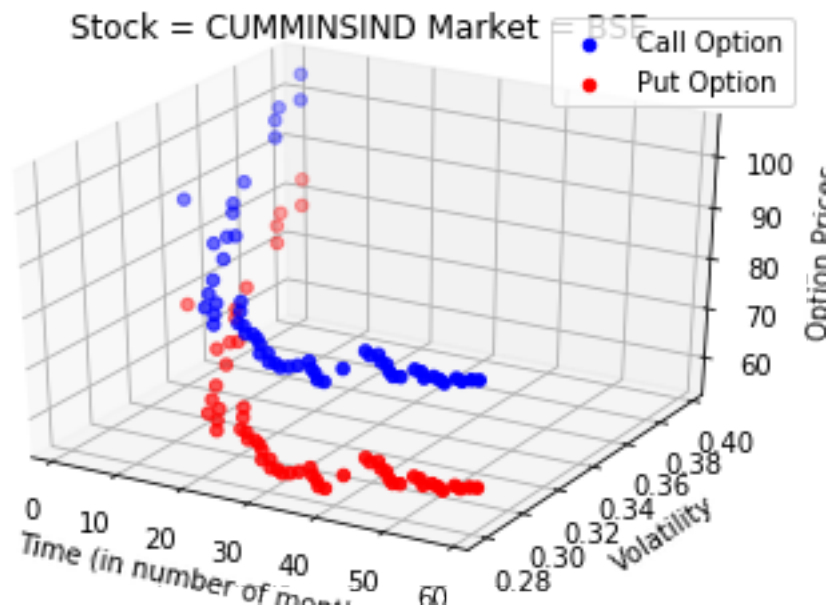
Stock : BALMLAWRIE Market : BSE
 Historical Volatility = 0.5141446576831114
 Call Price = [104.8 86.22 69.2 54.29 41.76 31.59 23.59 17.43 12.77 9.31
 6.75]
 Put Price = [0.46 1.74 4.58 9.53 16.87 26.57 38.42 52.12 67.33 83.73
 101.03]



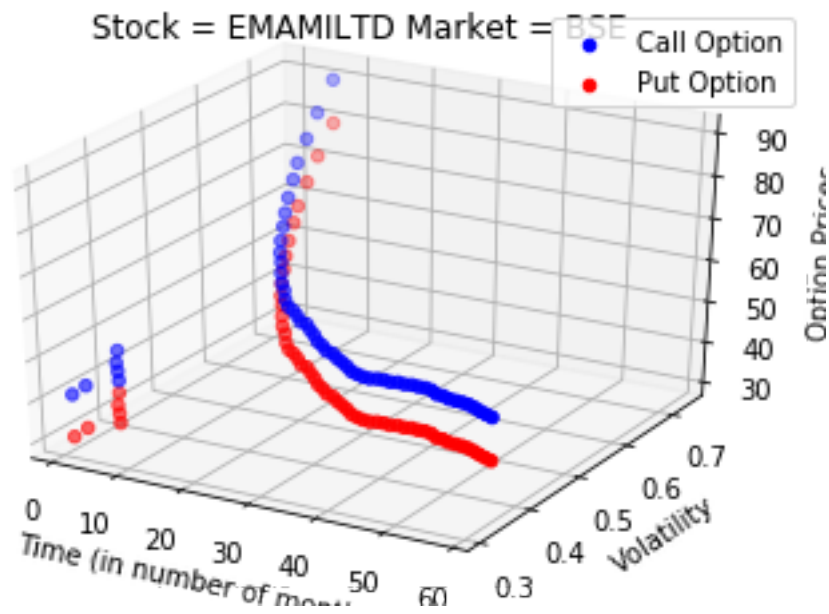
Stock : BHARTIARTL Market : BSE
 Historical Volatility = 0.386888799963
 Call Price = [160.39 130.41 101.88 76.21 54.62 37.63 25.04 16.18 10.21 6.32
 3.85]
 Put Price = [8.0000e-02 6.2000e-01 2.6000e+00 7.4500e+00 1.6370e+01 2.9900e+01
 4.7830e+01 6.9490e+01 9.4040e+01 1.2066e+02 1.4871e+02]



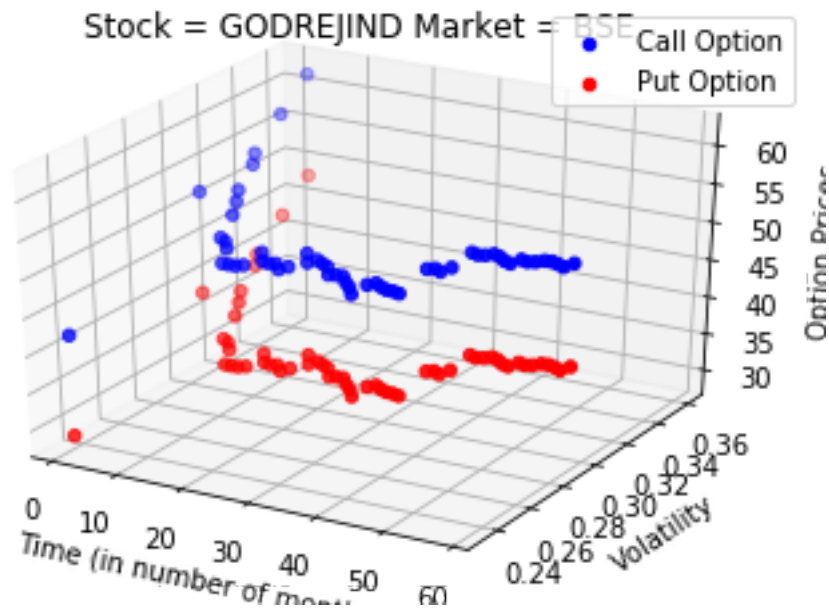
Stock : CUMMINSIND Market : BSE
 Historical Volatility = 0.333216257704825
 Call Price = [434.9 352.67 272.94 199.74 137.68 89.53 55.21 32.51 18.42 10.1 5.4]
 Put Price = [4.0000e-02 6.0000e-01 3.6500e+00 1.3230e+01 3.3950e+01 6.8580e+01 1.1704e+02 1.7712e+02 2.4580e+02 3.2027e+02 3.9834e+02]



Stock : EMAMILTD Market : BSE
 Historical Volatility = 0.31778766748294185
 Call Price = [214.27 173.68 134.11 97.52 66.4 42.34 25.42 14.47 7.88 4.13
 2.1]
 Put Price = [1.0000e-02 2.0000e-01 1.4200e+00 5.6200e+00 1.5280e+01 3.2010e+01
 5.5880e+01 8.5720e+01 1.1992e+02 1.5696e+02 1.9572e+02]



Stock : GODREJIND Market : BSE
 Historical Volatility = 0.23381713370724466
 Call Price = [279.82 226.56 173.55 122.34 77.11 42.68 20.71 8.9 3.44 1.21
 0.4]
 Put Price = [0.0000e+00 1.0000e-02 2.7000e-01 2.3300e+00 1.0360e+01 2.9200e+01
 6.0500e+01 1.0195e+02 1.4975e+02 2.0079e+02 2.5325e+02]

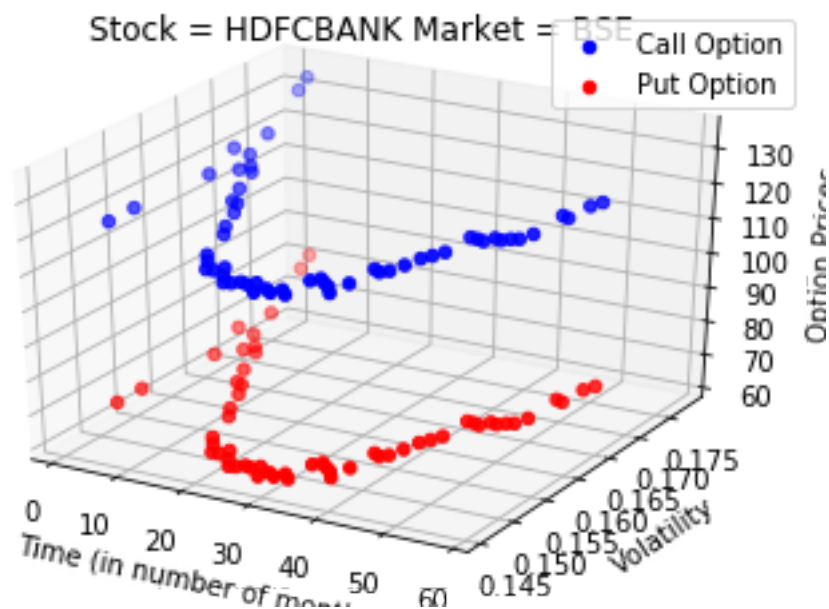


Stock : HDFCBANK Market : BSE

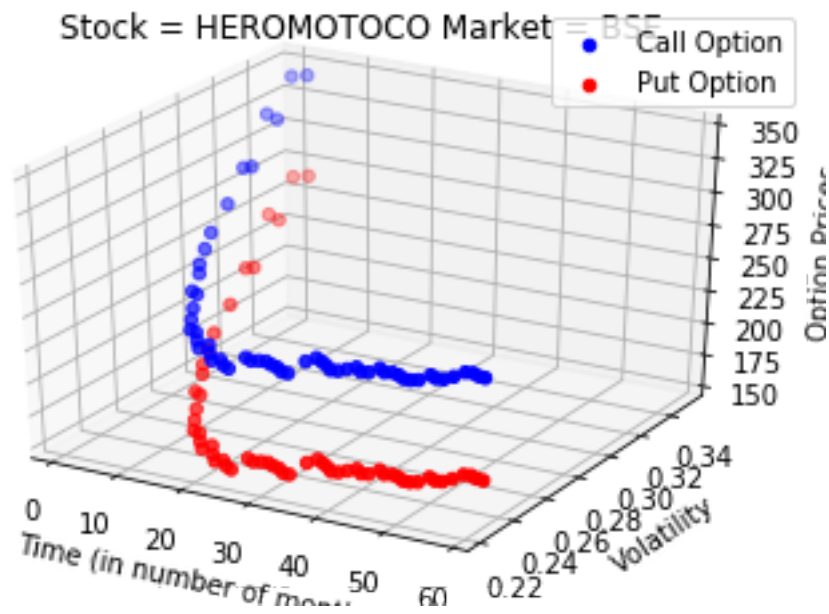
Historical Volatility = 0.14773366367738122

