

Options_Put

September 29, 2021

1 Put Option

```
[1]: import numpy as np
import matplotlib.pyplot as plt
import yfinance as yf
```

```
[2]: dfo = yf.Ticker("MSFT")
```

```
[3]: dfo.options
```

```
[3]: ('2020-03-19',
      '2020-05-14',
      '2021-03-18',
      '2020-03-26',
      '2020-06-18',
      '2020-04-02',
      '2020-04-30',
      '2022-06-16',
      '2020-04-16',
      '2022-01-20',
      '2020-07-16',
      '2020-04-23',
      '2020-09-17',
      '2022-03-17',
      '2020-12-17',
      '2021-06-17',
      '2021-09-16',
      '2022-09-15',
      '2020-10-15',
      '2020-04-08',
      '2021-01-14')
```

```
[4]: dfo_exp = dfo.option_chain('2020-03-19')
```

```
[5]: dfo_exp.puts
```

```

[5]:      contractSymbol      lastTradeDate  strike  lastPrice    bid  \
0  MSFT200320P00075000  2020-03-17 14:01:50    75.0      0.02    0.01
1  MSFT200320P00080000  2020-03-16 19:40:22    80.0      0.04    0.03
2  MSFT200320P00085000  2020-03-17 14:10:11    85.0      0.09    0.05
3  MSFT200320P00090000  2020-03-16 19:43:21    90.0      0.10    0.09
4  MSFT200320P00095000  2020-03-17 14:13:23    95.0      0.16    0.06
5  MSFT200320P00100000  2020-03-17 14:12:50   100.0      0.29    0.25
6  MSFT200320P00105000  2020-03-16 19:59:50   105.0      0.35    0.39
7  MSFT200320P00110000  2020-03-17 14:11:40   110.0      0.77    0.68
8  MSFT200320P00115000  2020-03-17 14:13:01   115.0      1.16    1.11
9  MSFT200320P00119000  2020-03-17 14:11:25   119.0      1.75    1.56
10 MSFT200320P00120000  2020-03-17 14:10:09   120.0      2.09    1.73
11 MSFT200320P00121000  2020-03-16 19:57:12   121.0      2.45    0.87
12 MSFT200320P00122000  2020-03-17 13:55:06   122.0      2.75    2.05
13 MSFT200320P00123000  2020-03-17 14:08:13   123.0      2.65    2.09
14 MSFT200320P00124000  2020-03-17 14:06:21   124.0      3.00    2.41
15 MSFT200320P00125000  2020-03-17 14:12:58   125.0      2.70    2.70
16 MSFT200320P00126000  2020-03-17 14:09:03   126.0      3.40    2.60
17 MSFT200320P00127000  2020-03-17 14:13:39   127.0      3.13    3.10
18 MSFT200320P00128000  2020-03-17 14:10:08   128.0      4.05    3.30
19 MSFT200320P00129000  2020-03-16 19:38:33   129.0      3.20    3.15
20 MSFT200320P00130000  2020-03-17 14:13:49   130.0      4.04    3.00
21 MSFT200320P00131000  2020-03-17 14:05:36   131.0      5.15    4.15
22 MSFT200320P00132000  2020-03-17 14:13:49   132.0      4.66    4.45
23 MSFT200320P00133000  2020-03-17 14:11:33   133.0      5.10    4.85
24 MSFT200320P00134000  2020-03-17 14:09:43   134.0      5.70    5.25
25 MSFT200320P00135000  2020-03-17 14:12:06   135.0      5.80    5.65
26 MSFT200320P00136000  2020-03-17 14:13:44   136.0      6.10    6.00
27 MSFT200320P00137000  2020-03-17 14:14:17   137.0      6.50    5.60
28 MSFT200320P00138000  2020-03-17 14:12:38   138.0      7.00    6.70
29 MSFT200320P00139000  2020-03-17 14:06:44   139.0      8.20    7.30
..      ...      ...      ...      ...      ...
37 MSFT200320P00147000  2020-03-17 14:01:40   147.0     14.00   11.60
38 MSFT200320P00148000  2020-03-17 13:58:25   148.0     13.48   12.10
39 MSFT200320P00149000  2020-03-17 13:33:59   149.0     12.20   13.15
40 MSFT200320P00150000  2020-03-17 14:08:02   150.0     14.97   13.65
41 MSFT200320P00155000  2020-03-16 19:57:29   155.0     16.57   14.80
42 MSFT200320P00157500  2020-03-16 19:57:12   157.5     20.67   17.25
43 MSFT200320P00160000  2020-03-17 13:30:52   160.0     19.50   18.60
44 MSFT200320P00162500  2020-03-16 19:38:42   162.5     21.90   24.20
45 MSFT200320P00165000  2020-03-16 19:38:45   165.0     26.25   23.70
46 MSFT200320P00167500  2020-03-17 14:08:56   167.5     31.10   29.30
47 MSFT200320P00170000  2020-03-17 14:07:08   170.0     33.86   31.85
48 MSFT200320P00172500  2020-03-16 18:55:03   172.5     30.90   34.30
49 MSFT200320P00175000  2020-03-17 14:07:08   175.0     38.84   36.80
50 MSFT200320P00177500  2020-03-16 19:45:02   177.5     36.30   39.25
51 MSFT200320P00180000  2020-03-16 19:39:09   180.0     38.85   38.45

