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Volatility Based Trading Strategies

Bruno Miguel Vieira Rodrigues
Master’s Degree in Finance

Supervisor:

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2 Abstrato

O papel da volatilidade nos mercados está bem estabelecido ao longo dos anos. Como os traders tentam prever os movimentos de preços enquanto têm um rácio risco-recompensa adequado, os instrumentos baseados na volatilidade podem ser vistos como uma vantagem no arsenal de cada investidor para avaliar o risco.

O principal objectivo desta dissertação é criar e testar uma estratégia de negociação cujo objectivo é tentar prever e tirar partido dos movimentos voláteis dos preços das acções. Por conseguinte, antecipamos que a nossa estratégia produza maiores retornos quando comparada com a estratégia de holding

É importante notar que as ferramentas utilizadas para criar esta estratégia são apenas ferramentas disponíveis para a maioria dos investidores, uma vez que um dos objectivos desta dissertação é criar uma estratégia facilmente replicável que qualquer pessoa pode utilizar e aplicar relativamente ao valor nominal do investimento.

Nesta dissertação escolhemos uma amostra de prazos e diferentes activos, tais como índices e acções da Bolsa de Valores dos EUA, para testar a nossa estratégia por ser uma das escolhas mais populares dos investidores em todo o mundo, tendo mais liquidez.

Para a preparar, escolhemos três indicadores direccionais e outros cujo objectivo é tentar prever se haverá um movimento volátil de preços nas acções/índices a curto prazo. Para tal, o indicador Volatilidade Histórica será o principal indicador que permitirá ao trader tirar conclusões.

Palavras-chave: Trading; Mercado de Acções; Análise Técnica; Estratégia de Negociação; Estratégia baseada na Volatilidade.

3 Abstract

The role of volatility in the markets is well established throughout years. As traders try to predict price movements while having an adequate risk-reward, tools based on volatility can be seen as an advantage on the arsenal of every investor to evaluate risk in the market.

The main goal of this dissertation is to create and test a trading strategy whose goal is to try to predict and take advantage of volatile movements in stock prices. Hence, we anticipate that our strategy produces bigger returns when compared to the holding strategy

It is important to notice that the tools used to create this strategy are only tools which are available to the majority of retail investors, as one of the purposes of this dissertation is to create an easily replicable strategy that anyone can use and apply regarding the nominal value of the investment.

In this dissertation we have chosen a sample timeframe and different assets such as indexes and stocks from the US Stock Market to test our strategy for being one of the most popular choices from investors all over the world, gathering liquidity from it.

To prepare it, we have chosen three directional indicators and others whose goal is try to predict if there will be a volatile price movement in the stock/index in the short term. For this, the indicator Historical Volatility will be the main indicator that will allow the trader to take conclusions.

Key-words: Trading; Stock Market; Technical Analysis; Trading strategy; Volatility-based Strategy.

4 Introduction

Charles Henry Dow, the investor whose name was given to the American index “Dow Jones”, released what is known as the birth of Technical Analysis in 1884. A series of average closing prices of eleven companies whose goal was to understand the economic landscape of the United States of America and have a general macro-economic outlook.(Silva and Nunes, 2017, page 36)

In contrast, technical analysis evolved as a tool for investors whose goal is trying to predict future movements in price by studying past price behavior of a stock. Investors use it to evaluate their own decisions about investments and opportunities in the market to take advantage off, by maximizing their risk-to-reward ratio when entering a trade or simply finding opportunities to invest and predict their future returns.

Technical Analysis can be used exclusively by an investor or in a conjunction with other methods such as Fundamental Analysis. This type of analysis assumes that information is accessible to all investors and consequently it is already reflected in the price of a stock commodity, ETF or any other financial instrument (Hayes, 2021) , something that the theory that stock prices follow a “Random Walk” also agrees on.

This two approaches diverge on the fact that if stock prices follow an unknow path, consequently the study of past price action would be meaningless to predict any future stock price movement (Malkiel, 2015) (defended by Random Walk Theory) whereas Technical Analysis is simply the study of previous price action in order to try to predict future movements.

Technical Analysis is characterized by having a set of different ways to analyze price history. In essence, it has diverse tools such as various indicators, visual patterns observed in candlestick charts, point and figures charts, etc. When an investor uses it, he is searching for the best possible price entry either in a long or short position on a financial instrument and the best exit point in order to maximize profits and minimize the risk to which he is exposed when entering the trade.

Given the importance of volatility on the markets, topic that has been studied worldwide, the goal of this dissertation is to create a trading strategy that predicts and tries to maximize profits from volatile periods on the market, in order to produce greater returns to investors when comparing this strategy to the standard one, the buy and hold strategy.

To address this issue, in this dissertation we will create a volatility squeeze-based trading strategy based on certain Technical Analysis indicators which will itself generate an indicator that gives oversold and overbought regions and consequently we can create trading rules with buy and sell signals.

Hence, after having the empirical results of our trading strategy using a large enough sample timeframe and a sample of different assets, we will compare its performance checking the validity of our trading strategy and it's performance.

With the results obtained, we may conclude about the important role of volatility in a trading strategy to generate greater returns and the validity of Technical Analysis tools, as well as their applicability in real world trading strategies.

Lastly, given there are many different types of strategies traders use to outperform the market, this dissertation will verify if the idea of volatility breakouts is indeed a good way to implement a strategy or at least a good tool to have on the trading arsenal to a any trader.

Lastly, our dissertation will be structured in order to insure a reader that is not familiar with finance terms and knowledge still can apply the knowledge he/she will learn from this dissertation in the investments they will take in the future.

In Section 4, we will be reviewing the basics of Technical Analysis and the tools it can provide investors to take better informed decisions, as well as the critics and limitations of it, in order to ensure the reader can have a critic vision and create its own opinion towards the validation of what we are studying. On Section 5 we will be reviewing mostly concepts that are very present to every investor or trader and are necessary to comprehend for a better understanding of the reasonings of decisions that are take in our volatility-based strategy. On Section 6, the Methodology, we will understand how the process of creating the strategy will be unfold and on Section 7 we will discuss the data chosen and the timeframe where we will back test our strategy. On Section 8, we will study the results of our strategy when applied to the timeframe we have chosen and to the data, i.e. the stocks and assets that were discussed on Section 7. Finally, on Section 9 we will use Descriptive Analysis to study the significance of our trading strategy and ensure that it produces good results so it can be consider a good strategy, analyzing all the results and appreciations on the last Section, the Conclusion one.

5 Review of Literature

5.1 Assumptions of Technical Analysis

According to most of the authors on Technical Analysis, there are mainly three assumptions that are the base and fundament of the theory.

Firstly, every information is accounted in the price of a financial instrument, meaning that if investors have full access to information in the same way, the price of a stock at a certain moment in time has already discounted all the information available to investors.

Other essential assumption is that price follows a trend, in contrast with the idea that the returns generated are randomized. This trend is identifiable by observing past price action of the financial instrument and it is assumed that it will continue that same trend until a new one is formed.

Finally, technical analysis assumes that history repeats itself and that patterns often tend to repeat themselves, in either big time frames or small ones. This concept brings into consideration the market psychology and the human behavior surrounding it, although nowadays trading is dominated by automated bots and algorithms, that are created by humans.

5.2 Technical and Fundamental Analysis

When talking about analyzing a stock, traders and investors are mainly directed to technical and fundamental analysis, which are two opposite studies of stock but present themselves as two ways to analyze that could work in conjunction to create better and more informed decisions.

Fundamental Analysis consists in evaluating a stock by valuing it having into consideration its business, i.e. evaluating a company by having a look at the company´s balance sheet, its earnings, the ability of the company to innovate or survive in case of a recession, if it is financially strong or not, by looking into financial indicators of a company…Fundamental analysis has a longer-term view of a company, producing results if a company is doing well or not throughout the years.

Technical Analysis has more of a short to medium-term approaches to a stock, where traders try to identify good opportunities to take a position in it. Technical Analysis, in contrast with Fundamental Analysis, takes a look into price action of the stock, pattern repetition, indicators…meaning that in this type of analysis it does not matter the Company´s outlook (balance sheet, future prospects…) as the theory defends that all those financial details are already reflected in the actual price of the stock. Usually, technical analysis is used by hedge funds in a time frame not longer than 6 months" (Fama and Blume, 1966).

5.3 Overview of Technical Indicators

To create our volatility-based strategy we will only use indicator only, not focusing our attention into visual patterns. These visual patterns can sometimes be interpreted differently by different traders and are more difficult to compute, hence there are significant statistical analysis problems on this last topic that still have to be solved (Griffioen, 2003, page 21).

The strategy will be based around volatility, and it consists in giving percentage weights on three different indicators, given the importance of each one of them. This only applies after having confirmation from the indicator Historical Volatility that we expect a volatility breakout, meaning that those three other indicators will be deciding on the direction we should predict the movement of the stock to take.

The first indicator to be used is the <u>Money flow index</u> indicator. This indicator is a momentum based-one and, in conjunction with the volume traded by a stock, it determines whether there is a market´s momentum trending upwards or downwards.(Murphy, 2021). If the indicator assumes values above 80, one can say the stock is overbought, while if the indicator is below 20 it may indicate it is oversold.

To proceed to the calculations of the Money Flow Index, according to Investopedia (Mitchell, n.d.) :

$$Money\ Flow\ Index = 100 - \frac{100}{1+Money\ Flow\ Ratio} \text{ where:} \qquad (1)$$

$$Money\ Flow\ Ratio = 100 - \frac{14\ Period\ Positive\ Money\ Flow}{14\ Period\ Negative\ Money\ Flow}; \qquad (2)$$

$$Raw\ Money\ Flow = Typical\ Price\ x\ Volume; \qquad (3)$$

$$Typical\ Price = \frac{High+Low+Close}{3}. \qquad (4)$$

The second indicator to be used in our strategy will be "RSI", Relative Strength Index. This one instead of being an indicator based on momentum like the previous one, is an oscillator whose values assumed are between 0 and 100. When the RSI assumes high values, it means that there were a lot of up movements and when it assumes low values it means there were a lot of down movements. Usually, traders assume a stock is undervalued if the RSI of a stock is below 30 and overvalued when RSI is larger than 70. Given this, we can create buy and sell signals on a stock (Silva and Nunes, 2017, page 98).

To calculate the value for the RSI we need to proceed into two steps (Fernando, 2021).

First, we must calculate the average percentage return generated during a period. The default period used is 14 periods, in which we will also use it in our strategy, since the majority of traders, as it is the default settings, use it.

$$RSI = 100 - [\frac{100}{1+\frac{Average\ Gain}{Average\ Loss}}] \qquad (5)$$

After having collected the results for the number of periods that we want to calculate the RSI, in our case the 14 periods (days), to achieve the value of the indicator RSI we simply need to:

$$RSI = 100 - [\frac{100}{1+\frac{(Previous\ Average\ Gain\ x\ 13)+Current\ Gain}{(Previous\ Average\ Loss\ x\ 13)+Current\ Loss}}] \qquad (6)$$

Like this, we achieved the RSI value for the 14 periods.

The last indicator of the three to create the directional part of our strategy are the Bollinger bands, created by John Bollinger.

It is characterized by being an envelope type of indicator. It appeals to the volatility of an asset using measures such as standard deviation to identify signals of buy or sell of an asset. The touch of the upper band of the Bollinger bands indicator produces a sell signal and the touch of the price of the asset of the lower band produces a buy signal.

The indicator is composed by a line of the moving average of the prices of the asset and then two other lines (one upwards and one downwards) which are calculated by adding and subtracting the standard deviation to the moving average (Silva and Nunes, 2017, page195).

The upper line of the Bollinger Band is calculated by (Hayes, n.d.):

$$\text{Upper Band} = \text{Moving Average (Typical Price, n)} + m \times \sigma[\text{Typical Price}, n] \tag{7}$$

$$\text{Lower Band} = \text{Moving Average (Typical Price, n)} - m \times \sigma[\text{Typical Price}, n] \tag{8}$$

Where:

$$\text{Typical Price} = \frac{High + Low + Close}{3}; \tag{9}$$

n = number of days in the smoothing period (the default number used is typically 20);

m = number of standard deviations (default is typically 2);

σ[Typical Price, n] = standard deviation over the last n periods of Typical Price;

$$\sigma = standard\ deviation = \sqrt{\frac{\sum_{i=1}^{n}(x_i - x_{avg})^2}{n-1}};\ x_{avg} \text{ is the mean of "x".} \tag{10}$$

Finally, we have the last indicator used in the strategy, the <u>Historical Volatility</u>.

Historical Volatility measures at one point in time by how much an asset price is deviating from its average, meaning it can be deviating in upwards momentum or downwards (Chen, 2020). When the indicator is rising in value, it means that the price is moving directionally in a faster way than usual, while if it is dropping it means that the movement of price is returning to the "basis" (*Historical Volatility*, n.d.). This is an important factor to our strategy as when volatility is verified in the market, there are larger price movements, presenting like that an opportunity to have more profits.

To calculate the Historical Volatility, we simply want to calculate the 1-day historical volatility i.e. sample standard deviation of n daily logarithmic returns.

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(R_i - R_{avg})^2}{n-1}}; \tag{11}$$

where:

$R_n = \ln\left(\frac{C_n}{C_{n-1}}\right)$;

ln= natural log; C_n= Closing prices

$R_{avg} = \frac{\sum_{i=1}^{n} R_i}{n}$;

Finally, the last step will be to annualize the historical volatility indicator´s results, by multiplying the results achieved previously by the square root of 252, which is the average number of trading days in a year. Hence, we achieved the annualized historical volatility.(*Historical Volatility*, n.d.)

5.4 Critics and limitations of Technical Analysis

Technical Analysis has had many critics over the years and there are not many studies made on the subject that address these limitations.

One of the main limitations pointed out by Technical Analysis skeptics is the fact that it is very subjective. As some technics such as chart reading rely on visual pattern recognition by traders, these are deemed as very subjective since one may vary of interpretation compared to other traders. The conclusions made by studies to address this situation are conflicting since opposite conclusions were made, remaining a good topic for future research. (Scott, Carr, n.d.) Given this subjectivity, there are difficulties academic studies show in properly testing how efficient is the use of Technical Analysis to generate greater returns for traders, being one of the main debated problems the data snooping. Data snooping happens when a researcher, in order to get his desired result (i.e. validation of his trading strategy, point of view…) searches for a database that will eventually validate his bias, meaning that the data set is chosen to validate a desired result (Griffioen, 2003).

Other critics are directed to indicators such as the Relative Strength Index or the MACD and others that are based on the price of the financial instrument. Given that, critics say that these are lagging indicators, meaning they produce buy and sell signals after the price movement that was expected already started, giving late entries on the positions a trader should take on a given financial instrument.

6 Important concepts

6.1 Money Management

According to (Silva and Nunes, 2017,page 25), to create an asset portfolio we should know beforehand what is our risk profile as an investor, for how long we are planning to have our funds invested and how much profit are we desiring. Only by knowing these details we can understand our profile as an investor, whether it is a risk averse profile or risk seeker one for example.

Important concepts such as risk tolerance, which refers to how much an investor or trader is willing to lose (potentially) in order to have potential profits, is important to have in mind and knowing this will allow the investor to understand in what financial asset to invest or the ones to avoid, whether it is riskier assets or simply risk free as the risk-free rate.

It is also very important to know for how long we are planning to hold the investment made and the necessity we have of that funds. If we have a big necessity of funds, we should expect the investment to be short-term instead of a long-term one. Also, when traders use leverage there are funding fees, that are simply fees collected by the broker due to the borrowing of money to the investor so he can use leverage, meaning that this could be a good tool for short-term trading but not for investing in the long-term.

