The Stock Market: Moderating price on the basis of a fair coin toss

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December 16, 2020

Problem Analysis

We were to toss a fair coin. If the coin gives a head, the price of the share goes up by 1, else decreases by 1. On the basis of it, we had to run at least 4 runs of a single stock or single runs of 4 stocks (equivalent) to find out the relationship, patterns and sequences in the same.

Solution

$$P(Y_1 = 1) = \frac{1}{2}$$

$$P(Y_2 = -1) = \frac{1}{2}$$

Y_1: The stock price increases by one dollar, Y_2: The stock price decreases by one dollar

Simulation setup, results and analysis

Two simulations were done. The base price for all shares were considered to be 100. Also, no share price is allowed to move less than 0. A constraint for the same has been added in the code. The first simulation had the following parameters:

- Number of Stocks = 100
- Base Price for all = 100
- Total number of days for simulation = 10,000

The inference for this setup was difficult to make in terms of the pattern because of excess data points in the graph. Thus, another experiment was carried out for better analysis and results.

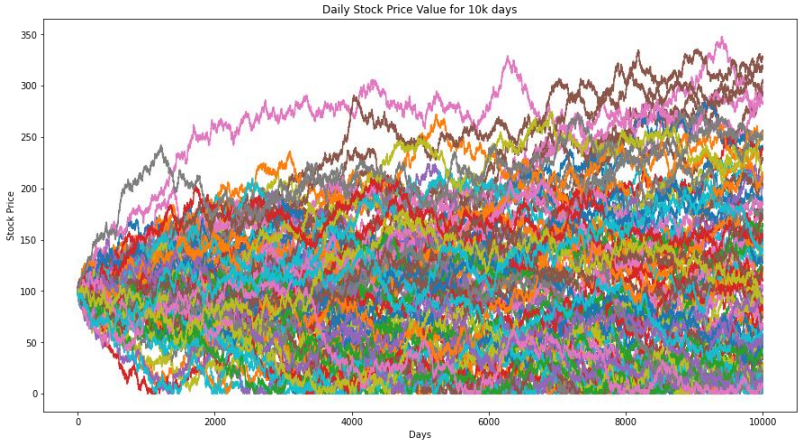

Figure 1: Daily stock price value for 100 stocks and 10,000 days

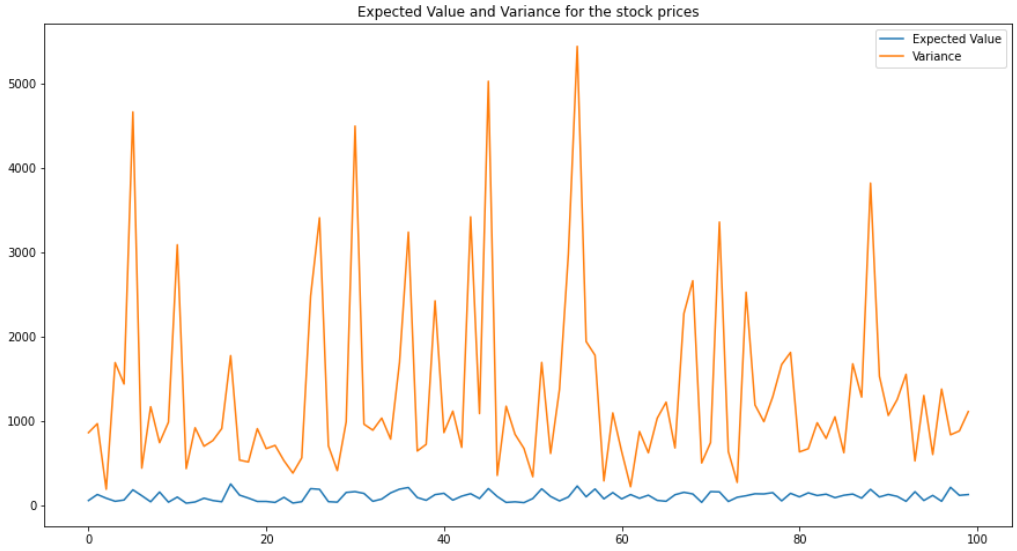

Figure 2: E(X) and V(X) for the value of stocks

The second graph shows that variance V(X) and Expected Value (E(X)). The variance is fluctuating a lot probably attributing to the random numbers generated for tossing of the coin.

