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The automation of strategies in the futures market as a vector for mitigating cognitive biases and optimizing performance: a praxeological analysis.

Automation of strategies in the futures market as a vector for mitigating cognitive biases and optimizing performance: a praxiological analysis

Cezario Soares da Silva - Specialist in Financial and Capital Markets. Investment Consultant, Professional Trader, and Researcher in Behavioral Finance and Algorithmic Trading. Commander of the Brazilian Chamber of Culture.

Summary

The contemporary financial market, characterized by high trading frequency and the inherent volatility of derivatives, poses severe challenges to human decision-making, often distorted by cognitive biases and emotional limitations. This scientific article proposes an exhaustive, technical, and multidisciplinary analysis of the implementation of automated *trading* systems (investment robots) in the B3 futures market, specifically in index and dollar contracts. The methodology adopted is based on a systematic literature review and empirical data analysis, correlating the postulates of Fama's Efficient Market Hypothesis (1970) with the findings of Kahneman and Tversky's Behavioral Finance (1979). The study is structured around three highly dense thematic axes, dissecting everything from market microstructure and execution latency, through economic psychology applied to risk management, to the architecture of algorithms for consistent returns. The results demonstrate that automation eliminates behavioral asymmetry and standardizes the execution of *setups.*

Technical aspects maximize the Sharpe Ratio of portfolios. It is concluded that the modern *trader* must transition from manual operator to system manager, using technology as a protective barrier against human fallibility and as a lever for financial scalability.
Keywords: Algorithmic Trading. Behavioral Finance. Futures Market. Risk Management. Automation.

Abstract

The contemporary financial market, characterized by high-frequency trading and the intrinsic volatility of derivatives, imposes severe challenges on human decision-making, often distorted by cognitive biases and emotional limitations. This scientific article proposes an exhaustive, technical, and multidisciplinary analysis of the implementation of automated trading systems (investment robots) in the B3 futures market, specifically in index and dollar contracts. The methodology adopted is based on a systematic bibliographic review and empirical data analysis, correlating the postulates of Fama's Efficient Market Hypothesis (1970) with the findings of Kahneman and Tversky's Behavioral Finance (1979). The study is structured into three thematic axes of extremely high density, dissecting everything from market microstructure and execution latency, through economic psychology applied to risk management, to the architecture of algorithms for return consistency. The results demonstrate that automation eliminates behavioral asymmetry, standardizes the execution of technical setups, and maximizes the Sharpe Ratio of portfolios. It is concluded that the modern trader must transition from a manual operator to a systems manager, using technology as a protective barrier against human fallibility and as a lever for financial scalability.

Keywords: Algorithmic Trading. Behavioral Finance. Futures Market. Risk Management. Automation.

1. Introduction

The evolution of global capital markets in recent decades has been marked by a abrupt and irreversible transition from open outcry auctions, dominated by physical human interaction and Noisy, for high-performance digital environments where processing speed and precision are essential.

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Algorithmic factors dictate liquidity and price formation. In this ecosystem dominated by microstructure
In the electronics market, the figure of the manual speculator or investor faces increasingly higher barriers to entry.
sophisticated, not only technological, but fundamentally psychological. The Finance Literature
Behavioral studies, which have won Nobel Prizes, show that when human beings are subjected to
In environments of financial risk and probabilistic uncertainty, it tends to operate under the influence of heuristics.
and biases — such as loss aversion and overconfidence — that systematically destroy value over time. The futures
market, specifically the Bovespa Index (WIN) contracts and
Due to its intrinsic leverage and intraday volatility, the Dollar Futures (WDO) on the B3 acts as a...
This acts as a catalyst for these biases, making consistency of earnings a statistically improbable goal.
for discretionary operators lacking robust automation tools.

The central problem addressed in this academic investigation lies in the inefficiency of execution.
A manual addresses the need for stochastic standardization of speculative investment strategies.
The hypothesis being put forward is that the adoption of *Algorithmic Trading* does not serve
not only to increase execution speed, but it primarily acts as a mechanism for
Behavioral *compliance ,* ensuring that the *trading* plan (the method) is executed to the letter.
regardless of the operator's emotional fluctuations or momentary market "noise".
The structure of this article aims to dissect how the programming of operational robots, based on
Quantitative technical analysis and mathematical risk management offers a solution to fallibility.
The fundamentals of algorithmic logic and risk mitigation through human development will be explored.
Automated *stop-losses* and strategy validation via *backtesting* prove that technology is the driving force.
inseparable from sustainable performance in the 21st-century financial landscape.

2. Market microstructure and the need for automated execution

The microstructure of the financial market refers to the specific mechanisms and rules.
operational processes through which assets are traded, including the formation of the order book.
(order book), liquidity dynamics, and the price discovery process . In a
In an electronic trading environment, efficiency is not measured solely by the ability to predict the
not only does it drive the price direction, but also the ability to interact efficiently with the order book.
minimizing the impact on the market *(slippage)* and transaction costs. Manual execution, therefore,
Due to its biological nature, it has a reaction time (human latency) that varies between 200 and 400 seconds.
milliseconds, a time interval considered an eternity in markets where algorithms...
High Frequency Trading (HFT) operates on a microsecond scale.
Temporal disparity puts the manual operator at a systemic disadvantage, frequently leading to...
in lagging positions or exiting them at prices worse than visually planned on the chart.

Automating strategies through investment robots (Expert Advisors) solves the

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problem of latency and execution accuracy when connecting directly to APIs *(Application Programming Interfaces)* of brokerage firms and stock exchanges. A well-programmed algorithm monitors dozens of variables simultaneously — moving averages, stochastic oscillators, order flow *(Tape Reading)* and trading volume — and triggers buy or sell orders at the exact millisecond that The logical conditions are met. This capability for parallel processing and execution... Instant trading allows for the exploitation of fleeting windows of opportunity, such as short-term arbitrage. Timeframes or volatility breakouts that would be humanly impossible to capture. consistently. Furthermore, automation ensures adherence to the entry and exit prices. programmed, within the limits of available liquidity, eliminating the hesitation that often occurs. It overwhelms the human operator in the face of a fast-paced market.

Another critical aspect of the microstructure mitigated by automation is the management of Dynamic position *sizing* . In manual strategies, lot calculation. ideal for each operation, considering the available capital and the acceptable risk per *trade,* often It is neglected or done half-heartedly in the heat of the moment. Automated systems, for example. On the other hand, they can recalculate the position size in real time, based on volatility. The asset's current ATR (Average *True Range)* or the updated account balance, ensuring that the exposure to risk remains mathematically constant and within safety parameters. established. This rigorous mathematical management of capital is fundamental to avoiding ruin. especially in futures markets where leverage can quickly multiply losses.

Consistency in strategy application is perhaps the greatest benefit of automation in... Context of the microstructure. A robot doesn't get tired, doesn't lose focus, and doesn't suffer from boredom in markets. It trades sideways and doesn't try to "get revenge" on the market after a loss *(revenge trading).* It executes the *setup* . configured — whether it's trend following, mean reversion, or breakout — with discipline. Spartan, 100% of the time. This allows the investor to assess the effectiveness of the strategy itself, isolating... The variable of human error. If an automated system presents losses in the long term, it is known... that the failure lies in the logic of the strategy or in market conditions, and not in an operational error. or the emotional state of the person who clicked the button, allowing for precise, data-driven technical adjustments. based on facts, not subjective assumptions.

Prior statistical validation, known as *backtesting,* is an exclusive prerogative of algorithmic approach. Before risking real capital, the strategist can submit their code for years. from historical market data, checking how the robot would have performed in different scenarios of Crisis, euphoria, high and low volatility. This process generates crucial metrics such as *Drawdown.* Maximum (largest percentage drop in capital), Profit Factor , Hit Rate and Mathematical expectation of the system. Armed with this data, the manager can optimize parameters for... to find the ideal balance between risk and return, discarding strategies that, although they may seem

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Promising in theory or visual analysis, they do not sustain positive profitability when subjected to...
due to the statistical rigor of long time series.

Scalability is the ultimate advantage of automation. A manual trader has a limit.
Physical and cognitive factors depend on how many assets or strategies you can monitor simultaneously. Try.
Trading futures, the dollar, stocks, and options simultaneously will inevitably lead to mental fatigue.
and to errors in judgment. Automated systems, however, are infinitely scalable; a single
The server can run dozens of different robots, across multiple assets and timeframes.
diversifying the risk of the *trading portfolio.* This diversification of strategies — operating a robot of
Trend in the dollar while a consolidation robot operates on the index — smooths the capital curve.
because the losses of one system on a bad day can be offset by the gains of another system.
On a favorable day, creating a portfolio of uncorrelated algorithms.

In conclusion, within this thematic area, automation is not a "magic" way to generate profits, but...
An indispensable technological tool for professionalization. It transfers the responsibility of
result of the operator's "talent" or "intuition" for the quality of strategy engineering and the
Robustness of programmed risk management. In the B3 futures market, highly efficient and
In a competitive environment, the survival and prosperity of the investor depend less and less on their
The ability to click quickly and increasingly rely on their capacity to develop, test, and manage.
logical systems that operate through it, transforming trading from a gambling activity into a
statistical probability management business.

3. Economic psychology and the suppression of cognitive biases via algorithms

Economic Psychology, or Behavioral Finance, challenged the classical paradigm of
an economy that viewed the financial agent as a purely rational being *(Homo Economicus),*
demonstrating that human decisions are systematically biased by mental shortcuts.
(heuristics) and emotions. Kahneman and Tversky (1979), in their Prospect Theory, proved that the
The pain of loss is psychologically twice as intense as the pleasure of an equivalent gain.
In manual trading, this translates into destructive behaviors: the trader tends to take profits.
quickly to ensure a sense of victory (exiting winning trades too early) and,
Conversely, it tends to hold onto losing positions in the irrational hope of recovery.
Transforming small losses into financial disasters. Automation acts as a "vest of..."
"Rational force," executing *stop* -loss orders and profit targets exactly as programmed.
ignoring emotional pain or momentary greed.

Overconfidence bias *is* another common pitfall that has been mitigated .
by robots. Discretionary traders often overestimate their ability to predict the
market, increasing the size of positions after a winning streak, believing they have

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"The market code has been cracked." This behavior usually precedes large losses, because the
The market is stochastic, and winning streaks can be random. Algorithms, being...
Lacking ego, they don't get "excited" by victories nor "depressed" by defeats. They maintain...
Hand size and technical strategy remain unchanged, preserving the integrity of management.
Statistical risk assessment, coldly designed, far from the heat of the trading floor. Mathematical consistency replaces the...
Emotional variability.

The disposition effect , which is the tendency to sell winning assets and
Holding onto losing assets is negated by the Boolean logic of the algorithms. An investment robot.
It is programmed with clear exit rules based on technical or financial indicators, not on
Hope or fear. If the moving average crosses into a sell signal, the robot will sell, realizing the loss.
The small amount needed to protect the principal capital. This ironclad discipline is extremely difficult to...
to be maintained by humans in situations of financial stress, where the prefrontal cortex (responsible
(through planning and logic) is frequently hijacked by the limbic system (responsible for
fight-or-flight reactions), leading to impulsive and irrational decisions.

Decision fatigue is a physiological factor often overlooked in manual trading, but
Critical to performance. The human brain has a limited capacity for making high-level decisions.
quality throughout the day. After hours of intense concentration on flashing screens, the quality of
The operator's judgment drops drastically, increasing the likelihood of operational errors and breakdowns.
Rules. Robots don't suffer from fatigue. They operate with the same precision and speed on the first try.
One minute before the trading session and the last minute of *after-market trading.* This tireless vigilance allows the trader
Capture opportunities that might otherwise go unnoticed due to fatigue or distraction, ensuring
Full coverage of the trading hours defined by the strategy.

Confirmation bias, where the operator seeks only information that corroborates their own.
Preconceived opinions about the market that ignore contrary signals are eliminated by the objectivity of the code.
A trader who believes the market will go up may ignore clear sell signals on their chart.
An algorithm, however, has no opinions or beliefs; it has logical conditions: "IF the price closes below the average
AND the volume is high, THEN sell". It will execute the sell order.
Regardless of optimistic news or general market sentiment. This neutrality
Absolute intelligence is vital for navigating volatile markets where the media narrative often diverges.
from the reality of prices.

The discipline imposed by automation also promotes an improvement in the quality of life of
investor. By delegating execution and monitoring to the machine, the professional frees themselves from
Continuous stress from "watching the price" reduces the anxiety associated with financial fluctuations.
It allows the trader to focus their time and intellectual energy on higher value-added activities.
such as researching new strategies, studying macroeconomics, or optimizing parameters.

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of existing robots. The emotional distance provided by technology not only protects
It reduces capital, but preserves the operator's mental health, an essential factor for career longevity.

It can be concluded, therefore, that the integration of algorithmic technology into the financial market is,
Above all, it's a tool for mental hygiene and behavioral discipline. By removing the
By removing the human element from the point of execution, cognitive biases that historically... are eliminated.
They transfer money from the impatient and emotional to the disciplined and systematic. Success in
From the perspective of economic psychology, the futures market does not depend on predicting the future, but on...
to react to the present in a probabilistic and controlled manner, a task for which robots, programmed by
Competent minds are unsurpassed.

4. Operational strategies and technical capital management (money management)

The architecture of operational strategies for automation requires a precise definition of
rules that can be translated into a programming language (such as MQL5 for MetaTrader or
(Python). Unlike subjective analysis ("the graph looks nice"), quantitative analysis requires
Exact parameters: What is the moving average period? What is the standard deviation of the Bollinger Bands?
What are the exact start and end times of operations? Clearly defining these parameters requires...
A trader formalizes their knowledge, transforming vague intuitions into a scientific method.
Testable. *Trend-following* strategies seek to capture large price movements.
Directional traders are willing to accept a lower hit rate in exchange for a high *payoff* (return per trade).
Mean reversion strategies, on the other hand, exploit price exaggerations, betting on...
Return to normal levels, generally with a high hit rate and lower *payoff* .

Capital management, or *money management,* is the mathematical heart of any system.
Successful trading requires more than just having a sound entry signal; you also need to know how much to risk.
Kelly's criterion and the 1% or 2% risk-per-trade rule are frequently used algorithms.
implemented in robots to ensure that no losing streak *is* able to
...to blow up the account. In the B3 futures market, where leverage is high, risk management...
Automated strategies should include daily *stop-loss* and *daily* profit limits.
(take profit). When these limits are reached, the robot automatically terminates operations.
protecting accumulated profits or preventing a bad day from becoming catastrophic.

The *Trailing Stop* technique is a powerful feature in systems.
automated. It allows the robot to automatically adjust the level of protection of the operation to
as the market moves in favor of the position. This ensures that, in strong movements of
The trend is for profits to be maximized and protected without relying on the manual intervention that many...
Sometimes, investors "close" the position too early for fear of giving back their profits. Automatic *breakeven* is another [example].
A vital tool, moving the stop to the entry point as soon as the price advances a certain amount.

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The number of points eliminates the risk of the operation and allows for a "free bet" on the market.

Intra-strategy and inter-strategy diversification is facilitated by automation. It is possible to run the same robot with different parameters (one more aggressive, the other more conservative) or to run Robots with opposing logic (one buy, the other sell) depending on signals from different time periods. charts. This algorithmic portfolio approach smooths out the volatility of returns. Over periods Where the market is moving sideways, trend-following robots lose, but reversal robots win. In periods In a direction with strong growth, the opposite occurs. The net result is a more stable and predictable capital curve. The ultimate goal of any professional resource management system.

Implementing volatility and time filters is crucial for the performance of robots. in the index and dollar futures. The Brazilian market has specific liquidity characteristics, with peaks Volume at the opening (9am-10am) and at the opening of the US market (10:30am-11:30am). Algorithms They can be programmed to operate only during these high-liquidity windows or, conversely, to Avoid times when high-impact news is being broadcast *(Payroll,* COPOM/FED decisions), and consult... Real-time economic calendars. These contextual filters increase the robustness of the strategy. preventing the system from operating under market conditions for which it was not designed ("noise") excessive or insufficient liquidity).

Continuous monitoring and periodic reoptimization *(walk-forward analysis)* are necessary for To maintain the validity of the robots. Markets change regimes (from low volatility to high volatility). Volatility, trending sideways). A set of parameters that worked perfectly. What happens in 2020 may fail in 2024. The automated systems manager must therefore conduct audits. constants of performance, recalibrating the algorithms to adapt to the new reality of volatility and correlation of assets, without falling into the trap of *overfitting ,* where the robot It is so optimized for the past that it loses the ability to generalize to the future.

It is concluded that the technical management of capital and the structuring of operational strategies Automated processes comprise the financial engineering necessary to extract consistent value from market. By transforming entry, exit, and risk rules into computer code, the investor The professional creates a factory of rational decisions, where the raw material is market data and the The end product is the risk-adjusted return. In this context, technology does not replace intellect. Human in strategy creation, but infinitely surpasses human in the discipline and precision of its execution. daily.

5. Conclusion

In-depth investigation into the intersection between market microstructure, the Economic psychology and automation technology allow us to consolidate the thesis that *algorithmic Trading* represents the highest stage in the evolution of a financial trader in the futures market.

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It has been demonstrated, through the analysis of latency and execution mechanisms, that the competition Manual labor in a machine-dominated environment is structurally disadvantageous. Automation, on the other hand, Leveling the speed of reaction and ensuring the mathematical precision of orders gives back to the investor. individual or institutional capacity to compete on a level playing field technically, provided that it is equipped robust and validated strategies.

The suppression of cognitive biases, as explored, reveals itself as the greatest asset. The intangible aspects of investment robots. By eliminating fear, greed, overconfidence, and... In case of hesitation, algorithms purify the decision-making process, allowing for probability... The statistical strategy manifests itself in the long term without the destructive interference of the human psyche. Risk management, transformed into inviolable lines of code, acts as a guarantee of The survival of capital, preventing emotional errors from causing irreversible financial damage. Consistency, so desired and rarely achieved by manual operators, becomes a a natural consequence of algorithmic discipline.

Furthermore, the analysis of operational strategies showed that automation allows for a Sophistication in capital and portfolio management inaccessible to manual trading. The ability to operate Multiple assets, timeframes, and logics simultaneously diversify risk and smooth the yield curve. Return. The need to formalize the rules for programming forces the trader to a level of Clarity and objectivity, which in itself already elevates the quality of your approach to the market. *Backtesting* Continuous optimization transforms speculation into data science.

It can be concluded, therefore, that the path to high performance in the financial market... Contemporary life undoubtedly involves the adoption of technological automation tools. A professional who masters the creation and management of investment robots transcends the figure of the "gambler". From the market to becoming a quantitative systems manager. In a scenario where information is Instantaneous volatility is the norm, a symbiosis between human creative intelligence (in the conception of the strategy) and the executive discipline of the machine (in market operation) constitutes the formula definitive for achieving consistent, scalable, and resilient results.

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