Finally, every investor should have an idea of the profit he wants to make on his investment, which is related to his risk profile and the time he has his funds invested. Hence, an investor that tolerates more risk is able to have bigger profits than the risk averse investor.

After designing our investor profile, we should now pass to the search of financial assets that are suitable for us. Diversification is an important part of the process as with distributing our funds throughout different classes of financial assets we reduce the systemic risk that we are exposed to. Systemic risk simply refers to the risk that any investor is exposed to when entering the market, it is at risk in which is not related to the individual stock that the investor chooses to put his/her money but rather the risk of the market itself as a whole. This could be seen as the possibility of a financial crisis where a company could be doing better than expected but due to that fact the stock probably decreases in price, large institutions defaulting leading to liquidations in stocks and investors turning into safe-haven assets rather than risk assets… simply put, systemic risk is the failure of the system itself rather than an individual company that makes part of it.

6.2 Leverage

When talking about trading or investments it is always important to mention some tools such as leverage. Leverage is when a trader borrows money from the broker/exchange so he can have more buying power to buy financial assets and in exchange he pays funding fees that work similarly to an interest rate. With more buying power comes more responsibility from the trader as the risk that he is exposed to is significantly bigger. Also, in leverage plays, the account´s funds are used as collateral so the exchange guarantees their clients are able to pay the potential losses of their positions. Hence, stop-losses and risk management gain even more importance specially when in leveraged trades.

One general rule for investors is that it is not recommended to allocate more than 10% of the total funds in each trade, allowing some margin to add to the position in case bigger opportunities are given by the market(Silva and Nunes, 2017,page 29).

6.3 Risk-to-Reward Ratio

Risk-to-Reward Ratio concept is crucial to any trader, whether we are referring to a long-term investor or simply has a strategy of short-term trades.

This ratio divides the profit a trader will have in case the trade goes in his favor and hits his target price by the loss that will be assumed by the trader in case it goes on the other direction. Hence, the trader will know by looking at this ratio how much will he profit per every dollar/euro risked on the notional position of the trade.

The Risk-to-Reward Ratio is calculated simply by dividing the difference between the entry price and the stop-loss price by the difference of the profit target and the entry point.

$$Risk - to - Reward\ Ratio = \frac{Price\ entry\ value - Stop\ loss\ value}{Price\ target\ of\ profit - Price\ entry\ value}; \qquad (12)$$

This ratio is particularly important due to the conclusions we as investors can take by understanding it, not only in a risk management way but also in a money management perspective.

If the ratio assumes values superior to one, it means that the risk is bigger than the potential reward, on the contrary, if it is less than 1, it means that the potential profit is greater than the potential loss (Milton, 2020).

Greater Risk-to-Reward ratios means that we can fail more trades and still be able to profit, for example, with 3 trades of same R:R ratio (3.5), if we invest the same amount in each trade and in four total trades we fail 3 but get 1 right, it means that we still make a 0.5 profit for every dollar invested (on the amount of each trade and not the total amount).

The relationship of the potential profit and potential loss is important since it translates to the trader if the profit potential is bigger than the loss potential or the contrary, leaving space for the trader to make a better decision based on it.

6.4 Stop Losses and Profits

Stop-Loss orders are a fundamental tool used by traders and investors worldwide. They are an order placed by the trader to buy (if it is a short position) or sell (if it is a long position) an asset if it reaches a certain price during the trading hours and whose purpose is to ensure losses do not exceed what the trader initially decided to risk of his portfolio or even lock in profits on a try to “let profits run” and secure a minimum profit (Anderson, 2021).

It is especially important when traders use leverage on volatile environments, as with leverage, all the capital for a trader is in risk since it is given as collateral to leverage its positions.

6.5 Transaction Costs

Transaction costs are as the costs that incur to allow an economic exchange to be done (Black, Hashimzade and Myles, 2009).

In the purpose of this dissertation, the transaction costs are commissions and spreads paid to financial brokers such as exchanges for example. In case of a trader using leverage, there are also funding fees, which are commissions paid over the time the leveraged position is opened to the broker for the money borrowed above the notional size of the account of the trader.

7 Methodology

Firstly, we will compute the indicators in Matlab according to the description of each one of them and based on that, we create part of our strategy in Matlab as well.

Our strategy will be composed of two indicators. One will be an oscillator, whose values vary between zero and infinite. For values above 70 on our indicator we will consider a sell signal and when it reaches values equal or below 30 we consider a buy signal. This indicator will only be useful after we predict there will be a big movement on the historical volatility indicator. Our second indicator will allow us to predict those situations in which we are led to believe there will be volatility in the financial asset in specific.

First and foremost, we chose a volatility-based strategy since in theory, when there is a higher beta (risk) of any stock or portfolio of stocks, the higher should the return be to compensate investors given the higher risk, otherwise there would be no incentive to invest in high-risk stocks. The strategy that we are putting in place is riskier when compared to the buy-and-old since we are looking for volatile stocks and time periods, and instead of holding we have simply to follow our strategy and see what returns we can get.

For us, it is important to use the default settings of each indicator since these values are the ones that are pre-defined by most exchanges/brokers to use, hence most investors use them to define their one strategy.

As written in the book *“A Random Walk down Wall Street”* by Burton G. Malkiel, low volatility strategies can produce higher returns, especially in a long-term view, but can we produce even higher returns trying to predict volatility increases in stocks and their price directions? In practice, we are trying to predict when the volatility of a stock is low but increases, generating higher price moves and trying to profit from them.

Our strategy simply aims to take advantage of any big variation of prices of a stock in a way to find good entry and exit prices in order to increase the notional value of a trader´s account instead of taking a long-term approach of holding.

Hence, we expect that given that it is a higher risk associated with this strategy, then we expect a higher return and outperform the market by using some tools of Technical Analysis.

Given that we already have our four indicators that will compose our strategy chosen, we can now proceed to create our volatility-based strategy. For this, we will attribute weights to each indicator and then proceed to evaluate when the buy and sell signals are produced.

We will use statistics in order to test if our trading strategy is profitable and outperforms the buy and hold standard strategy, in specific the statistical tests known as "t-tests".

The hypothesis to be studies are the following:

1) <u>The returns generated by our strategy (Model A and B) are significantly different from zero</u>

   Given a α level of confidence, if the value of the t-statistic is in absolute value bigger than the critical value related to the level of confidence chosen, we reject the null hypothesis.

2) <u>The returns generated by the sell signals are negative</u>

Since we are comparing it to a buy and hold strategy, the most important part is to understand if the sell signals generated by our strategy generate negative returns to holders during the period until the next buy signal, i.e. when we have no position in the asset. If they do so, it means that this trading strategy is outperforming the holding one.

Finally, our volatility-based strategy will produce two different Models, Model A and B.

Simply put, Model B has the same fundamentals as Model A as everything is the same besides the fact that Model B produces more signals since it does not have trades not being done because of the 'trendvs' indicator, whose purpose is to check if there are good conditions that would allow us to have good results given the type of position we wanted to open (long or short).

While in Model A there is a buy signal produced by the column 'Type', it is only valid if the 'trendvs' indicator equals to zero (since being equal to zero we consider to be good for long positions) or for shorts, if the signal is ‘Sell’ we only enter the position if ‘trendvs’ indicator is equal to 1, in Model B this type of filtering does not happen, meaning that we will have the same trades executed in Model A plus the ones rejected by the filter of the ‘trendvs’.

<u>Process step-by-step</u>

-We will take a position on the stock (long or short), so it is a price directional strategy.

-Volatility indicators will help us by identifying moments where volatility was low and is growing, so that bigger changes in the price of the stock are more likely and we can produce bigger returns for our investments, as well as having in mind that there is more risk involved.

-Money Flow Index will allow us to understand if it exists any trend or momentum on the stock so that the position we will afterwards assume will be in syntony with this trend, while the indicator Historical Volatility will tell us how fast are these directional changes in price happening and will help us understand if we should expect bigger changes in the price of the stock in the short term.

-Finally, the Relative Strength Index and Bollinger Bands produce buy and sell signals, so we can understand in a better way if it is a good strategy to enter on a trade by assessing these two indicators.

-How to identify Stop loss prices and stop profits? We will use the metrics generated by the Risk-to-Reward ratio, under which we define the maximum percentage we are willing to lose in a trade and based on a Risk-to-Reward ratio we define the profit target. An appropriate Risk-Reward ratio must be chosen in order to create a good trading strategy.

-To enter in a trade, we will identify the trend by subtracting the price of the stock by its price one week early and 1 month early and take a position based on the trend.

-While the RSI and Bollinger bands are expected to give us buy and sell signals, we will use money flow index to reassure the trend and give us an outlook of the volume trader by the stock, meaning more interest on it. Historical volatility will show us if we should expect a big move for the stock or not, and we will only enter the trade if in fact we are expecting a big move that will generate greater returns potentially.

-To check if this strategy is good, we will compare the results with the results obtained by the "Buy and Hold" Strategy. At first sight, we should definitely expect bigger returns since it is a volatility-based strategy, meaning that if there is more risk involved it should have bigger potential profits as well, to compensate that risk assumed by the trader.

8 Data

To proceed to the testing necessary to our strategy in a way to evaluate either the strategy is a good one or not, we will choose a sample period and compare the strategy´s results, of both Models (A and B) with the results of the buy and hold strategy, which is the standard one.

We will choose 5 different stocks and an index to test out the performance of our Models.

The first stock to be chosen is Tesla (ticker: $TSLA) which can be considered as one of the American stocks that is very volatile as its price variations are bigger when compared to most of the stocks that constitute American indexes (DOW JONES, S&P 500…) and it fulfills our criteria as it has both liquidity and enough volume that allow us to trade without worrying about big price variations caused by our trade notional size.

The other four companies chosen to be in our sample were Advanced Micro Devices Inc. (ticker: $AMD), NetFlix Inc. (ticker: $NFLX), Alibaba Group Holding Ltd. (ticker: $BABA) and finally Simon Property Group Inc. (ticker: $SPG). All of these stocks are listed on the NYSE, the American stock exchange, and were chosen to have a sample of some growth stocks to give us a better idea if the strategy was able to capture and profit from the big variations some of them had.

We retrieved daily data of the stock using the website *Finance.Yahoo* during a sample period big enough that allow us to properly test our strategy and take conclusions from it, in which it will be a five-year period. Finally, we will retrieve data from the index S&P 500 using its ETF Trust, $SPY to do so for our testing using indexes.

Since our goal is only to test the performance of our strategy and compare it to the buy and hold strategy, it is not interesting to proceed to considerations as risk free investment or any other investment in different currencies, like this we eliminate variables not so interesting to our purpose.

Due to a limitation of the data acquired, the timeframe of the 5 years in the stocks may differ the start date in a matter of a day between them, around the period of 06/04/17, which does not make any difference for our purpose to test the performance of our Strategy.

For the index S&P 500 the timeframe chosen differs from the others since in the same timeframe the signals our strategy provided were in fact very low due to the fact that the financial instrument, by being an index, implies less volatility and to try to evaluate its performance we then considered increasing the timeframe an adequate solution. To solve this issue, we decided to analyze an extended timeframe when compared to the others (19 years compared to 5years).

8.1 Stock choice Criteria

8.1.1 Liquidity

To understand the concept of liquidity, it is crucial to first understand what are the bid and ask prices.

The “bid price is “the price at which someone is willing to buy a certain stock or financial asset and has an order placed to do so. On the other hand, the “ask price is “the price at which someone who holds the asset is willing to sell it. The bid price is always lower than the ask price as if it was higher than the transaction would have already taken place. The difference between the bid and ask price is called the “bid-ask spread”, which is one direct indicator of the liquidity of the financial asset. The tinier this spread, the more liquid an instrument is, meaning that for our strategy, as liquidity is one of our criteria, we should go with the ones that have a tinier “bid-ask spread” (Silva and Nunes, 2017, page 52). Large “bid-ask spreads” cause a bigger price variation to open and close a position on that asset, meaning an investor should demand higher returns when investing in these low liquidity assets when compared to higher liquidity investments.

8.1.2 Volume

Volume is an indicator that allows investors to know what was the number of shares traded, i.e. exchanged by investors/traders, during a given time horizon. It is used by the majority of traders to identify how strong price moves are and identify trends in the price action. According to Burton Malkiel, the author of the book *“A Random Walk Down Wall Street”*, there are Price-Volume systems that propose the following:

On one hand, when a stock price increases on increasing volume, we can conclude that it exists an excess number of buyers, leading us to logically think that the stock will continue to increase in price. On the other hand, if a stock price falls while it is registered larger volumes compared to the ones traded usually, selling pressure is bigger than buying pressure and the price of the stock should continue to decrease. (Malkiel, 2015, page 109).

Finally, it is expected that a stock with higher volume during a sample period is more liquid than stocks with lower volume.

9 Empirical results

9.1 Assumptions

- No leverage will be used;

- Zero funding fees for short positions open;

-Spread of 0.125% on each transaction, that is, since a trade will have only 2 transactions then 0.25% spread for each trade to have into account liquidity and price effects of our transaction orders. (also to consider transaction costs);

-Buy and hold positions are simply a long opened at the beginning of our sample period and liquidate positions on the last day of the period;

-No positions will be held open in the end of the sample period, all of them will be liquidated even if there is no signal to do that;

-Risk Management only applies to Closing prices and not to prices that could be seen during the trading opening hours of the day, meaning that a stock could hit a Stop Loss price as many times as possible, but if it closes above that price (in a long position), then no action will be done.

9.2 Spreads

As stated previously in the previous Assumptions section, when back testing our Models, we will use a 0.125% spread on the price of the stocks and indices for each transaction. Thus, since the trades we will execute are composed by only 2 transactions, one to open the position and another to close it, each trade will have a spread of 0.25% embedded in the result of it. It is also important to notice that for simplicity reasons we will ignore the fact that in most exchanges, to open short positions on a financial instrument, a funding fee exists related to the time that we keep the position open.

9.3 Risk-to-Reward Ratio

Table 1- Trading Strategy statistics

Count Longs	**259**
Count Shorts	**62**
Count Stop Losses hi	**23**
Count Stop Profits	**4**

Table 2- Number of trades

Trades open	**321**
% Stop Losses hit	**7.17%**
% Profit Targets hit	**1.25%**

Source: Bruno Rodrigues

One thing to have into attention on our Models is the risk management, that is, the risk-to-reward ratio. A Risk-to-Reward ratio of 2.5 means that by entering a trade we are risking 1 monetary unit to win 2.5 for every monetary unit invested.

By using a 2.5 Risk-to-Reward ratio, we can see that in 321 trades, only four hit the targets and about twenty-three were losing trades (hit the Stop losses).

Those results show us that the Stop Losses were hit about six times more (5.76x) than the Targets, which is a very bad result given the Risk to Reward ratio is 2.5.

The targets are simply made by having a criteria Stop Loss and multiplying it by the ratio.

Table 3- Risk-to-Reward Ratios chosen

9	Risk	R:r	Targets
Longs	15.00%	**2.5**	37.50%
Shorts	10.00%	**2.5**	25.00%

Source: Bruno Rodrigues

10 Descriptive Analysis

In this section we will use descriptive analysis to research about the statistical significance of our strategy and consequently models and their profitability.

For this, we will make use of the 'T-Test', which is a statistical test whose t-statistic follows a Student t-distribution and is used to compare the means of two samples.

With this method is possible to test a hypothesis and find if there is any statistical significance to what we are inferring from. In our case, as we want to compare it with a mean equal to zero, we will use a Dummy variable to proceed the test using Excel´s Data function "*T-Test using unequal variance*".

