Identification of short term Fast-Slow patterns using the Nasdaq-100 future through a technical analysis application

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Abstract
In recent decades, the analysis of atypical behavior in asset prices has become relevant, since participants in financial markets recognize that the idea of perfect markets is distanced from reality. The purpose of this research is to present a trading strategy through the identification of short-term chart patterns, based on anomalies in the future price of the Nasdaq-100 index. The historical backtesting methodology will be used in the technical analysis of the asset to quantify the performance of the identified patterns. It will be verified that the anomalies in the stock index are not temporary; rather, they persist and recur on a recurring basis, especially in intraday events. Additionally, the best performing trading session will be determined. This work will provide retail traders with trading guidelines to approach the markets with a statistically profitable strategy.

Keywords: Nasdaq-100; market anomalies; futures market; technical analysis.

Identificación de patrones Fast-Slow de corto plazo empleando el futuro del Nasdaq-100 a través de una aplicación de análisis técnico

Resumen
En las últimas décadas, ha tomado relevancia el análisis de comportamientos atípicos en los precios de activos, ya que los participantes en los mercados financieros reconocen que la idea de mercados perfectos se distancia de la realidad. El propósito de esta investigación es presentar una estrategia de negociación a través de la identificación de patrones gráficos a corto plazo, basados en anomalías en la cotización del futuro del índice Nasdaq-100. Se empleará la metodología de backtesting histórico en el análisis técnico del activo para cuantificar el rendimiento de los patrones identificados. Se comprobará que las anomalías en el índice bursátil no son pasajeras; más bien, persisten y se repiten de forma recurrente, especialmente en eventos intradía. Además, se determinará la sesión bursátil de mejor rendimiento. Este trabajo brindará a los traders minoristas pautas de negociación para abordar los mercados con una estrategia estadísticamente rentable.

Palabras clave: Nasdaq-100; anomalías de mercado; mercado de futuros; análisis técnico.

1 Introduction

Traditionally, investors in the financial markets base their investment decisions on two main lines of analysis, with the objective of correctly selecting assets and determining the best time to do so: fundamental analysis and technical analysis. Fundamental analysis is in charge of the study of macro and micro economic forces that can affect the behavior of an economy to a greater or lesser extent, as well as the behavior of industries and sectors, including the analysis of

the financial results of companies (Abarbanell and Bushee, 1997). Technical analysis, on the other hand, is responsible for the study of price movements, analyzes and identifies repetitive events in the history of the price with the objective of establishing future behaviors in price trends, the study is based mainly on analyzing historical charts [1]

The formation of chart patterns or chartism is one of the branches of technical analysis, on which this study will be developed. A chart pattern is a formation that builds the historical price of an asset and according to the fulfillment of

certain criteria can generate a buy or sell signal. Patterns are classified into two groups, which in turn contain multiple variations: continuation and reversal formations. The continuation pattern signals that the previous trend will continue and that the strength of the movement in that direction is in place. The reversal pattern signals that once the pattern has been fully formed, the direction of the market will change, i.e., it will take the opposite trend to the one it had before formed [2]. The graphic pattern under study, given its characteristics and according to the scenario in which it is formed, can confirm a trading signal for continuation or reversal of the asset's movement; likewise, it generates reliability in contexts of high and low volatility.

Graphical patterns and other events observed in asset prices reflect behaviors or phenomena that are considered anomalous, Grossman and Stiglitz spoke of a series of events that make no apparent sense and cannot be demonstrated by traditional theory, these events that have no initial foundations and that are considered abnormalities open a wide spectrum of possible findings that the present study intends to explore [3]. These authors are the main exponents of financial anomalies, they consider that markets are informationally inefficient, this due to the fact that the various agents live with a clear asymmetry of information with respect to other actors, Grossman and Stiglitz oppose classical theories such as that of Fama with the Efficient Market Hypothesis (EMH) where he states that the market price of assets is traded at fair value and reflect with a good estimate their intrinsic price at a given time [4].

Recent decades have seen the awakening of a strong interest in the research field in deciphering the reasons why these unknown events are generated. The importance of these trends makes sense when the impact they have on the behavior of agents in the stock market is measured. The financial markets are made up of two large groups of participants that inject liquidity into the continuous dynamics of buying and selling assets. These two groups are institutional traders and retail traders; the latter group has clear disadvantages with respect to the former because they have limited capital, infrastructure and information, and mostly low efficiency investment and speculation strategies, thus being at the mercy of large investors who have more information and investment capacity [5].

In the speculative field, the main difference between the two groups refers to the fact that the institutional trader can resist a movement against the market without releasing or liquidating his positions, that is to say, he can remain in the market without having to materialize the associated losses and have the balance of his open operations temporarily in the red. This is unthinkable for the retail trader, because for him any moderately deep movement made by the market against his position can mean a great loss of his account, so he designs strategies to cut losses relatively soon. Another aspect to consider and that opposes against the group of retail investors and has a strong impact, reducing their account balances, are the transaction costs [6]. Institutional and retail have similar transaction costs and no difference is made between the size of their accounts [7].

