Shanthosh Sivashanmugham

R01470480

**OSCM 6350**

**Advanced prescriptive analytics**

**Final project**

**Stock valuation**

**Introduction**

Share prices are something that no one can predict. For years, researchers have tried to come up with a formula to predict the price of a share for a future date. Many have developed various approaches to predict the value of a share at a future date. There many factors that influence the price of a share. They can be classified into internal and external factors. Internal factors are those factors that can be influenced by the company. The company has total control over these factors. Internal factors include the company financials which investors use to decide whether they want to invest in a stock or not. A high interest for a stock can increase its value and vice versa. External factors include government policies, strategic move by competitors, natural elements like calamities and disasters (e.g. Covid 19). Thus, when there are so many variables that are considered while evaluating a share price and none can be known for sure, investors find it very hard to predict the value of a share for a future date.

**Analysis**

For this project I have used Monte Carlo simulation to predict the value of 5 different company shares after 30 days from November 18, 2020. The companies are Tesla, Apple, Expedia, GoPro, Netflix. I have also used the share price on November 27,2020 to compare with the average price that was found using simulation. I have run 100 simulations in this model.

The process involved in this analysis are as follows:

* The year to 11/18/20 stock volatility was retrieved from the website www.neticals.com
* The value was then converted to daily volatility
* The closing price of the various shares were acquired from yahoo finance for 11/18/20
* I then ran 100 Monte Carlo simulation to find the results of the share price after 30 days. Random numbers were created using NORM.INVERSE function. The probability values were generated randomly, mean was considered to be 0 according to the random walk theory and the daily share volatility was considered as standard deviation.
* The results were then studied using these measures: Mean, highest value, lowest value, standard deviation and frequency table.

**Results:**

**Tesla:**

|  |  |
| --- | --- |
| Mean price | 496.461387 |
| Standard deviation | 25.2733734 |
| highest price | 552.317732 |
| lowest price | 441.865099 |

This table shows us that the average price after the end of 30 days will $496.46. The highest price that can be achieved is $552.32 and lowest price is $441.87.

The frequency chart shows us the number of times the share falls into a certain price bracket.

The price bracket with the highest number of frequencies is 500-520 with 31 times. I feel safe to say that we can expect the price of tesla share to be in the 500-520 range after 30 days.

I also compared the actual value of a Tesla share on 11/27/20 with the average value that I got from the simulations for the same day.

|  |  |  |
| --- | --- | --- |
| Share price for 11/27/20 | | 585.76 |
| estimated share mean | | 495.057787 |
| Difference |  | -90.702213 |

I came to conclusion that Tesla share price is very volatile as the difference came up to -$90.7. The highest compared to other companies. Various analyst also feel that the value of Tesla share is over-valued and a crash is imminent. The stock market sentiment for tesla is bullish at the moment and no can expect when this run is going to be over.

**Apple:**

|  |  |
| --- | --- |
| Mean price | 119.894884 |
| Standard deviation | 9.43348004 |
| highest price | 150.839927 |
| lowest price | 94.7101042 |

The average price was found out to be $119.9 with maximum price reaching to $150.83 and the lowest price falling down to $94.71. The deviation from the mean was also comparatively lower than Tesla.

Most of the simulated share prices at the end of the 30-day period was also found to be between 140-160. Thus, the probability of the price falling in this bracket after 30 days is very high.

While comparing the actual share value on 11/27/20 and the simulated share price I got the following:

|  |  |  |
| --- | --- | --- |
| Share price for 11/27/20 | | 116.59 |
| estimated share mean | | 119.104813 |
| Difference |  | 2.51481296 |

The average price that I got from the simulations was $119.1 and the actual share price was $116.59 with a difference of $2.51. I can say that the simulation model was somewhat more effective in predicting the share price than Tesla’s. Analyst say that Apple’s share is neither undervalued nor overvalued. They have a pretty strong line-up of devices with iPhone being their cash cow. They have also entered into the service sector by offering Netflix competitor in the form of Apple Tv+, offering their own credit card service, a news subscription service, etc. They have started to shift their reliance from hardware to service business to be more future ready and also to diversify their income source.