Given that, we will be able to take conclusions about our Models, compare it's results and see if it happens to be a good alternative to the standard strategy of buy and hold.

Before proceeding to analyze the results given by the t-tests, it is important to have in mind that our strategy produces a relatively small sample of number of observations, especially in Model A. Having that into account any result given by the t-test and consequently any interpretation is going to be seen with a skeptic eye since a small sample may deviate results and not show the reality with efficacy.

For the tests, and in case of not being mentioned, we will use the standard alfa 0.05 that is used as a general standard on majority of t-Tests, that is, the significance level used in the following t-tests will be of 95%.

In our strategy we will have two models, Model A and B, in which the Model B is simply the strategy of the Model A but with less filtering, allowing us to have a bigger number of trades during the same sample period studied and consequently will give us a better insight into what this strategy can produce.

10.1 Initial strategy

To initiate the study of our strategy's statistical significance, we first looked at the returns generated by each trade and applied the study the T-tests to find if they were statistically significant, which they were not.

Table 4- Results of studying the Returns of the Model A

	Done in % With spread- Model A
Mean	0.936%
Variance	1.733%
Observations	53
Hypothesized Mean Difference	0
df	52
t Stat	0.51741491
P(T<=t) one-tail	0.30353036
t Critical one-tail	1.67468915
P(T<=t) two-tail	0.60706072
t Critical two-tail	2.00664681

Source: Bruno Rodrigues

Table 5-- Results of studying the Returns of the Model B

	Done in % With spread- Model B
Mean	0.244%
Variance	0.598%
Observations	268
Hypothesized Mean Difference	0
df	267
t Stat	0.51631533
P(T<=t) one-tail	0.30303077
t Critical one-tail	1.6505806
P(T<=t) two-tail	0.60606153
t Critical two-tail	1.96888862

Source: Bruno Rodrigues

As we can observe by the results of the T-tests applied to each model individually, the p-value were about 0.5 and 0.6, far superior to the alfa used to the study of the significance of the trading strategy, which was 0.5.

Given this, we would conclude that the returns were not statistically different from zero and due to that our strategy and Models were shown to not be good and our dissertation had failed to create a good trading strategy. Hence, the solution that allowed us to keep studying it and to get statistically significant results were simply change the returns by the price variation as the variable of study. Instead of looking at the returns of each trade, we will focus on the price variation given by each trade, that is, independent of the type of position we take (short or long), we will only consider the initial and final price of the financial asset to analyze, meaning that we are studying the price variations given by each signal produced by our strategy. With this small change, it was possible to obtain results that were significantly different from zero and with that we were able to advance in our study.

The first hypothesis to be evaluated will be:

H0: Price variation generated by signals (buy and sell) is statistically different from zero.

H1: Price variation generated by signals (buy and sell) is no statistically different from zero.

Table 6- Results of studying the Price Variations of Both Models

	Done in % With spread-Both Models
Mean	1.141%
Variance	0.769%
Observations	321
Hypothesized Mean Difference	0
df	320
t Stat	**2.330673341**
P(T<=t) one-tail	0.010195825
t Critical one-tail	1.649629305
P(T<=t) two-tail	**0.020391649**
t Critical two-tail	**1.967404974**

Source: Bruno Rodrigues

By looking at the results of the buy and sell signals generated by both models in conjunction, we will try to understand if this strategy is statistically different from zero and consequently produces good or bad results. After, we will proceed to analyze it model by model.

First and foremost, it is important to highlight that this t-Test was made at a 95% confidence level. We observe that the p-value (0.020391649) generated by the t-test is inferior to the alfa used (0.05), thus we end up not rejecting the null hypothesis. An important notice in the study of the significancy of the trading strategy is that the p-value in question that we shall take into consideration is the two-tail as the distribution of the T-test is a two-tailed T-student.

By not rejecting the null hypothesis, we can conclude there is no statistical evidence to support that the alternative hypothesis is correct, meaning that the returns generated by the signals might be different than zero, producing positive or negative returns at a 95% confidence level and given this sample.

Although until this moment the volatility based strategy can sound promising, when looking at the price variations generated model by model and applying the T-test to both of them isolated, instead of looking at the price variations of Model A and B in conjunction, we can conclude that the t-statistic of both T-Tests end up in the Rejection Area of the two-tailed distribution, thus resulting in a rejection of the null hypothesis and consequently the alternative hypothesis being considered correct given this sample and for a 95% confidence level. This means that for an alfa of 0.05, the returns generated by each model are not considered statistically different from zero.

Results:

Table 7-Results of studying the Price Variations of Model A

	Done in % With spread- Model A
Mean	2.78%
Variance	1.66%
Observations	53
Hypothesized Mean Difference	0
df	52
t Stat	**1.569091641**
P(T<=t) one-tail	0.061346157
t Critical one-tail	1.674689154
P(T<=t) two-tail	**0.122692314**
t Critical two-tail	2.006646805

Source: Bruno Rodrigues

	Done in % With spread- Model B
Mean	0.008168076
Variance	0.005915562
Observations	268
Hypothesized Mean Difference	0
df	267
t Stat	**1.738557893**
P(T<=t) one-tail	0.041632643
t Critical one-tail	1.650580601
P(T<=t) two-tail	**0.083265286**
t Critical two-tail	1.968888622

Source: Bruno Rodrigues

What can explain this situation? Essentially, and to emphasize, each model has a relatively small sample of number of observations. Having that into account any result given by the t-test is going to be seen with a skeptic eye. A 95% confidence level, although seen as the standard confidence level, can be considered high. When we increase the alfa to 0.15, thus decreasing the confidence level to 85%, we observe that we no longer reject the null hypothesis, so we can conclude that at an 85% confidence level, each model (A and B) produces results statistically different from zero.

With alfa= 0.15:

Table 8- Results of studying the Price Variations of Model A and B

	Done in % With spread- Model A
Mean	0.027798
Variance	0.016634
Observations	53
Hypothesized Mean Difference	0
df	52
t Stat	**1.569092**
P(T<=t) one-tail	0.061346
t Critical one-tail	1.046873
P(T<=t) two-tail	**0.122692**
t Critical two-tail	1.461117

Source: Bruno Rodrigues

	Done in % With spread- Model B
Mean	0.008168
Variance	0.005916
Observations	268
Hypothesized Mean Difference	0
df	267
t Stat	**1.738558**
P(T<=t) one-tail	0.041633
t Critical one-tail	1.03845
P(T<=t) two-tail	**0.083265**
t Critical two-tail	1.443685

Source: Bruno Rodrigues

Hypothesis number two:

H0: Price variations generated by sell signals are negative.

H1: Price variations generated by sell signals are not negative.

Table 9- Results of studying the Price Variations of the trades we enter as short positions

	Shorts Done in % to both Models with spread
Mean	**2.03%**
Variance	**0.24%**
Observations	62
Hypothesized Mean Difference	0
Df	61
t Stat	**3.261458**
P(T<=t) one-tail	0.000908
t Critical one-tail	1.670219
P(T<=t) two-tail	**0.001817**
t Critical two-tail	1.999624

Source: Bruno Rodrigues

By analyzing the short signals isolated from each model, we can verify that in both Models (A and B) we conclude that the price variations generated by the trades are statistically different from zero. Also, in both models we conclude that the returns are actually positive by looking at the mean and variance, which in a short position it means we incur in a loss, given that we are studying the price variations that occur after we enter a trade. This analysis allow us to understand that the short positions taken during the timeframe considered in the back testing actually decreased the profitability of both Models and consequently our strategy.

Results:

Table 10-Results of studying the Price Variations of the trades we enter as short positions in Model A

	Shorts Done in % With spread- Model A
Mean	**4.072%**
Variance	**0.205%**
Observations	12
Hypothesized Mean Difference	0
df	11
t Stat	**3.118496239**
P(T<=t) one-tail	0.004888088
t Critical one-tail	1.795884819
P(T<=t) two-tail	**0.009776176**
t Critical two-tail	2.20098516

Source: Bruno Rodrigues

Table 11-Results of studying the Price Variations of the trades we enter as short positions in Model B

	Shorts Done in % With spread- Model B
Mean	**1.536%**
Variance	**0.239%**
Observations	50
Hypothesized Mean Difference	0
df	49
t Stat	**2.219398**
P(T<=t) one-tail	0.01556
t Critical one-tail	1.676551
P(T<=t) two-tail	**0.03112**
t Critical two-tail	2.009575

Source: Bruno Rodrigues

How can we explain this? This situation can be explained by the fact that as we defined previously, this strategy is short positions averse, given that in the long run, the tendency for a stock is to increase in price. Thus, we translate this situation into a stricter risk management by using a stop loss of 10% compared to the 15% used in Longs positions. Since the stop loss is tighter in shorts, it can be seen as normal to have a bigger number of observations of stop losses hit in short positions rather than in long positions, especially in a volatile environment like the one we tend to take advantage of.

10.2 Trading Strategy Results

By looking at the table of the comparison of our strategy (Model A and B) to the buy and hold strategy, we can verify that in these 5 stocks chosen, our strategy outperformed the standard strategy when the stocks had a bad performance over the given period (BABA and SPG), suggesting it to be a good strategy in periods of recession. On the contrary, we can clearly verify that the buy and hold strategy outperforms by far our models when the stocks had an immense growth, such as AMD and TSLA for example.

Given this, we are led to believe that our volatility based strategy is more successful in stocks that do not do well in the long run and might be good to use during bear markets and recession times, which in theory makes sense given that volatility is higher during rough market conditions leading to our strategy to have more trades, situation that can explain a possible outperformance given that in our strategy we want to capitalize on volatility and in the periods where stocks lose the most.

Table 12- Results in percentage of the Models

	Model A	Model B	Buy & Hold
AMD	24.665%	-9.532%	704.974%
TSLA	26.510%	-16.222%	2037.232%
BABA	15.813%	44.857%	0.657%
NFLX	9.413%	33.178%	156.680%
SPY	-21.352%	-6.393%	301.888%
SPG	-4.133%	8.066%	-24.704%

Mean	8.486%	8.992%
Variance	3.38%	6.18%
Sum returns	50.916%	53.954%

Source: Bruno Rodrigues

<u>Strategy results with spreads considered in each trade</u>:

Table 13- Results in percentage of the Models taken into account a spread of 0.125% in each transaction

	Model A	Model B	Buy & Hold
AMD	**24.465%**	**7.758%**	704.974%
TSLA	**26.360%**	**-16.647%**	2037.232%
BABA	**15.663%**	**44.157%**	0.657%
NFLX	**9.263%**	**32.503%**	156.680%
SPY	**-21.852%**	**-9.518%**	301.888%
SPG	**-4.308%**	**7.091%**	-24.704%

Mean	8.265%	10.891%
Variance	3.42%	5.55%
Sum returns	49.591%	65.344%

Source: Bruno Rodrigues

When comparing both Model A and B, first and foremost is important to notice what differs between them. As said previously, Model B is the same as Model A but with less 'filters' that allow us to have a bigger number of signals and consequently trades within the same time period. With this in mind, we will now proceed to study the efficiency of the strategy´s signals.

By comparing both Models, we can verify that Model B outperforms Model A in stocks that Model A outperforms the buy and hold standard strategy and underperforms in 2 out of 4 stocks where Model A underperforms the standard strategy. Thus, is it fair to say that Model B is a better version of Model A? Looking at this sample of stocks and given this timeframe for the analysis, the mean of the returns generated by the Model B is slightly higher than Model A (8.992% compared to 8.486%) while the variance of Model B is about double the variance of Model A (6.18% compared to 3.38%), suggesting that the returns from Model B are more volatile than Model A.

<u>Studying the strategy without money management associated to it</u>:

By taking out the days in which the stop losses or target prices were exercised we are simply observing how the strategy unfolds during this sample period without the risk management associated to it. Also, it is important to note that by taking these days out we are eliminating the days in which volatility was higher, since stop losses and price targets are ceiling prices for the strategy itself.

With the results of the t-test we can see the strategy is statistically different from zero given this sample period and for this sample at a 95% confidence level. And it produces a return in average of 1.52% in each trade." This situation goes in contrast with the fact that analyzing the full strategy, that is, having the same sample of trades plus those in which stop losses and targets are hit, also with an alpha of 0.05, we reject the null hypothesis.

Table 14

	Done in % with spreads
Mean	**1.52%**
Variance	**0.51%**
Observations	294
Hypothesized Mean Difference	0
df	293
t Stat	**3.646448**
P(T<=t) one-tail	0.000157
t Critical one-tail	1.650071
P(T<=t) two-tail	**0.000315**
t Critical two-tail	1.968093

Source: Bruno Rodrigues

11 Conclusion

Looking at our results, it is verifiable that we were able to create a volatility-based strategy easily replicable by any retail investor, as it was intended. Given that our strategy produced results statistically different from zero and ended up being positive returns, we could say that this strategy could be further developed to gather more information and consequently produce better results.

With this, we can speculate more about the role of volatility in the markets and how can it be considered into different trading strategies.

As we have seen previously the important role of volatility in the markets, volatility-based strategies present to be a good subject for further analysis and development and are subject to the general understanding of the creator´s developer.

Finally, and as a suggestion for further research, it would be interesting to study how tools like the VIX and other macro environmental variables such as 10y US rates or price of oil to create a in-depth model that could represent a better understanding of macroeconomic risk factors and retrieve even better trading results given it is not focused only on one financial asset and has the environmental aspect of it taken into account.