In addition to the above, there is a lack of an investment strategy that allows them to compete. Thus, the retailer buys

and sells assets with diverse motivations that in many cases do not have a structured decision-making process. Contrary to this, the institutional ones have professionalized, robust and complex investment systems [8], which allow them to participate in the markets with profitable strategies and favorable conditions. This does not necessarily lead retailers to fail, on the contrary, it is a window that opens and that this study wishes to take advantage of.

For the above reasons, this research is important because it focuses on reducing the gap between the two types of participants, it wants to provide a contribution to retailers, specifically it tries to fill the void that exists in terms of ways or forms of negotiation of this type of traders, that is, through the identification of technical analysis patterns for trading in the short term (understood as the 24 hours that make up a trading day, divided into three major sessions, the Asian, European and American) and under a series of defined rules, the retail trader may have a trading strategy with a proven statistical advantage.

The analysis of the strategy will be done through the construction of a historical backtesting applied to the future of the Nasdaq-100 index, where the behavior of the graphic patterns will be simulated in an established time frame in order to quantify its profitability, confirm the optimal trading session and determine whether these phenomena could be classified as a technical anomaly. The patterns that the study proposes to identify have not been found in similar academic research, and empirically it can be said that this is an unusual and unconventional way of approaching trading in financial markets.

The document is divided into three parts. The first part deals with the efficient market hypothesis regarding market anomalies and their different types, as well as the variables that make up the strategy based on graphic patterns. The second stage describes how the identification and interaction between the variables that form the patterns under study is generated and in the third stage, the results obtained from the identification, its global profitability and its disaggregated profitability for the different stock market trading sessions are presented, and it is determined whether it can be considered a technical market anomaly and, finally, some conclusions are presented.

2 Theoretical Framework

2.1 The efficient markets hypothesis

Eugene Fama, proposed the EMH [4], suggesting that markets are rational and informationally efficient when the interaction among participants leads to an equilibrium situation where asset prices reflect all available information and quickly incorporate new information as it emerges into the price. These ideal trading conditions assume that no investor can beat the market by generating returns that could be considered unusual. Fama divides his hypothesis into three categories. Weak efficiency" is based entirely on the historical series of prices, where each asset sees reflected in its value all available information without the possibility of predicting future price behavior. The "semi-strong efficiency", in addition to the historical information, has the capacity to reflect all the new relevant information that

becomes public. Finally, "strong efficiency", in addition to historical and public information, involves private information, which indicates that as efficiency goes from weak to strong, the possibilities of obtaining extraordinary and continuous returns over time are exhausted.

Now, in the stock markets there is evidence that asset prices do not follow the principles of efficient and rational markets, the three degrees of efficiency are not fully met as mentioned by Fama, the day-to-day stock market reflects those prices draw deviations to the guidelines previously proposed [9]. Such deviations are known as market anomalies since they are abnormalities that occur within perfect markets.

2.2 Market Anomalies

The EMH is antagonized by the model developed by Grossman and Stiglitz, which suggests that informationally efficient markets can never be efficient, i.e., that they are inefficient. This condition is the result of the imbalance generated by an asymmetry in information, which indicates that the flow of information does not reach all investors in the same way [3]. This means that not all participants are well informed and therefore prices reflect partial information, causing the profitability of each individual to vary according to the degree of advantage obtained in decision making. The model also clarifies that information travels with a lag from informed individuals to uninformed individuals, which means that the first can make more intelligent investment decisions.

Now, anomalies are the indicator of inefficient markets, everything that is not explained by the efficiency hypothesis is considered an anomaly, i.e., deviations that occur and do not follow the rules of perfect markets, some of them occur once, or a few times and disappear, while others are identified and recurrently remain over the years. According to Kuhn [10], an anomaly is systematic evidence of prolonged episodes with a regularly recurring structure and does not respond to isolated events, however, it does not find consistency with the basic theory. For their part, Tversky & Kahneman (1986) defined an anomaly as a deviation to currently accepted paradigms, which is too widespread to be ignored, too systematic to be dismissed as a random error and too fundamental to be accommodated at the cost of weakening the normative framework [11].

Therefore, if an unknown phenomenon occurs once or very rarely, even if it is initially classified as an anomaly, this condition is only ratified if it meets certain characteristics. According to Tua [12], for an anomaly to be considered an inefficient market sample, it must meet two requirements: persistence and opportunity to be exploited. Anomalies are classified into three categories, fundamental, calendar and technical. A fundamental anomaly is an irregularity where the return on the securities differs from the actual valuation of the asset. Calendar anomalies are those where the occurrence of certain events is directly related to specific times of the year and technical anomalies correspond to phenomena that are identified mainly through asset price charts where the aim is to predict future behavior based on events that have occurred with historical prices.

Classical authors have shared the research carried out in different stock markets delving into the subject of market anomalies and agree that the series of phenomena observed and analyzed in the different trading parks cannot be explained by market efficiency since they are unusual occurrences of prices. From these authors some early research emerge, from the calendar line we find Gultekin and Gultekin [13], Tversky and Kahneman [11], Ariel [14], Agrawal and Tandon [15], Smirlock and Starks [16]. For fundamental anomalies, Fama and French [4] and for technical anomalies, Brock, Lakonishok [17] stand out.