Call Price = [1.08743e+03 8.80420e+02 6.73420e+02 4.66990e+02 2.69950e+02 1.16010e+02
3.43100e+01 6.93000e+00 9.90000e-01 1.10000e-01 1.00000e-02]

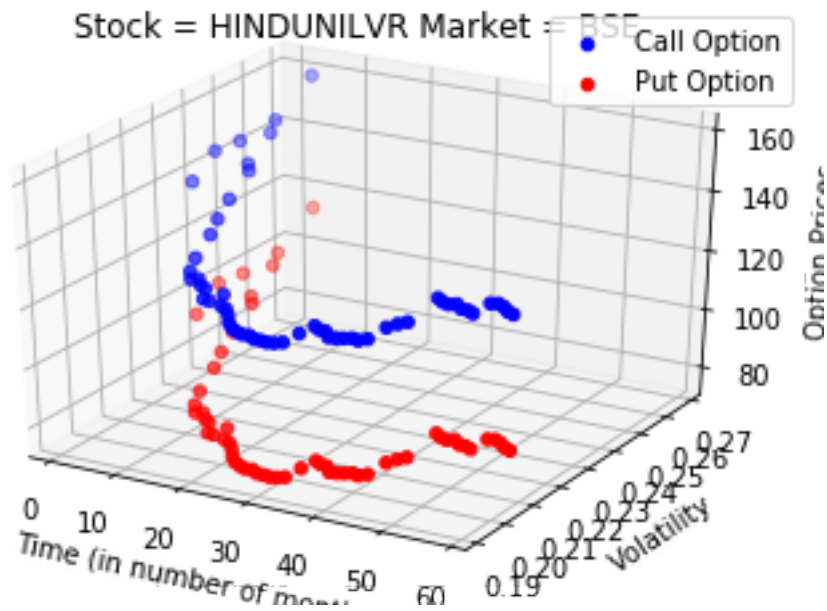
Put Price = [0.0000e+00 0.0000e+00 1.0000e-02 5.7000e-01 1.0540e+01 6.3610e+01
1.8891e+02 3.6853e+02 5.6960e+02 7.7572e+02 9.8263e+02]



Stock : HEROMOTOCO Market : BSE
 Historical Volatility = 0.34260498848331994
 Call Price = [1591.42 1290.99 1000.61 735.09 510.4 335.63 210.13 126.08 73.
 41.05 22.55]
 Put Price = [2.30000e-01 2.70000e+00 1.52200e+01 5.26100e+01 1.30820e+02 2.58950e+02
 4.36350e+02 6.55210e+02 9.05030e+02 1.17598e+03 1.46038e+03]



Stock : HINDUNILVR Market : BSE
 Historical Volatility = 0.23541954658753678
 Call Price = [931.47 754.19 577.77 407.5 257.24 142.89 69.73 30.19 11.77 4.2
 1.39]
 Put Price = [0.0000e+00 4.0000e-02 9.3000e-01 7.9800e+00 3.5040e+01 9.8000e+01
 2.0216e+02 3.3993e+02 4.9883e+02 6.6858e+02 8.4309e+02]

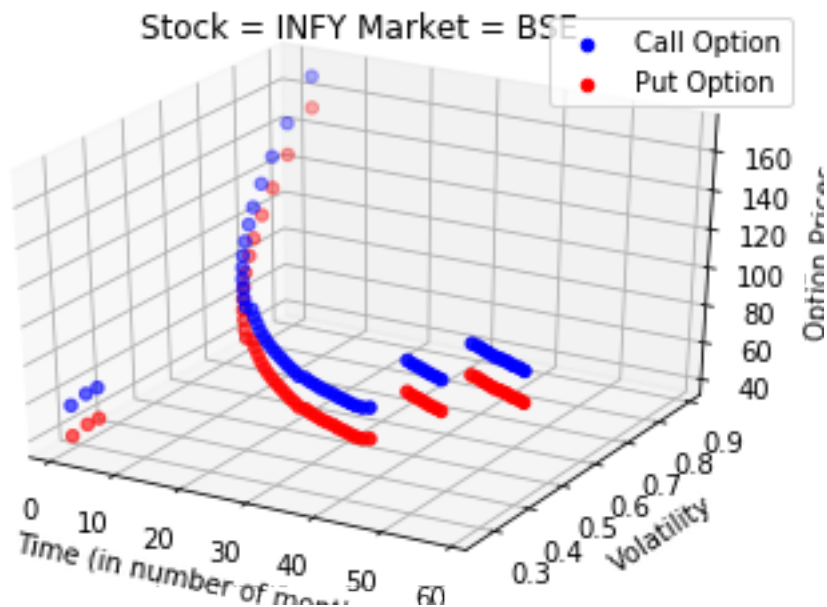


Stock : INFY Market : BSE

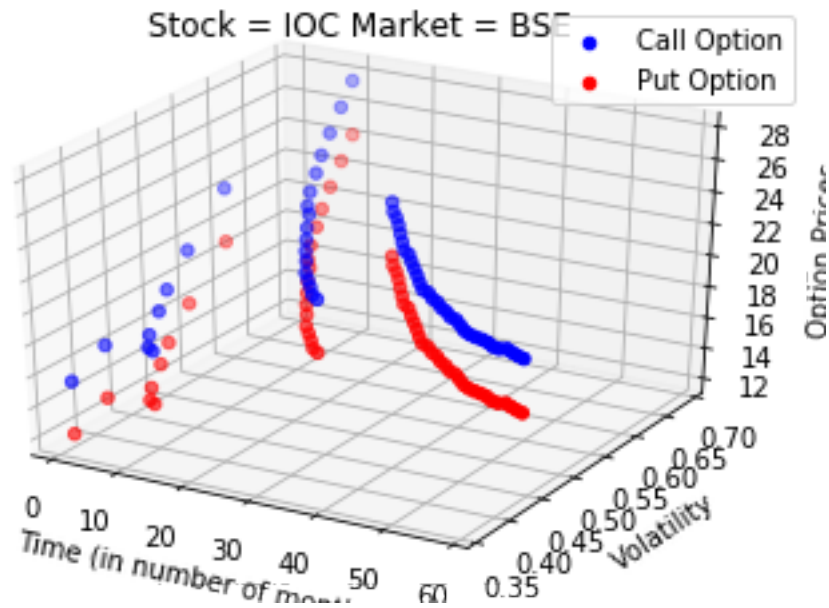
Historical Volatility = 0.25836442452883546

Call Price = [338.07 273.76 210.02 149.27 96.38 56.02 29.37 14.02 6.17 2.54 0.99]

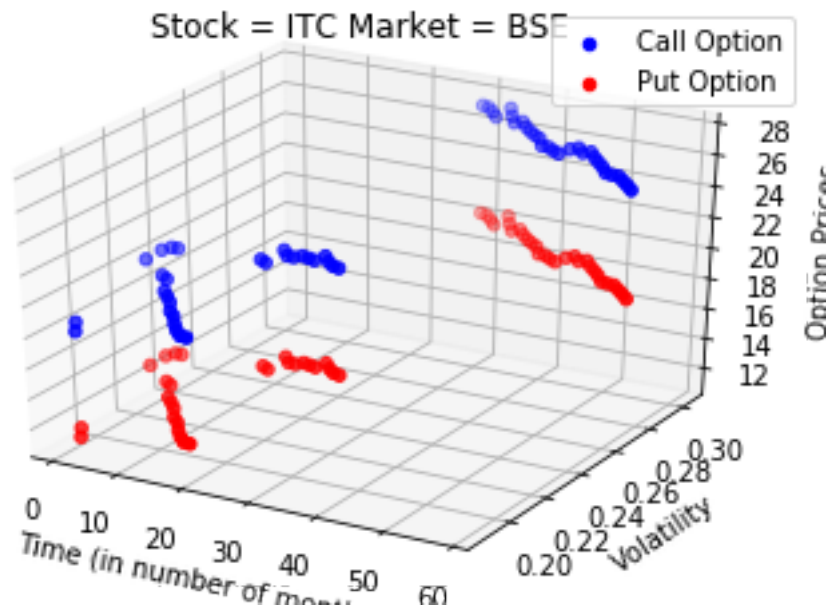
Put Price = [0.0000e+00 4.0000e-02 6.6000e-01 4.2700e+00 1.5730e+01 3.9730e+01 7.7440e+01 1.2644e+02 1.8295e+02 2.4367e+02 3.0647e+02]



Stock : IOC Market : BSE
 Historical Volatility = 0.35362198620971746
 Call Price = [70.26 57.02 44.28 32.68 22.88 15.23 9.7 5.94 3.52 2.03 1.15]
 Put Price = [1.000e-02 1.500e-01 7.800e-01 2.550e+00 6.120e+00 1.185e+01 1.968e+01
 2.930e+01 4.025e+01 5.214e+01 6.462e+01]