The second simulation has been done using the following parameters:

- Number of Stocks = 5
- Base Price = 100
- Total number of Days = 10,000

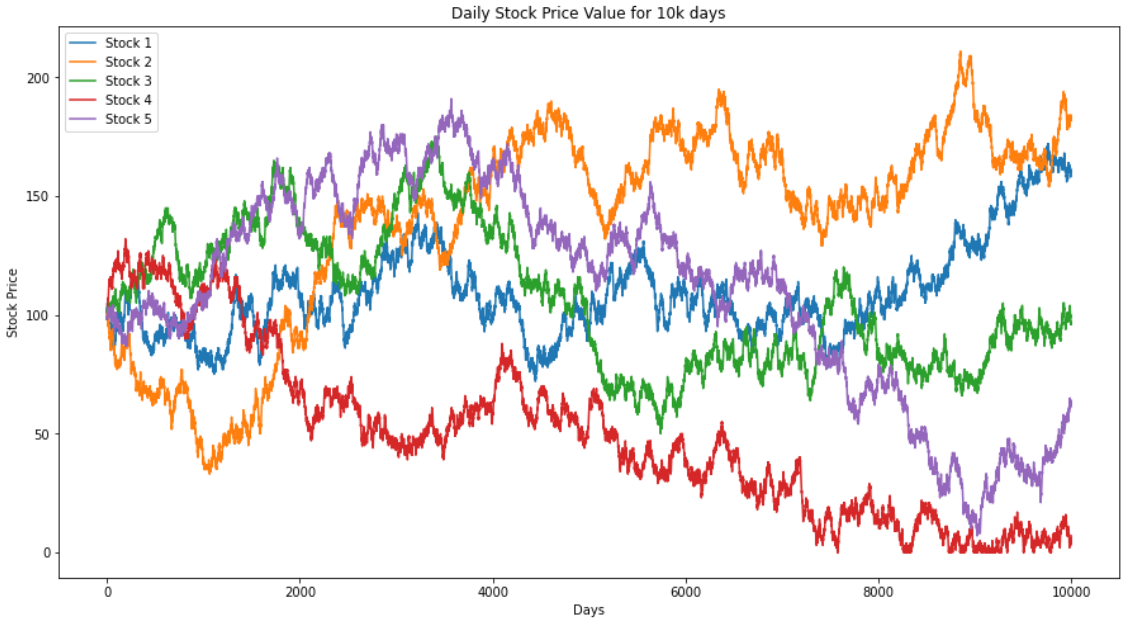

Figure 3: Daily Price for 5 stocks.

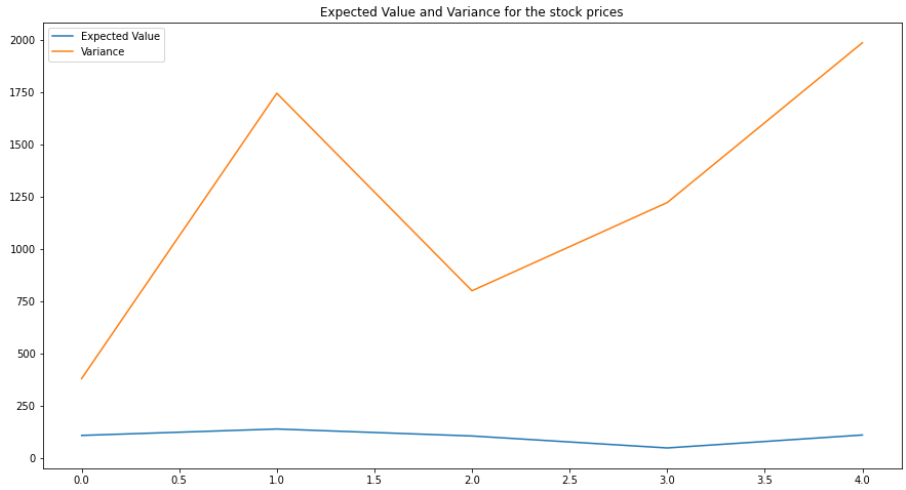

Figure 4: The Expected Value E(X) and Variance V(X) for the 5 stocks in consideration.

Takeaways

The 5 stock values even though generated by the same means look different. It is primary because of the fair coin toss. The price of the stock is directly dependent on its outcome.

The variance and Expected value are characteristic of the stock prices. For stocks with a high variance, it means that there were large fluctuations in their price, while those with relatively less variance values like Stock 1, the value does not fluctuate much as is evident in Figure 3. Both Stock 2 and Stock 5 have shown high variance, particularly because of fluctuations in their price due to different outcomes on the fair coin toss.

A lower expected value for the stocks signifies that the stock price on a daily basis was low for quite a considerable number of days while vice-vera for those with higher expected values. It is also important to note that one high price can shift the mean, however, there is not much drastic change possible as the price is being changed by only +1 or -1.

Expected Value	Variance	Analysis
Low	Low	Price was lower, didn't fluctuate much.
Low	High	On a large number of days, price was lower, and was fluctuating at a very high rate.
High	Low	Signifies that the stock has seen good days and has been of value
High	High	Not an ideal situation and not achievable easily also. This means that the stock price has been high but there have been large fluctuations in the price which in turn would affect the expected value, thus, not easy to achieve.

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