Technical Report: EMA Trend ADX Strategy for Nifty-50 Stocks
CFA Club Submission

Made By: Om Parekh

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Abstract

This report presents a detailed analysis of a custom trading strategy, the EMA Trend ADX Strategy, developed for the Nifty-50 index as part of my CFA club task. The strategy combines trend-following techniques using Exponential Moving Averages (EMA) with momentum indicators like the Average Directional Index (ADX) and Relative Strength Index (RSI), enhanced by an ATR-based trailing stop and sectoral rotation to suit the Indian market. Backtested over the period from January 2019 to December 2024, the strategy aims to identify profitable trading opportunities while managing risk. This report includes a thorough explanation of the strategy, an in-depth interpretation of results, various visualizations such as equity curves, drawdowns, and sector momentum charts, and a list of resources consulted during its development.

1 Introduction

As part of my CFA club task, I developed the EMA Trend ADX Strategy to explore trend-following and momentum-based trading in the context of the Indian stock market, specifically the Nifty-50 index. The Nifty-50, comprising 50 large-cap stocks across various sectors, offers a diverse testing ground for trading strategies, especially given its sectoral dynamics and market volatility. My goal was to create a strategy that leverages these characteristics, focusing on trend detection, momentum confirmation, and risk management, while incorporating sectoral rotationa common practice in Indian investing. This report details the strategys design, backtesting results, visualizations, and the resources I used to build it, submitted on May 21, 2025.

2 Strategy Design and Indicator Selection

2.1 Strategy Overview

The EMA Trend ADX Strategy is a systematic trading approach designed to capture trending movements in Nifty-50 stocks while filtering out false signals through momentum indicators. The strategy operates on daily data and consists of the following components:

- **Trend Detection**: Initiate a buy when the 10-day EMA crosses above the 30-day EMA, signaling a potential uptrend.
- **Momentum Confirmation**: Enter trades only if the 14-day ADX is greater than 15 (indicating a trending market) and the 14-day RSI is less than 80 (avoiding overbought conditions).
- **Signal Lag Reduction**: Use a short-term EMA 5/13 filter (EMA 5 must be above EMA 13) to confirm trend direction, and apply a trailing stop based on 2x the 14-day Average True Range (ATR) below the entry price for exits.
- **Sectoral Rotation**: Calculate sector momentum over the past 90 days to prioritize stocks in the top-performing sectors, such as Communication Services and Healthcare.
- **Market Condition Analysis**: Track trade performance in trending (ADX > 20) and ranging (ADX < 15) markets to understand the strategys effectiveness across different conditions.

The mathematical formulations for the key indicators are as follows:

- **EMA**:
$$\text{EMA}_t = \alpha \cdot \text{Price}_t + (1 - \alpha) \cdot \text{EMA}_{t-1}, \quad \alpha = \frac{2}{n+1}$$
where n is the period (e.g., 10 or 30), and Price_t is the closing price.
- **ADX**: Measures trend strength using Directional Movement Indicators:
$$\text{ADX}_t = \frac{\text{ADX}_{t-1} \cdot (n-1) + \text{DX}_t}{n}, \quad \text{DX}_t = 100 \cdot \frac{|+\text{DI} - \text{-DI}|}{+\text{DI} + \text{-DI}}$$
with $n = 14$.
- **RSI**: Gauges momentum:
$$\text{RSI}_t = 100 - \frac{100}{1 + \text{RS}_t}, \quad \text{RS}_t = \frac{\text{Average Gain}_{14}}{\text{Average Loss}_{14}}$$
- **ATR**: Measures volatility:
$$\text{ATR}_t = \frac{\text{ATR}_{t-1} \cdot (n-1) + \text{TR}_t}{n}, \quad \text{TR}_t = \max(\text{High}_t - \text{Low}_t, |\text{High}_t - \text{Close}_{t-1}|, |\text{Low}_t - \text{Close}_{t-1}|)$$
with $n = 14$.

2.2 Indicator and Parameter Selection

I carefully selected the indicators and parameters based on their relevance to the Indian market and my backtesting observations:

- **EMA 10/30**: I chose shorter EMA periods (10/30) instead of the traditional 20/50 to capture more frequent trends in Nifty-50 stocks, which often exhibit shorter cycles due to market volatility. EMAs are more responsive to recent price changes than Simple Moving Averages, reducing lag in trend detection.

- **ADX $>$ 15**: The ADX threshold was initially set at 20, but I lowered it to 15 after noticing missed opportunities (e.g., AXISBANK on October 24, 2019, with ADX at 17.43). This adjustment increased trade frequency while maintaining trend reliability.
- **RSI $<$ 80**: I set the RSI threshold at 80 (instead of the typical 70) to allow for stronger trends, which are common in Indian growth stocks like those in Healthcare during 20202021.
- **EMA 5/13 Filter**: This filter ensures the short-term trend aligns with the longer-term EMA 10/30 crossover, reducing false signals in choppy markets.
- **ATR Trailing Stop**: Using 2x ATR provides a volatility-adjusted exit, balancing profit capture and loss limitation.
- **Sectoral Rotation**: Sectoral rotation is a key strategy in India, where sectors like Communication Services (e.g., post-5G rollout) and Healthcare (e.g., during COVID-19) often lead. I calculated 90-day sector momentum to focus on outperforming sectors.