Stock : ITC Market : BSE
 Historical Volatility = 0.1846213526698629
 Call Price = [1.4430e+02 1.1683e+02 8.9380e+01 6.2250e+01 3.7300e+01 1.8220e+01
 7.0800e+00 2.2100e+00 5.6000e-01 1.2000e-01 2.0000e-02]
 Put Price = [0.0000e+00 0.0000e+00 2.0000e-02 3.6000e-01 2.8700e+00 1.1260e+01
 2.7600e+01 5.0190e+01 7.6020e+01 1.0305e+02 1.3042e+02]

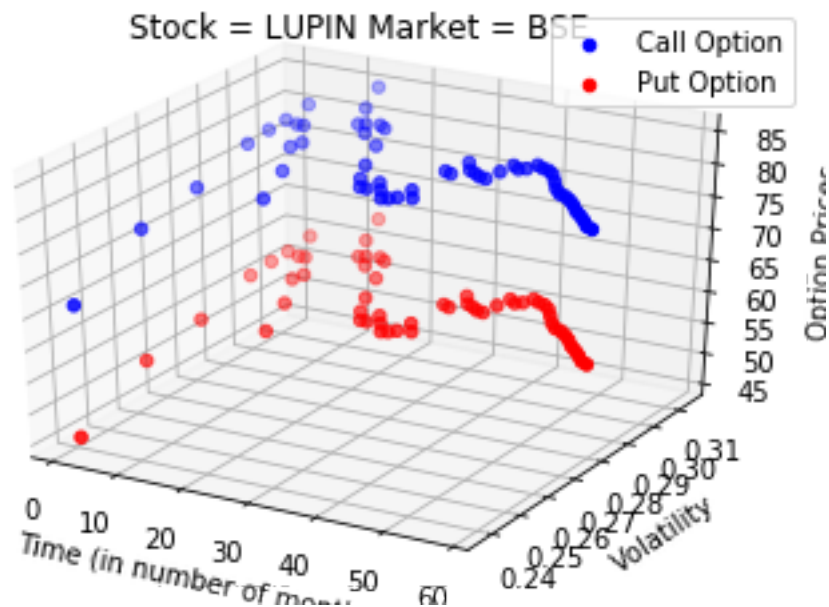


Stock : LUPIN Market : BSE

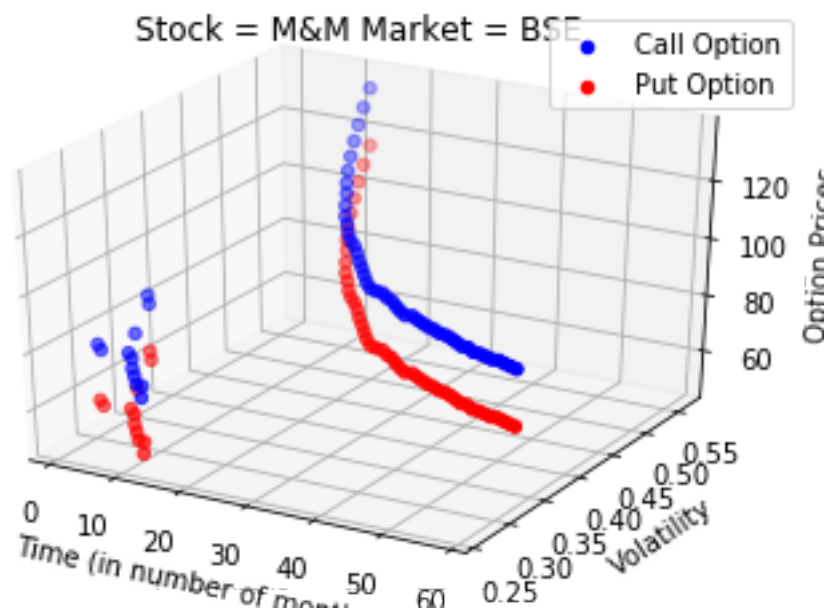
Historical Volatility = 0.25729316420726817

Call Price = [433.24 350.82 269.12 191.2 123.33 71.54 37.4 17.78 7.79 3.18 1.23]

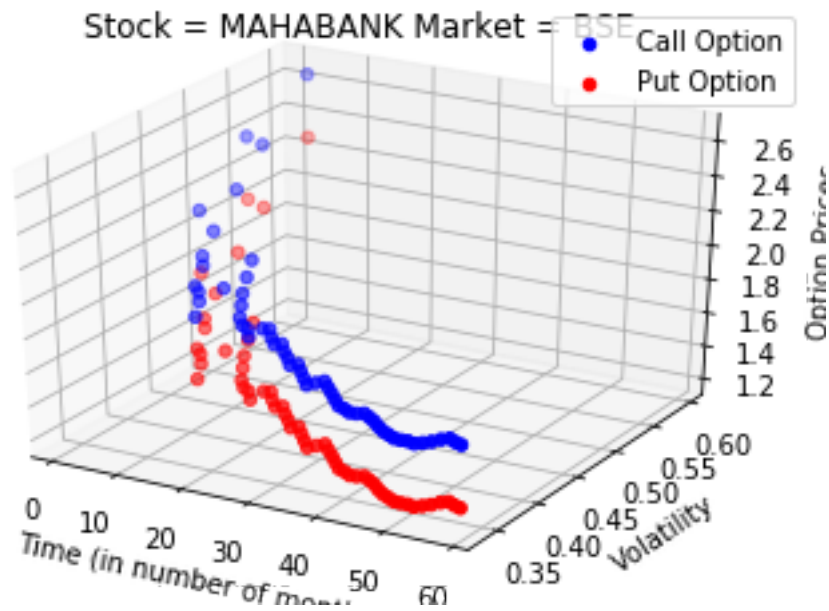
Put Price = [0.0000e+00 5.0000e-02 8.2000e-01 5.3800e+00 1.9980e+01 5.0660e+01 9.8990e+01 1.6185e+02 2.3433e+02 3.1219e+02 3.9271e+02]



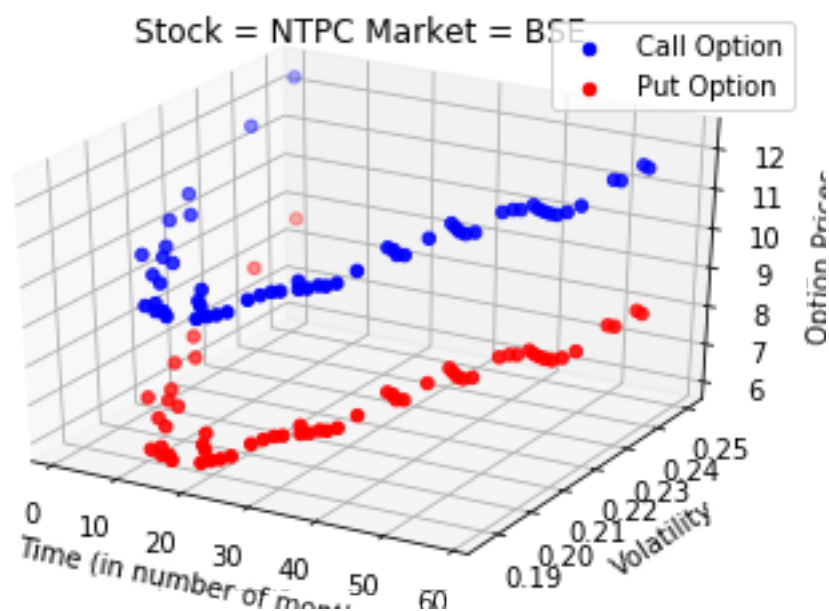
Stock : M&M Market : BSE
 Historical Volatility = 0.2911245275595171
 Call Price = [411.78 333.57 256.69 184.69 122.92 75.47 42.94 22.83 11.46 5.48 2.52]
 Put Price = [1.0000e-02 1.8000e-01 1.6900e+00 8.0800e+00 2.4690e+01 5.5630e+01 1.0149e+02 1.5976e+02 2.2677e+02 2.9918e+02 3.7460e+02]



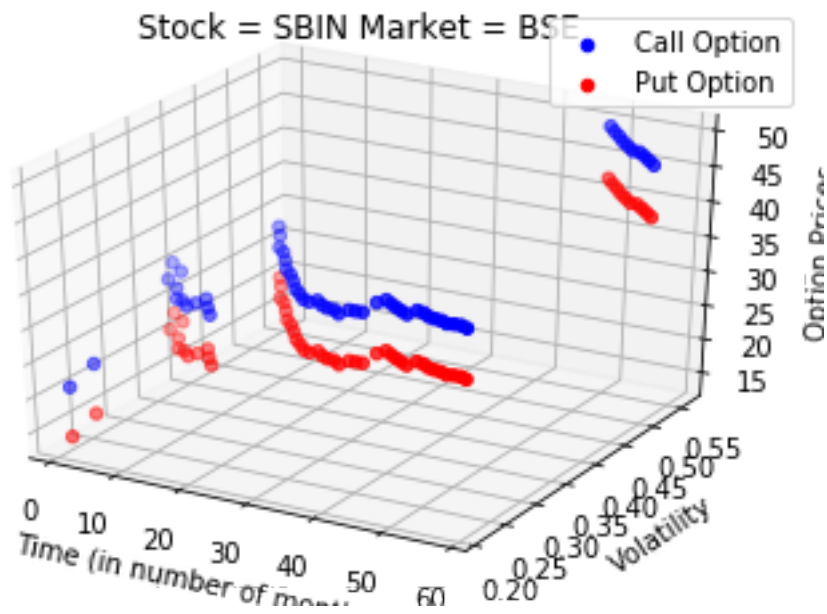
Stock : MAHABANK Market : BSE
 Historical Volatility = 0.5316142070390872
 Call Price = [7.67 6.32 5.09 4.02 3.12 2.38 1.8 1.35 1. 0.74 0.54]
 Put Price = [0.04 0.15 0.37 0.75 1.3 2.01 2.88 3.88 4.99 6.18 7.44]