12 Appendixes

Model A trades taken:

Ticker: $AMD

			Enter position																TESTE		
vs value	trendvs	dte	vs value at dte	Date	Minimum days between signals	Clos. prices at dte	Type of position	Date	trendvs	Type	Final	Closing prices	Fecho da posiçao	Close Price	Done in %	SL Price	SL HIT?	SL % made	TGT Price	TGT HIT?	TGT MADE %
0		15	0	25/04/2017	25/04/2017	13.49	Buy	25/04/2017	0	Buy	BUY	13.49	21/06/2017	13.98	3.632%	11.4665	24	-23%	18.54875	0	
40.8906	1	614	45.01112351	11/09/2019	11/09/2019	29.76	Buy	11/09/2019	0	Buy	BUY	29.76	06/11/2019	35.93	20.733%	25.296	0		40.92	0	
62.67426	1	796	51.45252355	02/06/2020	02/06/2020	53.540001	Buy	02/06/2020	0	Buy	BUY	53.540001	29/07/2020	76.089996	42.118%	45.509	0		73.6175	1	42.118%
58.69258	0	858	48.96833332	28/08/2020	28/08/2020	85.550003	Buy	28/08/2020	0	Buy	BUY	85.550003	26/10/2020	82.230003	-3.881%	72.7175	0		117.6313	0	
38.37148	1	896	45.72418556	22/10/2020	22/10/2020	79.419998	Buy	22/10/2020	0	Buy	BUY	79.419998	18/12/2020	95.919998	20.776%	67.507	0		109.2025	0	
41.94939	2	973	43.32853295	12/02/2021	12/02/2021	93.769997	Buy	12/02/2021	0	Buy	BUY	93.769997	13/04/2021	80.190002	-14.482%	79.7045	15	-17.08%	128.9337	0	
50.20734	0	1112	49.63998095	01/09/2021	01/09/2021	109.989998	Buy	01/09/2021	0	Buy	BUY	109.989998	28/10/2021	106.22	-3.428%	93.4915	0		151.2362	0	
27.06604	0	1151	81.63757741	27/10/2021	27/10/2021	122.279999	Sell	27/10/2021	1	Sell	SELL	122.279999	24/11/2021	139.87	-12.576%	134.508	15	-11.07%	91.71	0	

Ticker: $BABA

			Enter position					Do											TESTE		
vs value	trendvs	dte	vs value at dte	Date	Minimum days between signals	Clos. prices at dte	Type of position	Date	trendvs	Type	Final	Closing prices	Fecho da posiçao	Close Price	Done in %	SL Price	SL HIT?	SL % made	TGT Price	TGT HIT?	TGT MADE %
0		15	0	20/04/2017	20/04/2017	112.959999	Buy	20/04/2017	0	Buy	BUY	112.959999	16/06/2017	134.87	19.396%	96.016	0		155.32	0	
64.57331	0	435	29.07564337	19/12/2018	19/12/2018	137.139999	Buy	19/12/2018	0	Buy	BUY	137.139999	19/02/2019	170.17999	24.092%	116.569	0		188.5675	0	
53.38347	0	617	49.26808522	11/09/2019	11/09/2019	176.089996	Buy	11/09/2019	0	Buy	BUY	176.089996	06/11/2019	184.16	4.583%	149.6765	0		242.1237	0	
50.79462	1	877	45.91099185	22/09/2020	22/09/2020	275.290009	Buy	22/09/2020	0	Buy	BUY	275.290009	17/11/2020	256.79999	-6.717%	233.9965	0		378.5238	0	
45.6043	1	938	37.95626782	17/12/2020	17/12/2020	264.429993	Buy	17/12/2020	0	Buy	BUY	264.429993	17/02/2021	270.82999	2.420%	224.7655	2	-16.05%	363.5912	0	
48.28281	0	981	41.7591018	22/02/2021	22/02/2021	254	Buy	22/02/2021	0	Buy	BUY	254	20/04/2021	229.88001	-9.496%	215.9	0		349.25	0	

Ticker: $NFLX

			Enter position					Do											TESTE		
vs value	trendvs	dte	vs value at dte	Date	Minimum days between signals	Clos. prices at dte	Type of position	Date	trendvs	Type	Final	Closing prices	Fecho da posiçao	Close Price	Done in %	SL Price	SL HIT?	SL % made	TGT Price	TGT HIT?	TGT MADE %
35.41649	0	611	39.49194289	04/09/2019	04/09/2019	291.519989	Buy	04/09/2019	0	Buy	BUY	291.519989	30/10/2019	291.45001	-0.024%	247.792	0		400.84	0	
56.46264	0	922	44.00771634	25/11/2020	25/11/2020	485	Buy	25/11/2020	0	Buy	BUY	485	26/01/2021	561.92999	15.862%	412.25	0		666.875	0	
53.61403	1	975	44.51386235	12/02/2021	12/02/2021	556.52002	Buy	12/02/2021	0	Buy	BUY	556.52002	13/04/2021	553.72998	-0.501%	473.042	0		765.215	0	
64.4453	0	1015	50.4266903	13/04/2021	13/04/2021	553.72998	Buy	13/04/2021	0	Buy	BUY	553.72998	09/06/2021	485.81	-12.266%	470.6705	0		761.3787	0	
56.53446	0	1092	45.78974622	02/08/2021	02/08/2021	515.150024	Buy	02/08/2021	0	Buy	BUY	515.150024	28/09/2021	517.91998	0.538%	437.8775	0		708.3313	0	
78.59411	0	1131	46.56020038	27/09/2021	27/09/2021	592.640015	Buy	27/09/2021	0	Buy	BUY	592.640015	22/11/2021	627.03998	5.805%	503.744	0		814.88	0	

Ticker: $SPG

			Enter position					Do											TESTE		
vs value	trendvs	dte	vs value at dte	Date	Minimum days between signals	Clos. prices at dte	Type of position	Date	trendvs	Type	Final	Closing prices	Fecho da posiçao	Close Price	Done in %	SL Price	SL HIT?	SL % made	TGT Price	TGT HIT?	TGT MADE %
		15	0	26/04/2017	26/04/2017	165.039993	Buy	26/04/2017	0	Buy	BUY	165.039993	22/06/2017	159.13001	-3.581%	140.284	0		226.93	0	
44.55534	1	94	51.87334175	17/08/2017	17/08/2017	157.199997	Buy	17/08/2017	0	Buy	BUY	157.199997	13/10/2017	166.31	5.795%	133.62	0		216.15	0	
56.22465	0	323	51.69192763	17/07/2018	17/07/2018	170.479996	Buy	17/07/2018	0	Buy	BUY	170.479996	12/09/2018	184.94	8.482%	144.908	0		234.41	0	
57.75228	1	524	40.50335492	06/05/2019	06/05/2019	178.110001	Buy	06/05/2019	0	Buy	BUY	178.110001	02/07/2019	170.56	-4.239%	151.3935	0		244.9013	0	
56.76714	1	1104	50.18237608	23/08/2021	23/08/2021	129.460007	Buy	23/08/2021	0	Buy	BUY	129.460007	19/10/2021	134.58	3.955%	110.041	0		178.0075	0	
54.64045	0	1145	79.47087974	20/10/2021	20/10/2021	144.960007	Sell	20/10/2021	1	Sell	SELL	144.960007	17/11/2021	166.24001	-12.801%	159.456	11	-12.801%	108.72	0	
42.72596	0	1252	0	24/03/2022	24/03/2022	130.130005	Buy	24/03/2022	0	Buy	BUY	130.130005	06/04/2022	127.86	-1.744%	110.6105	0		178.9288	0	

Ticker: $SPY

			Enter position					Do											TESTE		
vs value	trendvs	dte	vs value at dte	Date	Minimum days between signals	Clos. prices at dte	Type of position	Date	trendvs	Type	Final	Closing prices	Fecho da posiçao	Close Price	Done in %	SL Price	SL HIT?	SL % made	TGT Price	TGT HIT?	TGT MADE %
0		452	72.14263412	20/10/2003	20/10/2003	105.040001	Sell	20/10/2003	1	Sell	SELL	105.040001	17/11/2003	104.93	0.105%	115.544	0		78.78	0	
28.90081	2	531	51.93606556	12/02/2004	12/02/2004	115.650002	Buy	12/02/2004	0	Buy	BUY	115.650002	12/04/2004	114.82	-0.718%	98.3025	0		159.0188	0	
31.24384	1	817	33.03241731	04/04/2005	04/04/2005	117.629997	Buy	04/04/2005	0	Buy	BUY	117.629997	31/05/2005	114.5	-2.661%	99.9855	0		161.7412	0	
50.15221	0	974	71.14239346	14/11/2005	14/11/2005	123.690002	Sell	14/11/2005	1	Sell	SELL	123.690002	13/12/2005	126.09	-1.903%	136.059	0		92.7675	0	
63.10222	1	1545	44.20898716	25/02/2008	25/02/2008	137.330002	Buy	25/02/2008	0	Buy	BUY	137.330002	22/04/2008	128	-6.794%	116.7305	0		188.8288	0	
74.49694	1	2052	79.28865614	01/03/2010	01/03/2010	111.889999	Sell	01/03/2010	1	Sell	SELL	111.889999	29/03/2010	115.49	-3.117%	123.079	0		83.9175	0	
41.73529	1	2713	37.39865768	10/10/2012	10/10/2012	143.279999	Buy	10/10/2012	0	Buy	BUY	143.279999	10/12/2012	141.02	-1.577%	121.788	0		197.01	0	
59.69332	0	2901	81.49473163	15/07/2013	15/07/2013	168.149994	Sell	15/07/2013	1	Sell	SELL	168.149994	12/08/2013	168.59	-0.261%	184.965	0		126.1125	0	
57.64099	0	3234	87.48117509	06/11/2014	06/11/2014	203.149994	Sell	06/11/2014	1	Sell	SELL	203.149994	05/12/2014	205.58	-1.182%	223.465	0		152.3625	0	
44.80623	0	3379	36.26083605	08/06/2015	08/06/2015	208.479996	Buy	08/06/2015	0	Buy	BUY	208.479996	04/08/2015	211.89	1.636%	177.208	0		286.66	0	
55.09089	0	3418	43.89217911	03/08/2015	03/08/2015	209.789993	Buy	03/08/2015	0	Buy	BUY	209.789993	29/09/2015	210.59	0.381%	178.3215	0		288.4612	0	
56.74939	0	3613	40.61804326	11/05/2016	11/05/2016	206.5	Buy	11/05/2016	0	Buy	BUY	206.5	08/07/2016	209.28	1.346%	175.525	0		283.9375	0	
52.2965	2	3828	47.42527067	20/03/2017	20/03/2017	236.770004	Buy	20/03/2017	0	Buy	BUY	236.770004	16/05/2017	235.33	-0.608%	201.2545	0		325.5588	0	
64.2874	1	3905	48.0715828	10/07/2017	10/07/2017	242.369995	Buy	10/07/2017	0	Buy	BUY	242.369995	05/09/2017	246.82001	1.836%	206.0145	0		333.2587	0	
61.45979	1	3946	52.88593482	06/09/2017	06/09/2017	246.899994	Buy	06/09/2017	0	Buy	BUY	246.899994	01/11/2017	250.06	1.280%	209.865	0		339.4875	0	
67.36574	1	4023	77.91314735	26/12/2017	26/12/2017	267.190002	Sell	26/12/2017	1	Sell	SELL	267.190002	25/01/2018	274.12	-2.528%	293.909	0		200.3925	0	
48.82634	1	4452	54.40497881	11/09/2019	11/09/2019	300.25	Buy	11/09/2019	0	Buy	BUY	300.25	06/11/2019	297.62	-0.876%	255.2125	0		412.8438	0	
51.84674	1	4528	76.49788117	30/12/2019	30/12/2019	321.079987	Sell	30/12/2019	1	Sell	SELL	321.079987	29/01/2020	327.45001	-1.945%	353.188	0		240.81	0	
39.7432	0	4851	77.68403062	13/04/2021	13/04/2021	412.859985	Sell	13/04/2021	1	Sell	SELL	412.859985	11/05/2021	417.51999	-1.116%	454.146	0		309.645	0	
41.16827	1	4984	79.56572374	20/10/2021	20/10/2021	452.410004	Sell	20/10/2021	1	Sell	SELL	452.410004	17/11/2021	464.72	-2.649%	497.651	0		339.3075	0	

Ticker: $TSLA

			Enter position					Do											TESTE		
vs value	trendvs	dte	vs value at dte	Date	Minimum days between signals	Clos. prices at dte	Type of position	Date	trendvs	Type	Final	Closing prices	Fecho da posiçao	Close Price	Done in %	SL Price	SL HIT?	SL % made	TGT Price	TGT HIT?	TGT MADE %
0		15	0	04/11/2016	04/11/2016	38.112	Buy	04/11/2016	0	Buy	BUY	38.112	04/01/2017	45.397999	19.117%	32.3952	0		52.404	0	
64.06101	2	176	51.5660318	28/06/2017	28/06/2017	74.248001	Buy	28/06/2017	0	Buy	BUY	74.248001	24/08/2017	70.585999	-4.932%	63.1108	2	-16.81%	102.091	0	
74.68222	1	524	71.10794713	13/11/2018	13/11/2018	67.746002	Sell	13/11/2018	1	Sell	SELL	67.746002	13/12/2018	75.358002	-10.101%	74.5206	1	-10.10%	50.8095	0	
53.32101	0	633	37.25432795	24/04/2019	24/04/2019	51.731998	Buy	24/04/2019	0	Buy	BUY	51.731998	20/06/2019	48.967999	-5.343%	43.9722	21	-18.41%	71.1315	0	
49.99266	1	723	49.7496084	30/08/2019	30/08/2019	45.122002	Buy	30/08/2019	0	Buy	BUY	45.122002	28/10/2019	48.562	7.624%	38.3537	0		62.04275	2	45%
49.97438	1	1257	0	13/10/2021	13/10/2021	811.080017	Buy	13/10/2021	0	Buy	BUY	811.080017	18/10/2021	870.10999	7.278%	689.418	0		1115.235	0	

Model B trades taken:

Ticker: $AMD

			Enter position					Do											TESTE		
vs value	trendvs	dte	vs value at dte	Date	Minimum days between signals	Clos. prices at dte	Type of position	Date	trendvs	Type	Final	Closing prices	Fecho da posiçao	Close Price	Done in %	SL Price	SL HIT?	SL % made	TGT Price	TGT HIT?	TGT MADE %
0		15	0	25/04/2017	25/04/2017	13.49	Buy	25/04/2017	0	Buy	Buy	13.49	23/05/2017	10.89	-19.274%	11.4665	**15**	**-23%**	18.54875	0	
0		104	59.36409415	30/08/2017	30/08/2017	12.67	Do nothing	30/08/2017	1	Buy	Buy	12.67	28/09/2017	12.74	0.552%	10.7695	0		17.42125	0	
0		133	50.92356788	11/10/2017	11/10/2017	13.88	Buy	11/10/2017	0	Buy	Buy	13.88	08/11/2017	11.71	**-15.634%**	11.798	**6**	**-21.54%**	19.085	0	
47.13772	0	164	41.94938792	24/11/2017	24/11/2017	11.38	Buy	24/11/2017	2	Buy	Buy	11.38	22/12/2017	10.54	-7.381%	9.673	0		15.6475	0	
36.17456	0	203	60.83555618	23/01/2018	23/01/2018	12.94	Do nothing	23/01/2018	0	Buy	Buy	12.94	21/02/2018	11.72	-9.428%	10.999	0		17.7925	0	
33.55211	1	224	29.33995509	22/02/2018	22/02/2018	11.84	Buy	22/02/2018	1	Buy	Buy	11.84	22/03/2018	10.91	-7.855%	10.064	0		16.28	0	
56.96736	1	246	32.44163538	26/03/2018	26/03/2018	10.44	Buy	26/03/2018	0	Buy	Buy	10.44	24/04/2018	10.09	-3.352%	8.874	0		14.355	0	
58.08912	0	281	82.19632275	15/05/2018	15/05/2018	12.45	Sell	15/05/2018	0	Sell	Sell	12.45	30/05/2018	13.82	-9.913%	13.695	**1**	**-9.91%**	9.3375	0	
58.10103	0	323	60.11965567	16/07/2018	16/07/2018	16.58	Do nothing	16/07/2018	1	Buy	Buy	16.58	13/08/2018	19.73	18.999%	14.093	0		22.7975	0	
83.58612	1	346	50.982637	16/08/2018	16/08/2018	19.33	Buy	16/08/2018	1	Buy	Buy	19.33	14/09/2018	32.720001	69.271%	16.4305	0		26.57875	**9**	**45.16%**
60.84243	0	471	57.45110321	15/02/2019	15/02/2019	23.68	Do nothing	15/02/2019	0	Buy	Buy	23.68	18/03/2019	23.25	**-1.816%**	20.128	0		32.56	0	
45.68881	0	515	62.32231689	22/04/2019	22/04/2019	28.18	Do nothing	22/04/2019	0	Buy	Buy	28.18	20/05/2019	26.68	-5.323%	23.953	0		38.7475	0	
44.11442	0	566	51.89271706	03/07/2019	03/07/2019	31.190001	Buy	03/07/2019	1	Buy	Buy	31.190001	01/08/2019	29.860001	-4.264%	26.5115	0		42.88625	0	
40.8906	1	614	45.01112351	11/09/2019	11/09/2019	29.76	Buy	11/09/2019	0	Buy	Buy	29.76	09/10/2019	28.459999	**-4.368%**	25.296	0		40.92	0	
46.71559	0	637	59.72442951	14/10/2019	14/10/2019	30.530001	Do nothing	14/10/2019	0	Buy	Buy	30.530001	11/11/2019	36.310001	18.932%	25.9505	0		41.97875	0	
57.24923	0	660	77.8648832	14/11/2019	14/11/2019	38.349998	Sell	14/11/2019	2	Sell	Sell	38.349998	29/11/2019	39.150002	-2.043%	42.185	0		28.7625	0	
58.98311	1	693	66.58714807	03/01/2020	03/01/2020	48.599998	Do nothing	03/01/2020	0	Buy	Buy	48.599998	03/02/2020	48.02	-1.193%	41.31	0		66.825	0	
53.23367	0	722	59.79835772	14/02/2020	14/02/2020	55.310001	Do nothing	14/02/2020	2	Buy	Buy	55.310001	16/03/2020	38.709999	-30.013%	47.0135	**9**	**-20.43%**	76.05125	0	
62.67426	1	796	51.45252355	02/06/2020	02/06/2020	53.540001	Buy	02/06/2020	0	Buy	Buy	53.540001	30/06/2020	52.610001	**-1.737%**	45.509	0		73.6175	**0**	
59.49548	2	818	47.78976944	02/07/2020	02/07/2020	52.34	Buy	02/07/2020	1	Buy	Buy	52.34	31/07/2020	77.43	47.937%	44.489	0		71.9675	**3**	**45.38%**
58.69258	0	858	48.96833332	28/08/2020	28/08/2020	85.550003	Buy	28/08/2020	0	Buy	Buy	85.550003	28/09/2020	79.480003	**-7.095%**	72.7175	0		117.6313	0	
37.64595	0	895	39.4324434	21/10/2020	21/10/2020	79.199997	Buy	21/10/2020	0	Buy	Buy	79.199997	18/11/2020	82.540001	4.217%	67.32	0		108.9	0	
27.73897	0	921	55.9045775	27/11/2020	27/11/2020	87.190002	Do nothing	27/11/2020	0	Buy	Buy	87.190002	28/12/2020	91.599998	5.058%	74.1115	0		119.8863	0	
31.6123	0	941	38.80603408	28/12/2020	28/12/2020	91.599998	Buy	28/12/2020	0	Buy	Buy	91.599998	27/01/2021	88.839996	-3.013%	77.86	0		125.95	0	
41.94939	2	973	43.32853295	12/02/2021	12/02/2021	93.769997	Buy	12/02/2021	0	Buy	Buy	93.769997	15/03/2021	82.5	**-12.019%**	79.7045	**5**	**-17.08%**	128.9337	0	
41.68092	0	1003	53.18194215	29/03/2021	29/03/2021	77.139999	Buy	29/03/2021	1	Buy	Buy	77.139999	27/04/2021	85.209999	10.461%	65.569	0		106.0675	0	
31.49928	0	1033	50.67090177	11/05/2021	11/05/2021	76.830002	Buy	11/05/2021	2	Buy	Buy	76.830002	09/06/2021	79.959999	4.074%	65.3055	0		105.6413	0	
64.70939	1	1054	65.11262368	10/06/2021	10/06/2021	81.559998	Do nothing	10/06/2021	0	Buy	Buy	81.559998	09/07/2021	90.900002	11.452%	69.326	0		112.145	0	
59.19813	0	1075	71.77868389	12/07/2021	12/07/2021	90.809998	Sell	12/07/2021	0	Sell	Sell	90.809998	26/07/2021	91.82	-1.100%	99.891	0		68.1075	0	
61.3814	1	1105	46.78614165	23/08/2021	23/08/2021	108.769997	Buy	23/08/2021	0	Buy	Buy	108.769997	21/09/2021	102.82	-5.470%	92.4545	0		149.5587	0	
44.338	0	1128	40.39396844	24/09/2021	24/09/2021	105.800003	Buy	24/09/2021	1	Buy	Buy	105.800003	22/10/2021	119.82	13.251%	89.93	0		145.475	0	
27.06604	0	1151	81.63757741	27/10/2021	27/10/2021	122.279999	Sell	27/10/2021	1	Sell	Sell	122.279999	10/11/2021	139.87	-12.576%	134.508	**5**	**-11.07%**	91.71	0	