**Expedia:**

|  |  |
| --- | --- |
| Mean price | 122.717993 |
| Standard deviation | 2.66234475 |
| highest price | 129.026702 |
| lowest price | 116.281525 |

The average price was found out to be $122.71 with maximum price reaching to $129.02 and the lowest price falling down to $116.28. The deviation from the mean was lower as the daily volatility was also less at only 0.00366148.

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The frequency table is high at three different intervals and they range from 120-126. This can be due to a smaller class size compared to the others. There is a very high probability that the share price will close anywhere between 120 and 126 as the frequency of other intervals is very low.

I also compared the actual value of a Expedia share on 11/27/20 with the average value that I got from the simulations for the same day.

|  |  |  |
| --- | --- | --- |
| Share price for 11/27/20 | | 123.73 |
| estimated share mean | | 122.560167 |
| Difference |  | -1.1698327 |

The simulation model correctly predicted the share value to a large extent with the difference being only -$1.17.

**GoPro:**

|  |  |
| --- | --- |
| Mean price | 8.01198767 |
| Standard deviation | 0.12712974 |
| highest price | 8.31302417 |
| lowest price | 7.69668921 |

The standard deviation value is the lowest compared to all other shares. This can be mainly be because of the daily volatility being the lowest at 0.00255234. Thus, we can say that GoPro shares aren’t that very volatile and are more consistent than other stocks. This can also mean that the Rate of return is also very low as the share value didn’t increase much. The average mean price for the end the 30-day period was $8.01 with the highest value reaching up to $8.31 and the lowest value falling down to $7.7.

Looking at the frequency table it can be safe to the say that the probability of the share price falling between 7.8 and 8.2 is very high with a probability of 0.9.

While comparing the actual share value on 11/27/20 and the simulated share price I got the following:

|  |  |  |
| --- | --- | --- |
| Share price for 11/27/20 | | 7.16 |
| estimated share mean | | 8.00555196 |
| Difference |  | 0.84555196 |

The simulation worked well to predict the share price on 11/27/20 with having the difference of 0.85. This can also be argued that it happened only due to a low share price and a low daily volatility rate.

**Netflix:**

|  |  |
| --- | --- |
| Mean price | 481.306452 |
| Standard deviation | 11.9100525 |
| highest price | 514.319841 |
| lowest price | 454.629773 |

The average price from the simulation worked out to be $481.3 with the highest price going up to $514.32 and the lowest price falling to $454.63. Even though the daily volatility being only 0.00499779 the standard deviation was high at 11.91.

It can be safe to say that the price will close within 470-490 with a probability of 0.55 at the end of the 30 day period.

|  |  |  |
| --- | --- | --- |
| Share price for 11/27/20 | | 491.36 |
| estimated share mean | | 481.495425 |
| Difference |  | -9.8645748 |

The simulation model did a fair job while predicting the price on 11/27/20 with the price difference being only -$9.87. Netflix underwent a bullish run at the start of March when countries all around the world went under lockdown and forced more people to stay at home. This increased the demand for online streaming and the run is still going strong.

**Conclusion**

It can be concluded that the Monte Carlo was successful in predicting the price of the shares to some extent even though it failed to predict Tesla’s share accurately. But shares of Tesla are very volatile right now and no one can predict what is going to be next for Tesla. The price of the shares could have been even more accurate if the number of simulations had been higher. I can definitely depend on Monte Carlo simulation to have a basic idea of what the stock value will be in future. I can see Monte Carlo simulation playing a huge role while investors choose different companies’ shares for their portfolio.

**Appendix**:

Random walk theory suggests that share prices are very random and it can never be predicted accurately. It also suggests that past movement of a share can never be used to predict the future movement of the shares. Thus, while generating random numbers using NORM.INVERSE the mean is assumed to be zero.