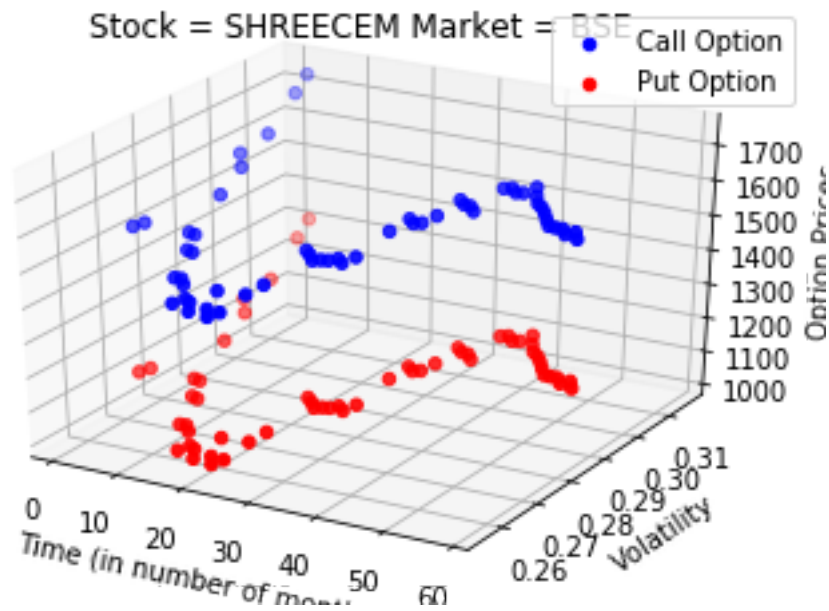
Stock : NTPC Market : BSE
 Historical Volatility = 0.2456098091947936
 Call Price = [76.16 61.67 47.27 33.45 21.33 12.1 6.11 2.77 1.14 0.44 0.16]
 Put Price = [0.000e+00 1.000e-02 1.000e-01 7.800e-01 3.160e+00 8.430e+00 1.693e+01
 2.809e+01 4.097e+01 5.476e+01 6.898e+01]



Stock : SBIN Market : BSE
 Historical Volatility = 0.20734423437060684
 Call Price = [1.5147e+02 1.2264e+02 9.3860e+01 6.5680e+01 4.0290e+01 2.0960e+01
 9.1500e+00 3.3900e+00 1.0800e+00 3.1000e-01 8.0000e-02]
 Put Price = [0.0000e+00 0.0000e+00 5.0000e-02 7.1000e-01 4.1500e+00 1.3660e+01
 3.0690e+01 5.3760e+01 8.0290e+01 1.0835e+02 1.3695e+02]



Stock : SHREECEM Market : BSE
 Historical Volatility = 0.26754174202849373
 Call Price = [8818.75 7141.66 5482.94 3909.81 2546.62 1504.74 808.96 399.32 183.11
 78.94 32.34]
 Put Price = [4.00000e-02 1.69000e+00 2.17200e+01 1.27340e+02 4.42900e+02 1.07976e+03
 2.06273e+03 3.33183e+03 4.79437e+03 6.36895e+03 8.00110e+03]

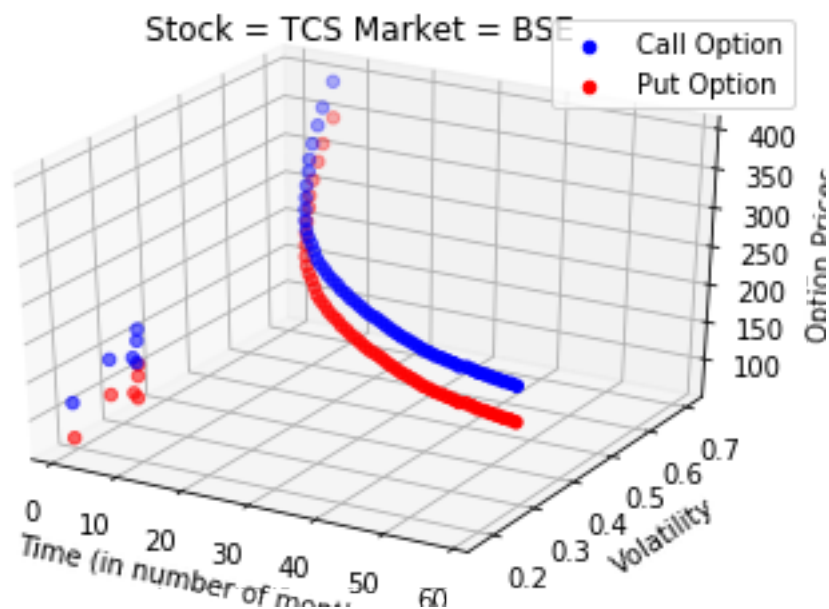


Stock : TCS Market : BSE

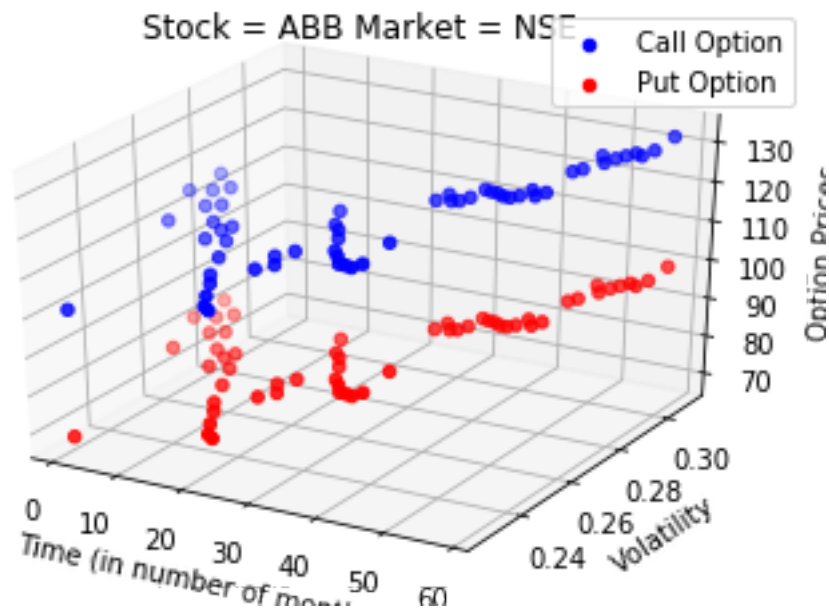
Historical Volatility = 0.1729911714041277

Call Price = [9.7015e+02 7.8547e+02 6.0084e+02 4.1772e+02 2.4734e+02 1.1648e+02
4.2110e+01 1.1730e+01 2.5900e+00 4.7000e-01 7.0000e-02]

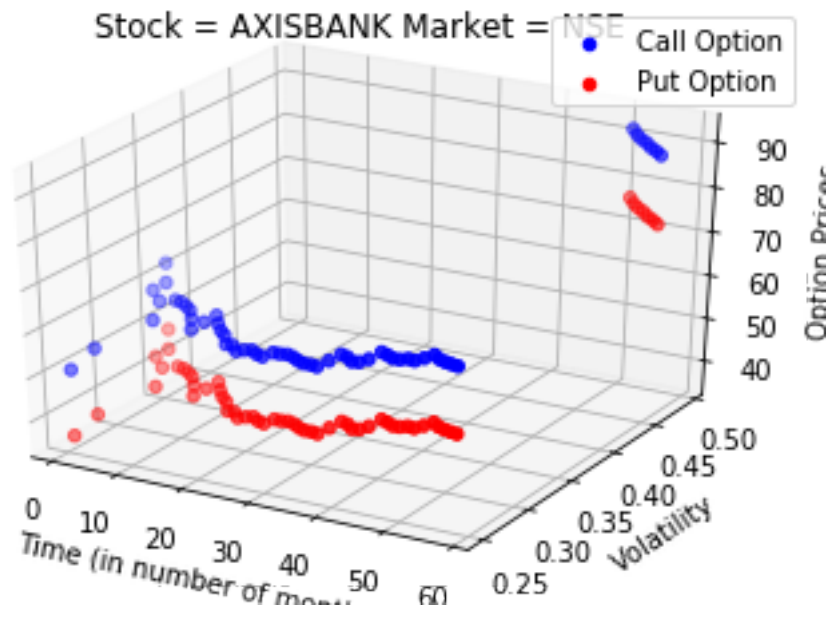
Put Price = [0.0000e+00 0.0000e+00 5.0000e-02 1.6100e+00 1.5910e+01 6.9730e+01
1.8004e+02 3.3434e+02 5.0988e+02 6.9244e+02 8.7672e+02]



