Università degli studi di Padova

Stochastic Methods for Finance

Forward annual dividend rate estimation

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1   Goal

The goal of this report is to deduce the **Pfizer Inc.** forward annual dividend rate using a box spread and the Put-Call parity. Finally the result is compared with the one apperaing on the `https://finance.yahoo.com` website.

2   About Pfizer Inc.

Pfizer Inc. is an american multinational that works in the pharmaceutical industry. It was founded in 1849 by Charles Pfizer and Charles F. Erhart. Its actual Chariman & CEO is Albert Bourla. It is listed on the New York Stock Exchange and belongs to the Dow Jones index. Some important data provided by the website are shown in the following table (currency in USD):

Market Cap (intraday)	**197.24B**
EBITDA	**14.89B**
Gross Profit (ttm)	**33.33B**
Last split factor	**1054:1000**
Last split date	**Nov 16, 2020**
Closing price (March, 23, 2021)	**35.36**
Forward Annual Dividend Rate	**1.56**
Ex-Dividend Date	**Jan 27, 2021**

3   Procedure

As we're going to explain, the idea is to use stock options in order to build a deterministic payoff (Box Spread, see later) from which we can estimate the discount factor for a given maturity. This discount factor is used into the Put-Call parity (see later) in order to estimate the dividend.

Our underlying is the Pfizer Inc. stock price and we set its value S_0 as the closing price of 23 March 2021. So we have:

$$S_0 = 35.36$$

In the *Options* section can be found the **Calls** and **Puts** options for different expiration dates. Before going into details we set a number of maturities that we will use for calculations. For our goal we have selected 6 dates:

- T_1 = May, 21, 2021;

- T_2 = June, 18, 2021;

- T_3 = July, 16, 2021;

- T_4 = Sptember, 17, 2021;

- T_5 = January, 21, 2022;

- T_6 = September, 16, 2022;

3.1 Box spread

We select two strikes: K_- and K_+ with $K_- < K_+$. The box spread strategy is the following:

- buy a Call with strike K_-, sell a Call with strike K_+;

- buy a put with stike K_+, sell a put with strike K_-.

In this way, we produce a deterministic payoff payoff at the maturity T equal to $K_+ - K_-$. Since the following holds:

$$\text{Call}_{K_-} - \text{Call}_{K_+} + \text{Put}_{K_+} - \text{Put}_{K_-} = (K_+ - K_-)D(0,T), \tag{1}$$

we can deduce the discount factor $D(0,T)$ from the prices of the Calls and Puts options provided by the website: we will consider the *Last Price* for the computations.

3.2 Put-Call parity

Now, the discount factor can be used in the Put-Call parity. Indeed, since we assume the absence of arbitrage opportunity, the following relation that links the price of Call and Put options for a strike K and a maturity T must hold (in presence of dividends):

$$\text{Call}_K - \text{Put}_K = S_0 - KD(0,T) - Div, \tag{2}$$

where Div is the dividend and $D(0,T)$ is the discount factor for the maturity T. Now, from this equation one can determine the Div.

3.3 Calculations

In this subsection we show the calculations for the Box-Spread and the Put-Call parity. For the Box-Spread, the selected stikes are

$$K_- = 30 \qquad K_+ = 40,$$

whereas the stike used for the P-C parity is

$$K_{P-C} = 35.$$

In the following table we show the results for the discount factors and the dividends obtained:

Maturity T_i	Discount factor $D(0,T_i)$	Dividend (USD per stock)
T_1	0.97	1.03
T_2	0.97	1.27
T_3	0.98	0.95
T_4	0.991	0.565
T_5	1.016	0.225
T_6	1.01	1.01

4 Conclusion

As can be seen in the previous table, the dividend represented as an amount of cash per stock. So, in averege, we obtain:

$$\text{Div}_{average} = 0.842, \tag{3}$$

which is quite different from the one provided by yahoo (see first table) equal to 1.56. One reason for this difference could be the fact that the Put-Call parity that we used for the computations is valid for European-style options. Indeed, Pfizer Inc. provides American-style options and this can lead to different prices on Calls and Puts. For this report, European-style options were difficoult to be used, since those are in general available for stock indexes and not for companies.