Integration of Technical Indicator-Based Stock Price Prediction with Algorithmic Trading

Evidence from Selected Indian Textile Sector Stocks

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Abstract

Purpose:

This study aims to integrate technical indicator-based stock price prediction methods with algorithmic trading strategies and evaluate their comparative performance in the Indian equity market.

Design/Methodology/Approach:

A quantitative research design was adopted using historical daily stock data from January 2023 to March 2024. Three textile sector stocks—Arvind Limited (ARVIND.NS), Vardhman Textiles Limited (VTL.NS), and K.P.R. Mill Limited (Indian textile company)□ (KPRMILL.NS)—were selected. Three strategies were implemented: Central Pivot Range (CPR), Moving Average Convergence Divergence (MACD), and a hybrid CPR+MACD strategy. Back testing was conducted using Python-based analytical tools. Performance was evaluated using net profit, win rate, total trades, and maximum drawdown.

Findings:

Results indicate that while CPR generated higher trade frequency and MACD captured momentum effectively, the hybrid CPR+MACD strategy achieved superior win rates and more consistent profitability with relatively lower drawdowns.

Practical Implications:
The findings provide a systematic, emotion-free trading framework for retail and institutional traders operating in emerging markets.

Originality/Value:
Unlike prior research predominantly focused on deep learning models, this study contributes by empirically comparing classical technical indicators within a structured algorithmic framework in a sector-specific Indian context.

Keywords: Algorithmic trading, Stock price prediction, Central Pivot Range (CPR), MACD, Back testing, Indian stock market, Technical analysis

1. Introduction

The rapid evolution of algorithmic trading has transformed financial markets by enabling rule-based, high-speed trade execution. Traditional discretionary trading approaches are often influenced by emotional biases and inefficiencies. Integrating predictive indicators into automated frameworks provides a structured approach to market participation.

Technical indicators such as CPR and MACD remain widely used due to their simplicity and interpretability. CPR identifies key support-resistance zones using prior price data, whereas MACD captures trend momentum through exponential moving averages. This study evaluates whether integrating these indicators improves trading performance in selected Indian textile sector stocks.

2. Literature Review

Recent literature (2021–2024) highlights five dominant research streams:

2.1 Deep Learning-Based Forecasting

LSTM, GRU, CNN-auto encoders, and hybrid Transformer-based models have demonstrated strong capability in modeling sequential stock data and capturing nonlinear dependencies.

2.2 Candlestick Pattern Encoding

Pattern-based models improve interpretability by transforming candlestick formations into structured inputs for machine learning algorithms.

2.3 Metaheuristic Optimization

Optimization techniques such as Sparrow Search Algorithm (SSA) and Artificial Rabbits Optimization (ARO) enhance neural network parameter tuning and forecasting accuracy.

2.4 MACD and Indicator-Based Systems

Studies show that MACD performance improves when combined with RSI, Bollinger Bands, or optimized parameters rather than default configurations (12, 26, 9). However, standalone MACD strategies may underperform in sideways markets.

2.5 Infrastructure and Risk-Aware Models

Research emphasizes execution efficiency, latency management, sentiment integration, and volatility-aware modeling.

Research Gap:
Although deep learning approaches dominate current research, limited empirical work compares classical technical indicators like CPR and MACD within a systematic backtesting framework in emerging markets and sector-specific contexts.

3. Research Methodology

3.1 Research Design

This study adopts a quantitative analytical design using historical daily price data.

3.2 Sample Selection

Three textile sector companies were selected to ensure sectoral consistency while capturing varied volatility patterns:

- Arvind Limited (ARVIND.NS)
- Vardhman Textiles Limited (VTL.NS)

- K.P.R. Mill Limited (KPRMILL.NS)

3.3 Data Collection

Daily OHLCV data were collected using the *finance* Python library from January 2023 to March 2024.

