

The Utility of Technical Indicators in LSTM-Based Stock Market Prediction

CONTEXT

The stock market is notoriously noisy and heavily affected by real-world events, making stock price behavior **challenging to predict**.

Traditionally, algorithmic traders rely heavily on **technical indicators** (such as moving averages and momentum oscillators) to capture market trends.

However, one could reason that deep learning architectures might implicitly learn these exact indicators purely from training on raw stock market data. It is a topic of ongoing discussion and research whether it is **beneficial** or **redundant** to use technical indicators alongside raw stock data for predictions.^[1]

THE QUESTION

Do **technical indicators** improve price movement prediction compared to training on **raw OHLCV data** alone?

PROCEDURE

Model Architecture

- We use a two-layer stacked **Long Short-Term Memory (LSTM)** neural network.

Time Window Format

- Input** $[N \times 30 \times F]$ is structured as a time window of fixed length (30 trading days). The input shape is (samples x time steps x features).
- Output** $[N \times 3]$ is a probabilistic label prediction determined by the **Triple Barrier Method (TBM)**^[3]. Predicts which barrier will be touched first:

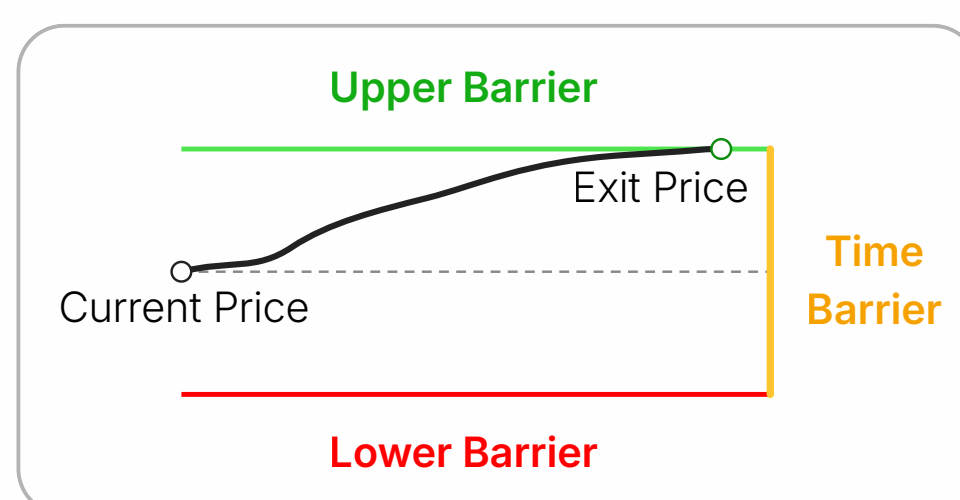


Figure 1. Visual representation of the three barriers

Three Branches with Different Inputs

- B1: **Raw OHLCV only (5 feat.)**
- B2: **Technical Indicators only (13 feat.)**
- B3: **OHLCV + Indicators (18 feat.)**

DATA SOURCE

Daily historical OHLCV data (2014-2024) fetched via the **yfinance** library across three asset classes:

- Equities: **SPY, AAPL, MSFT**
- Cryptocurrency: **BTC-USD, ETH-USD**
- Foreign Exchange (FX): **EUR/USD, GBP/USD** futures

Raw Features

Stationary-transformed and normalized before input

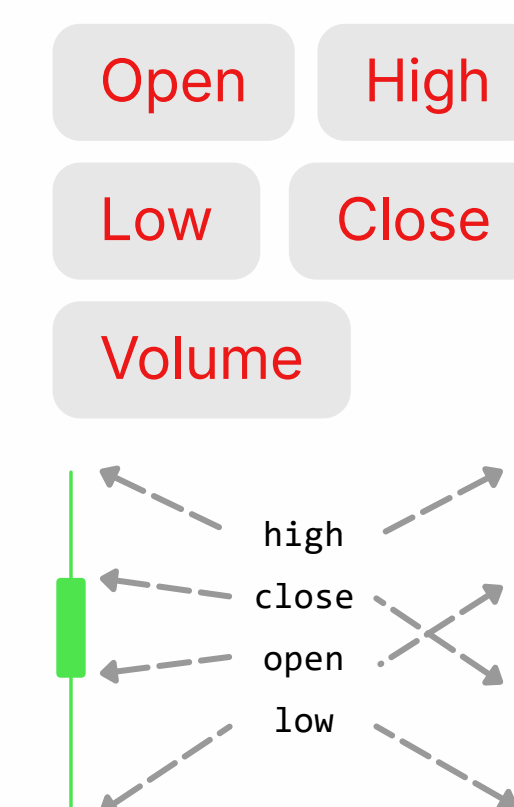


Figure 2. Candlestick Representation of OHLC

Engineered Features

Directly calculated from OHLCV data using the **ta** library.