```

| | | | | | |
|----|---------------------|---------------------|-------|--------|--------|
| 52 | MSFT200320P00182500 | 2020-03-16 18:32:54 | 182.5 | 40.55 | 44.25 |
| 53 | MSFT200320P00185000 | 2020-03-16 19:21:57 | 185.0 | 42.53 | 43.00 |
| 54 | MSFT200320P00187500 | 2020-03-09 19:06:10 | 187.5 | 45.75 | 46.30 |
| 55 | MSFT200320P00190000 | 2020-03-16 19:45:31 | 190.0 | 49.75 | 51.85 |
| 56 | MSFT200320P00192500 | 2020-03-12 17:12:14 | 192.5 | 45.65 | 54.30 |
| 57 | MSFT200320P00195000 | 2020-03-16 19:39:47 | 195.0 | 56.10 | 56.85 |
| 58 | MSFT200320P00197500 | 2020-03-13 15:57:13 | 197.5 | 52.65 | 55.80 |
| 59 | MSFT200320P00200000 | 2020-03-16 18:52:53 | 200.0 | 60.85 | 58.40 |
| 60 | MSFT200320P00202500 | 2020-03-16 19:39:09 | 202.5 | 63.20 | 61.00 |
| 61 | MSFT200320P00205000 | 2020-03-13 17:03:02 | 205.0 | 60.65 | 63.80 |
| 62 | MSFT200320P00210000 | 2020-03-13 19:34:01 | 210.0 | 67.80 | 68.30 |
| 63 | MSFT200320P00220000 | 2020-03-16 14:37:53 | 220.0 | 72.60 | 78.30 |
| 64 | MSFT200320P00230000 | 2020-03-11 18:43:16 | 230.0 | 77.35 | 88.30 |
| 65 | MSFT200320P00240000 | 2020-03-11 19:54:30 | 240.0 | 85.50 | 97.80 |
| 66 | MSFT200320P00250000 | 2020-03-11 19:58:52 | 250.0 | 105.75 | 108.30 |