3.4 Tools and Implementation

The study utilized:

- Python
- pandas
- pandas_ta
- matplotlib
- Custom back testing scripts

3.5 Strategy Formulation

3.5.1 CPR Strategy

- Buy: Price > TC
- Sell: Price < BC

3.5.2 MACD Strategy

- Buy: MACD bullish crossover
- Sell: MACD bearish crossover

3.5.3 Hybrid CPR + MACD

- Long: Price > TC + MACD bullish crossover
- Short: Price < BC + MACD bearish crossover

3.6 Performance Metrics

- Net Profit (₹)

- Total Trades
- Win Rate (%)
- Maximum Drawdown (₹)

Initial capital per trade: ₹10,000.

4. Results

4.1 CPR Strategy

Stock	Trades	Net Profit (₹)	Win Rate (%)	Max Drawdown (₹)
ARVIND.NS	55	6,391.76	45.45	–515.97
VTL.NS	55	888.89	34.55	–527.06
KPRMILL.NS	59	3,186.88	47.46	–367.93

CPR generated frequent trades with moderate profitability.

4.2 MACD Strategy

Stock	Trades	Net Profit (₹)	Win Rate (%)	Max Drawdown (₹)
ARVIND.NS	11	3,726.20	45.45	–1,006.58
VTL.NS	7	2,170.68	71.43	–136.67
KPRMILL.NS	10	2,611.50	50.00	–505.85

MACD produced fewer but higher-risk trades.

4.3 CPR + MACD Strategy

Stock	Trades	Net Profit (₹)	Win Rate (%)	Max Drawdown (₹)
ARVIND.NS	7	3,487.00	71.43	–592.44
VTL.NS	6	2,721.10	83.33	–119.42
KPRMILL.NS	7	3,176.46	57.14	–144.44

The hybrid strategy demonstrated:

- Highest win rate (83.33% for VTL.NS)
- Lower drawdowns relative to standalone MACD
- Consistent profitability across stocks

5. Discussion

The CPR strategy performed well in trending conditions but generated false signals during consolidation. MACD effectively captured momentum but suffered from lag-induced drawdowns.

The hybrid CPR+MACD approach reduced false breakouts by combining price-level confirmation with trend validation. This improved signal quality and risk-adjusted returns.

Sectoral analysis indicates that relatively stable stocks (e.g., VTL.NS) responded better to the hybrid approach, while volatile stocks (e.g., ARVIND.NS) produced higher raw profits under CPR alone.

6. Conclusion

This study demonstrates that integrating CPR and MACD within an algorithmic framework enhances trading consistency and reduces emotional bias. Among the tested approaches, the hybrid CPR+MACD strategy provides the most balanced performance in terms of profitability, accuracy, and drawdown control.

The results support the viability of structured technical indicator integration for systematic trading in emerging markets such as India.

7. Limitations and Future Research

Limitations:

- Limited to three stocks
- Daily timeframe only
- No transaction cost modeling
- No machine learning integration

Future Scope:

- Multi-sector portfolio analysis
- Inclusion of transaction costs and slippage
- Integration with sentiment analysis
- Real-time automated deployment
- Risk-adjusted metrics such as Sharpe and Sortino ratios

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Abbreviation	**Full Form**
AI	Artificial Intelligence
AT	Algorithmic Trading
BC	Bottom Central Pivot
CNN	Convolutional Neural Network
CPR	Central Pivot Range
DPP	Deep Predictor for Price Movement
EMA	Exponential Moving Average
GRU	Gated Recurrent Unit
LSTM	Long Short-Term Memory
MACD	Moving Average Convergence Divergence
MFI	Money Flow Index
ML	Machine Learning
MLP	Multi-Layer Perceptron
OHLCV	Open, High, Low, Close, Volume
P	Pivot Point
RSI	Relative Strength Index
SAR	Stop and Reverse
SSA	Sparrow Search Algorithm
TC	Top Central Pivot
VPVMA	Volume-Price Volatility Moving Average
VTL.NS	Vardhman Textiles Limited (NSE Ticker)
KPRMILL.NS	K.P.R. Mill Limited (NSE Ticker)
ARVIND.NS	Arvind Limited (NSE Ticker)
yfinance	Yahoo Finance Python Library