



Article

Algorithmic trading on the MIB based on investor sentiment, measured by fan tokens of Italian football teams

Operaciones algorítmicas en el MIB basadas en el sentimiento de los inversores, medido a través de los fan tokens de equipos de fútbol italianos

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Abstract: The objective of this research is to investigate the utility of football teams' fan tokens as an indicator of investor sentiment and, consequently, as a leading predictor of financial market movements. This study falls within the domain of behavioral finance, which has previously demonstrated how investor sentiment, influenced in part by sports outcomes, can impact financial markets and serve as an early barometer of market trends. We have developed an algorithmic trading system that takes long or short positions in the Italian MIB (Milano Italia Borsa) index, utilizing futures contracts, or alternatively, direct and inverse Exchange-Traded Funds (ETFs). The investment strategy is guided by the performance of fan tokens associated with Italian first division football teams. The backtesting results of the trading system, spanning from March 2021 to December 2022, have yielded a net profit of €5,885.78, translating to a profit factor of 1.12, outperforming the market benchmark represented by the MIB index. Consequently, it can be inferred that the sentiment-driven trend of fan tokens can effectively serve as a leading indicator of market developments. This research highlights yet another instance of market inefficiencies that have already been identified by behavioral finance.

Keywords: Investors' mood, fan tokens, behavioural finance, algorithmic trading.

JEL Classification: G0; G12; G4.

How to cite

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Resumen: El objetivo de esta investigación es analizar la utilidad de los *fan tokens* de equipos de fútbol como un indicador del sentimiento de los inversores y, en consecuencia, como un predictor adelantado de los movimientos de los mercados financieros. Este estudio se enmarca en el ámbito de las finanzas conductuales, que previamente han demostrado cómo el sentimiento de los inversores, influido en parte por los resultados deportivos, puede impactar en los mercados financieros y servir como un barómetro temprano de las tendencias del mercado. Se ha desarrollado un sistema de trading algorítmico que toma posiciones largas o cortas en el índice MIB (Milano Italia Borsa), utilizando contratos de futuros o, alternativamente, ETFs (Fondos Cotizados en Bolsa) directos e inversos. La estrategia de inversión está guiada por el desempeño de los *fan tokens* asociados con equipos de fútbol de la primera división italiana. Los resultados del *backtesting* del sistema accionario, que abarcan desde marzo de 2021 hasta diciembre de 2022, han arrojado un beneficio neto de 5,885.78 €, lo que se traduce en un factor de beneficio de 1.12, superando al índice de referencia del mercado representado por el MIB. En consecuencia, se puede inferir que la tendencia impulsada por el sentimiento reflejado en los *fan tokens* puede servir eficazmente como un indicador adelantado de los desarrollos del mercado. Esta investigación pone de relieve otro caso de ineficiencias del mercado que ya han sido identificadas por las finanzas conductuales.

Palabras clave: Sentimiento de los inversores, fan tokens, finanzas conductuales, operaciones algorítmicas.

Clasificación JEL: G0; G12; G4.

1. Introduction

Several researchers have identified that external events could predict stock market evolution. In the literature we can find that weather, air pollution, sports results, or seasonality correlate with stock market performance.

Those factors cannot be explained with traditional economic theories. In those, the economic decisions from investors are expected to be rational, using the information available and maximizing the probabilities of winning. However, behavioural economics and finance experts identified some cognitive bias on how we analyse information, or how we change our risk profile based on some heuristics.

Some of those heuristics impacting the decision-making process involve the cognitive process to analyse information, but also the emotional activation of the investors. Sentiment of the brokers could impact loss aversions and the investor risk profile but also affect the available information and the overall market expectations, being more optimistic and therefore increasing purchases (expect a positive evolution of the economy or the stock's price) or pessimistic and increasing sales (expecting a negative evolution).

In some cultures, such as Italy, sports play a major role influencing the national sentiment. Soccer has a strong awareness and presence in the social interactions and could play a role driving this local sentiment. As seen in previous research, success on major sport events could anticipate market gains, and especially bad results could predict market losses.

Sports clubs are increasing their presence in the stock markets and exploring new ways of connecting with their fans. On top of merchandising and new experiences available, some clubs are using blockchain technology to offer their fan digital assets such as tokens, which generally provide some rewards or privileges (such as voting rights). Those tokens are traded in the market, and their price evolution is expected to provide some indication of the interest and sentiment on those clubs depending on their results.