| | ask | change | percentChange | volume | openInterest | impliedVolatility \ |
|----|------|-----------|---------------|--------|--------------|---------------------|
| 0 | 0.03 | -0.010000 | -33.333336 | 884 | 1640.0 | 2.656253 |
| 1 | 0.05 | -0.060000 | -60.000000 | 276 | 1751.0 | 2.593754 |
| 2 | 0.08 | -0.060000 | -40.000000 | 190 | 1774.0 | 2.484379 |
| 3 | 0.12 | 0.000000 | 0.000000 | 382 | 3945.0 | 2.390629 |
| 4 | 0.30 | -0.200000 | -55.555557 | 24 | 701.0 | 2.324223 |
| 5 | 0.29 | -0.300000 | -50.847458 | 218 | 4255.0 | 2.222661 |
| 6 | 0.47 | -0.490000 | -58.333332 | 2 | 2961.0 | 2.150395 |
| 7 | 0.84 | -0.540000 | -41.221375 | 233 | 6313.0 | 2.144536 |
| 8 | 1.32 | -0.560000 | -32.558144 | 73 | 4519.0 | 2.114263 |
| 9 | 1.82 | -0.180000 | -9.326422 | 28 | 622.0 | 2.081059 |
| 10 | 1.95 | -0.650000 | -23.722630 | 13836 | 23146.0 | 2.077153 |
| 11 | 2.34 | 0.000000 | 0.000000 | 166 | 1144.0 | 1.928711 |
| 12 | 2.45 | 0.790000 | 40.306120 | 135 | 57.0 | 2.094731 |
| 13 | 2.48 | -0.150000 | -5.357138 | 478 | 1214.0 | 2.042974 |
| 14 | 2.75 | -0.450000 | -13.043479 | 216 | 300.0 | 2.071294 |
| 15 | 3.00 | -2.150000 | -44.329895 | 256 | 14682.0 | 2.085942 |
| 16 | 3.15 | -0.800000 | -19.047613 | 620 | 456.0 | 2.026860 |
| 17 | 3.60 | -1.300000 | -29.345366 | 154 | 137.0 | 2.091313 |
| 18 | 3.75 | 1.000000 | 32.786892 | 248 | 398.0 | 2.068852 |
| 19 | 3.80 | 1.920000 | 150.000000 | 157 | 233.0 | 1.986328 |
| 20 | 3.50 | -1.510000 | -27.207210 | 1099 | 6829.0 | 1.858887 |
| 21 | 4.55 | 0.060000 | 1.178781 | 209 | 317.0 | 2.061040 |
| 22 | 4.80 | -0.840000 | -15.272731 | 99 | 343.0 | 2.052251 |
| 23 | 5.20 | -0.900000 | -15.000001 | 145 | 190.0 | 2.068852 |
| 24 | 5.65 | -1.270000 | -18.220947 | 289 | 763.0 | 2.087163 |
| 25 | 5.85 | -1.990000 | -25.545567 | 1350 | 6497.0 | 2.074224 |
| 26 | 6.35 | -2.050000 | -25.153372 | 209 | 296.0 | 2.085454 |
| 27 | 6.85 | -2.100000 | -24.418608 | 173 | 173.0 | 2.014165 |
| 28 | 7.15 | -1.750000 | -20.000000 | 204 | 309.0 | 2.076421 |
| 29 | 7.75 | -1.400001 | -14.583339 | 1207 | 460.0 | 2.113286 |

| | | | | | | |
|----|--------|-----------|------------|-----|---------|----------|
| .. | ... | ... | ... | ... | ... | ... |
| 37 | 12.45 | 1.700000 | 13.821136 | 637 | 5127.0 | 2.228032 |
| 38 | 13.05 | 0.080000 | 0.597014 | 445 | 463.0 | 2.227543 |
| 39 | 13.75 | 0.309999 | 2.607229 | 277 | 895.0 | 2.286137 |
| 40 | 14.45 | -1.780000 | -10.626864 | 650 | 14829.0 | 2.290043 |
| 41 | 17.35 | -2.330000 | -12.328043 | 1 | 17135.0 | 2.087895 |
| 42 | 19.40 | 0.000000 | 0.000000 | 314 | 4143.0 | 2.201665 |
| 43 | 21.80 | -5.750000 | -22.772278 | 30 | 16019.0 | 2.230961 |
| 44 | 25.90 | 0.000000 | 0.000000 | 134 | 2509.0 | 2.841800 |
| 45 | 27.10 | 17.250000 | 191.666670 | 158 | 11285.0 | 2.553715 |
| 46 | 30.90 | 4.380001 | 16.392221 | 373 | 4687.0 | 3.131838 |
| 47 | 33.60 | 1.920000 | 6.011271 | 291 | 15084.0 | 3.288820 |
| 48 | 35.90 | 0.000000 | 0.000000 | 35 | 16780.0 | 3.391115 |
| 49 | 38.45 | 1.700001 | 4.577277 | 480 | 12732.0 | 3.519044 |
| 50 | 40.95 | 0.000000 | 0.000000 | 41 | 307.0 | 3.633302 |
| 51 | 40.80 | 14.649998 | 60.537178 | 478 | 13176.0 | 3.109866 |
| 52 | 45.80 | 0.000000 | 0.000000 | 8 | 410.0 | 3.844727 |
| 53 | 45.65 | 12.029999 | 39.442620 | 823 | 32071.0 | 3.250002 |
| 54 | 48.15 | 0.000000 | 0.000000 | 1 | 299.0 | 3.442872 |
| 55 | 53.15 | 0.000000 | 0.000000 | 179 | 3053.0 | 4.157231 |
| 56 | 55.55 | 0.000000 | 0.000000 | 5 | 26.0 | 4.241216 |
| 57 | 58.15 | 0.000000 | 0.000000 | 252 | 1252.0 | 4.355473 |
| 58 | 57.45 | 0.000000 | 0.000000 | 4 | NaN | 3.674806 |
| 59 | 59.95 | 0.000000 | 0.000000 | 84 | 8.0 | 3.774903 |
| 60 | 65.40 | 9.799999 | 18.352058 | 66 | NaN | 4.228032 |
| 61 | 65.40 | 0.000000 | 0.000000 | 10 | 0.0 | 4.050298 |
| 62 | 69.95 | 0.000000 | 0.000000 | 4 | 8.0 | 4.094731 |
| 63 | 79.95 | 0.000000 | 0.000000 | 30 | 30.0 | 4.400883 |
| 64 | 89.95 | 0.000000 | 0.000000 | 25 | 1.0 | 4.685063 |
| 65 | 100.50 | 0.000000 | 0.000000 | 20 | 1.0 | 4.957035 |
| 66 | 109.95 | 0.000000 | 0.000000 | 7 | 8.0 | 5.199222 |