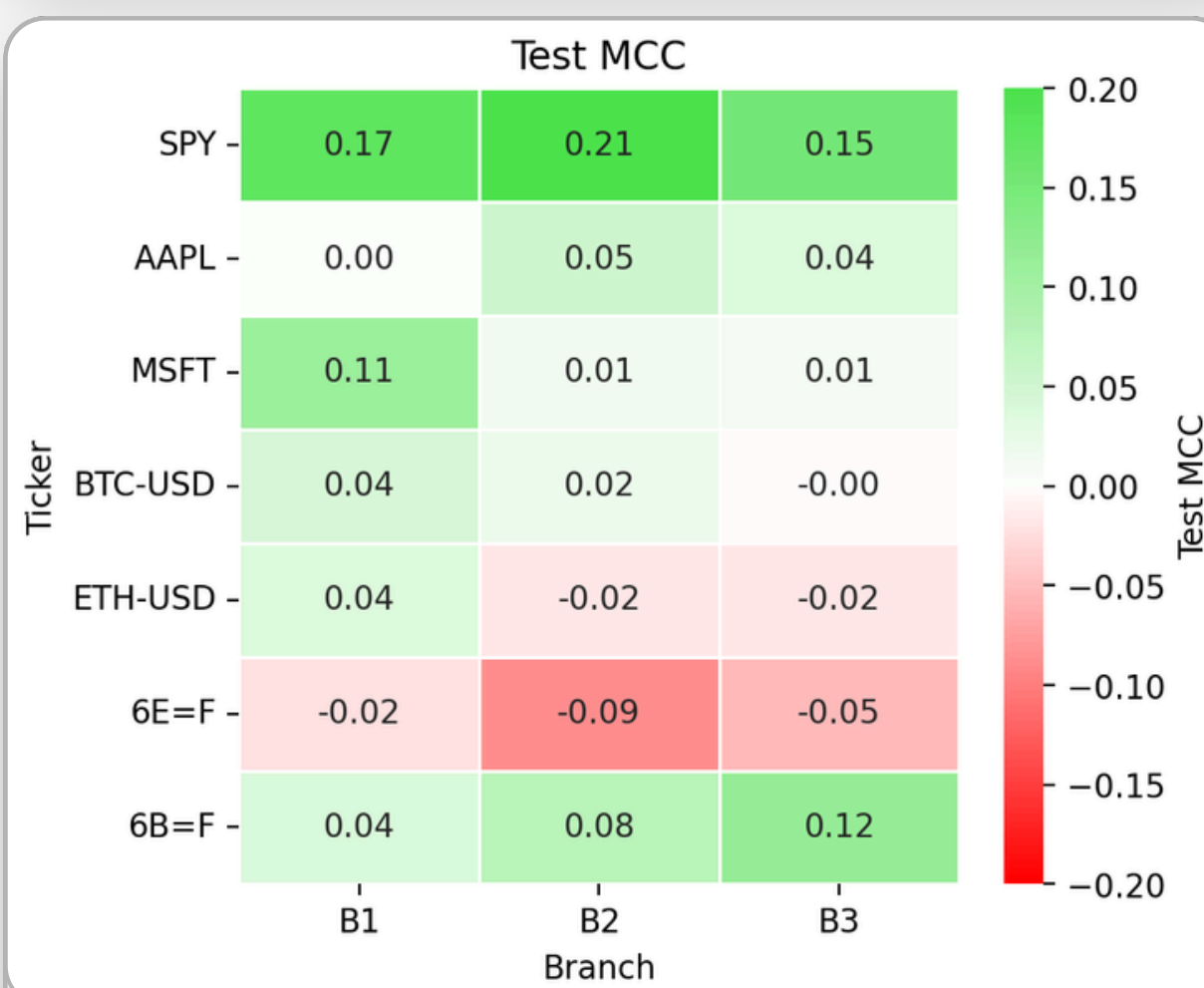


Figure 3. Performance Comparison of Input Branches Across Tickers

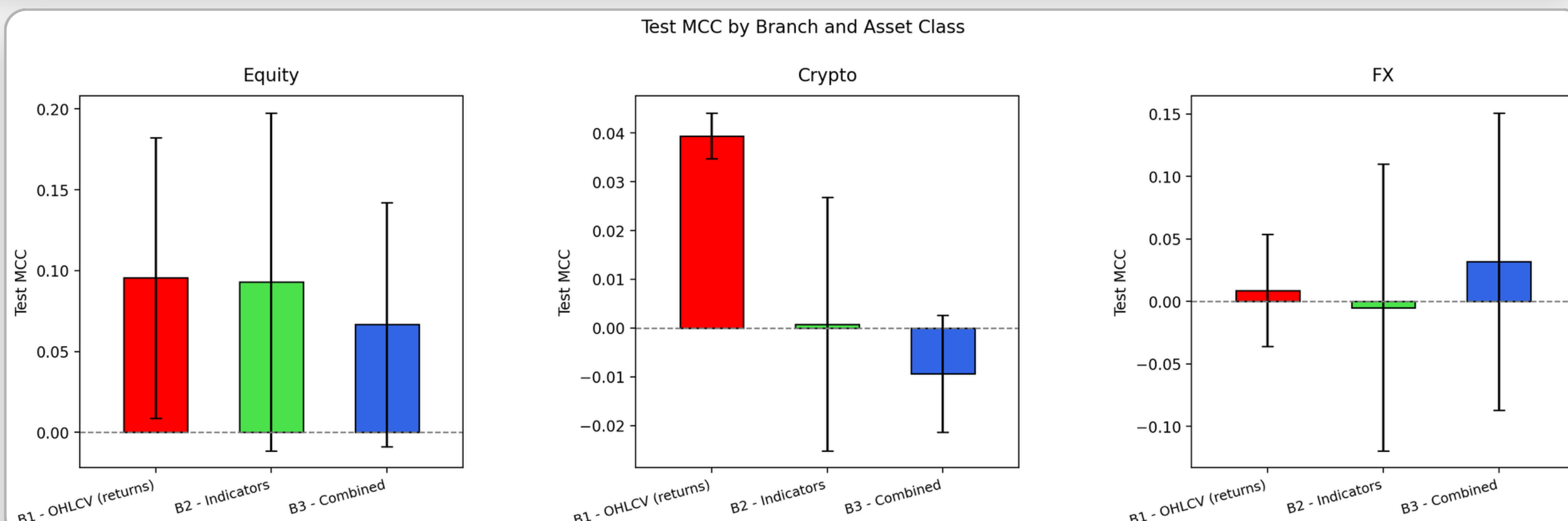


Figure 4. MCC Distribution Across Ablation Branches by Market Regime

RESULTS

Test MCC: Multiclass Matthews Correlation on 3-class TBM labels (Down / Neutral / Up), computed from the full confusion matrix.

- MCC = 1:** always right
- MCC = 0:** no association (same as guessing with no input)
- MCC = -1:** always wrong

REFERENCES

- [1] Sohit Agarwal, R. M. D. . "LSTM Deep Learning Based Stock Price Prediction with Bollinger Band, RSI, MACD, and OHLC Features and OHLC Features". *International Journal of Intelligent Systems and Applications in Engineering*, vol. 12, no. 3, Mar. 2024, pp. 1169-76
- [2] Saidd, N. "Do Technical Indicators Improve Deep Learning Forecasts? An Empirical Ablation Study Across Asset Classes." *Preprints* 2026
- [3] López de Prado, Marcos. *Advances in Financial Machine Learning*. John Wiley & Sons, 2018
- [4] Araci, Dogu. "FinBERT: Financial Sentiment Analysis with Pre-trained Language Models." *arXiv*, 2019

ANALYSIS

B3 vs B1: Do indicators add value?

Evidence suggests **no**.

- B3 - B1 = **-0.03** (equity), **-0.05** (crypto), **+0.02** (FX). The LSTM extracts equivalent signal from raw returns.
- FX is the only category where a feature-augmented branch (B3, **+0.032**) beats raw OHLCV, but not statistically significant.
- Only 3 of 21 McNemar tests were significant ($\alpha = 0.05$), and all favored raw inputs.

B2 vs. B1: Indicators vs. OHLCV

- B2 ≤ B1** in all three categories. Stripping the raw return series may lose important information indicators don't fully recover.

CONCLUSION

- Explicit technical indicators **do not** improve LSTM directional prediction over raw stationary OHLCV.
- The absolute skill was low (MCC $\approx$ 0-0.2) highlighting how **difficult** it is to predict market movements.

FUTURE WORK

- Sentiment:** Test whether adding non-price features (news headline sentiments, encodable by transformers such as **FinBERT**^[4]) could increase usefulness of derived technical indicators or outperform OHLCV models without the need for any historical price information