Gultekin and Gultekin [13] in their study found the existence of seasonality in the main stock markets of industrialized countries. Seasonality refers to the fact that there is a clear difference in average returns measured on a month-to-month basis. They used parametric and non-parametric methods for testing, but since the result between the methods was similar, they decided to report them with the non-parametric tests. The seasonality anomaly found was generally reflected in a significantly large average return at the end of the fiscal year.

Ariel has a direct impact on calendar anomalies [14], determining anomalous behavior for stocks, since they exhibit positive average returns only during the first half of the months, and show zero returns during the second half. His study focused on the U.S. stock market from 1963 to 1981. In turn, Agrawal and Tandon found two calendar anomalies, known as "the turn-of-the-month effect" and "the turn-of-the-year effect" [15]. In the first, during these four days that mark the change from one month to another, the yield is higher overall than that of the remaining days of the month. For the second anomaly describes the increase in stock prices in the last week of December and the first week of January.

From the point of view of technical anomalies, two of the most well-known technical analysis strategies, the moving average and the trading range breakout [18]. Applied to the Dow Jones between 1897 and 1986, they performed a statistical analysis with the bootstrap technique. They applied these tests on four models: the random walk, the AR (1), the GARCH-M and the exponential GARCH, concluding that the returns obtained when applying these two trading strategies with these models were not consistent. Sullivan took other popular analysis techniques, such as channel breaks, moving averages, supports and resistances, trading volume, chose measurement parameters for each, the objective was to establish as many rules as possible and determine which was the most profitable over a 100-year time span (1897-1996), and used the Dow Jones index [19]. They used Bootstrap to obtain the data that allowed them to quantify the performance of about 7,850 variables. The five-day moving average was the best rule with a 17.2% average annual return.

2.3 Nasdaq-100 Index

The technology Nasdaq-100 (NDX) is one of the three most representative stock indexes of the North American stock market, along with the SP500 and the Dow Jones. It brings together 100 of the largest non-financial companies in terms of market capitalization, both domestic and international [19]. No company in the index can have a weighting of more than 24%. The Nasdaq-100 is an index
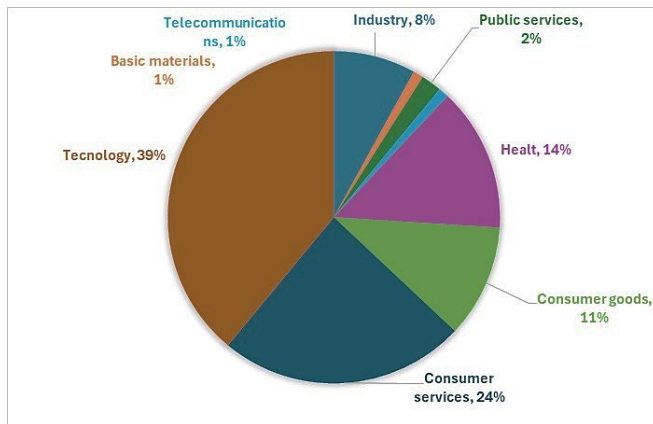
Figure 1. Nasdaq-100 Index Composition by Industry.
Source: Own Elaboration with data from Bloomberg (2020).

concentrated in the technology sector and it is there where the world's largest companies shine, it is also integrated by other large industries such as healthcare and consumer services. It is the world's fastest growing stock index by large capitalization, and since the 2008 crisis it has outperformed the SP500 index with higher annual returns and volatility (Nasdaq website). Observing that technology presents accelerated growth in the world and that its influence on companies is being decisive in obtaining better results and confirming through volatility calculations, the future of the Nasdaq-100 index is chosen to develop this research. Fig. 1 shows the composition of the Nasdaq-100 index by industry, a marked participation of technology companies is evident, which currently weigh 39%, and also shows an outstanding collaboration of the companies that make up the technology industries such as consumer services, health and consumer goods with weights of 24%, 14% and 11% respectively.

2.4 Strategy based on the Fast-Slow Pattern

The graphic pattern under study arises from the continuous observation of the price behavior of various financial assets, and it is through constant analysis that rules or guidelines have been defined that the retail trader must abide by and execute in order to obtain results close to or similar to those that the research will reveal. The pattern is also the response to the non-institutional trader's need to have a competitive advantage when positioning himself ahead of the market. The operator will have in front of him a future price chart of the Nasdaq-100 in the form of Japanese candlesticks, which will take direction to make investment decisions through the guidelines that will be detailed below, these allow the trader to begin the construction of his work chart that will be interpreted as he identifies that the rules of his action plan are being created.

The trader who wishes to use the strategy based on the short-term Fast-Slow Pattern (hereinafter PFS), should identify and execute the purchase or sale of the Nasdaq-100 index future at the moment when the following three rules occur strictly and in order:

1. Identification and marking on the chart of the trading zones, which correspond to: the maximum and minimum price of the most recent Asian, European and American sessions, as well as the highest and lowest price of the trading day of the immediately previous day.
2. Formation of the Fast-Slow pattern over at least one of the established trading zones (rule 1).
3. Formation of one of the established Japanese candlestick patterns, which will be the trigger for market entry.

It is important to emphasize that the essence of the strategy is the formation of the Fast-Slow pattern, however, this will only be important when it is formed over one of the established trading zones, therefore the zones are the first element (rule 1) to be identified and marked on the asset's price chart.