Fan tokens are classified as utility token, as they provide some service and rights to the owner. They are described as fungible, and for fans could also play a merchandising role – collective display of the club support.

These tokens are launched by clubs or national teams with a large fan base. For instance, some Italian soccer clubs such as Roma or Juventus launched their fan tokens since 2020, which provides some historical database to assess its market evolution and predictive capabilities over economic cycles and potentially anticipate other investor behaviours – stock market.

Therefore, in this paper we explore if fan tokens quotations trends could be used to anticipate market trends and therefore provide investment opportunities. We propose the development of an algorithm which invest in the Italian stock exchange, using futures of MIB (Milano Italia Borsa) index, based on the fan token prices of the major Italian teams. This algorithm will take long positions (buy) when the fan tokens price increase, and a short one (sell) when the token price decrease.

Alternatively, the investment strategy can be implemented using any other financial instrument that replicates this index and enables long and short trading, such as direct and inverse Exchange-Traded Funds (ETFs).

2. Theoretical framework

Behavioral economists have investigated how people make economic decisions. Prospect theory from Tversky and Kahneman (1974) indicate that the desired outcome of an event might generate some expectations which could lead to biased predictions – winning the game. This theory points at the irrationality involved on financial investment decisions, where investors analyse the available information but not in a rational way – pointing at availability of the information and anchoring effect among others.

Since then, behavioural economists have developed the dual process theory, indicating that some intuitive fast way of processing stimuli is always active and involved in the heuristic process. A long list of cognitive biases has been identified by psychologists, including some framing and anchoring effects, as well as the emotional activation impact.

Those theories contrast with the traditional approach from the theory of expected utility (von Neumann & Morgenstern, 1944) – which indicated that investors would take the decision path which maximizes utility (gains) – which would imply a perfect rational assessment of all the information available.

In the sector of sports clubs, there is a major impact of performance (sport results) affecting the financial results of those companies (Ashton et al., 2003). According to the traditional Neoclassical approach, the positive results of a team will impact the financial results of that club, as their income could potentially increase. Different revenue avenues could be identified linked to a winning strike, from additional ticket sales, sponsorships, merchandising, broadcasting new contracts, specific economic prizes; (winning a National League) as well as the right to participate in regional competitions (Championship League in European soccer). Those positive results could grant present and future incomes, so we would expect a larger investor interest and a positive stock price evolution.

Although behavioural finance points that on top of those positive rational effects, winning a game will generate some irrational biases in the investors, linked to the expected future results or to the emotional activation. Authors have demonstrated that the incidental emotions (not related to the target object) of the decision makers could drive different outcomes in many difference areas such as price, help and trust provided (Palma-Ruiz et al., 2020). Andrade and Ariely (2009) proved that the effect could be enduring, and even substitute the original cause of the behaviours, while some experiments showed that this long-term effect might not be present (Harding & He, 2011) or only in some specific cases.

Specifically on sports event, Edmans et al. (2007) and many other researchers conducted studies to analyse the link of specific sports events and the investor sentiment. The authors demonstrated the

impact on international soccer results on the evolution of specific stock markets (from countries with strong soccer traditional and relevance). Chang et al. (2012) studied the potential effects of sentiment related to American Football club performance, on stock returns at the firm level by using companies based in the same city.

Some other authors explore further this relation, with aspects such as the relevance of the match or the team (national teams, top clubs in the country). Benkraiem et al. (2009) showed the relevance of major clubs' results in a European database and added the importance of matches being home or away. Geyer-Klingenberg et al. (2018) performed a meta-analysis which discovered that the relationship among the sport result and the stock market performance is more relevant when there is a loss, which is consistent with the prospect theory and investor's expected results as pointed by Tversky and Kahneman. This effect is more relevant in club results than national teams. It even seems that just goal scoring could impact the stock market price of the teams, without a specific need for positive results on the match (Galloppo & Boido, 2020).

The impact in stock price linked to national or club results is seen in many different sports, not only soccer or American football. Academics have explored this relationship in rugby, cricket or basketball.

We find different options to measure this mood impact in the markets, from general effects in the local economy, which is the overall stock markets – based on their aggregated index. This dependent measure incorporates the national companies (Edmans et al., 2007; Berument et al., 2006; Demirhan, 2013), and some others focus only on the stock price of the firms based on specific cities – based on a stronger link to local clubs (Chang et al., 2012). In the latter, we would expect the stock price to be impacted by the sport results not only by the mood change but also by the rational expectation to improve the financial results (winning championships will provide additional company revenue streams), and those revenues could impact the local economy based on the club location.