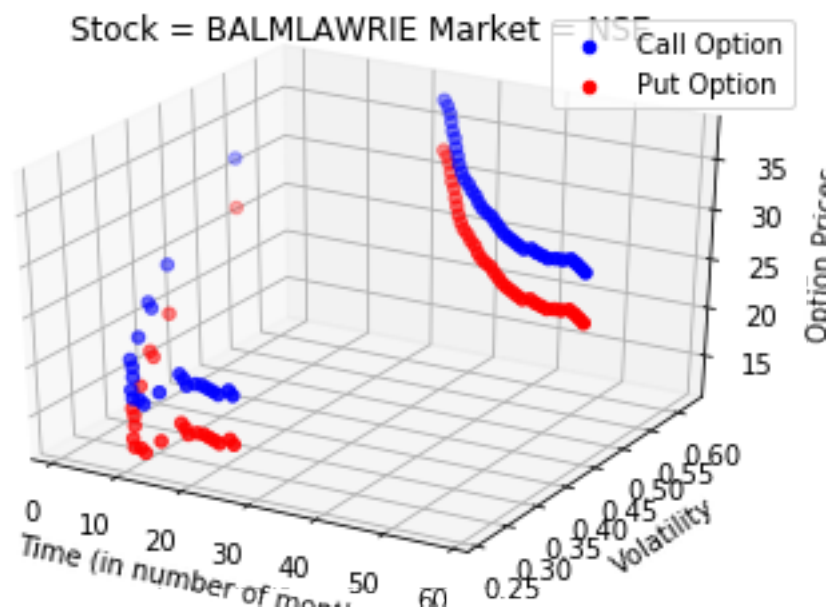
Stock : ABB Market : NSE
 Historical Volatility = 0.23218875040908418
 Call Price = [684.88 554.53 424.74 299.28 188.31 103.88 50.12 21.36 8.17 2.85
 0.92]
 Put Price = [0.0000e+00 2.0000e-02 6.2000e-01 5.5200e+00 2.4930e+01 7.0870e+01
 1.4749e+02 2.4911e+02 3.6629e+02 4.9134e+02 6.1979e+02]



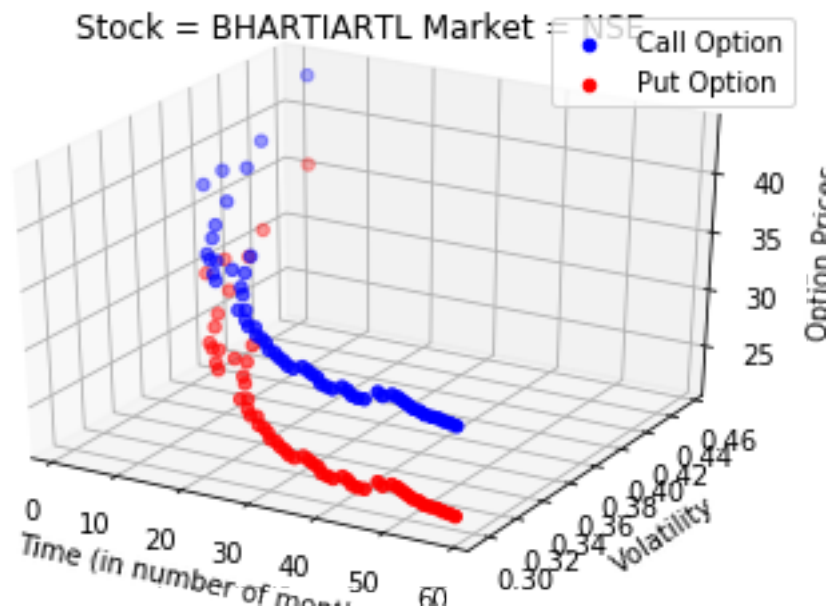
Stock : AXISBANK Market : NSE
 Historical Volatility = 0.24613044466769016
 Call Price = [317.6 257.17 197.13 139.52 89.02 50.54 25.55 11.61 4.81 1.84
 0.66]
 Put Price = [0.0000e+00 2.0000e-02 4.4000e-01 3.2900e+00 1.3250e+01 3.5240e+01
 7.0710e+01 1.1722e+02 1.7088e+02 2.2837e+02 2.8765e+02]



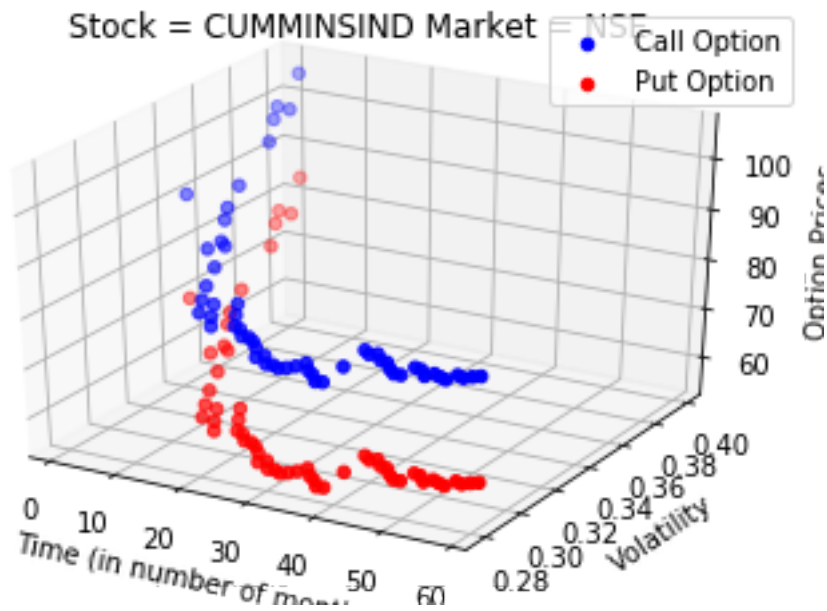
Stock : BALMLAWRIE Market : NSE
 Historical Volatility = 0.50978778624724
 Call Price = [104.6 86.01 68.96 54.02 41.47 31.3 23.3 17.16 12.53 9.09 6.57]
 Put Price = [0.44 1.67 4.46 9.35 16.62 26.28 38.11 51.79 66.99 83.38 100.69]



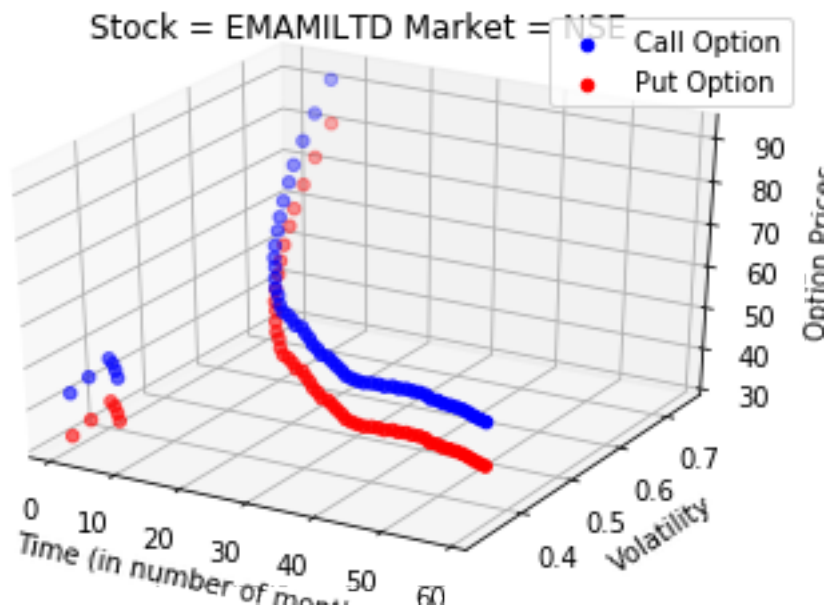
Stock : BHARTIARTL Market : NSE
 Historical Volatility = 0.3820157555020673
 Call Price = [160.18 130.2 101.62 75.87 54.19 37.16 24.58 15.77 9.87 6.05
 3.65]
 Put Price = [7.0000e-02 5.7000e-01 2.4700e+00 7.2000e+00 1.6000e+01 2.9440e+01
 4.7340e+01 6.9010e+01 9.3590e+01 1.2025e+02 1.4833e+02]



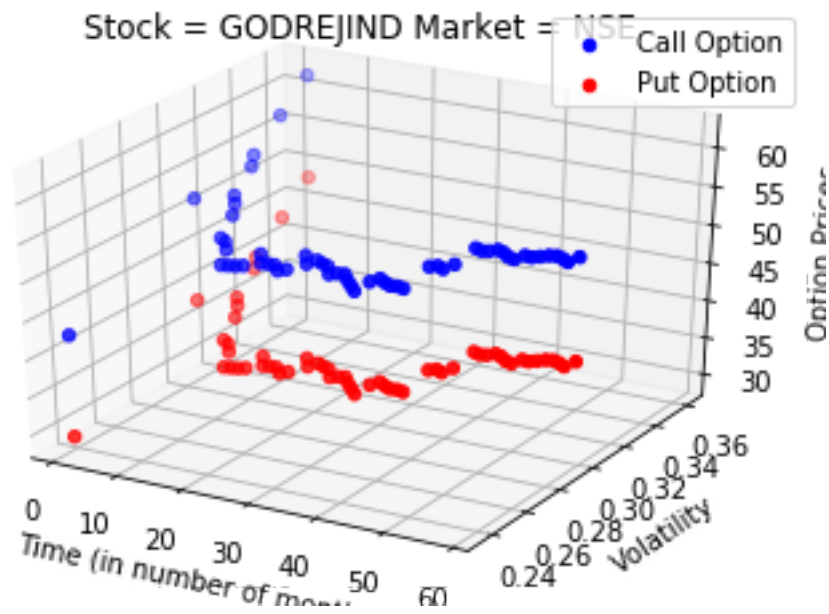
Stock : CUMMINSIND Market : NSE
 Historical Volatility = 0.3367077672653575
 Call Price = [435.39 353.12 273.43 200.39 138.51 90.45 56.1 33.27 19. 10.52
 5.68]
 Put Price = [5.0000e-02 6.5000e-01 3.8400e+00 1.3670e+01 3.4660e+01 6.9470e+01
 1.1799e+02 1.7804e+02 2.4664e+02 3.2103e+02 3.9907e+02]



