Simple Moving Average (SMA) investment strategy during COVID-19 pandemic, a highly volatile economic period.

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***Abstract*—During the Covid-19 pandemic the financial market experienced an increase in its volatility, making it riskier for most investors. However, short-term traders were able to take advantage of volatility by creating indicators for buying and selling opportunities. Simple Moving Average indicator (SMA) calculates the average of a range of prices by the number of periods within that range, making it easier to detect if the market is bullish or bearish at that moment. Using this SMA indicator makes it possible to establish the optimal expected return taking in consideration several number of periods for each stock. This allows the investor to see the optimal expected return, the exact number of periods needed for the calculation, and the most profitable stocks.**

This paper intends to answer two main questions. The first one is whether using the SMA to determine when to sell and buy stock over an extended period of time brings overall positive returns to the investor. If it is the case that SMA brings positive returns, the second question would be: is this method better than the Buy and Hold strategy? Which one brings the optimal returns?

A computational implementation of the SMA is proposed as a possible method to answer this questions by running a backtesting simulation of an investor using SMA against an investor using the Buy and Hold method. This simulation is constrained by taking into account the top 5 best and worst companies of the S&P 500 index on the following time frame: March 2020 through March 2022.

***Index Terms*—Simple Moving Average, Stock Market, Trading, Indicator**

I. Introduction

This past two years the world has experienced one of the largest health threats of modern history. The COVID-19 pandemic's effects were heavily felt not only in hospitals and health related institutions but also in the economic sector. Governments have implemented policies in an effort to stop the spread of the virus but this policies have important economic consequences that are being reflected worldwide in the stock markets.

Volatility and risk on the global stock market have increased substantially and there's a high correlation between the reactions of individual markets and the severity of the outbreak in each country. [1] While policies are needed to stop the spread of the virus and level the stock markets are needed, non-conventional policy interventions have caused further uncertainty on the short-term while potentially creating long-term problems. [1]

Volatile economic periods, as the one caused by COVID-19, tend to be challenging for traders and investors as the market turns risky and unpredictable. Is therefore important to them to understand which is the optimal investment strategy to use in this periods of economic turmoil. In this research we intend to test the effectiveness of the Simple Moving Average strategy (SMA) by back-testing it against the traditional Buy and Hold method (BH).

We chose the SMA because is one of the technical indicators most used by professional investors. Besides that, it's also interesting to evaluate because there are mixed opinions on the academic world regarding technical indicators. On one hand SMA has proven to outperform the Buy and Hold method in other periods of economic crisis such as the 2001-2002 Dot-Com bubble crash and the 2007-2008 Global Financial Crisis [2], but even when there is evidence that prove SMA has been effective back-testing in some historic contexts, the use of technical indicators is relatively recent and has received some critics from financial academics. An example of this is Malkiel (2007) stating that "Technical analysis is an anathema to the academic world" and that after transaction costs technical methods "don't do better than a buy-and-hold strategy for most investors." [3]

The goal of our research is to test whether the SMA outperforms the traditional buy-and-hold method in the specific context of the COVID-19 global pandemic investing on the S&P 500 index.

II. Method

To be able to earn money in the stock market one must sell stocks at a higher price than the originally paid: "buy low, sell high". There are two main methods to identify ideal times to buy and sell stock, this are fundamental analysis and technical analysis. Fundamental analysis centers on the idea that sometimes a stock deviates from its intrinsic value, thus being undervalued or overvalued, this indicating when one should buy or sell a stock. This type of analysis studies available information of the company "fundamentals" to determine the intrinsic value of the stock. Technical analysis aims to forecast the future stock price through the study of past price data and the identification of patterns. It rests on the idea that prices move in trends, therefore one should buy when the trend is going upwards and sell when it's going downwards. [2],

The buy-and-hold strategy is usually associated with a fundamental analysis method, while the SMA is an example of technical analysis and it's used as a tool to identify trends.

A. Buy and Hold

The buy-and-hold rule, as opposed to trading, rests on the idea that one should buy a good stock and hold to it for a very long time. It is usually a long-term investment strategy based on the empirical observation that if one buys stock from a good company good returns can be expected on the long run, even if the prices fluctuate on a daily basis (volatility). People investing on a buy-and-hold strategy don't trade their stock on a regular basis according to market fluctuation. They don't sell when something happens to the market, they sell when something happens to them. [4]

There are several ideas supporting buy-and-hold over trading strategies. Barber and Odean (2002) state that excessive trading, often caused by over-confidence, tend to result on poor performance for individual investors. This same study found that from 1991 to 1996 investors that traded less obtained significantly better returns than those who traded more. [5] Also, transaction costs have to be taken into account [6], and usually when this are present trading is reduced. [4]

B. Simple Moving Average

Identifying trends in stock market data is complicated, mainly because of the wild fluctuation on the stock prices driven by supply and demand. Moving averages such as the SMA are used to "smooth" the stock price data thus revealing the underlying trend. [2]

The SMA is given by the following equation:

$$SMA_t(n) = \frac{1}{n}\sum_{i=0}^{n-1} P_{t-i} \tag{1}$$

This equation can also be formulated recursively to accelerate it's computation:

$$SMA_t(n) = SMA_t(n) + \frac{P_t - P_{t-n}}{n} \tag{2}$$

The two main characteristics of a moving average are it's lag-time and it's smoothness. Investors ideally would like averages that have a short lag-time (reflect better recent price changes), and high smoothness (less smooth averages lead to a bigger number of trades, increasing the transaction costs). The problem is that this two characteristics are directly related, so that the smoother an average is, the longer it's lag-time. [2]

- The SMA Lag Time is given by:

$$Lag(SMA_n) = \frac{\sum_{i=0}^{n-1} i}{\sum_{i=0}^{n-1} 1} = \frac{n-1}{2} \tag{3}$$

- As the SMA Herfindahl index equals $\frac{1}{n}$ it's smoothness is given by:

$$Smoothness(SMA_n) = (\frac{1}{n})^{-1} = n \tag{4}$$

- An SMA lag time can be written as a linear function of it's smoothness as follows:

$$Lag(SMA_n) = \frac{1}{2} \times Smoothness(SMA_n) - \frac{1}{2} \tag{5}$$

C. Back-testing SMA against BH

This experiment will be conducted performing a two year back-test from March 2020 to March 2022 over the S&P 500 stock data obtained from yahoo finance. The test will be performed over the top 5 best and worst performing companies from the index.

- BH: For the buy-and-hold method we will "buy" stock on March 1st 2020, hold it and then "sell" it on March 1st 2022.
- SMA:A python implementation will be used over the two year period to automatically "buy" when the market is bearish and "sell" when it's bullish according to the SMA analysis.

We will then proceed to analyse the returns of both investing strategies and determine whether the SMA would have been a better method than buy-and-hold investing on the S&P 500 during the COVID-19 pandemic. [1]

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