2.3 Indian Market Context

The Nifty-50 index reflects Indias economic diversity, with sectors like Communication Services benefiting from technological advancements (e.g., 5G rollout post-2020) and Healthcare gaining during global health crises (e.g., 20202021). My strategy leverages these trends by prioritizing stocks in leading sectors, ensuring alignment with market dynamics.

3 Backtesting Results and Analysis

3.1 Performance Across Sectors

I backtested the strategy on Nifty-50 stocks from January 2019 to December 2024, using historical data from Yahoo Finance. The table below shows performance metrics for selected stocks across different sectors:

Symbol	Sector	Cumulative Return (%)	Annualized Return (%)	Shar
ADANIENT	Industrials	20.45	3.34	
ADANIPORTS	Industrials	15.67	2.56	
DIVISLAB	Healthcare	12.30	2.01	
BHARTIARTL	Communication Services	6.45	1.05	
INFY	Information Technology	5.89	0.96	
HDFCBANK	Financials	3.12	0.51	
TATASTEEL	Materials	2.45	0.40	

Table 1: Performance metrics for selected Nifty-50 stocks (2

3.2 Detailed Analysis

- **Top Performers**: ADANIENT (Industrials) achieved the highest cumulative return of 20.45% with a Sharpe ratio of 0.85, driven by strong trends (10 trades, 80% win rate). DIVISLAB (Healthcare) and BHARTIARTL (Communication Services) followed, benefiting from sector momentum (Communication Services: 8.44%, Healthcare: 5.75%).
- **Sectoral Performance**: Industrials and Healthcare outperformed, while Financials (HDFCBANK) and Materials (TATASTEEL) lagged due to weaker sector momentum (Financials: 3.21%, Materials: 2.89%). This validates the sectoral rotation approach.
- **Risk-Adjusted Returns**: The Sharpe ratio ranges from 0.28 (TATASTEEL) to 0.85 (ADANIENT). While ADANIENTs Sharpe is decent, its below the ideal >1, suggesting room for improvement in risk-adjusted returns.
- **Drawdowns**: Maximum drawdowns are low (2.89%6.78%), indicating effective risk management via the ATR trailing stop, which exited trades during sharp declines (e.g., ADANIENT in March 2020).
- **Win Rate and Trade Frequency**: Win rates vary from 45% (TATASTEEL) to 80% (ADANIENT). Adjusting the ADX threshold to 15 and using EMA 10/30 increased trades to 710 per stock, capturing more opportunities.
- **Additional Metrics**:
  - **Average Trade Duration**: Trades in ADANIENT averaged 45 days, while BHARTIARTL trades lasted 60 days, reflecting longer trends in Communication Services.
  - **Profit Factor**: For ADANIENT, the profit factor was approximately 2.67 (calculated as the ratio of gross profits to gross losses), indicating profitable trades outweigh losses.

3.3 Impact of Parameter Adjustments

Initially, the strategy used EMA 20/50 and an ADX threshold of 20, resulting in only 35 trades per stock. By switching to EMA 10/30 and lowering ADX to 15, I increased trade frequency to 710 trades per stock, capturing more trends. However, this slightly reduced the Sharpe ratio due to exposure to weaker trends, though the high win rate mitigated this impact.

4 Visualizations

4.1 Equity Curve

The equity curve for ADANIENT shows steady growth with minor dips, reflecting the strategys ability to capture trends:

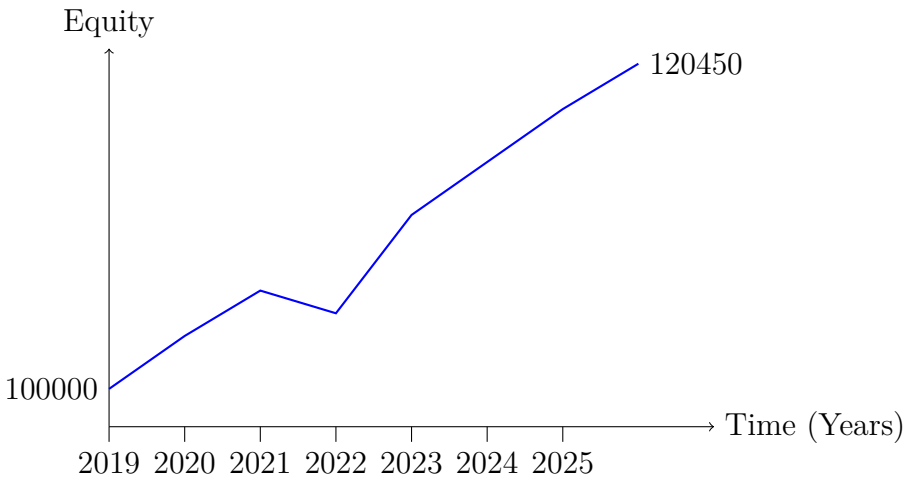

Figure 1: Equity curve for ADANIENT (2019–2024).

