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Some Review on Use of Mathematics & AI in stock Market

Santosh C. Rudrawar
Dept. Of Mathematics Siddharth College Jafrabad, Dist-Jalna, Maharashtra, India

Abstract- In this paper we discus on Mathematics plays a crucial role in the stock market, particularly in understanding financial concepts, evaluating investments and developing trading strategies. Key mathematical concepts used in the stock market include compound interest, probability, averages and various financial ratio like Return on Equity and Price/Earnings ratios. AI trading techniques possess a higher accuracy rate than traditional methods. It is due to their ability to analyze and learn from massive models have in built risk management algorithms that adjust portfolios based on real time data. It helps minimize potential losses.

Keywords- Basic Mathematics, Calculus, Excel Sheet AI techniques.

I. INTRODUCTION

The two primary forms of analysis in the stock market are fundamental and technical. The fundamentals refer to financial statement trends, including profitability, capitalization and cash flow. Technical analysis refers to all matters concerning price, volume, momentum and moving averages. These relate to price trends in the overall market, not only for price and its immediate trends, but also for the weighting of indexes, new high and new low statistics, advances and declines, short interest, volatility, mutual fund cash to asset ratio, and the large block ratio. Unlike fundamental analysis of individual companies and technical analysis affecting price, these indicators apply to the overall market and help investors determine whether the current mood of the market is positive or negative. Simple mathematics shows that "winning" on only four or five of every 10 trades can put a trader ahead, depending on how much was won versus how much was lost. Mathematics, teamed with patience, builds stock market wealth more reliably than "big score" attempts. Power law on the other hand, calculates how changes in the value of one quantity affect another quantity, such as how a company's value affects stock price in its industry. This helps calculate standard deviations, which can help traders better understand potential risks and allow them to buy or sell accordingly computer based quantitative analysis, which studies how, amounts or quantities, relate to each other, is the most common mathematical model used by trading houses. The field includes algorithms, which study patterns of behavior in entities such as the financial sector. These calculations can help identify potential risks ahead, but overreliance on quantitative models and algorithms can lead to wild speculation, imprudent investing and "flash crashes." This is when the market takes an unanticipated nosedive although stocks trades come from many different sources such as autonomous computer trading programs or program-trading orders set by investors all of them have a human being somewhere in the process even if just to set in place the rules of the autonomous trading system. Over the course of the day stokes price usually fluctuates whether in wide swings or narrow bands. Ultimately all sources of trading and all fluctuations in the market over the short term are driven by one factor human psychology. The linear programming model has been applied in a large number of areas including finance, transportation scheduling, production and inventory management, telecommunications. Many problems simply lend themselves to a linear programming solution but in

many cases some ingenuity is required for the modelling. Linear programming also has interesting theoretical application in combinatorial optimization and complexity theory. The classical tool for solving the linear programming problem in practice is the class of simplex algorithms proposed and developed by George Dantzing (1963).Methods of nonlinear programming methods have also become practical tools for certain classes of linear programming problems

How to Predict The Stock Market

II. CALCULUS

However calculus allows us to understand this at a greater depth. Calculus benefits us in this context because of how effectively it analyzes rates of change and accumulation. Derivatives a common technique of calculus are financial instruments that attain their value from an asset, such as a stock or commodity. The value of the derivative is based on the rate of change of this asset, which can be analyzed using calculus. This allows traders and investors to make predictions about the future behavior of the market and make trades accordingly based on how quickly the value is changing. Derivatives can be applied to graphs that have already been derived. In the graph, we can see a red line that represents the stock price after removing external value (corporate, dividend, etc.) versus the average closing price of the stock on a third period, the latter of which is similar to the derivatives in sense.

This process is called deriving a function (or in this case the graph of a stock price) to a greater degree. If we derive it twice in total we are observing the second derivative of the graph and are effectively observing the rate is changing. The larger the number of times we derive a function, the more are able to understand why it moves the way it does. It really is interesting how math drives the movements of stock. We can see this used in the model above how the derivative models the path of the stock price. The derivative although useful is a simpler tool of calculus and is only an introduction to what is possible using calculus in the stock market. Using more complex applications of calculus in probability and function behavior can help us view the stock market from an outstanding perspective.