2.5 Trading Zones and Trading Sessions

Any price set by the financial asset can be negotiated (buy or sell), but a trader and especially a retailer cannot participate in the market at any price, that is to say, he cannot afford to buy and sell at the slightest variation in the quotation. Any trader using technical analysis will establish "his zone(s)" where he will seek to benefit from the fluctuations of the asset of his choice and from this choice derives much of his success. A trading zone (base zone) refers to a range of prices (several consecutive prices) and not to a specific one, this means that the final signal for the trader to participate in the market can occur at any price in the range. The size of the range is discretionary chosen by the trader. This study proposes to consider trading zones of which no previous research was found, and according to empirical evidence has an interesting potential to be explored.

Traditionally, the strategies that have within their components the identification of supports and resistances use the "price" factor for their plotting, that is, they will find for a certain reason a negotiation zone (price range) that allows them to define their entry to the market. The proposal presented in this document uses the price variable in a secondary place, the "time" variable has the leading role, since it is the time of the stock market day that will set the initial guideline for the drawing of the zone.

A trading day starts at 00.00 GMT and is divided into three trading days, the Asian, the European and the American. The Asian trading day starts and closes between 00.00-7.00 GMT, which is the trading hours when most of the stock exchanges of that continent are actively trading, and the other two sessions work in the same way, followed by the European stock exchanges from 7.00-13.30 and the American stock exchanges, with United States at the top, that start at 13.30 (summer time) or 14.30 (winter time), finishing operations at 20.00 or 21.00 depending on the time of the year. The period from 20/21.00-24.00 is considered a "dead" time as there is little or no trading activity. Each trading session is of high importance as it involves frantic competition between all types of participants. The listed time slots correspond to general trading ranges for each continent and to the opening and closing times of most stock exchanges, although there are some that, depending on their time of day, share activity with stock exchanges on other continents.
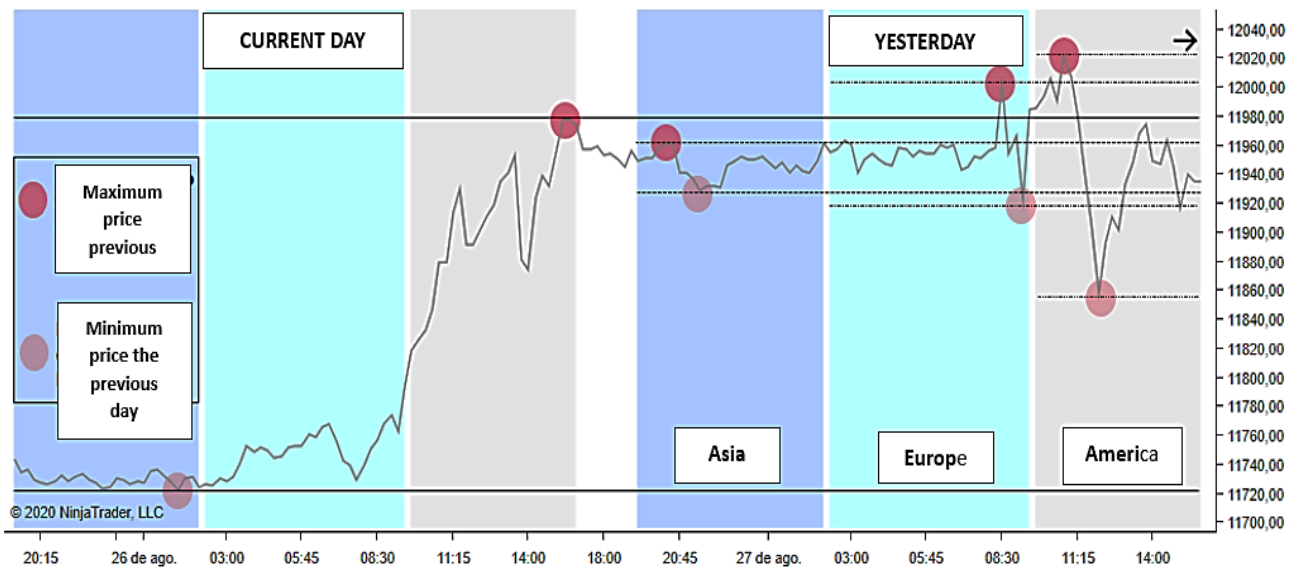
Figure 2. Trading Zones and Trading Sessions.
Source: Own Elaboration with Ninja Trader 8 Platform.

Fig. 2 shows the fluctuation of the price of the asset within the schedules of each of the sessions, which will mark and define clear and objective levels that will be used as trading zones, which correspond to the maximum and minimum prices of each band, i.e., each session will mark two zones. Also, the highest and lowest quote of the previous trading day are taken into consideration. According to the above, the trader will have eight potential objective trading zones in every moment, four tops (dark circles in the figure) and four bottoms (light circles in the figure). The most recent session of each time frame will always be used.

Having stated the above, the first rule of the strategy will be to have the potential trading zones defined at all times, and it will be on them that the observation of the price of the Nasdaq-100 index futures will be focused.