Ticker: $BABA

			Enter position					Do											TESTE		
vs value	trendvs	dte	vs value at dte	Date	Minimum days between signals	Clos. prices at dte	Type of position	Date	trendvs	Type	Final	Closing prices	Fecho da posiçao	Close Price	Done in %	SL Price	SL HIT?	SL % made	TGT Price	TGT HIT?	TGT MADE %
0		15	0	20/04/2017	20/04/2017	112.959999	Buy	20/04/2017	0	Buy	Buy	112.959999	18/05/2017	121.27	**7.357%**	96.016	0		155.32	0	
71.06672	0	38	68.97853738	23/05/2017	23/05/2017	122.93	Do nothing	23/05/2017	1	Buy	Buy	122.93	21/06/2017	143.28999	16.562%	104.4905	0		169.0288	0	
75.59006	0	69	68.02979501	07/07/2017	07/07/2017	142.429993	Do nothing	07/07/2017	1	Buy	Buy	142.429993	04/08/2017	153.33	7.653%	121.0655	0		195.8412	0	
67.19061	1	110	66.20979162	05/09/2017	05/09/2017	169.919998	Do nothing	05/09/2017	0	Buy	Buy	169.919998	03/10/2017	178.56	5.085%	144.432	0		233.64	0	
62.46578	1	138	64.72522983	13/10/2017	13/10/2017	178.449997	Do nothing	13/10/2017	1	Buy	Buy	178.449997	10/11/2017	186.41	4.461%	151.6825	0		245.3687	0	
67.80876	1	160	54.73040569	14/11/2017	14/11/2017	181.789993	Buy	14/11/2017	1	Buy	Buy	181.789993	13/12/2017	176.47	-2.926%	154.5215	0		249.9612	0	
70.6042	0	185	53.6270917	20/12/2017	20/12/2017	172.639999	Buy	20/12/2017	0	Buy	Buy	172.639999	22/01/2018	184.02	6.592%	146.744	0		237.38	0	
68.72951	1	274	60.47983436	01/05/2018	01/05/2018	179.5	Do nothing	01/05/2018	0	Buy	Buy	179.5	30/05/2018	197.98	10.295%	152.575	0		246.8125	0	
62.6776	0	295	52.40502995	31/05/2018	31/05/2018	198.009995	Buy	31/05/2018	0	Buy	Buy	198.009995	28/06/2018	188.38001	-4.863%	168.3085	0		272.2637	0	
66.69795	1	326	46.76415245	16/07/2018	16/07/2018	190.350006	Buy	16/07/2018	1	Buy	Buy	190.350006	13/08/2018	177.67999	**-6.656%**	161.7975	0		261.7313	0	
68.38353	0	348	24.38280096	15/08/2018	15/08/2018	169.830002	Buy	15/08/2018	0	Buy	Buy	169.830002	13/09/2018	165.53	-2.532%	144.3555	0		233.5163	0	
64.57331	0	435	29.07564337	19/12/2018	19/12/2018	137.139999	Buy	19/12/2018	0	Buy	Buy	137.139999	18/01/2019	157.02	**14.496%**	116.569	0		188.5675	0	
67.27972	1	475	61.78043529	19/02/2019	19/02/2019	170.179993	Do nothing	19/02/2019	0	Buy	Buy	170.179993	19/03/2019	182.14	7.028%	144.653	0		233.9975	0	
64.17585	1	500	45.86913986	26/03/2019	26/03/2019	178.080002	Buy	26/03/2019	0	Buy	Buy	178.080002	24/04/2019	185.67	**4.262%**	151.368	0		244.86	0	
59.73485	0	521	57.24203703	25/04/2019	25/04/2019	187.880005	Do nothing	25/04/2019	0	Buy	Buy	187.880005	23/05/2019	156	-16.968%	159.698	**2**	**-15.46%**	258.335	0	
55.50316	1	566	62.11207168	28/06/2019	28/06/2019	169.449997	Do nothing	28/06/2019	1	Buy	Buy	169.449997	29/07/2019	177.02	4.467%	144.0325	0		232.9937	0	
53.38347	0	617	49.26808522	11/09/2019	11/09/2019	176.089996	Buy	11/09/2019	0	Buy	Buy	176.089996	09/10/2019	165.19	**-6.190%**	149.6765	0		242.1237	0	
46.45586	0	657	64.05504331	06/11/2019	06/11/2019	184.160004	Do nothing	06/11/2019	0	Buy	Buy	184.160004	05/12/2019	200	8.601%	156.536	0		253.22	0	
47.08809	0	684	72.43832466	16/12/2019	16/12/2019	206.970001	Sell	16/12/2019	0	Sell	Sell	206.970001	31/12/2019	212.10001	**-2.419%**	227.667	0		155.2275	0	
54.44765	0	704	58.41262393	15/01/2020	15/01/2020	225.059998	Do nothing	15/01/2020	1	Buy	Buy	225.059998	13/02/2020	220.36	-2.088%	191.301	0		309.4575	0	
57.09477	0	811	68.05331265	18/06/2020	18/06/2020	223.539993	Do nothing	18/06/2020	1	Buy	Buy	223.539993	17/07/2020	247.14	10.557%	190.009	0		307.3675	0	
56.2227	2	843	63.45597834	04/08/2020	04/08/2020	262.200012	Do nothing	04/08/2020	1	Buy	Buy	262.200012	01/09/2020	298	13.654%	222.87	0		360.525	0	
50.79462	1	877	45.91099185	22/09/2020	22/09/2020	275.290009	Buy	22/09/2020	0	Buy	Buy	275.290009	20/10/2020	309.81	**12.539%**	233.9965	0		378.5238	0	
44.01822	0	899	61.29953328	22/10/2020	22/10/2020	306.279999	Do nothing	22/10/2020	0	Buy	Buy	306.279999	19/11/2020	259.89002	-15.146%	260.338	**4**	**-15.66%**	421.135	0	
45.6043	1	938	37.95626782	17/12/2020	17/12/2020	264.429993	Buy	17/12/2020	0	Buy	Buy	264.429993	19/01/2021	251.64999	-4.833%	224.7655	**2**	**-16.05%**	363.5912	0	
48.28281	0	981	41.7591018	22/02/2021	22/02/2021	254	Buy	22/02/2021	0	Buy	Buy	254	22/03/2021	237.12	-6.646%	215.9	0		349.25	0	
50.72078	2	1027	57.78300077	28/04/2021	28/04/2021	236.720001	Do nothing	28/04/2021	1	Buy	Buy	236.720001	26/05/2021	211.78	-10.536%	201.212	0		325.49	0	
47.87596	0	1051	44.82299428	02/06/2021	02/06/2021	219.589996	Buy	02/06/2021	1	Buy	Buy	219.589996	30/06/2021	226.78	**3.274%**	186.6515	0		301.9362	0	

Ticker: $NFLX

			Enter position					Do											TESTE		
vs value	trendvs	dte	vs value at dte	Date	Minimum days between signals	Clos. prices at dte	Type of position	Date	trendvs	Type	Final	Closing prices	Fecho da posiçao	Close Price	Done in %	SL Price	SL HIT?	SL % made	TGT Price	TGT HIT?	TGT MADE %
0		30	75.05362481	12/05/2017	12/05/2017	160.809998	Sell	12/05/2017	0	Sell	Sell	160.809998	26/05/2017	162.42999	-0.997%	176.891	0		120.6075	0	
0		88	55.78058432	04/08/2017	04/08/2017	180.270004	Do nothing	04/08/2017	1	Buy	Buy	180.270004	01/09/2017	174.74001	-3.068%	153.2295	0		247.8713	0	
74.66949	1	109	62.45508096	05/09/2017	05/09/2017	174.520004	Do nothing	05/09/2017	0	Buy	Buy	174.520004	03/10/2017	179.19	2.676%	148.342	0		239.965	0	
57.36325	0	144	61.65305757	24/10/2017	24/10/2017	196.020004	Do nothing	24/10/2017	1	Buy	Buy	196.020004	21/11/2017	196.23	0.107%	166.617	0		269.5275	0	
39.90798	0	166	42.52759108	24/11/2017	24/11/2017	195.75	Buy	24/11/2017	0	Sell	Sell	195.75	08/12/2017	188.53999	3.824%	215.325	0		146.8125	0	
33.74347	1	280	58.81141195	10/05/2018	10/05/2018	329.600006	Do nothing	10/05/2018	0	Buy	Buy	329.600006	08/06/2018	360.57001	9.396%	280.16	0		453.2	0	
56.79153	2	301	69.39571016	11/06/2018	11/06/2018	361.450012	Do nothing	11/06/2018	0	Buy	Buy	361.450012	10/07/2018	415.63001	14.990%	307.2325	0		496.9938	0	
59.66422	0	479	56.81465452	26/02/2019	26/02/2019	364.970001	Do nothing	26/02/2019	1	Buy	Buy	364.970001	26/03/2019	359.97	-1.370%	310.2245	0		501.8338	0	
71.40092	0	509	39.44852791	09/04/2019	09/04/2019	364.709991	Buy	09/04/2019	0	Sell	Sell	364.709991	24/04/2019	374.23001	-2.544%	401.181	0		273.5325	0	
70.93789	1	559	61.99145869	20/06/2019	20/06/2019	365.209991	Do nothing	20/06/2019	1	Buy	Buy	365.209991	19/07/2019	315.10001	-13.721%	310.4285	0		502.1637	0	
35.41649	0	611	39.49194289	04/09/2019	04/09/2019	291.519989	Buy	04/09/2019	0	Sell	Sell	291.519989	18/09/2019	291.56	-0.014%	320.672	0		218.64	0	
45.74065	1	638	55.697795	11/10/2019	11/10/2019	282.929993	Do nothing	11/10/2019	2	Buy	Buy	282.929993	08/11/2019	291.57001	3.054%	240.4905	0		389.0287	0	
47.70525	0	665	58.28792062	19/11/2019	19/11/2019	302.600006	Do nothing	19/11/2019	0	Buy	Buy	302.600006	18/12/2019	320.79999	6.015%	257.21	0		416.075	0	
67.78268	0	722	69.12341043	12/02/2020	12/02/2020	380.01001	Do nothing	12/02/2020	1	Buy	Buy	380.01001	12/03/2020	315.25	-17.042%	323.0085	**1**	**-17.04%**	522.5138	0	
72.9399	1	786	57.40915224	14/05/2020	14/05/2020	441.950012	Do nothing	14/05/2020	1	Buy	Buy	441.950012	12/06/2020	418.07001	-5.403%	375.6575	0		607.6813	0	
56.46264	0	922	44.00771634	25/11/2020	25/11/2020	485	Buy	25/11/2020	0	Sell	Sell	485	10/12/2020	501.09	-3.211%	533.5	0		363.75	0	
56.74433	1	943	49.53245945	28/12/2020	28/12/2020	519.119995	Buy	28/12/2020	0	Sell	Sell	519.119995	12/01/2021	494.25	5.032%	571.032	0		389.34	0	
53.61403	1	975	44.51386235	12/02/2021	12/02/2021	556.52002	Buy	12/02/2021	0	Sell	Sell	556.52002	01/03/2021	550.64002	1.068%	612.172	0		417.39	0	
64.4453	0	1015	50.4266903	13/04/2021	13/04/2021	553.72998	Buy	13/04/2021	0	Sell	Sell	553.72998	27/04/2021	505.54999	9.530%	609.103	0		415.2975	0	
55.12457	0	1039	49.60275089	17/05/2021	17/05/2021	488.940002	Buy	17/05/2021	1	Sell	Sell	488.940002	01/06/2021	499.07999	-2.032%	537.834	0		366.705	0	
42.31264	0	1060	54.31314053	16/06/2021	16/06/2021	492.410004	Buy	16/06/2021	1	Sell	Sell	492.410004	30/06/2021	528.21002	-6.778%	541.651	0		369.3075	0	
47.50994	1	1082	45.76088614	19/07/2021	19/07/2021	532.280029	Buy	19/07/2021	0	Sell	Sell	532.280029	02/08/2021	515.15002	3.325%	585.508	0		399.21	0	
65.82215	0	1104	66.62186731	18/08/2021	18/08/2021	521.869995	Do nothing	18/08/2021	0	Buy	Buy	521.869995	16/09/2021	582.07001	11.535%	443.5895	0		717.5712	0	
94.92918	0	1125	65.36871997	17/09/2021	17/09/2021	589.349976	Do nothing	17/09/2021	1	Buy	Buy	589.349976	15/10/2021	613.15002	4.038%	500.9475	0		810.3562	0	
79.09999	0	1150	65.12209241	22/10/2021	22/10/2021	664.780029	Do nothing	22/10/2021	0	Buy	Buy	664.780029	19/11/2021	645.71997	-2.867%	565.063	0		914.0725	0	
74.61299	1	1172	37.29552117	23/11/2021	23/11/2021	654.059998	Buy	23/11/2021	1	Sell	Sell	654.059998	08/12/2021	628.08002	4.136%	719.466	0		490.545	0	
70.50533	0	1193	42.43058696	23/12/2021	23/12/2021	614.090027	Buy	23/12/2021	1	Sell	Sell	614.090027	07/01/2022	541.06	13.498%	675.499	0		460.5675	0	