III. RATIOS

2.1 Price to Earnings (P/E) ratio

As the name suggests P/E ratio is the ratio of the current share price to the earning of the company per share. This ratio can tell you if the company is undervalued or overvalued in the market.

Let say that a company has an overall earing of Rs. 2000. Also it has 100 shares trading in the market. Therefore its earning per share is Rs.20 Further, let say that the shares of the company are trading at Rs.100 per share hence we have P/E ratio = 100/20=05

Hence it is easy to deduce that if a company has a higher P/E ratio it is that much overvalued. What should be the ideal P/E ratio of stock that you can invest in?

The answer to this question is not straightforward. This is because you cannot compare P/E ratios as absolute value since every industry has a different benchmark.

2.2 Return on Equity (RoE) ratio

As the name suggests the RoE ratio is measure of the rate of return on the stock of a company. In other words it tells investors how good the company is at generating returns on stock investments. Mathematically

RoE = Net Income / Total Shareholders' Equity
This is an important ratio because it shows the company's ability to turn equity investments into profits.

Let say that you are the promoter of a company and have contributed Rs. 100 in equity and the total equity of the company is Rs. 100.

Using this equity if the company generates an income of Rs.20, then the RoE is 20% imagine another company with the same total equity but generating an income of Rs.40 its RoE ratio will be 40% .The company that generates better RoE is considered better.

2.3 Price to Book (P/B) ratio

The price to book ratio is a simple comparison of a company's market value (market capitalization) to its book value. It compares the company's stock price to its book value per share. Before we understand the P/B ratio, let's look at what book value means, the simplest way to understand book value is to think that if a company stops doing all business pays off its loans and sells its assets, what will be the value of the company. Here is an example,

Lets say that the value of a company is Rs. 10000. It decides to shut down the company and receives Rs.10000 out of this it has pay Rs.4000 as loan repayment. Also the company has some assets that fetch it Rs.2000 therefor

The total book value of the company = 10000-4000+2000=Rs.8000

Next let's say that the total number of outstanding shares was 1000. Therefore the book value of the company per share = 8000/1000=Rs.8

P/B ratio = Market price of share / Book value per share

Let's say that the market price of a share of the company is Rs.800

Therefore P/B ratio = 800/8 = 100

If the company has a low P/B ratio then it is said to be undervalued and high P/B ratio is overvalued. It is an excellent way to identify companies whose stock prices have sky-rocketed without any asset base.

2.4 Dividend Yield or the Dividend price ratio

Dividend yield or the dividend price ratio is the amount of money or dividend that a company pays its shareholders over the course of a year divided by its current stock price. It is an indicator of the returns you can expect on your investment. Let's say that you purchased a stock at the market price of Rs. 100. A year later, the stock price is still Rs.100. Is this a good investment? A quick look at the appreciation of share price says that it is not you got a zero percent return. However have you considered the dividend before making this decision? What is dividend?

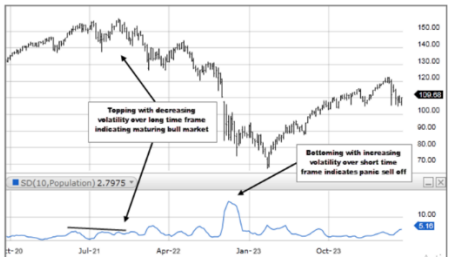
Let's say that the company makes a profit of Rs.1000. out of this it decides to keep Rs 600 for business expansion and distribute Rs.400 among its shareholders. Assuming that there were 100 shares in the market each shareholder will receive a dividend of Rs.4. This becomes the return on investment for the shareholder. Even if the share price did not appreciate the shareholder earned a return on his investment.

Dividend yield is an important ratio because there are many stocks that do not appreciate in price but offer handsome dividends. If the dividend yield is higher, the investor has a better chance of receiving higher dividends for the same investment as compared to a stock with a low dividend yield..

IV. STANDER DEVIATION

Standard deviation is the statistical measure of market volatility, measuring how widely prices are dispersed from the average price. If prices trade in a narrow trading range, the standard deviation will return a low value that indicates low volatility. Conversely if prices swing wildly up and down then standard deviation returns a high value that indicates high volatility. Standard deviation rises as prices become more volatile. As price action calms, standard deviation heads lower. Price moves with increased standard deviation show average strength or weakness. Market tops that are

accompanied by increased volatility over short periods of time indicate nervous and indecisive traders. Market tops with decreasing volatility over long time frames indicate maturing bull markets.