2.1 Fast-Slow Pattern (PFS)

The essence of the PFS focuses on the "time" that the price takes to develop the movements that make it up. For a correct understanding of the graphical pattern under study, it is important to clarify that the historical price chart of a financial asset is composed of two variables, time (X-axis) and price (Y-axis). Their characteristics are described below:
1. It is composed of two movements, which will always be comparable to each other and which go in opposite directions, that is a first upward movement (A-B) and a second downward movement (B-C), the order of which can be reversed, bearish-bullish.
2. The formation and identification of the PFS must necessarily take place over a trading zone, that is to say, it starts (point A) and ends (point C) its formation over a base zone and it is there where its validity to be traded is determined. It will not be valid when it is formed in

zones other than those indicated.
3. In relation to the time variable, the displacement or segment B-C must be formed at least twice as long as it takes for the segment A-B to be formed. For example: A-B one hour, B-C two hours or more.
4. In relation to the price variable, the two advances will be of similar sizes.

In Fig. 3, the dynamics of the bullish and bearish PFS is observed, each scheme originates from point A which is located in a base zone, then moves in one direction until reaching the highest or lowest point (B), and thus concludes the first advance, finally it moves in the opposite direction to C, in at least twice the time it took the first journey, if it is triple or more, the empirical evidence shows a tendency to better results. So, in this way, the second rule of the proposed strategy is configured.

2.2 Japanese Candlestick Formation

The Japanese candlestick (consisting of body and shadow) is one of the many ways to graphically represent the price of financial assets and the most popular among technical analysis traders. Since the focus of the research is the short term, the analysis of this rule will be performed on a chart with a periodicity of two minutes, i.e. each time this period elapses, a new candlestick will be drawn. The various price fluctuations determine the shape and size of each candlestick; therefore, it is essential to define the variants to be used in the strategy. A candlestick by itself does not transcend, that is why in the first two rules it is assigned a specific context.
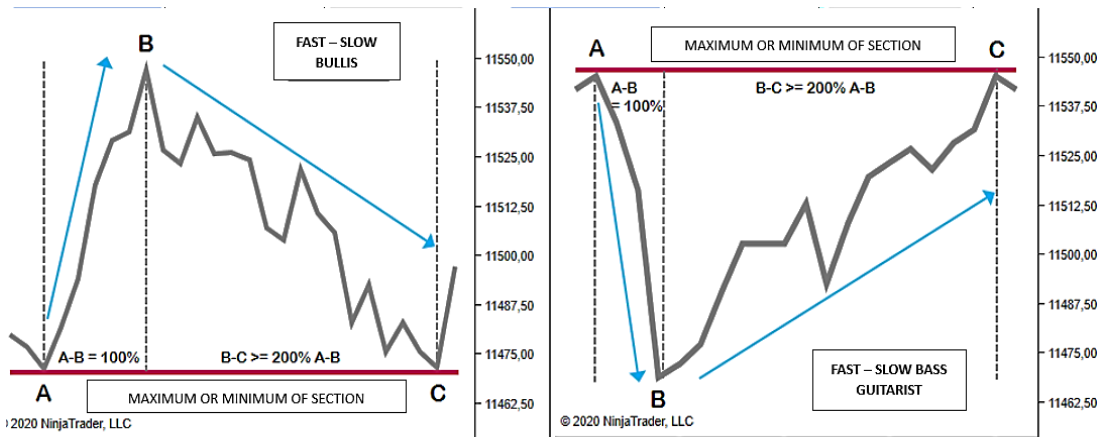
Figure 3. Fast-Slow Pattern Bullish and Bearish.
Source: Own Elaboration with Ninja Trader 8 Platform.

The Japanese candlesticks constitute the third guideline of the strategy. These become the "trigger" that determines the "ideal" moment to execute the plan. The candles will only have protagonism when the two initial rules have been fully complied, that is, they must be formed in a trading zone and when the PFS is completed at point C, it is just at that moment that one of the formations must be drawn, if it is achieved, the trader must enter the market according to what the strategy determines, in case the first two patterns are generated and the candlestick pattern is not obtained, the entry will be canceled.

The most influential characteristic for identifying an adequate candle formation is its dimension or length, it means that this aspect is decisive for the validity of rule three. In general terms, the triggers are patterns that are characterized by outstand due to their size with respect to the preceding candles, when they do not stand out they are considered invalid. The study proposes formations with variants for the two directions that a market can take, when

reference is made with respect to a bullish pattern it is indicated that the direction that is intended to be projected is ascending and the opposite is the case in a negative one. This document present three types of patterns: Envelope, Star and Pin Bar.

Enveloping Pattern: Consisting of two candles. It is characterized because the length of the body of the second candlestick wraps the body of the previous candlestick in its entirety. The two candles must have opposite directions.

Star Pattern: It is formed by a minimum of three candles and a maximum of five. It is characterized because the first and last candles go in opposite directions and their sizes are significant, the intermediate one(s) are generally of small length.