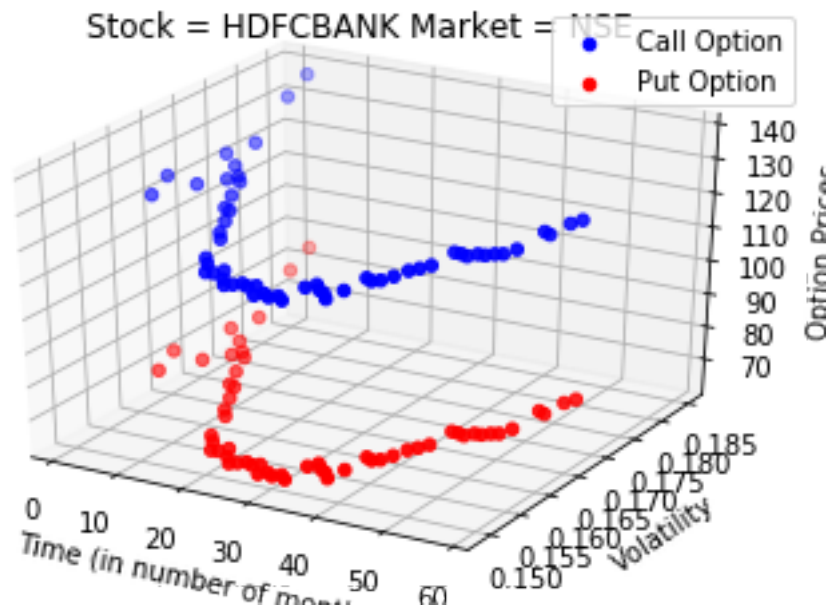
Stock : EMAMILTD Market : NSE
 Historical Volatility = 0.33178811085067444
 Call Price = [215.26 174.55 135.06 98.78 68.01 44.15 27.16 15.95 9. 4.92 2.62]
 Put Price = [2.0000e-02 2.9000e-01 1.7700e+00 6.4600e+00 1.6670e+01 3.3780e+01 5.7760e+01 8.7520e+01 1.2155e+02 1.5844e+02 1.9711e+02]



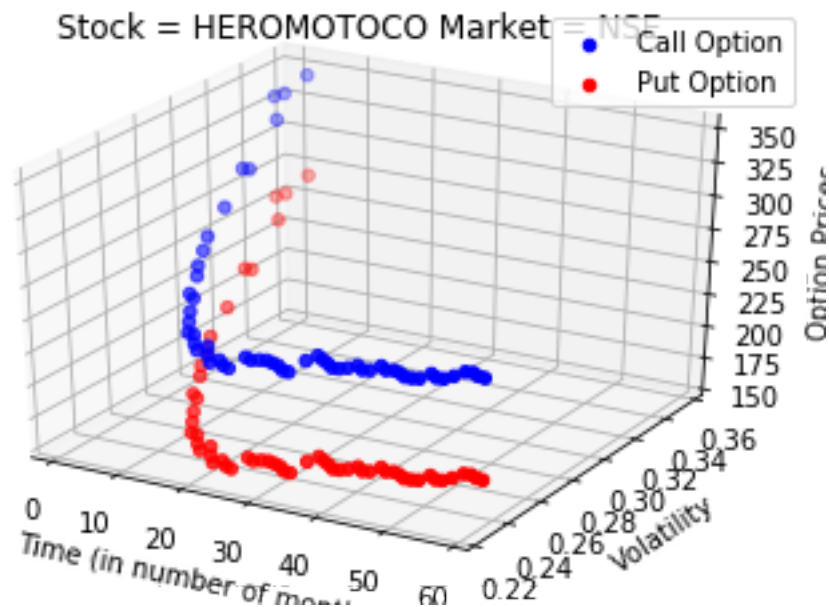
Stock : GODREJIND Market : NSE
 Historical Volatility = 0.2363949204141693
 Call Price = [279.97 226.69 173.67 122.53 77.42 43.1 21.1 9.18 3.6 1.29
 0.43]
 Put Price = [0.0000e+00 1.0000e-02 2.9000e-01 2.4400e+00 1.0640e+01 2.9600e+01
 6.0910e+01 1.0228e+02 1.4999e+02 2.0098e+02 2.5342e+02]



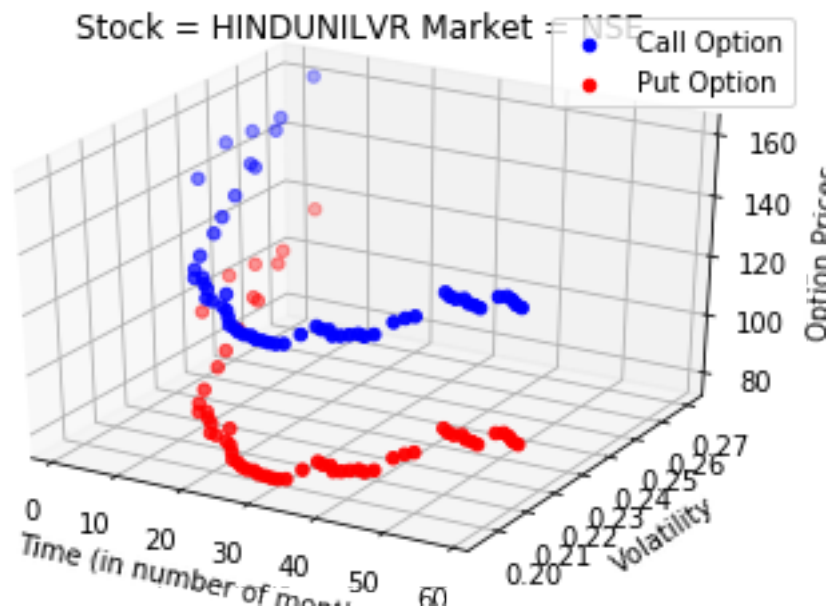
Stock : HDFCBANK Market : NSE
 Historical Volatility = 0.1604171356629825
 Call Price = [1.08704e+03 8.80110e+02 6.73200e+02 4.67320e+02 2.73330e+02 1.23260e+02
 4.06700e+01 9.81000e+00 1.79000e+00 2.60000e-01 3.00000e-02]
 Put Price = [0.0000e+00 0.0000e+00 2.0000e-02 1.0700e+00 1.4010e+01 7.0870e+01
 1.9522e+02 3.7129e+02 5.7020e+02 7.7560e+02 9.8230e+02]



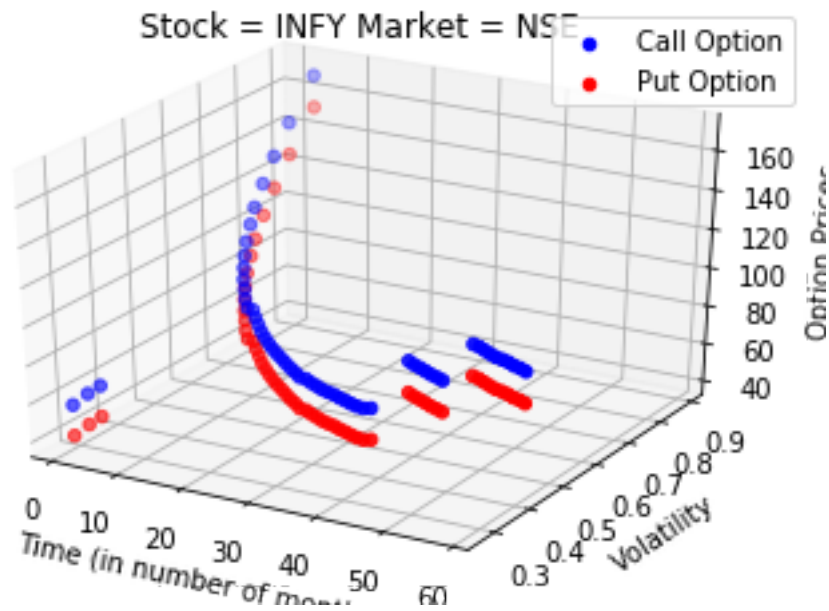
Stock : HEROMOTOCO Market : NSE
 Historical Volatility = 0.3357726068524632
 Call Price = [1590.63 1290.01 998.76 731.68 505.36 329.64 204.14 120.84 68.87
 38.05 20.49]
 Put Price = [1.80000e-01 2.33000e+00 1.38300e+01 4.95100e+01 1.25960e+02 2.53000e+02
 4.30250e+02 6.49720e+02 9.00510e+02 1.17244e+03 1.45765e+03]



