**Summary – Nikolas Lippmann Pareschi**

Microsoft (MSFT) data was imported from Yahoo [1] and saved into the sheet named: MSFT. I used the data to compute the standard deviation and the sigma. The sheet Black\_Scholes from the Final\_Project\_Sample\_Spreadsheet was updated using the data from MSFT. The sheet Binomial\_model\_MSFT\_data was also updated using data from MSFT and the calculation made in MSFT sheet.

The sheet Binomial\_Tree calculates the price of a call option using 4 steps. The sheet VBA WTI Analysis The sheet VBA – Binomial 5 steps calculates the price of calls and puts. The function MAX is used here. I used for reference the sheets provided in the site of University of San Diego California [2].

The sheet Black\_Scholes\_Optional computes the price of calls and puts and the DELTA considering dividends. The references were the classrooms and notes provided in Financial Markets I / WQU [3] and the book Financial Markets and Institutions, 11 th edition, from Jeff Madura [4].

The sheet WTI Analysis uses data from Quandl [5] for the prices of WTI spot rates. In the sheet several metrics are calculated, such as simple moving averages using the close prices of the last 20 and 100 days, the minimum and maximum price considering the close price of last 50 days. Later I proposed 3 models for forecasting prices:

1. To forecast the price of the next day the system uses the slope of the SMA(20) to define if we are going to buy or sell. Then we use the average variation of prices in 1 day, considering the last 10 days to compute the average. We then sum the absolute value of this price to the close if we have a positive slope for the SMA(20) - BUY or subtract the value if we have a negative slope for the SMA(20) – SELL.
2. To forecast the price of the next month we use the futures curve at the time. I have used marketqview data [6] for data. At the time the next futures contract was in contango so we decide that we were going to SELL the instrument. The forecasted price used the same logic, but uses the price variation of the last month (22 trading days).
3. To forecast the price of the next year I considered several factors. Commodities were falling since 2008 and there are some literature [7] which states that after several years of down prices we do not have momentum working anymore, instead it is best to consider a return to the mean approach. But how much will the price rise? I used for that the same return from 2014. AS the price felt 61.78% in 1 year we consider that the prices would rise 61.78%.

All 3 predicted prices had a ratio of (Forecasted Price-Actual Price)/Forecasted Price < 0.1.

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| --- | --- |
| 1 Ratio | -0.03398 |
| 2 Ratio | 0.052481 |
| 3 Ratio | 0.080925 |

The sheet VBA WTI Analysis is the sheet WTI Analysis with VBA/MACROs. The Sheet VBA – Black Scholes and Greeks is computes the Black Scholes and Greeks in VBA. I used for reference the tables provided in [8]

REFERENCES:

[1] <https://finance.yahoo.com/quote/MSFT/history?p=MSFT>

[2] <https://act.ucsd.edu/cwp/tools/search?site=math&q=binomial+options%20more:math>

[3] <https://wqu.edlumina.com/dashboard>

[4] <https://www.amazon.com/Financial-Markets-Institutions-Stock-Coupon/dp/1133947875/ref=asap_bc?ie=UTF8>

[5] <https://www.quandl.com/collections/markets/crude-oil>

[6] <http://marketqview.com/forwardcurves.php>

[7] <https://goldeneaglegroup.wordpress.com/2016/05/31/return-to-the-mean/>

[8] <http://investexcel.net/black-scholes-greeks-vba/>