Pin Bar Pattern: It is composed of a candlestick. It is characterized by having a large shadow (upper in bearish pattern and lower in bullish) and a generally small body.
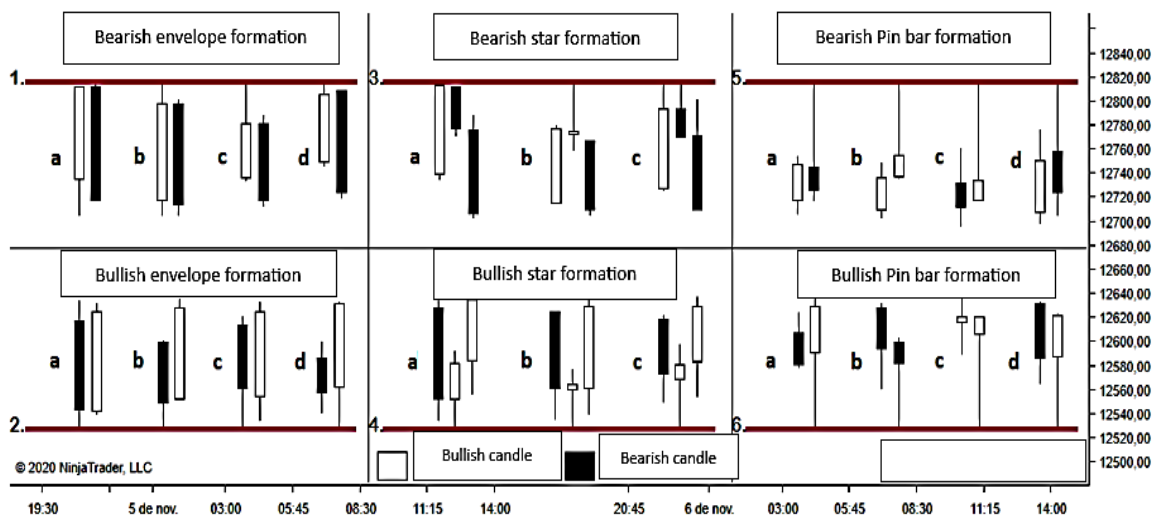

Figure 4. Japanese Candlestick Patterns, Bullish and Bearish.
Fuente: Own Elaboration with Ninja Trader 8 Platform.

With the candlestick formation, regardless of which type occurs, what the trader projects is that the market generates a "twist" point, that is, in the context that the market goes in a downward direction and reaches point C of the PFS, when the candlestick pattern is drawn in that area, it causes a turn in the direction and from that moment begins a bullish path, likewise, it applies to a change from bullish to bearish. Fig. 4 illustrates the three types of formations for bullish and bearish market turns, equally, several examples are observed for each variant, the above plurality is important sinc markets are dynamic and small changes do not indicate that a formation is distorted.

2.1 General Rules of the Strategy

In addition to the three main rules that make up the proposed strategy, there were other general rules that were used in the development of the strategy, which are listed below:

- Stop Loss: For buy/sell transactions the stop loss was placed four ticks (minimum price variation) below/above the minimum/maximum price of the candlestick pattern that generated the entry. Dynamic stops were not considered.
- Take Profit: The minimum profit ratio over risk that was handled in the totality of transactions is 1, i.e., profits of less than one unit are not accepted when the risk assumed is one unit.
- Entry at End of Session: No transactions were opened thirty minutes or less before the end of any of the trading sessions analyzed.
- News or Events: No trades were taken when there were sixty minutes or less to the release of U.S. unemployment rates or interest rates, as well as speeches of the nation's and Federal Reserve´s presidents. For other macroeconomic releases of lesser impact, no trades were taken when there were fifteen minutes or less before their release.

3 Methodology

The data set used during the development of the short trading strategy was obtained from the US Nasdaq-100 stock market, the professional electronic trading platform Ninja Trader 8 was used for historical observation of price behavior. The graphical visualization of the asset price was carried out in a two-minute time frame, that is to say, each Japanese candlestick on the chart represents this time unit and based on defined rules the interaction between the opening, closing, minimum and maximum prices is interpreted. The observation window for the research is from the beginning of October 2019 to the end of September 2020. The Nasdaq-100 index as underlying asset was selected because it lists the world's largest companies by market capitalization, mainly from the technology sector, and because it has a higher average annual volatility than the S&P 500 index. To establish the above, there were taken the daily returns of the futures of these indexes from October 2018 to September 2019 and the standard deviation of these returns was calculated, then annualized and the result shows that the Nasdaq-100 derivative during this period had an average annual volatility of 23% compared to 17% for the SP500 derivative. Volatility is of great importance to the intraday trader as it represents greater trading opportunities.

4 Backtesting

One of the most recurrent methodologies to evaluate the development of a trading strategy in a given time window is "historical backtesting". It consists of performing a simulation using historical data in order to establish what would have been the result of applying an investment strategy in that selected period [20]. One of the main advantages of backtesting is the possibility of creating multiple scenarios that can be analyzed quantitatively and qualitatively. This analysis tool takes on an important meaning when applied in an honest, meticulous and realistic manner, reflecting reasonableness and logic in the results.

Computational progress has allowed the implementation of new backtesting methodologies such as the one proposed by Seda [21], who through algorithmic configurations automatically incorporates recent data to the multiplicity of assets and variables, with the purpose of selecting and incorporating into its portfolio the best investment instruments of the moment. The most usual methodology and the one used in this study is the one that selects the period to be measured and the data remains static, it means that it does not incorporate new data. Investment funds, portfolio managers and retailers use the statistics of their backtests to choose their trading strategies and allocate capital. In order to obtain the results, it was imperative to create a database that would allow the historical data to be stored in an orderly and coherent manner. The first step consisted of determining the variables according to the proposed objectives, among the main ones the following were selected:

Trading Session and day of the week: Seeks to determine in which of the trading sessions the greatest number of operations are generated, as well as the most effective and profitable. Also, to know the day in which the strategy showed the best performance.