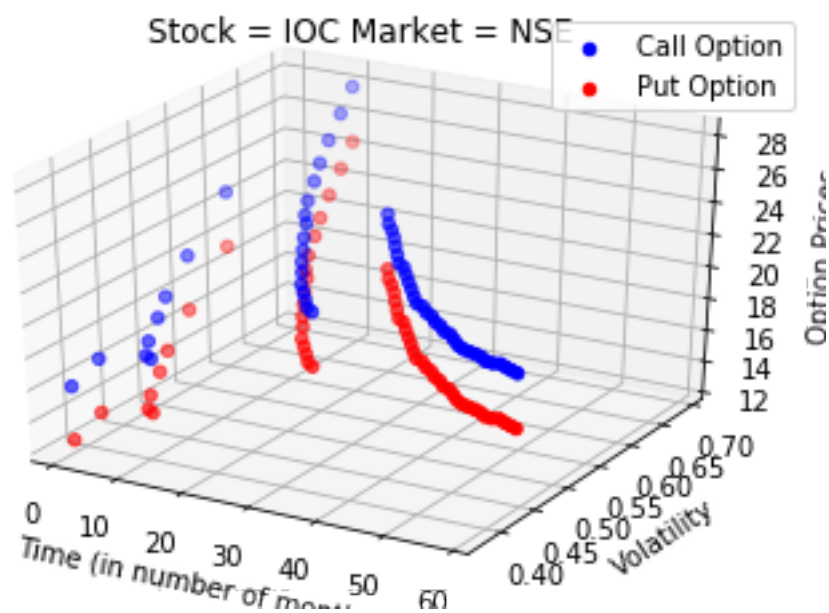
Stock : HINDUNILVR Market : NSE
 Historical Volatility = 0.2409514009820285
 Call Price = [932.29 754.87 578.46 408.71 259.44 145.78 72.48 32.19 12.96 4.8
 1.66]
 Put Price = [0.0000e+00 5.0000e-02 1.1100e+00 8.8300e+00 3.7040e+01 1.0085e+02
 2.0502e+02 3.4221e+02 5.0045e+02 6.6977e+02 8.4410e+02]



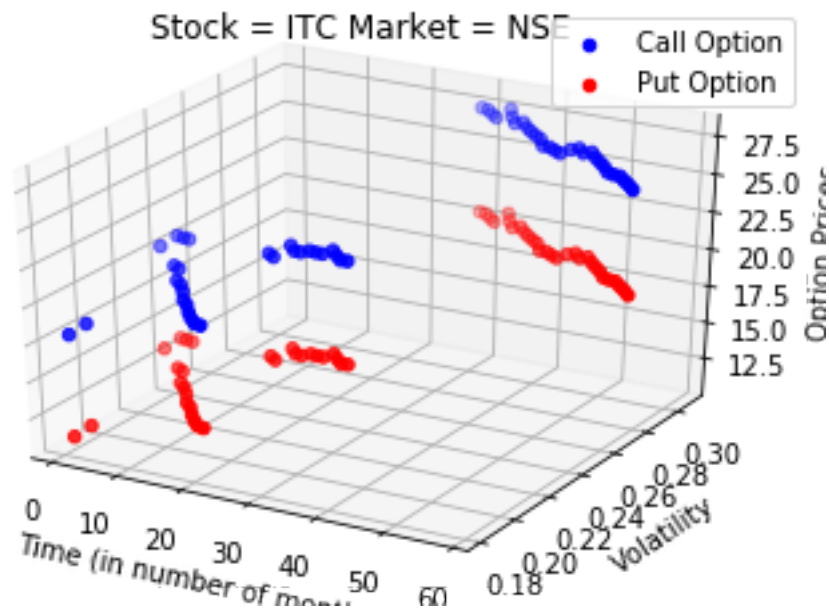
Stock : INFY Market : NSE
 Historical Volatility = 0.2630940406646563
 Call Price = [337.61 273.4 209.82 149.38 96.89 56.8 30.17 14.66 6.59 2.78
 1.11]
 Put Price = [0.0000e+00 5.0000e-02 7.5000e-01 4.5700e+00 1.6350e+01 4.0530e+01
 7.8170e+01 1.2693e+02 1.8313e+02 2.4358e+02 3.0618e+02]



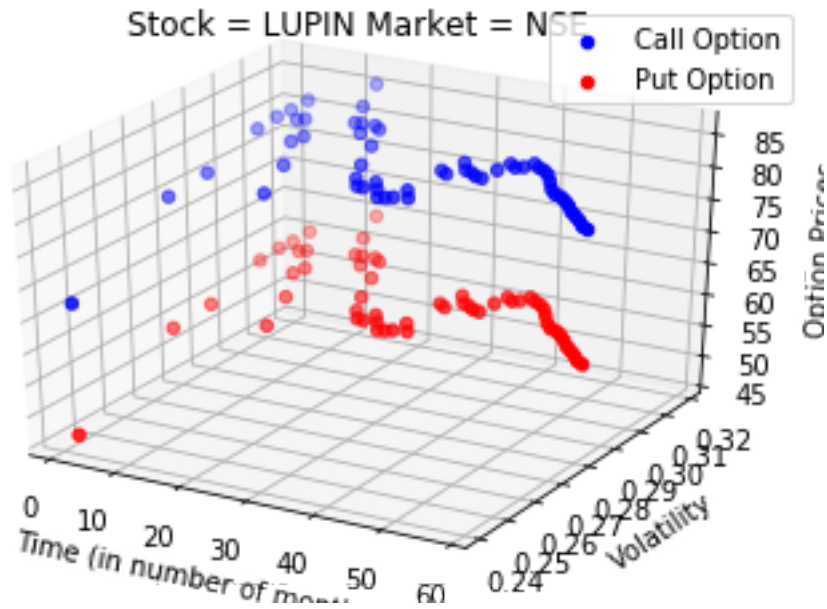
Stock : IOC Market : NSE
 Historical Volatility = 0.3676042803056978
 Call Price = [70.24 57.04 44.4 32.96 23.31 15.75 10.23 6.42 3.91 2.33 1.36]
 Put Price = [2.000e-02 1.900e-01 9.200e-01 2.840e+00 6.560e+00 1.237e+01 2.021e+01
 2.977e+01 4.063e+01 5.241e+01 6.481e+01]



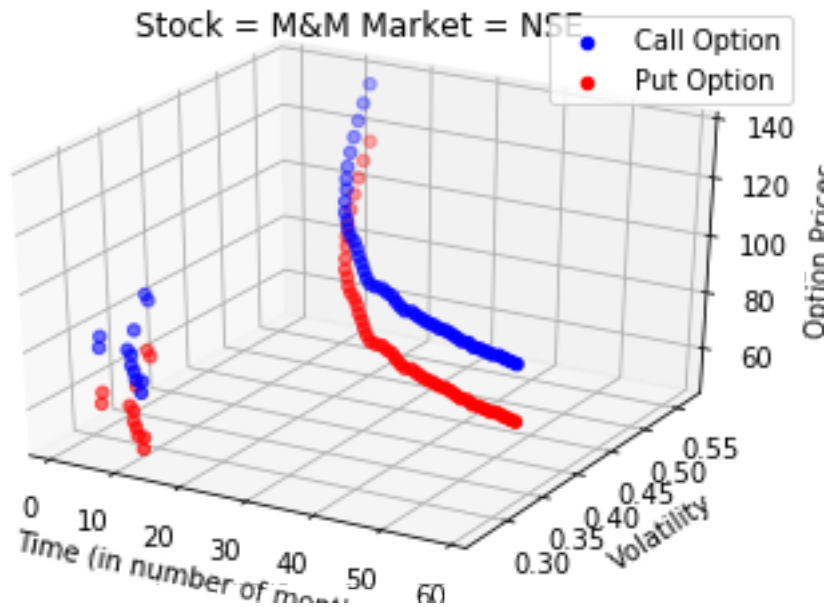
Stock : ITC Market : NSE
 Historical Volatility = 0.1776490322194474
 Call Price = [1.4430e+02 1.1683e+02 8.9370e+01 6.2180e+01 3.6990e+01 1.7680e+01
 6.5900e+00 1.9200e+00 4.5000e-01 9.0000e-02 1.0000e-02]
 Put Price = [0.0000e+00 0.0000e+00 1.0000e-02 2.8000e-01 2.5700e+00 1.0730e+01
 2.7100e+01 4.9910e+01 7.5910e+01 1.0301e+02 1.3041e+02]



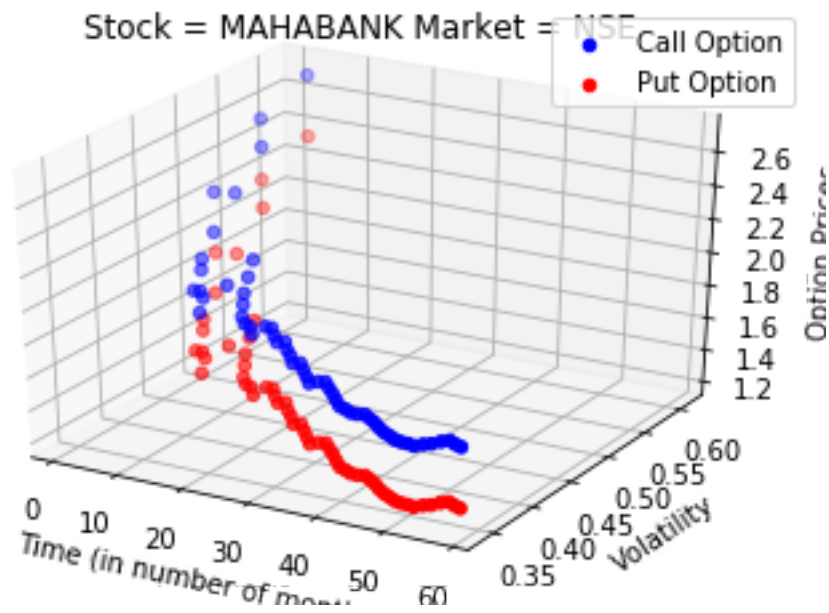
Stock : LUPIN Market : NSE
 Historical Volatility = 0.26948005723128615
 Call Price = [432.58 350.32 269. 191.96 125.26 74.26 40.13 19.94 9.22 4.01
 1.66]
 Put Price = [0.0000e+00 9.0000e-02 1.1200e+00 6.4200e+00 2.2070e+01 5.3410e+01
 1.0162e+02 1.6378e+02 2.3541e+02 3.1255e+02 3.9254e+02]



