Dividend Rate from Market Options Data

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Abstract

One of the main goals of quantitative finance is to built up models trying to predict the characteristics of the markets to make predictions. These models like the binomial one for option pricing are based on some theoretical assumptions that not always agreed with real-world data [1]. The goal of this brief project is to estimate the dividend policy of a company studying its the dividend rate without a real model but using simple relations among the variable and the market data. First is used a box-spread to calculate the discount factor and then the put-call parity to estimate the value of the dividend rate.

1. Introduction

A dividend is a distribution of a part of the company's earning to a class of its shareholders; these can be paid as cash or in the form of additional stock. The decision of a company to distribute dividends or how to distribute them is part of the dividend policy of that company and it's determined by the company's board of directors. Some company doesn't distribute dividends, as Amazon, while other companies, like Apple, distributes dividends at some dates and this generally accompanies a proportional increase or decrease in company's stock price. The main parameters that can describe how a company manage dividends are the dividend rate (value of the dividend) or the dividend yield (value expressed as percentage of the value of the stock). To manage with the dividend rate it is firstly necessary to find a company with a dividend policy proven over years and with an active option market; for this reason I chose Microsoft Corporation.

1.1. Company

Microsoft is an American multinational technology company that develops and sells software, electronics and related services; it was founded by Bill Gates in 1975. Is is considered one of the Big Five tech companies in U.S. along with Google, Apple, Amazon and Facebook. Microsoft went public and launched its IPO in 1986 with an opening price of 21$ per share. It is traded as Nasdaq and as a component of Nasdaq-100, DJIA, S&P100 and S&P500 index funds. The main institutional stock holders are Vanguard Group, Blackrock and State Street Corporation for a total of 18% share. The company had started offering dividends since 2003 initially yearly and from 2005 quarterly; through the years the company increased in dividend payouts; the current Forward Annual Dividend Rate in 2.24 with an Annual Dividend Yield of 0.95%. The last split was in Feb 2003 with a split factor of 2:1. Microsoft has a capitalization of 1.78 Trillion dollars with a yearly revenue of 153.258 Billions and a gross profit of 96.94 Billions. The EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) of the company is 71.69 Billions; this is an useful parameter to compare companies that operate in the same sector because is an approximation of the company cash flow. For comparison the EBITDA of Google and Apple are 59.4B and 85.16B respectively.

2. Data

Nowadays is it possible to access to a huge amount of data by different platforms, in this case the data used for the computations are available on the *yahoo! finance* website as NASDAQ. (2021, March 17). Microsoft Corporation (MSFT). [Stock quote] and [Stock Options]. The site provides financial information as stock quotes, financial reports of the companies, statistics and market data (as options prices). On the company profile is it possible to see and download the historical data of the stock prices. To access the options data it is necessary to select a prefixed maturity date among those available.

3. Method

3.1. Box-spread

The first step consist in computing the discount factor, to make this I am going to use a *box spread*. The box spread strategy is used in option trading to delete the randomness of the payoff using two synthetic derivatives. First of all we have to select two different *strike prices* called K_1 and K_2. The first synthetic long option is constructed by taking a long call position (buy) C_{K_1} and a short put position P_{K_1} (sell) with strike K_1. The second synthetic short option is

composed by a long put P_{K_2} and a short call C_{K_2} positions with strike K_2. A graphic representation of the payoff is reported in Fig 1.
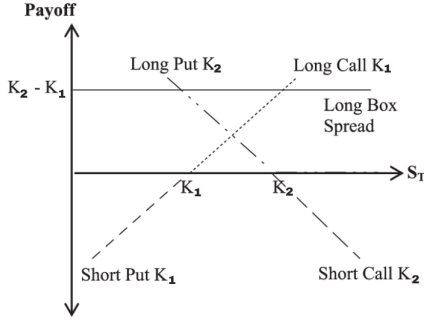

Figure 1. Payoff of the box-spread.

Considering the payoff of these positions the stock price clears itself from the equation and the payoff of the long box spread is given by the difference between the strike prices, multiplied by the discount factor at time T, $D(0,T) = e^{-rT}$ as reported in eq 1.

$$C_{K_1} - C_{K_2} + P_{K_2} - P_{K_1} = (K_2 - K_1)D(0,T) \quad (1)$$

The values of K_1 and K_2 chosen are between $\pm 5/10\%$ of the current *at-the-money* (ATM) price. And the cost of the Call and Put used are referred to the *Last Price* available on Yahoo! Finance. From the discount factor $D(0,T)$ it is possible to calculate the interest rate $r = -\frac{ln(D(0,T))}{T}$ where T is the time expressed as a fraction of the year: $T = \frac{\#days}{365}$.