Candlestick formation or pattern: This is a determining variable, it is wished to know which of the proposed patterns was the greatest trigger of income in the registered operations, as well as to know its effectiveness and profitability.

Maximum Displacement in Favor (MDF) and Against (MDC): This variable is ideal to establish an adequate amount of maximum loss allowed per operation (stop loss), as well as the profit taking (take profit).

Once the analysis variables were determined, data collection was performed using the Ninja Trader 8 electronic trading platform. The observation window was established, and the trading strategy was strictly simulated on each day. Finally, it was proceeded to quantify the variables. Tables 1, 2 and 3, contain the total of the variables of the database required to perform the backtesting, each observation gathers all the information of row one in the three tables (operation # 1).

Table 1
Backtesting data reported for each observation or scenario. Part 1

Operation #	Date	Day	Session (*)	Time		Duration (Minutes)	Price	C / V
				Entry	Exit			
1	03/10/19	Thursday	American	10:56	12:48	112	7594,00	C

Source: Own Elaboration (2020)

Table 2
Backtesting data reported for each observation or scenario. Part 2

Operation #	Pattern (*)	Level 1	Level 2	Level 3	Operation Type (*)	MDF (*)	MDC (*)	Stop
1	Star	Max Eur Ant	Max Asi Ant		Cont	241	-49	-53

Source: Own Elaboration (2020)

Table 3
Backtesting data reported for each observation or scenario. Part 3

Operation #	Trend in M2	Route						
		1	2	3	4	5	6	7
1	Yes	-49	67	-10	241	112	239	

Source: Own Elaboration (2020)

The backtesting is composed of main variables (*) that are analyzed in this research, it also reviews secondary variables that are not the object of study, however, they are included because they may arouse the interest of analysis in other traders

1 Data and Results

The collection period showed 541 observations generated during the three trading sessions. The study aimed to quantify and establish the best Risk-Reward Ratio (hereinafter RRR) of the strategy, it was proposed to examine from the 1 to 1 relationship, to the 7 to 1, the above allows us to find a sensible relationship between the level of risk and take profit.

Fig. 5 shows the scheme of each of the proposed RRRs, starting at 1 to 1. This indicates that for each unit of risk (stop) that is decided to assume, at least one unit of reward (profit)

will be obtained, the measurement covers up to the ratio 1 to 7. It is considered that as the RRR increases, the probabilities of obtaining it decrease.

According to Table 4, it can be established that short-term PFS is a profitable strategy in six of the seven ratios proposed. The highest effectiveness is recorded in the 1 to 1 RRR, where 71.72% of the transactions recorded profits and only 28.28% losses. However, in terms of profitability, the RRR that gives the best performance in this measurement is the 1 to 2, where over the period covered a return of 91.10% would have been obtained, higher if compared to the 63.40% of the 1 to 1. The last ratio shows a total deterioration of the measurements, which suggests that the 1 to 7 ratio should not be taken in any scenario. The profitability found is free of commissions.
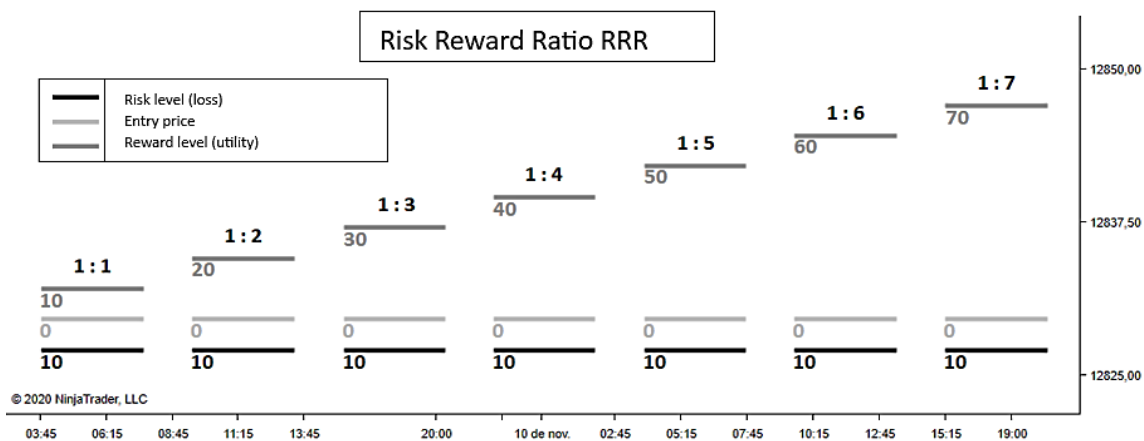

Figure 5. Risk-Reward Ratio Scheme.
Fuente: Own Elaboration with Ninja Trader 8 Platform.

Table 4
Effectiveness and Profitability of the Fast-Slow Pattern by Risk-Reward Ratio.