Market bottoms that are accompanied by decreased volatility over long periods of time indicate bored and disinterested traders. Market bottoms with increasing volatility over relatively short time periods indicate panic sell offs.

Calculate the SMA for period n

Calculate the SMA value from step one from the close for each of the past n periods and square them

Sum the squares of the differences and divide by n

Calculate the square root of the result from step three

SD=Sqrt[(Sum the ((Close for each of the past n Periods -n Period SMA for current bar)^∧ 2)/n]

v. IMPROVE YOUR INVESTING WITH EXCEL

You probably knew that Microsoft's Excel spreadsheet program is a fine tool for keeping track of your investment in an organized manner, enabling you to see and sort positions, including entry price, periodic closing prices, and returns. But actually Excel can do much more than serve as a glorified financial statement. It can automatically calculate metrics such as an asset's or a portfolio's standard deviation, percentage of return and overall profit and loss. If you're rusty with Excel, you can boost your spreadsheet skills with an online Excel course.

Excel spreadsheets can not only keep track of investments but also calculate performance and degree of volatility. Excel can calculate the difference of an asset's current price minus its entry price Excel can calculate the percentage return on an asset and assess profit and loss. One particularly helpful Excel feature is its ability to calculate standard deviation, a complex formula that assesses risk.

What is Ai Trading?

AI trading refers broadly to the use of artificial intelligence, predictive analytics and machine learning to analyze historical market and stock data get investment ideas build portfolios and automatically buy and sell stocks.

How Ai Stock Trading Works

AI trading companies use various AI tools to interpret the financial market use data to calculate price changes identify reasons behind price fluctuations carry out sales and trades and monitor the ever changing market.

The are several types of AI trading

6.1 Quantitative trading uses quantitative modeling to analyze the price and volume of stocks and trades identifying the best investment opportunities. Because of its advanced capabilities investors often use quantitative trading to complete major transactions involving up to hundreds of thousands of shares..

6.2 Algorithmic trading is when stock investors use algorithms that make decisions based on historical data to execute trading decisions. These algorithms apply machine learning and deep learning to analyze market trends and financial news before making trades in small portions.

6.3 High – frequency trading is when large quantities of stocks and shares are bought and sold rapidly. This type of trading depends on high powered computers that can simultaneously analyze multiple markets and complete millions of trades in a few seconds giving investors a competitive advantage.

6.4 Automated trading is a way of executing trades using preprogrammed trading instruction. It is similar to algorithmic trading but operators on more basic trading strategies.

6.5 Arbitrage trading exploits market differences by buying an asset in one market and selling it for a higher price in a different market. Because AI trading tools can monitor multiple markets at the same time they can quickly spot varying values across markets and allow investors to capitalize on these inefficiencies and generate small profits.

AI trading use in different cases like Data Mining, Sentiment Analysis, Real time Analysis, Predictive Modeling, Risk Modeling

Risks of AI trading is less transparency, too reliant on historical data, larger scale errors, cyber security concerns

VI. CONCLUSION

Basic math is essential for calculating key financial ratios. These ratios help evaluate a company's financial health and determine whether its shares are undervalued or overvalued. Math is used to calculate the returns on investments including both the percentage return and the total return. This allows investors to assess their portfolio's performance and make adjustments as needed. Basic statistics and probability help in understanding and managing risk in the stock market. This includes calculating things like standard deviation and understanding concepts like volatility. Some indicators used in technical analysis like moving averages also rely on basic mathematical principles. Excel spreadsheets can be used to keep a detailed record of your investment portfolio including the date of purchase, the number of shares, the price per share and the total investment amount. Excel can be used to perform various financial calculation such as calculating the standard deviation of an asset's returns or the overall profit and loss. It can also be used to calculate technical indicators, such as the Relative Strength Index, Moving Averages, Fibonacci retracements, which can help in identify potential entry and exit points in trade. AI leverages machine learning, big data analytics and predictive algorithms to analyze market patterns execute trades and develop robust investment strategies residential areas of Mymensingh.

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