3.2. Dividend Rate

The aim is to calculate the *Annual Dividend Rate* of a company deducing it from its stocks values in the market. To make this I used the *Put-Call parity* equation that in the case of dividends (div) it can be written as follow in equation 2:

$$C_K - P_K = S - K * D(0,T) - D(0,T) * div \quad (2)$$

Where S is the current price of the stock. So choosing a strike price K (I used the ATM price), using the related Call and Put costs (C_K and P_K) and the discount factor $D(0,T)$ calculated before is possible to extract the div from the formula. If we consider proportional dividends rate ($div = S * e^{qT}$) is it also possible to calculate the dividend parameter q.

4. Procedure

To calculate the Annual Dividend Rate I used 5 different maturity dates and for each of these I calculate firstly the

discount factor and then the div. At the end I made an average between the values to have the final results. The strike prices used for the box-spread are between the $\pm 10\%$ of the ATM price. The choice of these values are also in relation with a not too low *volume* and *open interest*. These metrics describe the liquidity and the activity of the option for that particular strike price. For completeness I report the data used for the time maturity $T = \frac{65}{365}$ (21 May 2020) in Table 1.

Type	Strike	Last Price	Volume	Open Interest
Put	210	2.92	234	2,563
Call	210	31.37	61	357
Put	260	24.71	1	40
Call	260	3.55	697	3,476

Table 1. Prices of the options settled a given strike price (K_1 and K_2)

The data are update to 17th March 2021 with a stock price of 238.31$.

4.1. Main Results

Date	$D(0,T)$	r	q	div
16 April	0.993	0.085	-58.54	1.94
21 May	0.992	2.878	-23.20	2.31
18 June	0.992	0.030	-18.10	2.25
20 August	0.984	0.038	-9.84	3.55
15 October	0.989	0.018	-8.12	2.12

Table 2. Table of the values of the parameter calculated for different value of the maturity date.

In Table 2 are reported the results of the discount factor $D(0,T)$, the interest parameter r, the dividend parameter q and the value of the dividend rate (div) settled a given maturity date ($Date$).
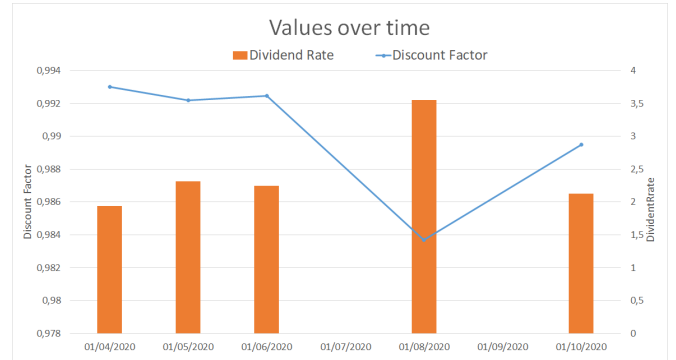

Figure 2. Values of the dividend rate and the discount factor over time.

The values of the discount factor $D(0, T)$ are approximately constant around 0.992 that involves the positivity of the interest parameter r. The value of the final dividend rate obtained as mean from the five values is $div = 2.44$ and the value of the dividend yield obtained as the percentage of the current stock price is 1.02%. These value can be confronted with the ones provided by yahoo! that have the values of 2.24 and 0.94% respectively. The experimental value of the dividend rate is compatible with the real one with an error of 8%. In Fig 2 are reported the values of the parameters over time.

5. Conclusions

The estimated dividend rate of the Microsoft stock computed from the market real data it seems to be compatible with the one provided by yahoo! finance. Despite the fact of not having used a real model to make the computations the results are quite reliable, nevertheless some assumptions has been made as the proportionality of the dividends. In the last month the stock price of Microsoft stayed quite constant while in the last six months it increased by about 15% and with the others tech companies like Apple and Amazon is one of the most important companies in the Nasdaq, second for capitalization.

References

[1] John Hull. *Optionen, futures und andere derivate*, volume 1. Pearson Deutschland GmbH, 2009.