Ticker: $SPG

			Enter position					Do											TESTE		
vs value	trendvs	dte	vs value at dte	Date	Minimum days between signals	Clos. prices at dte	Type of position	Date	trendvs	Type	Final	Closing prices	Fecho da posiçao	Close Price	Done in %	SL Price	SL HIT?	SL % made	TGT Price	TGT HIT?	TGT MADE %
		15	0	26/04/2017	26/04/2017	165.039993	Buy	26/04/2017	0	Buy	Buy	165.039993	24/05/2017	159.78	-3.187%	140.284	0		226.93	0	
0		38	40.82405006	30/05/2017	30/05/2017	154.979996	Buy	30/05/2017	1	Buy	Buy	154.979996	27/06/2017	162.37	4.768%	131.733	0		213.0975	0	
34.39535	0	60	61.78272526	29/06/2017	29/06/2017	162.580002	Do nothing	29/06/2017	1	Buy	Buy	162.580002	28/07/2017	160.52	-1.267%	138.193	0		223.5475	0	
44.55534	1	94	51.87334175	17/08/2017	17/08/2017	157.199997	Buy	17/08/2017	0	Buy	Buy	157.199997	15/09/2017	164.77	4.816%	133.62	0		216.15	0	
54.79991	0	116	50.66774345	19/09/2017	19/09/2017	159.729996	Buy	19/09/2017	0	Buy	Buy	159.729996	17/10/2017	167.10001	4.614%	135.7705	0		219.6287	0	
47.4645	0	138	52.01908489	19/10/2017	19/10/2017	165.520004	Buy	19/10/2017	1	Buy	Buy	165.520004	16/11/2017	159.87	-3.413%	140.692	0		227.59	0	
50.41036	0	161	54.54164179	21/11/2017	21/11/2017	159.149994	Buy	21/11/2017	0	Buy	Buy	159.149994	20/12/2017	163.98	3.035%	135.2775	0		218.8312	0	
54.88976	0	185	62.04400906	27/12/2017	27/12/2017	170.770004	Do nothing	27/12/2017	1	Buy	Buy	170.770004	26/01/2018	163.71001	-4.134%	145.1545	0		234.8088	0	
45.78493	1	205	35.52810052	26/01/2018	26/01/2018	163.710007	Buy	26/01/2018	2	Buy	Buy	163.710007	26/02/2018	159.07001	-2.834%	139.1535	0		225.1013	0	
52.70481	1	235	48.84059371	12/03/2018	12/03/2018	156.740005	Buy	12/03/2018	1	Buy	Buy	156.740005	10/04/2018	154.92999	-1.155%	133.229	0		215.5175	0	
52.05413	0	259	51.86038114	16/04/2018	16/04/2018	152.279999	Buy	16/04/2018	0	Buy	Buy	152.279999	14/05/2018	158.02	3.769%	129.438	0		209.385	0	
50.29793	1	281	64.75034594	16/05/2018	16/05/2018	154.309998	Do nothing	16/05/2018	0	Buy	Buy	154.309998	14/06/2018	164.05	6.312%	131.1635	0		212.1762	0	
36.45851	1	302	65.98267729	15/06/2018	15/06/2018	164.479996	Do nothing	15/06/2018	0	Buy	Buy	164.479996	16/07/2018	170.66	3.757%	139.808	0		226.16	0	
57.32886	1	322	56.75090485	16/07/2018	16/07/2018	170.660004	Do nothing	16/07/2018	1	Buy	Buy	170.660004	13/08/2018	174.78999	2.420%	145.061	0		234.6575	0	
66.33938	1	344	59.67995028	15/08/2018	15/08/2018	177.139999	Do nothing	15/08/2018	1	Buy	Buy	177.139999	13/09/2018	181.56	2.495%	150.569	0		243.5675	0	
51.56282	0	366	49.49414829	17/09/2018	17/09/2018	183.460007	Buy	17/09/2018	0	Buy	Buy	183.460007	15/10/2018	176.64	-3.717%	155.941	0		252.2575	0	
35.5281	2	388	49.03287588	17/10/2018	17/10/2018	172.75	Buy	17/10/2018	0	Buy	Buy	172.75	14/11/2018	183.52	6.234%	146.8375	0		237.5313	0	
42.04094	0	410	59.81997688	16/11/2018	16/11/2018	185.070007	Do nothing	16/11/2018	0	Buy	Buy	185.070007	18/12/2018	186.95	1.016%	157.3095	0		254.4713	0	
39.03878	0	446	63.71531784	11/01/2019	11/01/2019	172.350006	Do nothing	11/01/2019	2	Buy	Buy	172.350006	11/02/2019	178.5	3.568%	146.4975	0		236.9813	0	
46.27849	0	466	61.86594618	11/02/2019	11/02/2019	185.300003	Do nothing	11/02/2019	1	Buy	Buy	185.300003	12/03/2019	183.28	-1.090%	157.505	0		254.7875	0	
40.40211	1	487	39.59099618	13/03/2019	13/03/2019	178.139999	Buy	13/03/2019	1	Buy	Buy	178.139999	10/04/2019	181.11	1.667%	151.419	0		244.9425	0	
54.86906	1	509	70.52586322	12/04/2019	12/04/2019	185.520004	Sell	12/04/2019	0	Sell	Sell	185.520004	29/04/2019	175.75	5.559%	204.072	0		139.14	0	
68.72853	1	529	38.84473704	13/05/2019	13/05/2019	175	Buy	13/05/2019	0	Buy	Buy	175	11/06/2019	168.09	-3.949%	148.75	0		240.625	0	
82.91687	1	551	33.39066826	13/06/2019	13/06/2019	163.820007	Buy	13/06/2019	0	Buy	Buy	163.820007	12/07/2019	159.92999	-2.375%	139.247	0		225.2525	0	
59.71188	0	572	46.32655913	15/07/2019	15/07/2019	162.600006	Buy	15/07/2019	1	Buy	Buy	162.600006	12/08/2019	159.64	-1.820%	138.21	0		223.575	0	
53.94398	0	598	40.30464035	20/08/2019	20/08/2019	147.520004	Buy	20/08/2019	0	Buy	Buy	147.520004	18/09/2019	150.14999	1.783%	125.392	0		202.84	0	
51.30144	0	624	51.58822871	26/09/2019	26/09/2019	155.619995	Buy	26/09/2019	0	Buy	Buy	155.619995	24/10/2019	147.19	-5.417%	132.277	0		213.9775	0	
59.43939	0	646	71.59964615	28/10/2019	28/10/2019	153.839996	Sell	28/10/2019	0	Sell	Sell	153.839996	11/11/2019	155.42	-1.017%	169.224	0		115.38	0	
65.48301	0	668	41.55327586	27/11/2019	27/11/2019	151.220001	Buy	27/11/2019	1	Buy	Buy	151.220001	27/12/2019	144.01	-4.768%	128.537	0		207.9275	0	
37.48282	1	688	56.45915736	27/12/2019	27/12/2019	147.589996	Do nothing	27/12/2019	0	Buy	Buy	147.589996	28/01/2020	145.28999	-1.558%	125.4515	0		202.9362	0	
44.03239	0	708	43.10252387	28/01/2020	28/01/2020	139.990005	Buy	28/01/2020	0	Buy	Buy	139.990005	26/02/2020	142.08	1.493%	118.9915	0		192.4863	0	
51.00852	1	1012	60.55111454	13/04/2021	13/04/2021	113.379997	Do nothing	13/04/2021	1	Buy	Buy	113.379997	11/05/2021	122.36	7.920%	96.373	0		155.8975	0	
51.64187	0	1045	48.43063495	28/05/2021	28/05/2021	128.490005	Buy	28/05/2021	0	Buy	Buy	128.490005	28/06/2021	133.28	3.728%	109.2165	0		176.6738	0	
79.80715	1	1072	44.55052808	08/07/2021	08/07/2021	125.089996	Buy	08/07/2021	1	Buy	Buy	125.089996	05/08/2021	125.1	0.008%	106.3265	0		171.9987	0	
56.76714	1	1104	50.18237608	23/08/2021	23/08/2021	129.460007	Buy	23/08/2021	0	Buy	Buy	129.460007	21/09/2021	134.58	3.955%	110.041	0		178.0075	0	
66.16576	1	1128	52.06192974	27/09/2021	27/09/2021	134.149994	Buy	27/09/2021	2	Buy	Buy	134.149994	25/10/2021	132.62	-1.141%	114.0275	0		184.4562	0	
52.21491	0	1151	76.50378301	28/10/2021	28/10/2021	147.119995	Sell	28/10/2021	0	Sell	Sell	147.119995	11/11/2021	165.44	-11.074%	161.832	7	-11.50%	110.34	0	
46.72591	1	1201	66.43676426	10/01/2022	10/01/2022	160.880005	Do nothing	10/01/2022	0	Buy	Buy	160.880005	08/02/2022	146.78	-8.764%	136.748	0		221.21	0	
42.72596	0	1252	0	24/03/2022	24/03/2022	130.130005	Buy	24/03/2022	0	Buy	Buy	130.130005	00/01/1900	127.86	-1.744%	110.6105	0		178.9288	0	