Other studies have analysed the impact of national soccer teams on national stock indices. Gómez-Martínez and Prado-Román (2014) show that after a victory for the national team we should expect an appreciation of its stock market index and a depreciation after an unfavourable result.

Lately, we also find some authors already analysed the evolution of the fan token prices of different clubs based on their match results. Fan tokens commercialized by some sport companies could provide some good measure of this investor sentiment as they are less impacted by the "rational" financial impact of good results – such as winning games – versus the stock market. Also, the owners of those token are probably club supporters, so that club performance could impact them on a strong emotional level. Academics focusing on this area (Demir et al., 2022) have learned that winning or losing soccer matches in the prestigious tournaments in Europe (Champions League) affect disproportionately the fan token price.

However, other authors (Mazur & Vega, 2022) do not see the correlation between the real-life performance of the in the fan token return. This could happen as there are some other important factors driving the fan token value, such as the price of other tokens and the value of the cryptocurrencies used to buy them (Scharnowski et al., 2021).

As fan tokens are good measures of the investor sentiment of the club fans, in an aggregated way could provide some predictive level on the national investor behaviors and anticipate the evolution of the national stock market.

3. Hypothesis and methodology

The hypothesis to be validated in this research is:

H₀: Investor sentiment, measured by the evolution of fan tokens of Italian football clubs, can anticipate the evolution of the Italian stock market.

For this study we have developed an algorithmic trading system on the Trading Motion¹ platform that opens long or short positions, on a weekly basis, following the investment signals set by the fan tokens of the main Italian soccer teams. The developed trading system is like the one used by Gómez-Martínez et al. (2020) which opened long or short positions depending on the results of the Juventus matches, in the future of the MIB, Bayern, in the DAX, and PSG, in the CAC. In our case, instead of using the sports results, we will use the appreciation or depreciation of the fan tokens of the Italian football clubs.

The system workflow is as follows:

1. The weekly profitability registered by the listed fan tokens of the following teams is calculated:
 - a. Rome, listed since 06/21/2020
 - b. Juventus, listed since 09/1/2020
 - c. Milan, listed since 02/22/2021
 - d. Inter, listed since 09/14/2021
 - e. Lazio, listed since 10/21/2021
2. The inversion signal is defined:
 - a. If the average of the weekly returns of the fan token is positive, a positive sentiment is understood, and a long position is opened in the future of the MIB
 - b. If the average of the weekly returns of the fan token is negative, a negative sentiment is understood, and a short position is opened in the future of the MIB
3. Trading: At first hour of every Monday a position is opened.
 - a. If the investment signal coincides for the next week, the open position is maintained
 - b. If the investment signal does not match for the next week, the position is closed and the opposite position is opened

The hypothesis of this research will be validated if the performance of the backtest of the algorithmic trading system is profitable and beats the market.

The data on the prices of the fan tokens have been collected from the website <https://coinmarketcap.com>.

The back test has been run from March 2021 to December 2022. We considered March as the start date since it is when at least three of the teams with their fan tokens were listed in the market and it appeared to be a good indicator for the market sentiment.

4. Results

The back test performance summary is shown in Table 1.

Table 1. Back test performance summary on FTSE MIB.

Main chart: Mini FTSE MIB 30-minute bars [01/03/2021 - 07/12/2022]	
Net P&L	5,885.78 €
Gross P&L	6,295.00 €
Profit factor	1.12
Sharpe ratio	0.74
Slippage per side	-0.45
Commission per side	0.00 €
Annual ROI	13.30 %
Net P&L over Drawdown	1.03
Mathematical expectation	110.44

¹ For more information visit <https://www.tradingmotion.com>

The back test Session analysis is shown in Table 2.

Table 2. Backtest performance summary on FTSE MIB.

Analyzed sessions	456
Sessions in market	447
Winning sessions	227
Winning sessions profit	56,215.08 €
Winning sessions average	247.64 €
Losing sessions	220
Losing sessions profit	-50,329.30 €
Losing sessions average	-228.77 €
Worst drawdown	-5,712.54 €
Worst drawdown date	29/08/2022
Best session	1,405.00 €
Best session date	26/11/2021
Worst session	-1,060.00 €
Worst session date	10/06/2022
30 days volatility	53.83 %
1 year volatility	116.35 %
5 years volatility	0.00 %
Suggested capital	25,000.00 €
Required capital	1,300.00 €

We can see that Net P&L is €5,885.78 and Gross P&L €6,295.00. The profit factor (ratio between profits and losses) is greater than 1, which indicates that the system is viable, and the Sharpe ratio is 0.74.