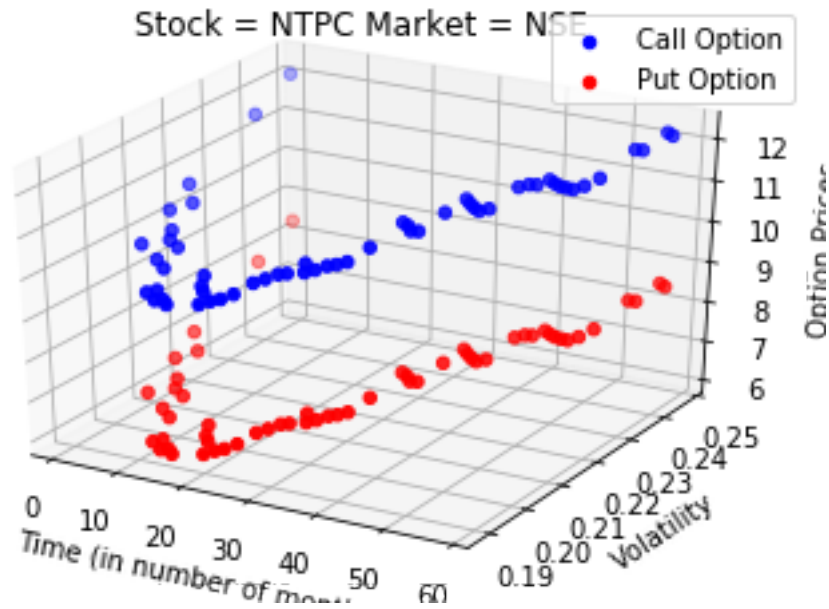
Stock : M&M Market : NSE
 Historical Volatility = 0.29730785531956333
 Call Price = [411.86 333.67 256.96 185.33 124.01 76.85 44.32 23.97 12.28 6.01 2.83]
 Put Price = [1.0000e-02 2.2000e-01 1.9100e+00 8.6900e+00 2.5770e+01 5.7010e+01 1.0287e+02 1.6093e+02 2.2763e+02 2.9976e+02 3.7499e+02]



Stock : MAHABANK Market : NSE
 Historical Volatility = 0.5584213685952092
 Call Price = [7.69 6.36 5.15 4.1 3.22 2.49 1.91 1.46 1.1 0.83 0.63]
 Put Price = [0.06 0.18 0.43 0.83 1.4 2.12 3. 4. 5.1 6.28 7.53]



Stock : NTPC Market : NSE
 Historical Volatility = 0.2420666111229389
 Call Price = [76.37 61.83 47.39 33.49 21.28 11.99 5.98 2.67 1.08 0.4 0.14]
 Put Price = [0. 0. 0.09 0.74 3.07 8.31 16.84 28.06 41.01 54.87 69.15]

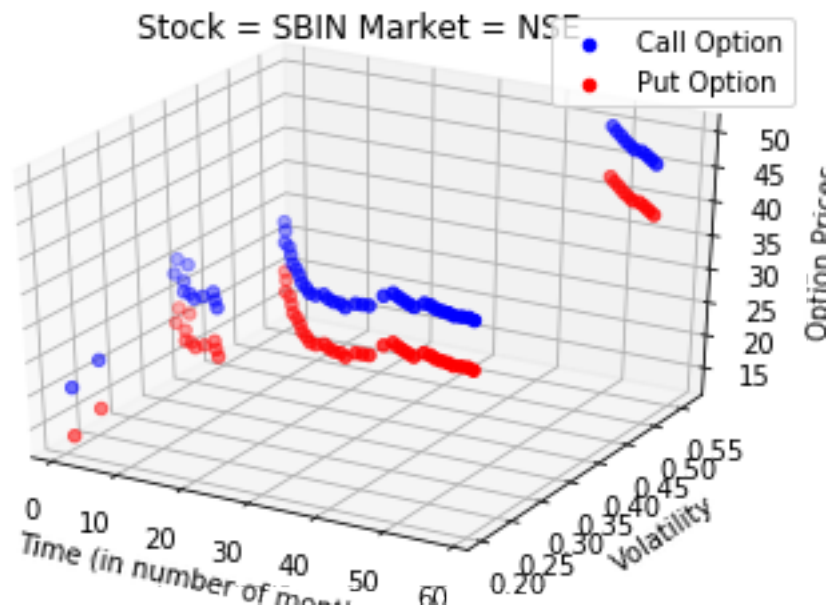


Stock : SBIN Market : NSE

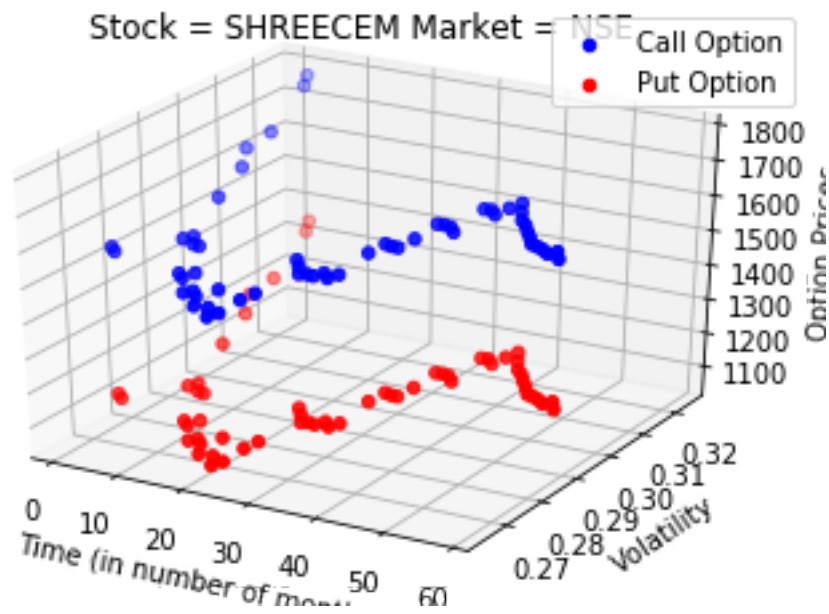
Historical Volatility = 0.19956783152418642

Call Price = [1.5160e+02 1.2274e+02 9.3920e+01 6.5610e+01 3.9920e+01 2.0350e+01
8.5700e+00 3.0000e+00 9.0000e-01 2.3000e-01 5.0000e-02]

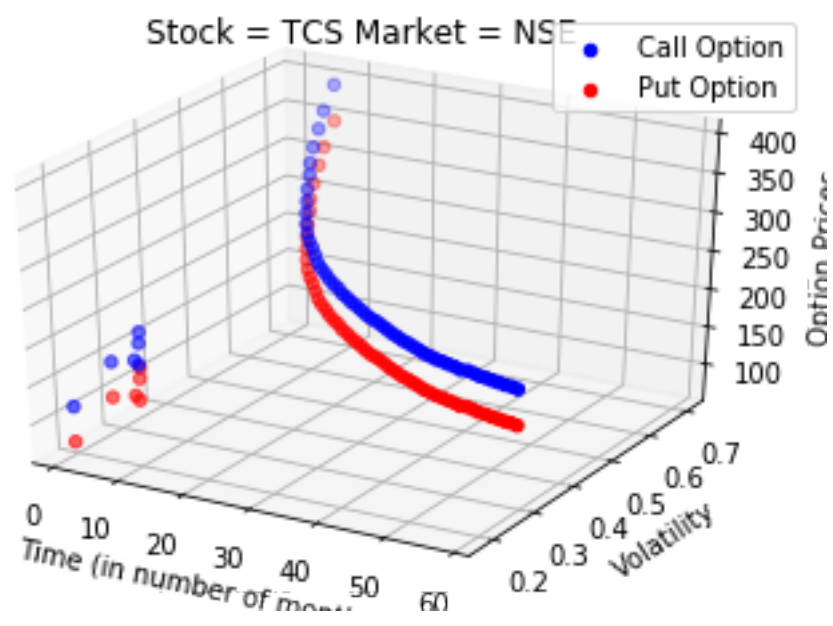
Put Price = [0.0000e+00 0.0000e+00 4.0000e-02 5.8000e-01 3.7500e+00 1.3040e+01
3.0120e+01 5.3420e+01 8.0170e+01 1.0837e+02 1.3705e+02]



Stock : SHREECEM Market : NSE
 Historical Volatility = 0.2683225132787214
 Call Price = [8830.87 7151.53 5490.88 3916.6 2552.91 1510.5 813.72 402.76 185.3
 80.19 33.]
 Put Price = [4.00000e-02 1.75000e+00 2.21600e+01 1.28930e+02 4.46300e+02 1.08494e+03
 2.06921e+03 3.33931e+03 4.80290e+03 6.37884e+03 8.01271e+03]



Stock : TCS Market : NSE
 Historical Volatility = 0.17549101992180124
 Call Price = [9.6989e+02 7.8526e+02 6.0069e+02 4.1776e+02 2.4799e+02 1.1774e+02
 4.3270e+01 1.2370e+01 2.8200e+00 5.3000e-01 9.0000e-02]
 Put Price = [0.0000e+00 0.0000e+00 6.0000e-02 1.7600e+00 1.6620e+01 7.1000e+01
 1.8116e+02 3.3489e+02 5.0998e+02 6.9232e+02 8.7650e+02]



In []: