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TRADING ALGORITHM BASED ON TECHNICAL INDICATORS AND ARTIFICIAL INTELLIGENCE

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Rezumat: *Această lucrare investighează capacitatea investitorilor individuali, fără competenţe IT avansate, de a crea, testa şi opera roboţi de tranzacţionare. Strategia algoritmică, bazată pe identificarea zonelor Supply/Demand şi filtrarea volatilităţii prin Average True Range (ATR), a fost generată cu un chatbot AI contra-cost şi testată riguros în platforma MetaTrader 5. Cercetarea confirmă că, deşi AI oferă un cadru viabil, optimizarea fină a parametrilor indicatorilor este crucială pentru rentabilitatea ajustată la risc.*

Cuvinte cheie: *Algoritm de tranzacţionare, Inteligenţă artificială, MetaTrader 5, Optimizare*

Abstract: *This paper investigates the capacity of individual investors, without advanced IT competencies, to create, test, and operate trading robots (Expert Advisors). The algorithmic strategy, based on identifying Supply/Demand zones and filtering volatility using the Average True Range (ATR), was generated with a cost-based AI chatbot and rigorously tested within the MetaTrader 5 platform. The research confirms that, although AI offers a viable framework, the fine optimization of indicator parameters is crucial for risk-adjusted profitability.*

Keywords: *Expert Advisor, Artificial Intelligence, MetaTrader 5, Optimization*

JEL Classification: G11, G15, C53, O33

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1. INTRODUCTION

The accelerating development of financial technologies and Artificial Intelligence (AI) has driven a substantial increase in the adoption and popularity of trading robots (Expert Advisors) within financial markets. These sophisticated systems are capable of collecting, analyzing, and processing vast volumes of data in real-time, executing market entry and exit decisions with a velocity and precision that is challenging for typical retail investors lacking advanced competencies in the IT domain.

Despite this technological gap, specialized literature indicates that trading strategies built upon carefully selected classic technical indicators, when combined with adequate risk management tactics, still possess the potential to generate competitive returns. The central problematic of this research is to examine the extent to which an individual investor, without profound IT expertise, can successfully design, test, and optimize an algorithmic strategy by leveraging current, cost-based AI technologies. The goal is to determine the feasibility and potential profitability of such solutions for the common investor.

The motivation for this investigation derives from the desire to offer an accessible and efficient alternative for retail traders who want to benefit from technological advances without spending large amounts on developing and maintaining complex IT infrastructure. Understanding how accessible AI tools can be integrated into popular trading platforms, such as MetaTrader 5, responds directly to the market's demand for practical and small-scale algorithmic trading solutions.

This paper is structured to initially present the theoretical framework, establishing the importance of technical indicators proven effective in previous studies. Next, the methodology describes the generation of the initial Expert Advisor using a cost-based AI chatbot. The main part of the research focuses on the back testing process in MetaTrader 5, emphasizing key performance parameters such as Total Return, Maximum Drawdown, Win Rate, and Profit Factor. Finally, the study concludes with the optimization of the strategy through the fine-tuning of technical parameters.

The expected outcomes include demonstrating the viability of an easily implementable, AI-generated trading algorithm for retail investors. More importantly, the research aims to show how proper optimization can significantly impact risk-adjusted profitability, potentially improving the competitiveness of retail investors by providing solutions adapted to their resource and knowledge limitations.

2. DEFINING THE RESEARCH PROBLEM

2.1. Strategy Construction and Core Algorithmic Logic

The proposed Expert Advisor (EA) is built on the premise that trading strategies based on well-chosen classic technical indicators, combined with disciplined risk management, can achieve competitive returns. The approach follows a general algorithmic framework designed for liquid instruments and applied to the hourly (H1) timeframe.

The strategy leverages insights from micro-structure literature, focusing on identifying local Supply/Demand (S/D) zones. These zones are identified by "impulsive candles," initially defined as bars with a real body of at least ten pips, which signal a recent, significant imbalance in demand

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or supply. The algorithm waits for the price to return for the first time into this preserved S/D zone (the "first retest") before executing a trade in the direction of the initial impulse.

Risk management follows the standard one-percent rule, ensuring that potential losses do not exceed one percent of account capital. Exit levels are determined dynamically using the 14-period Average True Range (ATR) indicator, which measures true market volatility. The Stop-Loss is placed at a distance equal to 1×ATR, while the Take-Profit is set at 2×ATR, establishing a minimum 1:2 risk–reward ratio.

To prevent execution during unfavorable market conditions, the strategy applies several filters. Execution is suspended if the ATR(14) value does not exceed three times the minimum price increment (point) of the symbol, ensuring that trades are only taken in genuinely active sessions. In addition, positions are opened only between 07:00 and 16:00 UTC, corresponding to the high-volume overlap of the London and New York trading sessions, thereby avoiding low-liquidity periods.

2.2. Algorithm Generation and Initial Back testing

The process of constructing the EA began with requesting a cost-based AI chatbot to generate the initial code structure in the MetaQuotes Language 5 for use in the MetaTrader 5 platform.

The first version incorporated the Supply and Demand (S/D) logic together with several complementary technical indicators, including the MACD, RSI, Bollinger Bands, and Fibonacci levels. The algorithm operated with a lookback window of 20 H1 bars, required impulsive candles with a body of at least 20 pips, and used an ATR filter threshold of 30 pips. A trading signal was validated only when all five technical conditions were met simultaneously: confirmation of the S/D zone, a MACD crossover, an RSI overbought or oversold reading, a price position consistent with Bollinger Bands, and proximity to key Fibonacci retracement levels.

The MQL5 code was compiled in MetaEditor and subjected to initial back testing using the MT5 Strategy Tester to assess historical performance. Evaluation metrics included Total Return, Maximum Drawdown, Win Rate, and Profit Factor. The results indicated that the algorithm was syntactically correct but functionally ineffective, as no trades were executed during the test period. This outcome was attributed to the overly restrictive nature of the parameters and the requirement for complete confluence among all indicators, which collectively prevented any valid trade signals from being generated. Following this stage, the algorithm's logical structure and parameter thresholds were iteratively revised with the assistance of the AI tool to enable proper signal generation and trade execution.

2.3. Adjustments and Optimization

Following the inoperability of the initial code, the study continued with an optimization phase designed to evaluate how parameter adjustments influenced both performance and stability. Two main scenarios were developed to test the effects of fine-tuning and structural simplification within the algorithm.

The first scenario focused on enhancing signal frequency while preserving stability through multiple indicator checks. The analysis window was significantly expanded from 20 to 200 H1 bars, while the minimum impulsive candle size was reduced from 20 to 10 pips. A dedicated data structure was introduced to track up to one hundred simultaneous Supply and Demand zones, marking those that successfully triggered a breakout. The secondary indicators (MACD, RSI, Bollinger Bands, and Fibonacci levels) were retained not as active decision-making tools but as passive filters. Their purpose was to introduce a mandatory delay, requiring the EA to wait until indicator memory had stabilized, thereby eliminating a considerable number of false signals generated by short-term market fluctuations immediately after the closure of an H1 candle. Stop-Loss and Take-Profit levels were redefined as exact multiples of the Average True Range, with the Stop-Loss set at one ATR and the Take-Profit at two ATRs relative to the zone boundaries.

The second scenario aimed to test the impact of simplifying the model and reducing computational complexity. All secondary indicators were removed, leaving the strategy dependent solely on the core Supply and Demand logic, the ATR-based volatility filter, the time filter, and the one-percent risk rule. This approach sought to reduce memory consumption and execution time, assessing whether the fundamental S/D structure, without auxiliary confirmations, could achieve higher gross profitability even at the cost of reduced control over risk exposure.

The study then utilized back testing results from both optimization scenarios across various symbols (USDJPY, GBPUSD, EURUSD, GER40, US30) to facilitate a detailed comparison of their performance profiles, particularly focusing on the crucial effect optimization has on risk-adjusted profitability.

3. PRESENTING THE RESEARCH FINDINGS

The findings are categorized based on the two distinct optimization approaches implemented: Scenario 1, which prioritized stability and multi-indicator filtering, and Scenario 2, which prioritized gross profit through simplification.

Table no. 1 – Results Summary

Symbol & algorithm version	Net Return (USD)	Win Rate (%)	Maximum drawdown (%)	Sharpe Ratio	Average Return/Transaction	Average Loss/Transaction
USDJPY Scenario 1	5.310,62	41,40	11,58	3,30	235,79 USD	117,85 USD
GBPUSD Scenario 1	1.064,29	36,43	14,41	1,21	200,14 USD	101,74 USD
EURUSD Scenario 1	87,17	33,88	23,92	0,07	204,35 USD	103,99 USD
GER40 Scenario 1	1.757,44	50,00	5,57	6,99	248,01 USD	130,85 USD
US30 Scenario 1	977,71	50,00	4,72	6,49	196,95 USD	99,18 USD
USDJPY Scenario 2	64.670,39	36,99	45,32	0,76	571,57 USD	303,18 USD
GER40 Scenario 2	8.920,49	34,78	80,20	0,26	392,62 USD	205,18 USD

Source: Author's processing

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3.1. Scenario 1

The strategy demonstrated superior performance on the USD/JPY currency pair, generating a net profit of $5,310.62 from an initial $10,000 capital over five years, corresponding to a cumulative gain of 53.1%. Although the Win Rate was 41.4%, below the 50% threshold, the average profit per winning transaction (236 pips) was almost double the average loss (118 pips), confirming the effectiveness of the 1:2 risk-reward setup. Crucially, the Maximum Drawdown (MDD) remained controlled at 11.58%(Balance) and 12.68%(Equity), which is considered acceptable for investors with average risk tolerance, typically defined as under 15%. The Sharpe Ratio achieved an optimal value of 3.30, significantly exceeding the benchmark of 2, indicating high risk-adjusted returns and stability. The frequency was moderate, with 186 executed transactions.

Performance on the GBP/USD pair yielded a limited net profit of $1,064.29 over five years (10% cumulative). The Profit Factor (1.13) confirmed that gross gains exceeded gross losses, sustained by a win rate of 36.43% where the average win (200.14 pips) was nearly double the average loss (101.74 pips). The Maximum Drawdown, at 14.41%, positioned the strategy at the threshold of medium risk tolerance. The Sharpe Ratio of 1.21 suggested a reasonable, but not exceptional, reward for the risk assumed.

The strategy struggled significantly on the EUR/USD pair, achieving a net profit of only $87.17, translating to less than growth. The Profit Factor (1.01) showed virtually no margin of safety. The Maximum Drawdown reached 23.92%(Balance) and 25.45%(Equity), surpassing the conventional tolerance threshold for retail investors. Consequently, the Sharpe Ratio was negligible at 0.07, indicating that the risk assumed was barely compensated by the return generated.

The strategy exhibited exceptionally high risk-adjusted performance on the GER40 index CFD. It generated a cumulative return of approximately over 17% five years, with an extremely low Maximum Drawdown of 5.57% (Balance). The 50% Win Rate, combined with a 1.89 average win/loss ratio, demonstrated high signal quality. Most notably, the Sharpe Ratio reached 6.99, signaling an exceptional return relative to the portfolio's volatility. The frequency was extremely low, with only 30 trades in five years.

The US30 index mirrored the high-quality performance of the GER40. It achieved a cumulative return of nearly with a minimal Drawdown of 4.72%. The Profit Factor was sustained by a Win Rate and a 2:1 average win/loss ratio. The Sharpe Ratio was robust at 6.49, confirming a top-tier risk-adjusted performance profile.

3.2. Scenario 2

Scenario 2 was a simplified iteration designed to test the impact of eliminating the stability filters. All secondary indicators (MACD, RSI, Bollinger Bands, Fibonacci) were removed, leaving only the core Supply/Demand logic, the ATR volatility filter, and the time filter.

The strategy generated a significantly high net profit of approximately $64,670.39. However, this result was achieved at the cost of extreme capital volatility: the Maximum Drawdown reached 45.32%. The trading frequency increased drastically to over 600 orders per year. The gross profit was assured by a strong average win/loss ratio (2:1), but the frequency of losses magnified the exposure. The performance adjusted for risk was poor, reflected by a Sharpe Ratio of 0.76.

On the GER40 index, Scenario 2 generated a net profit of $8,920.49, but the simplicity led to severe vulnerability. The number of orders surged to 3,243 over five years, increasing transaction costs and exposure. Most critically, the relative Maximum Drawdown reached 80.20% (both Balance and Equity), exceeding typical retail tolerance levels by a wide margin. The Sharpe Ratio was 0.26, indicating that the small supplementary return barely exceeded the volatility experienced by the account.

The optimization process and comparative analysis clarified the influence of parameter calibration and indicator integration on overall performance. The strategy demonstrated superior risk-adjusted results on Index CFDs (GER40 and US30), where Sharpe Ratios approached 7 and Drawdowns remained below 6%. These instruments benefited from impulsive market behavior on the H1 timeframe, producing cleaner and more efficient Take-Profit executions compared to the noisier currency pairs such as EURUSD.

The comparison between the two optimization scenarios confirmed that precise parameter tuning is essential for maintaining a favorable balance between profitability and risk. The simplified approach in Scenario 2, which removed indicator-based filters, increased nominal profits but caused extreme volatility and Drawdowns exceeding 45%, resulting in statistically inefficient outcomes. In contrast, Scenario 1 achieved moderate but stable profitability, characterized by controlled Drawdowns and Sharpe Ratios near 7.

Overall, the findings highlight that effective algorithmic implementation, particularly when using AI-generated code, relies not on maximizing gross profit but on disciplined optimization and parameter calibration within the MT5 environment to ensure consistent risk-adjusted performance.

4. CONCLUSIONS

The research confirms the practical feasibility of constructing and optimizing an Expert Advisor through accessible AI-assisted tools within the MetaTrader 5 environment. The transformation of the AI-generated prototype into a profitable and risk-controlled system demonstrates that individual investors can design functional algorithmic strategies without requiring advanced programming expertise, provided the process is guided by disciplined parameter calibration.

The results emphasize that optimization plays a decisive role in determining risk-adjusted profitability. Fine-tuning parameters such as lookback length and impulsive candle thresholds, together with the inclusion of passive technical filters, significantly enhanced stability and Sharpe Ratios, particularly in index-based trading. Conversely, excessive simplification of the algorithm increased nominal profit but led to uncontrolled risk exposure, confirming that consistent returns in retail algorithmic trading depend on precision rather than aggressiveness.

Several limitations were identified during the study. The EA's performance remains sensitive to the quality and representativeness of the historical data used for backtesting, as discrepancies between simulated and live market conditions may distort statistical outcomes. Moreover, the current approach is strictly technical and lacks integration with external information sources such as financial news or sentiment data, which could improve adaptability during volatile events. Finally, reliance on a general-purpose AI model introduces variability in code efficiency, suggesting that specialized programming assistants could yield superior structural accuracy.

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Future research should focus on integrating dedicated AI programming agents capable of autonomously refining code and parameter settings, thereby reducing development time and improving reproducibility. Another promising direction involves incorporating external data streams like macroeconomic indicators, news analytics, and sentiment signals, to enhance the algorithm's contextual awareness and resilience in dynamic markets.

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