RRR	1 : 1	1 : 2	1 : 3	1 : 4	1 : 5	1 : 6	1 : 7
N° Total Trades	541	541	541	541	541	541	541
% Profit	71,72%	52,68%	38,26%	29,57%	22,18%	17,19%	6,84%
% Stop	28,28%	47,32%	61,74%	70,43%	77,82%	82,81%	93,16%
Net profit (%)	63,40%	91,10%	79,31%	67,36%	44,36%	37,25%	-61,79%

Source: Own Elaboration (2020)

Table 5
Effectiveness and Profitability of the Fast-Slow Pattern per Trading Session.

Session	Europe	America	Asia
N° Trades	189	230	122
Participation	34,94%	42,51%	22,55%
% Profit	52,38%	55,65%	47,54%
% Stop	47,62%	44,35%	52,46%
Net profit (%)	22,07%	57,28%	11,75%

Source: Own Elaboration (2020)

Table 6.
Effectiveness and Profitability of the Fast-Slow Pattern by Japanese Candlestick Formation.

Candlestick formation	Pin Bar	Enveloping	Star
N° Trades	130	171	240
Participation	24,03%	31,61%	44,36%
% Profit	56,15%	47,95%	54,17%
% Stop	43,85%	52,05%	45,83%
Net profit (%)	16,19%	25,14%	49,77%

Source: Own Elaboration (2020)

Table 7
Effectiveness and Profitability of the Fast-Slow Pattern per Trading Day.

Trading Day	Monday	Tuesday	Wednesday	Thursday	Friday	Sunday
N° Trades	93	124	117	92	98	17
Participation	17,19%	22,92%	21,63%	17,01%	18,11%	3,14%
% Profit	51,61%	54,84%	41,88%	58,70%	59,18%	47,06%
% Stop	48,39%	45,16%	58,12%	41,30%	40,82%	52,94%
Net Profit (%)	14,12%	23,38%	9,81%	17,21%	26,09%	0,50%

Source: Own Elaboration (2020)

Table 5 shows the performance of the PFS strategy from the variable of trading sessions. The results are convincing in favor of the performance that occurred during the American session, 42.51% of the events were registered in this session with a total of 230, likewise, the effectiveness of the session is superior to the others with 55.65% of successful operations and 44.35% of stops. Additionally, it is interesting the profitability generated; this session alone contributed 57.28% of the 91.10% of the overall result of the RRR 1 to 2.

Table 6 shows the behavior of the PFS measured by the triggers of the Japanese candlestick formations, where the pattern that detonated the most trades was the Star, with 240 events corresponding to 44.36% of the total number of observations. It also contributed with the best performance of the measurement, providing 49.77% of the total of 91.10% of the best overall RRR. However, it was not the most effective training; this item is attributed to Pin Bar, which contributed 56.15% of successful cases.

Numerous studies have been based on the behavior that the price could perform on a specific day of the week, Table 7 shows the dynamics of the PFS per stock market day analyzed, Tuesday is observed as the day with the highest trading activity, generating 22.92% of the events, corresponding to 124 cases of the total, however, it is not the day that contributes the best performance to the strategy, Friday leads the ranking of effectiveness and profitability where it participates with 59.18% and 26.09% respectively.

1 Conclusions

The financial markets in recent decades have developed new approaches to the traditional ones, the large traders continue to be at the vanguard in the development of investment methods, the retailer on the other hand participates in the different markets thanks to technological advances, low initial capital requirements and the development of strategies with statistical backing. The results of this study provide the retail trader with a strategy of defined parameters and positive profitability generation, which is favorable given the accentuated divergence at all levels that exists between the two groups of stock market agents, from the most informed, capitalized and sophisticated

to those who lack practically all of the above or have them in a very limited form, which evidences a gigantic asymmetry of resources between the two groups. The results of the research place the strategy based on the identification of the PFS as a recurrent imperfection of the market, that is to say, it has been established that the behavior of the graphic pattern under study is classified as a technical anomaly, in the year of observation using an intraday time frame, it has not been an ephemeral behavior of the price but a repeated formation with positive results that can be systematically exploited.

It is confirmed that a high RRR is not required to obtain profitability, on the contrary, it deteriorates as profit increases. The research showed a good performance of the American session, this was the time zone that produced the most market entry signals and at the same time the most profitable. It can be established that this is not an isolated result; the Yankee session is characterized by producing the most severe fluctuations in asset prices. Likewise, the European session, which is characterized by a volatility historically lower than the American and higher than the Asian, showed results in line with this tradition. As far as candlestick patterns are concerned, the Star formation is the one that showed the most, however, the three variables show similar positive results, that is to say, they have an acceptable reliability in the RRR 1 to 2.

The Nasdaq-100 index future is an asset that is characterized by a great speed and extension in its movements, this vehicle is proposed to investors who have tolerance to high volatilities, otherwise, the trader could be overwhelmed by the rapidity of the movements it performs. Furthermore, given the empirical evidence, operators are advised to manage a single asset for purely speculative purposes; if the objective is to invest in the medium and long term, the creation of a portfolio with multiple instruments would be the best scenario. Based on the foregoing, it is suggested to implement the proposed strategy in different assets in multiple markets, in different time frames and observation windows in order to know its coverage and behavior in different contexts. Additionally, it is worth considering that the PFS can be identified on alternative trading zones, in such a way that the potential of the short-term pattern can be validated in other areas of the price chart.

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