Ticker: $SPY

			Enter position					Do											TESTE		
vs value	trendvs	dte	vs value at dte	Date	Minimum days between signals	Clos. prices at dte	Type of position	Date	trendvs	Type	Final	Closing prices	Fecho da posiçao	Close Price	Done in %	SL Price	SL HIT?	SL % made	TGT Price	TGT HIT?	TGT MADE %
0		63	28.90081131	05/04/2002	05/04/2002	112.690002	Buy	05/04/2002	2	Buy	Buy	112.690002	03/05/2002	107.58	-4.535%	95.7865	0		154.9488	0	
0		411	58.26936302	21/08/2003	21/08/2003	100.769997	Do nothing	21/08/2003	1	Buy	Buy	100.769997	19/09/2003	103.67	2.878%	85.6545	0		138.5587	0	
0		452	72.14263412	20/10/2003	20/10/2003	105.040001	Sell	20/10/2003	1	Sell	Sell	105.040001	03/11/2003	105.99	-0.896%	115.544	0		78.78	0	
54.34196	0	485	59.3575553	05/12/2003	05/12/2003	106.849998	Do nothing	05/12/2003	0	Buy	Buy	106.849998	06/01/2004	112.55	5.335%	90.8225	0		146.9187	0	
67.78765	0	504	79.53384929	05/01/2004	05/01/2004	112.440002	Sell	05/01/2004	1	Sell	Sell	112.440002	20/01/2004	114.2	-1.541%	123.684	0		84.33	0	
28.90081	2	531	51.93606556	12/02/2004	12/02/2004	115.650002	Buy	12/02/2004	0	Buy	Buy	115.650002	12/03/2004	112.58	-2.655%	98.3025	0		159.0188	0	
42.04413	2	569	55.57574201	07/04/2004	07/04/2004	114.629997	Do nothing	07/04/2004	0	Buy	Buy	114.629997	06/05/2004	111.81	-2.460%	97.4355	0		157.6162	0	
48.18128	1	603	55.55491335	26/05/2004	26/05/2004	112.239998	Do nothing	26/05/2004	1	Buy	Buy	112.239998	25/06/2004	113.84	1.426%	95.404	0		154.33	0	
40.57533	2	623	47.87425874	25/06/2004	25/06/2004	113.839996	Buy	25/06/2004	0	Buy	Buy	113.839996	26/07/2004	108.75	-4.471%	96.764	0		156.53	0	
46.07979	1	665	67.63370621	25/08/2004	25/08/2004	111.099998	Do nothing	25/08/2004	1	Buy	Buy	111.099998	23/09/2004	110.95	-0.135%	94.435	0		152.7625	0	
29.58705	1	686	46.67809409	24/09/2004	24/09/2004	111.459999	Buy	24/09/2004	0	Buy	Buy	111.459999	22/10/2004	109.99	-1.319%	94.741	0		153.2575	0	
39.99671	1	718	73.1009295	09/11/2004	09/11/2004	116.879997	Sell	09/11/2004	0	Sell	Sell	116.879997	23/11/2004	118.16	-1.083%	128.568	0		87.66	0	
36.75714	0	739	62.09972217	09/12/2004	09/12/2004	119.209999	Do nothing	09/12/2004	2	Buy	Buy	119.209999	07/01/2005	118.44	-0.646%	101.3285	0		163.9137	0	
56.12179	1	760	47.23112286	10/01/2005	10/01/2005	119	Buy	10/01/2005	1	Buy	Buy	119	08/02/2005	120.21	1.017%	101.15	0		163.625	0	
51.22499	0	781	60.68917352	09/02/2005	09/02/2005	119.309998	Do nothing	09/02/2005	0	Buy	Buy	119.309998	10/03/2005	121.24	1.618%	101.4135	0		164.0512	0	
36.76214	0	805	42.84073811	16/03/2005	16/03/2005	119.120003	Buy	16/03/2005	1	Buy	Buy	119.120003	14/04/2005	115.77	-2.812%	101.252	0		163.79	0	
38.42174	0	848	58.93588184	17/05/2005	17/05/2005	117.580002	Do nothing	17/05/2005	0	Buy	Buy	117.580002	15/06/2005	121.09	2.985%	99.943	0		161.6725	0	
59.93169	0	869	55.22525362	16/06/2005	16/06/2005	121.400002	Do nothing	16/06/2005	1	Buy	Buy	121.400002	15/07/2005	122.84	1.186%	103.19	0		166.925	0	
55.44728	0	890	65.17709591	18/07/2005	18/07/2005	122.349998	Do nothing	18/07/2005	1	Buy	Buy	122.349998	15/08/2005	123.82	1.201%	103.9975	0		168.2312	0	
54.2875	1	912	44.02059024	17/08/2005	17/08/2005	122.199997	Buy	17/08/2005	1	Buy	Buy	122.199997	15/09/2005	123.15	0.777%	103.87	0		168.025	0	
48.98509	1	933	56.83504959	16/09/2005	16/09/2005	123.5	Do nothing	16/09/2005	1	Buy	Buy	123.5	14/10/2005	118.67	-3.911%	104.975	0		169.8125	0	
55.96066	0	971	74.0118832	09/11/2005	09/11/2005	122.389999	Sell	09/11/2005	1	Sell	Sell	122.389999	23/11/2005	127.03	-3.653%	134.629	0		91.7925	0	
35.64582	1	992	54.85088661	09/12/2005	09/12/2005	126.330002	Buy	09/12/2005	0	Buy	Buy	126.330002	10/01/2006	128.89999	2.034%	107.3805	0		173.7038	0	
51.68826	1	1011	57.55740607	09/01/2006	09/01/2006	128.770004	Do nothing	09/01/2006	0	Buy	Buy	128.770004	07/02/2006	125.48	-2.555%	109.4545	0		177.0588	0	
48.34207	0	1032	51.06665255	08/02/2006	08/02/2006	126.620003	Buy	08/02/2006	1	Buy	Buy	126.620003	09/03/2006	127.38	0.600%	107.627	0		174.1025	0	
62.92027	1	1054	53.35561534	13/03/2006	13/03/2006	128.830002	Buy	13/03/2006	0	Buy	Buy	128.830002	10/04/2006	129.74001	0.706%	109.5055	0		177.1413	0	
61.82641	1	1076	46.96340034	12/04/2006	12/04/2006	128.880005	Buy	12/04/2006	1	Buy	Buy	128.880005	11/05/2006	130.95	1.606%	109.548	0		177.21	0	
58.77186	1	1156	61.4748728	07/08/2006	07/08/2006	127.900002	Do nothing	07/08/2006	1	Buy	Buy	127.900002	05/09/2006	131.67	2.948%	108.715	0		175.8625	0	
62.67874	2	1178	56.93695529	07/09/2006	07/09/2006	129.910004	Do nothing	07/09/2006	0	Buy	Buy	129.910004	05/10/2006	135.17999	4.057%	110.4235	0		178.6263	0	
50.99251	1	1200	72.96809468	09/10/2006	09/10/2006	135.089996	Sell	09/10/2006	1	Sell	Sell	135.089996	23/10/2006	137.47	-1.731%	148.599	0		101.3175	0	
44.71554	0	1223	64.4005337	09/11/2006	09/11/2006	138.179993	Do nothing	09/11/2006	0	Buy	Buy	138.179993	08/12/2006	141.42	2.345%	117.453	0		189.9975	0	
58.26936	1	1245	49.70182728	12/12/2006	12/12/2006	141.720001	Buy	12/12/2006	1	Buy	Buy	141.720001	12/01/2007	143.24001	1.073%	120.462	0		194.865	0	
63.07166	2	1266	61.24510511	16/01/2007	16/01/2007	142.960007	Do nothing	16/01/2007	1	Buy	Buy	142.960007	13/02/2007	144.66	1.189%	121.516	0		196.57	0	
54.51979	0	1288	66.44217189	15/02/2007	15/02/2007	145.800003	Do nothing	15/02/2007	1	Buy	Buy	145.800003	16/03/2007	138.53	-4.986%	123.93	0		200.475	0	
63.6984	1	1318	66.01774697	30/03/2007	30/03/2007	142	Do nothing	30/03/2007	0	Buy	Buy	142	30/04/2007	148.28999	4.430%	120.7	0		195.25	0	
46.09576	0	1339	81.30694893	01/05/2007	01/05/2007	148.669998	Sell	01/05/2007	1	Sell	Sell	148.669998	15/05/2007	150.57001	-1.262%	163.537	0		111.5025	0	
47.36462	0	1360	67.18343169	31/05/2007	31/05/2007	153.320007	Do nothing	31/05/2007	1	Buy	Buy	153.320007	28/06/2007	150.38001	-1.918%	130.322	0		210.815	0	
55.85414	0	1391	57.92735118	16/07/2007	16/07/2007	154.830002	Do nothing	16/07/2007	2	Buy	Buy	154.830002	13/08/2007	145.23	-6.200%	131.6055	0		212.8913	0	
53.68926	1	1448	59.52345769	04/10/2007	04/10/2007	154.020004	Do nothing	04/10/2007	0	Buy	Buy	154.020004	01/11/2007	151.03	-1.941%	130.917	0		211.7775	0	
63.10222	1	1545	44.20898716	25/02/2008	25/02/2008	137.330002	Buy	25/02/2008	0	Buy	Buy	137.330002	25/03/2008	134.85001	-1.806%	116.7305	0		188.8288	0	
66.73518	1	2004	62.03657364	17/12/2009	17/12/2009	110.18	Do nothing	17/12/2009	1	Buy	Buy	110.18	19/01/2010	115.06	4.429%	93.653	0		151.4975	0	
74.49694	1	2052	79.28865614	01/03/2010	01/03/2010	111.889999	Sell	01/03/2010	1	Sell	Sell	111.889999	15/03/2010	115.49	-3.117%	123.079	0		83.9175	0	
70.34426	1	2074	61.53643999	31/03/2010	31/03/2010	117	Do nothing	31/03/2010	0	Buy	Buy	117	29/04/2010	120.86	3.299%	99.45	0		160.875	0	
50.12704	1	2209	68.61662206	12/10/2010	12/10/2010	117.010002	Do nothing	12/10/2010	0	Buy	Buy	117.010002	09/11/2010	121.61	3.931%	99.4585	0		160.8888	0	
57.81264	0	2253	71.92349934	14/12/2010	14/12/2010	124.669998	Sell	14/12/2010	0	Sell	Sell	124.669998	29/12/2010	125.92	-0.993%	137.137	0		93.5025	0	
42.57022	0	2275	72.4538963	14/01/2011	14/01/2011	129.300003	Sell	14/01/2011	1	Sell	Sell	129.300003	31/01/2011	128.67999	0.482%	142.23	0		96.975	0	
52.7452	1	2297	60.71893911	16/02/2011	16/02/2011	133.850006	Do nothing	16/02/2011	0	Buy	Buy	133.850006	17/03/2011	127.85	-4.483%	113.7725	0		184.0438	0	
59.68903	0	2328	60.2511961	01/04/2011	01/04/2011	133.149994	Do nothing	01/04/2011	1	Buy	Buy	133.149994	02/05/2011	136.22	2.306%	113.1775	0		183.0812	0	
49.03378	1	2348	59.36013682	02/05/2011	02/05/2011	136.220001	Do nothing	02/05/2011	1	Buy	Buy	136.220001	31/05/2011	134.89999	-0.969%	115.787	0		187.3025	0	
49.67602	1	2527	67.13152094	17/01/2012	17/01/2012	129.339996	Do nothing	17/01/2012	2	Buy	Buy	129.339996	14/02/2012	135.19	4.523%	109.939	0		177.8425	0	
62.01366	1	2549	69.33608222	16/02/2012	16/02/2012	136.050003	Do nothing	16/02/2012	0	Buy	Buy	136.050003	16/03/2012	140.3	3.124%	115.6425	0		187.0688	0	
48.91699	0	2579	56.41922141	30/03/2012	30/03/2012	140.809998	Do nothing	30/03/2012	0	Buy	Buy	140.809998	30/04/2012	139.87	-0.668%	119.6885	0		193.6137	0	
52.96521	1	2608	39.75937969	11/05/2012	11/05/2012	135.610001	Buy	11/05/2012	1	Buy	Buy	135.610001	11/06/2012	131.41	-3.097%	115.2685	0		186.4638	0	
45.58655	0	2674	69.11950992	15/08/2012	15/08/2012	140.949997	Do nothing	15/08/2012	1	Buy	Buy	140.949997	13/09/2012	146.59	4.001%	119.8075	0		193.8062	0	
32.39889	0	2703	51.18081292	26/09/2012	26/09/2012	143.289993	Buy	26/09/2012	0	Buy	Buy	143.289993	24/10/2012	141.02	-1.584%	121.7965	0		197.0237	0	
42.9673	2	2751	68.87139018	06/12/2012	06/12/2012	141.979996	Do nothing	06/12/2012	0	Buy	Buy	141.979996	07/01/2013	145.97	2.810%	120.683	0		195.2225	0	
58.38692	1	2780	82.59055715	18/01/2013	18/01/2013	148.330002	Sell	18/01/2013	1	Sell	Sell	148.330002	04/02/2013	149.53999	-0.809%	163.163	0		111.2475	0	
66.31087	1	2816	62.353167	13/03/2013	13/03/2013	155.899994	Do nothing	13/03/2013	0	Buy	Buy	155.899994	11/04/2013	159.19	2.110%	132.515	0		214.3625	0	
43.21305	0	2852	67.73310848	03/05/2013	03/05/2013	161.369995	Do nothing	03/05/2013	0	Buy	Buy	161.369995	03/06/2013	164.35001	1.847%	137.1645	0		221.8837	0	
55.48504	1	2899	71.18116002	11/07/2013	11/07/2013	167.440002	Sell	11/07/2013	0	Sell	Sell	167.440002	25/07/2013	168.92999	-0.882%	184.184	0		125.58	0	
73.10093	0	2921	44.57880778	12/08/2013	12/08/2013	169.110001	Buy	12/08/2013	0	Buy	Buy	169.110001	10/09/2013	168.87	-0.142%	143.7435	0		232.5263	0	
66.91506	0	2942	65.2360191	11/09/2013	11/09/2013	169.399994	Do nothing	11/09/2013	1	Buy	Buy	169.399994	09/10/2013	165.60001	-2.243%	143.99	0		232.925	0	
68.93102	1	2975	76.96574511	28/10/2013	28/10/2013	176.229996	Sell	28/10/2013	0	Sell	Sell	176.229996	11/11/2013	177.32001	-0.615%	193.853	0		132.1725	0	
43.94019	0	2997	64.23084497	27/11/2013	27/11/2013	181.119995	Do nothing	27/11/2013	1	Buy	Buy	181.119995	27/12/2013	183.85001	1.507%	153.952	0		249.04	0	
45.69336	0	3017	59.45785233	27/12/2013	27/12/2013	183.850006	Do nothing	27/12/2013	1	Buy	Buy	183.850006	28/01/2014	179.07001	-2.600%	156.2725	0		252.7938	0	
50.98395	0	3053	64.14186244	20/02/2014	20/02/2014	184.100006	Do nothing	20/02/2014	0	Buy	Buy	184.100006	20/03/2014	187.75	1.983%	156.485	0		253.1375	0	
55.37502	0	3075	40.86839761	24/03/2014	24/03/2014	185.429993	Buy	24/03/2014	2	Buy	Buy	185.429993	22/04/2014	187.89	1.327%	157.6155	0		254.9662	0	
46.78879	1	3101	57.03272012	30/04/2014	30/04/2014	188.309998	Do nothing	30/04/2014	1	Buy	Buy	188.309998	29/05/2014	192.37	2.156%	160.0635	0		258.9262	0	
25.68109	1	3122	73.59978755	30/05/2014	30/05/2014	192.679993	Sell	30/05/2014	0	Sell	Sell	192.679993	13/06/2014	194.13001	-0.747%	211.948	0		144.51	0	
47.60204	0	3144	61.90047127	01/07/2014	01/07/2014	197.029999	Do nothing	01/07/2014	1	Buy	Buy	197.029999	30/07/2014	196.98	-0.025%	167.4755	0		270.9162	0	
59.73826	1	3178	59.61729246	19/08/2014	19/08/2014	198.389999	Do nothing	19/08/2014	0	Buy	Buy	198.389999	17/09/2014	200.75	1.190%	168.6315	0		272.7862	0	
64.88497	1	3199	54.20580446	18/09/2014	18/09/2014	201.820007	Buy	18/09/2014	1	Buy	Buy	201.820007	16/10/2014	186.27	-7.705%	171.547	0		277.5025	0	
57.64099	0	3234	87.48117509	06/11/2014	06/11/2014	203.149994	Sell	06/11/2014	1	Sell	Sell	203.149994	20/11/2014	205.58	-1.182%	223.465	0		152.3625	0	
48.67881	2	3255	58.96564884	08/12/2014	08/12/2014	206.610001	Do nothing	08/12/2014	0	Buy	Buy	206.610001	07/01/2015	202.31	-2.081%	175.6185	0		284.0888	0	
56.66216	0	3303	69.05501495	18/02/2015	18/02/2015	210.130005	Do nothing	18/02/2015	0	Buy	Buy	210.130005	18/03/2015	210.46001	0.157%	178.6105	0		288.9288	0	
60.2763	1	3335	57.57950871	06/04/2015	06/04/2015	207.830002	Do nothing	06/04/2015	0	Buy	Buy	207.830002	04/05/2015	211.32001	1.679%	176.6555	0		285.7663	0	
46.04348	1	3365	51.24884567	18/05/2015	18/05/2015	213.100006	Buy	18/05/2015	2	Buy	Buy	213.100006	16/06/2015	210.25	-1.337%	181.135	0		293.0125	0	
53.33536	0	3386	41.53437195	17/06/2015	17/06/2015	210.589996	Buy	17/06/2015	1	Buy	Buy	210.589996	16/07/2015	212.3	0.812%	179.0015	0		289.5612	0	
54.79299	0	3414	62.11060985	28/07/2015	28/07/2015	209.330002	Do nothing	28/07/2015	0	Buy	Buy	209.330002	25/08/2015	187.27	-10.538%	177.9305	0		287.8288	0	
38.00072	1	3488	68.57360763	10/11/2015	10/11/2015	208.559998	Do nothing	10/11/2015	1	Buy	Buy	208.559998	09/12/2015	205.34	-1.544%	177.276	0		286.77	0	
39.12109	0	3575	71.41639706	17/03/2016	17/03/2016	204.630005	Sell	17/03/2016	0	Sell	Sell	204.630005	01/04/2016	206.92	-1.107%	225.093	0		153.4725	0	
40.45287	0	3600	53.80949349	22/04/2016	22/04/2016	208.970001	Buy	22/04/2016	1	Buy	Buy	208.970001	20/05/2016	205.49001	-1.665%	177.6245	0		287.3338	0	
57.74852	1	3625	51.96692001	27/05/2016	27/05/2016	210.240005	Buy	27/05/2016	1	Buy	Buy	210.240005	27/06/2016	199.60001	-5.061%	178.704	0		289.08	0	
72.80257	0	3658	70.45478972	15/07/2016	15/07/2016	215.830002	Sell	15/07/2016	0	Sell	Sell	215.830002	29/07/2016	217.12	-0.594%	237.413	0		161.8725	0	
52.55921	0	3680	55.4104626	16/08/2016	16/08/2016	217.960007	Do nothing	16/08/2016	1	Buy	Buy	217.960007	14/09/2016	213.14999	-2.207%	185.266	0		299.695	0	
50.70533	0	3713	50.76887494	03/10/2016	03/10/2016	215.779999	Buy	03/10/2016	1	Buy	Buy	215.779999	31/10/2016	212.55	-1.497%	183.413	0		296.6975	0	
51.52817	0	3748	75.38790405	21/11/2016	21/11/2016	220.149994	Sell	21/11/2016	1	Sell	Sell	220.149994	06/12/2016	221.7	-0.699%	242.165	0		165.1125	0	
58.18846	0	3769	59.61974712	21/12/2016	21/12/2016	225.770004	Do nothing	21/12/2016	0	Buy	Buy	225.770004	23/01/2017	226.14999	0.168%	191.9045	0		310.4338	0	
58.25318	1	3789	61.23021659	23/01/2017	23/01/2017	226.149994	Do nothing	23/01/2017	1	Buy	Buy	226.149994	21/02/2017	236.49001	4.572%	192.2275	0		310.9562	0	
46.26693	1	3811	75.25369668	23/02/2017	23/02/2017	236.440002	Sell	23/02/2017	1	Sell	Sell	236.440002	09/03/2017	236.86	-0.177%	260.084	0		177.33	0	
58.17758	1	3833	40.15565581	27/03/2017	27/03/2017	233.619995	Buy	27/03/2017	0	Buy	Buy	233.619995	25/04/2017	238.55	2.110%	198.577	0		321.2275	0	
33.29313	1	3854	61.15425365	26/04/2017	26/04/2017	238.399994	Do nothing	26/04/2017	1	Buy	Buy	238.399994	24/05/2017	240.61	0.927%	202.64	0		327.8	0	
44.71997	0	3877	55.7165952	30/05/2017	30/05/2017	241.5	Do nothing	30/05/2017	0	Buy	Buy	241.5	27/06/2017	241.33	-0.070%	205.275	0		332.0625	0	
55.05014	1	3900	53.69728061	30/06/2017	30/06/2017	241.800003	Buy	30/06/2017	1	Buy	Buy	241.800003	31/07/2017	246.77	2.055%	205.53	0		332.475	0	
51.67738	0	3920	69.20680993	31/07/2017	31/07/2017	246.770004	Do nothing	31/07/2017	0	Buy	Buy	246.770004	28/08/2017	244.57001	-0.892%	209.7545	0		339.3088	0	
56.91371	0	3942	63.35520597	30/08/2017	30/08/2017	246.009995	Do nothing	30/08/2017	1	Buy	Buy	246.009995	28/09/2017	250.35001	1.764%	209.1085	0		338.2637	0	
76.05877	1	3963	69.93280305	29/09/2017	29/09/2017	251.229996	Do nothing	29/09/2017	1	Buy	Buy	251.229996	27/10/2017	257.70999	2.579%	213.5455	0		345.4412	0	
58.62545	1	3985	63.58700617	31/10/2017	31/10/2017	257.149994	Do nothing	31/10/2017	1	Buy	Buy	257.149994	29/11/2017	262.70999	2.162%	218.5775	0		353.5812	0	
72.83886	0	4007	70.81459617	01/12/2017	01/12/2017	264.459991	Sell	01/12/2017	0	Sell	Sell	264.459991	15/12/2017	266.51001	-0.769%	290.906	0		198.345	0	
58.11998	0	4029	78.92943894	04/01/2018	04/01/2018	271.609985	Sell	04/01/2018	1	Sell	Sell	271.609985	19/01/2018	280.41	-3.138%	298.771	0		203.7075	0	
74.56005	0	4116	57.46543554	10/05/2018	10/05/2018	272.019989	Do nothing	10/05/2018	0	Buy	Buy	272.019989	08/06/2018	278.19	2.268%	231.217	0		374.0275	0	
62.1828	0	4137		11/06/2018	11/06/2018	278.559998	Buy	11/06/2018	0	Buy	Buy	278.559998	10/07/2018	278.89999	0.122%	236.776	0		383.02	0	
52.0653	0	4160	59.70358872	13/07/2018	13/07/2018	279.589996	Do nothing	13/07/2018	0	Buy	Buy	279.589996	10/08/2018	283.16	1.277%	237.6515	0		384.4362	0	
62.62242	1	4181	56.68491553	13/08/2018	13/08/2018	282.100006	Do nothing	13/08/2018	1	Buy	Buy	282.100006	11/09/2018	289.04999	2.464%	239.785	0		387.8875	0	
36.91959	0	4202	57.53870452	12/09/2018	12/09/2018	289.119995	Do nothing	12/09/2018	0	Buy	Buy	289.119995	10/10/2018	278.29999	-3.742%	245.752	0		397.54	0	
46.44809	1	4307	66.70342161	13/02/2019	13/02/2019	274.98999	Do nothing	13/02/2019	1	Buy	Buy	274.98999	14/03/2019	281.16	2.244%	233.7415	0		378.1112	0	
73.5922	1	4328	59.41743959	15/03/2019	15/03/2019	281.309998	Do nothing	15/03/2019	1	Buy	Buy	281.309998	12/04/2019	290.16	3.146%	239.1135	0		386.8012	0	
74.4787	1	4349	67.84536462	15/04/2019	15/04/2019	289.970001	Do nothing	15/04/2019	1	Buy	Buy	289.970001	14/05/2019	283.39999	-2.266%	246.4745	0		398.7088	0	
81.30695	1	4393	68.19556084	18/06/2019	18/06/2019	292.399994	Do nothing	18/06/2019	0	Buy	Buy	292.399994	17/07/2019	297.73999	1.826%	248.54	0		402.05	0	
54.64598	0	4415	53.79041171	19/07/2019	19/07/2019	297.170013	Buy	19/07/2019	0	Buy	Buy	297.170013	16/08/2019	288.85001	-2.800%	252.5945	0		408.6088	0	
48.82634	1	4452	54.40497881	11/09/2019	11/09/2019	300.25	Buy	11/09/2019	0	Buy	Buy	300.25	09/10/2019	291.26999	-2.991%	255.2125	0		412.8438	0	
51.64485	1	4483	60.29518261	24/10/2019	24/10/2019	300.369995	Do nothing	24/10/2019	1	Buy	Buy	300.369995	21/11/2019	310.26999	3.296%	255.3145	0		413.0087	0	
47.61228	0	4505	75.31809799	25/11/2019	25/11/2019	313.369995	Sell	25/11/2019	0	Sell	Sell	313.369995	10/12/2019	313.53	-0.051%	344.707	0		235.0275	0	
49.68431	0	4526	83.83305085	26/12/2019	26/12/2019	322.940002	Sell	26/12/2019	1	Sell	Sell	322.940002	10/01/2020	325.70999	-0.850%	355.234	0		242.205	0	
55.69872	0	4679	67.32846552	05/08/2020	05/08/2020	332.109985	Do nothing	05/08/2020	0	Buy	Buy	332.109985	02/09/2020	357.70001	7.705%	282.2935	0		456.6512	0	
61.35013	1	4765	61.36269748	07/12/2020	07/12/2020	369.089996	Do nothing	07/12/2020	1	Buy	Buy	369.089996	06/01/2021	373.54999	1.208%	313.7265	0		507.4987	0	
62.77413	1	4788	63.92200779	11/01/2021	11/01/2021	378.690002	Do nothing	11/01/2021	1	Buy	Buy	378.690002	09/02/2021	390.25	3.053%	321.8865	0		520.6988	0	
57.59224	0	4813	69.81334853	17/02/2021	17/02/2021	392.390015	Do nothing	17/02/2021	1	Buy	Buy	392.390015	17/03/2021	397.26001	1.241%	333.5315	0		539.5363	0	
36.37223	0	4849	75.19708529	09/04/2021	09/04/2021	411.48999	Sell	09/04/2021	0	Sell	Sell	411.48999	23/04/2021	416.73999	-1.260%	452.639	0		308.6175	0	
36.76038	1	4884	50.412584	28/05/2021	28/05/2021	420.040009	Buy	28/05/2021	0	Buy	Buy	420.040009	28/06/2021	427.47	1.769%	357.034	0		577.555	0	
50.263	1	4910	68.75565836	07/07/2021	07/07/2021	434.459991	Do nothing	07/07/2021	1	Buy	Buy	434.459991	04/08/2021	438.98001	1.040%	369.291	0		597.3825	0	
54.25285	1	4932	70.23126689	06/08/2021	06/08/2021	442.48999	Sell	06/08/2021	0	Sell	Sell	442.48999	20/08/2021	443.35999	-0.196%	486.739	0		331.8675	0	
34.60558	0	4953	56.31737869	07/09/2021	07/09/2021	451.459991	Do nothing	07/09/2021	1	Buy	Buy	451.459991	05/10/2021	433.10001	-4.067%	383.741	0		620.7575	0	
41.16827	1	4984	79.56572374	20/10/2021	20/10/2021	452.410004	Sell	20/10/2021	1	Sell	Sell	452.410004	03/11/2021	464.72	-2.649%	497.651	0		339.3075	0	
40.4787	0	5007	0	22/11/2021	22/11/2021	467.570007	Buy	22/11/2021	0	Buy	Buy	467.570007	07/12/2021	468.28	0.152%	397.4345	0		642.9088	0	