Figure 1 plots the evolution of the Profit and Loses (P&L), and the evolution of the FTSE MIB index (red line). It is graphically demonstrated that the algorithm trading system has been able to beat the market.

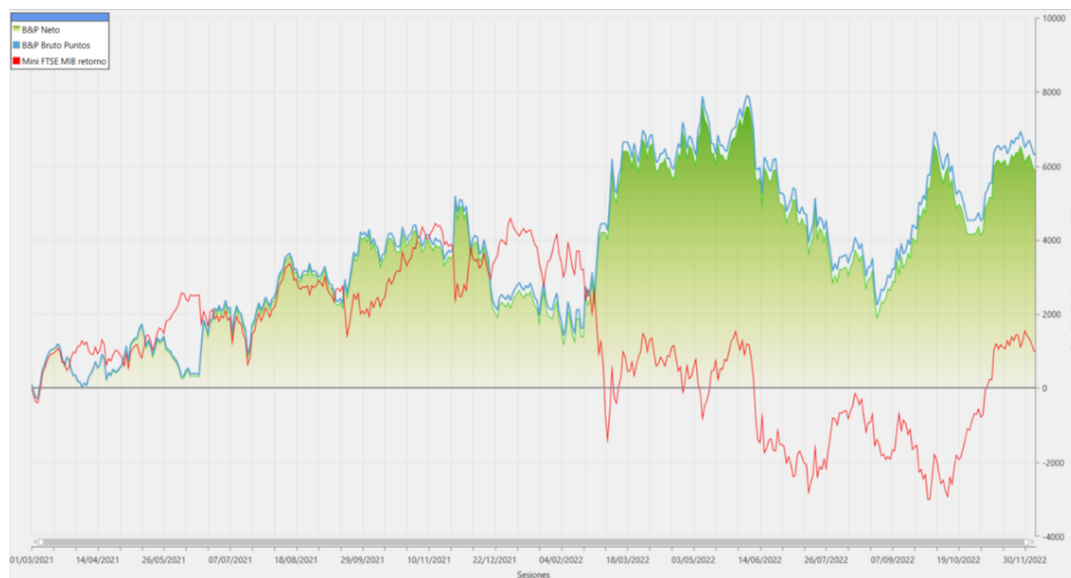


Figure 1. Backtest P&L over FTSE MIB.

These figures allow us to validate the H_0 hypothesis of this research.

5. Conclusions

In this paper we have deepened into the study of behavioural finance. Previous studies have shown that sports results affect investor sentiment and change their level of risk aversion or tolerance. Therefore, the objective is to identify signals that allow us to measure investor sentiment to anticipate the market trend.

In this case we have explored the possibility that the price of the fan tokens of the Italian football clubs are an indicator of investor sentiment and that they anticipate the trend of the Italian stock market according to the MIB index. Therefore, we developed an algorithmic trading system that opens long or short positions following the investment signals set by the fan tokens of the main Italian soccer teams.

Is it possible that the happiness or sadness caused by sports results, measured according to the evolution of the fan token, affects investor sentiment and is a signal that anticipates the evolution of the market? The results of the back test performance tell us that we must answer "yes".

The back test performance records a €5,885.78 Net P&L and €6,295.00 for Gross P&L. The profit factor (ratio between profits and losses) is greater than 1, which indicates that the system is viable. From a visual approach, in the graph of the P&L of the back test compared to the evolution of the index, we check that the trading system has beaten the market.

Fan tokens are a new and very interesting crypto asset. Considering that they do not have any monetary return associated with them, their price reflects only an emotional relationship. In this study we have used this emotional relationship to measure investor sentiment and use it to implement an investment strategy that has proven to be highly profitable in a long and short context. We will need a prospective study to conclude that this investment signal is still profitable.

To conclude, this paper has identified a novel leading indicator for crafting investment strategies based on investor sentiment using football club fan tokens. The investment strategies described prove profitable during the period of study and can be implemented using ETFs. As a result, we provide further evidence of the potential of investor sentiment for devising alternative investment strategies.

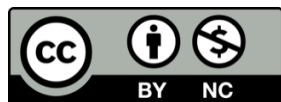
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