| | inTheMoney | contractSize | currency |
|----|------------|--------------|----------|
| 0 | False | REGULAR | USD |
| 1 | False | REGULAR | USD |
| 2 | False | REGULAR | USD |
| 3 | False | REGULAR | USD |
| 4 | False | REGULAR | USD |
| 5 | False | REGULAR | USD |
| 6 | False | REGULAR | USD |
| 7 | False | REGULAR | USD |
| 8 | False | REGULAR | USD |
| 9 | False | REGULAR | USD |
| 10 | False | REGULAR | USD |
| 11 | False | REGULAR | USD |
| 12 | False | REGULAR | USD |
| 13 | False | REGULAR | USD |

| | | | |
|----|-------|---------|-----|
| 14 | False | REGULAR | USD |
| 15 | False | REGULAR | USD |
| 16 | False | REGULAR | USD |
| 17 | False | REGULAR | USD |
| 18 | False | REGULAR | USD |
| 19 | False | REGULAR | USD |
| 20 | False | REGULAR | USD |
| 21 | False | REGULAR | USD |
| 22 | False | REGULAR | USD |
| 23 | False | REGULAR | USD |
| 24 | False | REGULAR | USD |
| 25 | False | REGULAR | USD |
| 26 | False | REGULAR | USD |
| 27 | False | REGULAR | USD |
| 28 | False | REGULAR | USD |
| 29 | False | REGULAR | USD |
| .. | ... | ... | ... |
| 37 | True | REGULAR | USD |
| 38 | True | REGULAR | USD |
| 39 | True | REGULAR | USD |
| 40 | True | REGULAR | USD |
| 41 | True | REGULAR | USD |
| 42 | True | REGULAR | USD |
| 43 | True | REGULAR | USD |
| 44 | True | REGULAR | USD |
| 45 | True | REGULAR | USD |
| 46 | True | REGULAR | USD |
| 47 | True | REGULAR | USD |
| 48 | True | REGULAR | USD |
| 49 | True | REGULAR | USD |
| 50 | True | REGULAR | USD |
| 51 | True | REGULAR | USD |
| 52 | True | REGULAR | USD |
| 53 | True | REGULAR | USD |
| 54 | True | REGULAR | USD |
| 55 | True | REGULAR | USD |
| 56 | True | REGULAR | USD |
| 57 | True | REGULAR | USD |
| 58 | True | REGULAR | USD |
| 59 | True | REGULAR | USD |
| 60 | True | REGULAR | USD |
| 61 | True | REGULAR | USD |
| 62 | True | REGULAR | USD |
| 63 | True | REGULAR | USD |
| 64 | True | REGULAR | USD |
| 65 | True | REGULAR | USD |
| 66 | True | REGULAR | USD |

[67 rows x 14 columns]

```
[6]: df = yf.download("MSFT")
```

[*****100%*****] 1 of 1 completed

```
[7]: df.head()
```

```
[7]:
```

| | Adj Close | Close | High | Low | Open | Volume |
|------------|-----------|----------|----------|----------|----------|------------|
| Date | | | | | | |
| 1986-03-13 | 0.062378 | 0.097222 | 0.101562 | 0.088542 | 0.088542 | 1031788800 |
| 1986-03-14 | 0.064606 | 0.100694 | 0.102431 | 0.097222 | 0.097222 | 308160000 |
| 1986-03-17 | 0.065720 | 0.102431 | 0.103299 | 0.100694 | 0.100694 | 133171200 |
| 1986-03-18 | 0.064049 | 0.099826 | 0.103299 | 0.098958 | 0.102431 | 67766400 |
| 1986-03-19 | 0.062935 | 0.098090 | 0.100694 | 0.097222 | 0.099826 | 47894400 |

```
[8]: df.tail()
```

```
[8]:
```