Ticker: $TSLA

			Enter position					Do											TESTE		
vs value	trendvs	dte	vs value at dte	Date	Minimum days between signals	Clos. prices at dte	Type of position	Date	trendvs	Type	Final	Closing prices	Fecho da posiçao	Close Price	Done in %	SL Price	SL HIT?	SL % made	TGT Price	TGT HIT?	TGT MADE %
0		15	0	04/11/2016	04/11/2016	38.112	Buy	04/11/2016	0	Buy	Buy	38.112	05/12/2016	37.360001	**-1.973%**	32.3952	0		52.404	0	
44.45452	0	58	76.58458598	09/01/2017	09/01/2017	46.256001	Sell	09/01/2017	0	Sell	Sell	46.256001	24/01/2017	50.922001	-9.163%	50.8816	**1**	**-9.16%**	34.692	0	
82.6673	1	101	32.92365306	13/03/2017	13/03/2017	49.234001	Buy	13/03/2017	1	Buy	Buy	49.234001	10/04/2017	62.478001	26.900%	41.8489	0		67.69675	0	
75.79186	0	151	54.30748522	23/05/2017	23/05/2017	60.771999	Buy	23/05/2017	0	Buy	Buy	60.771999	21/06/2017	75.279999	23.873%	51.6562	0		83.5615	0	
53.2116	0	216	52.10754982	24/08/2017	24/08/2017	70.585999	Buy	24/08/2017	0	Buy	Buy	70.585999	22/09/2017	70.218002	-0.521%	59.9981	0		97.05575	0	
55.01814	1	239	54.13635778	27/09/2017	27/09/2017	68.194	Buy	27/09/2017	2	Buy	Buy	68.194	25/10/2017	65.167999	-4.437%	57.9649	0		93.76675	0	
66.89995	1	261	43.87679104	27/10/2017	27/10/2017	64.174004	Buy	27/10/2017	0	Buy	Buy	64.174004	27/11/2017	63.362	-1.265%	54.5479	0		88.23926	0	
51.93546	1	344	38.45122043	28/02/2018	28/02/2018	68.612	Buy	28/02/2018	1	Buy	Buy	68.612	28/03/2018	51.556	-24.859%	58.3202	**2**	**-18.62%**	94.3415	0	
74.68222	1	524	71.10794713	13/11/2018	13/11/2018	67.746002	Sell	13/11/2018	1	Sell	Sell	67.746002	28/11/2018	69.573997	-2.627%	74.5206	**0**		50.8095	0	
66.94236	0	580	35.28405553	06/02/2019	06/02/2019	63.444	Buy	06/02/2019	1	Buy	Buy	63.444	07/03/2019	55.318001	-12.808%	53.9274	0		87.2355	0	
53.32101	0	633	37.25432795	24/04/2019	24/04/2019	51.731998	Buy	24/04/2019	0	Buy	Buy	51.731998	22/05/2019	48.967999	-5.343%	43.9722	**4**	**-18.41%**	71.1315	0	
49.99266	1	723	49.7496084	30/08/2019	30/08/2019	45.122002	Buy	30/08/2019	0	Buy	Buy	45.122002	30/09/2019	48.562	7.624%	38.3537	0		62.04275	0	
62.66368	1	753	72.67601038	14/10/2019	14/10/2019	51.391998	Sell	14/10/2019	1	Sell	Sell	51.391998	28/10/2019	65.542	-21.589%	56.5312	**3**	**-14.26%**	38.544	0	
56.28239	2	796	77.18558088	13/12/2019	13/12/2019	71.678001	Sell	13/12/2019	1	Sell	Sell	71.678001	30/12/2019	82.940002	-13.578%	78.8458	**7**	**-11.30%**	53.7585	0	
59.05109	0	1178	53.01687927	22/06/2021	22/06/2021	623.710022	Buy	22/06/2021	1	Buy	Buy	623.710022	21/07/2021	644.65002	3.357%	530.1535	0		857.6013	0	
47.60244	1	1200	47.39603632	23/07/2021	23/07/2021	643.380005	Buy	23/07/2021	0	Buy	Buy	643.380005	20/08/2021	699.09998	8.661%	546.873	0		884.6475	0	
35.86419	1	1249	0	01/10/2021	01/10/2021	775.219971	Buy	01/10/2021	0	Buy	Buy	775.219971	00/01/1900	843.03003	8.747%	658.937	0		1065.927	0	

Most important codes used in Matlab:

To construct the "trendvs" indicator:

```
function trend= trendvs(MFI,period,vs)
positionlist=[]
for i = period+1:length(MFI)

   if vs(i)-vs(i-1) < vs(i-1)-vs(i-2) < vs(i-2)-vs(i-3) % is good for selling, indicator is decreasing faster

   positionlist(end+1)= 1; % 1 is good for selling
   elseif  vs(i)-vs(i-1) > vs(i-1)-vs(i-2) > vs(i-2)-vs(i-3) % is good for buying,indicator is growing
Faster

      positionlist(end+1)= 0
   else
      positionlist(end+1)= 2
   end

end
   trend= positionlist
   end
```

To construct the "vsvalue" indicator:

```
function vs= Volsqueeze(RSI,MFI,Excel,upper,middle,lower)
vs=[];
period=14;
for i = period+1:length(MFI) %começa porque RSI nao tem valores antes e acaba porque MFI
nao tem valores depois
vs(i)= MFI(i)*0.35 + RSI(i)*0.65;

   if upper(i) < Excel.Close(i) %sell signal
        vs(i)= vs(i)+15;
   end
               end
```

```
        if lower(i) > Excel.Close(i) %buy signal
            vs(i)= vs(i)-15;
        end
```

To construct the “dte” indicator:

```
%FIRST: PREDICT A BIG MOVE:

%I want a value of historical volatility indicator low and that is growing fast
function dte=trade(HISTVOL,N) %N é o usado no histvol
daystoenter=[] %list to be added the days to enter
for i= N+1:length(HISTVOL)-1 % ESTA MAL ESTA PARTE, MUDAR
 if HISTVOL(i)< mean(HISTVOL)*0.5 % talvez em vez de '50' meter aqui uma média ou assim
      if HISTVOL(i)-HISTVOL(i-1) > HISTVOL(i-1)-HISTVOL(i-2)> HISTVOL(i-2)-HISTVOL(i-3)
     disp('ENTER POSITION, very low HISTVOL and growing')
     disp(i)
     daystoenter(end+1)= i;
      end
      if HISTVOL(i)-HISTVOL(i-1) < HISTVOL(i-1)-HISTVOL(i-2)
     disp('MIGHT BE SOON to enter position, very low HISTVOL, but still descending')
      end
   elseif HISTVOL(i)< mean(HISTVOL)*0.7 % talvez em vez de '50' meter aqui uma média ou assim
      if HISTVOL(i)-HISTVOL(i-1) > HISTVOL(i-1)-HISTVOL(i-2)> HISTVOL(i-2)-HISTVOL(i-3)
      disp('ENTER POSITION, very low HISTVOL and growing')
      disp(i)
      daystoenter(end+1)= i;
      end
      if HISTVOL(i)-HISTVOL(i-1) < HISTVOL(i-1)-HISTVOL(i-2) %É MAU, indica que ainda está a decrescer
      disp('MIGHT BE SOON to enter position, very low HISTVOL, but still descending')
```

```
     end
   elseif HISTVOL(i)< mean(HISTVOL)*1
     if HISTVOL(i)-HISTVOL(i-1) > HISTVOL(i-1)-HISTVOL(i-2)
    disp('MIGHT BE SOON to enter position, very low HISTVOL and descending')
     end
     if HISTVOL(i)-HISTVOL(i-1) < HISTVOL(i-1)-HISTVOL(i-2)
    disp('NOT ENTER ANY POSITION YET,not ideally low HISTVOL and still descending, very careful')
     end
     elseif HISTVOL(i)>= mean(HISTVOL)*1
       disp('still early to look for volatility squeezes')
 end
end
dte= daystoenter
end
```

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