| | Adj Close | Close | High | Low | Open \ |
|------------|------------|------------|------------|------------|------------|
| Date | | | | | |
| 2020-03-11 | 153.630005 | 153.630005 | 157.699997 | 151.149994 | 157.130005 |
| 2020-03-12 | 139.059998 | 139.059998 | 153.470001 | 138.580002 | 145.300003 |
| 2020-03-13 | 158.830002 | 158.830002 | 161.910004 | 140.729996 | 147.500000 |
| 2020-03-16 | 135.419998 | 135.419998 | 149.350006 | 135.000000 | 140.000000 |
| 2020-03-17 | 146.570007 | 146.570007 | 147.500000 | 135.000000 | 140.000000 |

| | Volume |
|------------|----------|
| Date | |
| 2020-03-11 | 56371600 |
| 2020-03-12 | 93226400 |
| 2020-03-13 | 92727400 |
| 2020-03-16 | 87905900 |
| 2020-03-17 | 80963800 |

```
[9]: df['Adj Close'][-1]
```

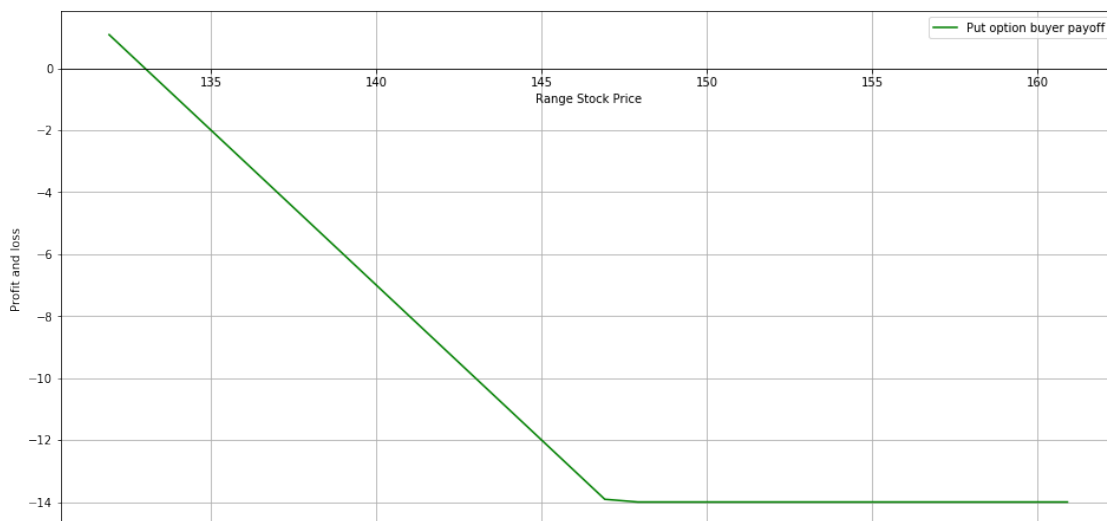
```
[9]: 146.57000732421875
```

```
[10]: spot_price = df['Adj Close'][-1] # current price
share_price = np.arange(0.9*spot_price, 1.1*spot_price)
strike_price = dfo_exp.puts['strike'][37] # exercise price of an options that
→ is fixed price
put_price = dfo_exp.puts['lastPrice'][37] # price of an option or premium
```

```
[11]: def put_option(share_price, strike_price, put_price):
    pnl = np.where(share_price < strike_price, strike_price - share_price, 0)
```

```
return pnl - put_price
```

```
[12]: payoff_long_put = put_option(share_price, strike_price, put_price)
# Plot the graph
plt.subplots(figsize=(16,8))
plt.gca().spines['bottom'].set_position('zero')
plt.plot(share_price, payoff_long_put, label='Put option buyer payoff', color='g')
plt.xlabel('Range Stock Price')
plt.ylabel('Profit and loss')
plt.grid(which='both')
plt.legend()
plt.show()
```



```
[13]: payoff_short_put = payoff_long_put * -1.0
# Plot
plt.subplots(figsize=(16,8))
plt.gca().spines['bottom'].set_position('zero')
plt.plot(share_price, payoff_short_put, label='Short 147 Strike Put', color='r')
plt.xlabel('Range Stock Price')
plt.ylabel('Profit and loss')
plt.grid(which='both')
plt.legend()
plt.show()
```