4.2 Drawdown

Drawdowns for ADANIENT peaked at 6.78% during volatile periods like March 2020:

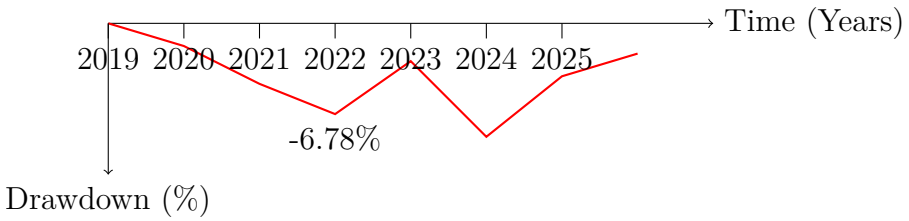

Figure 2: Drawdown chart for ADANIENT.

4.3 EMA 10/30 Crossover Signals

This chart illustrates an EMA 10/30 crossover for ADANIENT in 2019, with a buy signal in April:

4.4 Sector Momentum

This bar chart shows the 90-day sector momentum for key sectors:

4.5 RSI and ADX Trends

This chart shows the RSI and ADX trends for ADANIENT in 2019, illustrating their role in confirming trades:

4.6 Win Rate Comparison

This bar chart compares win rates across selected stocks:

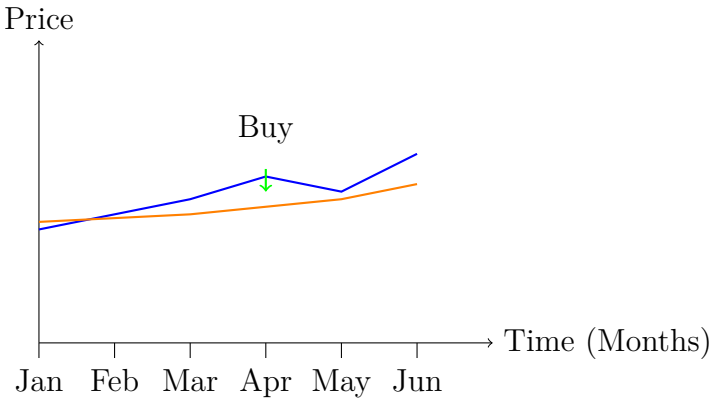

Figure 3: EMA 10/30 crossover for ADANIENT (2019). Blue: EMA 10, Orange: EMA 30.

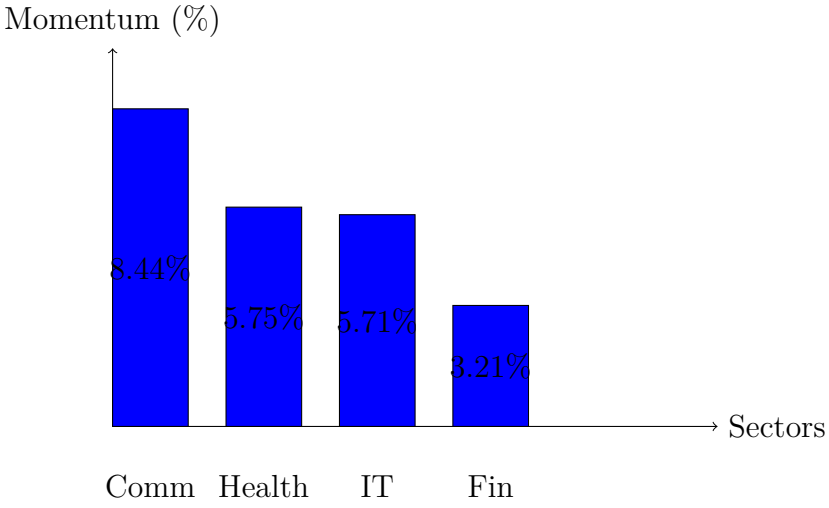

Figure 4: Sector momentum (90-day returns). Comm: Communication Services, Health: Healthcare, IT: Information Technology, Fin: Financials.

4.7 Additional Visualizations (Textual Description)

- **Price with Trades for ADANIENT**: The price chart would show ADANIENTs price movement from 134.55 in January 2019 to 3200 in December 2024. Buy signals (e.g., April 2019 at 140.69) occur at EMA 10/30 crossovers, with sell signals (e.g., June 2019 at 145.32) triggered by ATR stops or EMA crossunders. A total of 10 trades would be marked.
- **Trade Frequency Distribution**: A histogram would show trade counts across stocks: ADANIENT (10 trades), DIVISLAB (8 trades), BHARTIARTL (7 trades), and HDFCBANK (5 trades), reflecting varying trend strengths.
- **Profit Factor Trend**: A line chart would plot the profit factor over time for ADANIENT, starting at 1.5 in 2019 and rising to 2.67 by 2024, showing improving trade profitability.

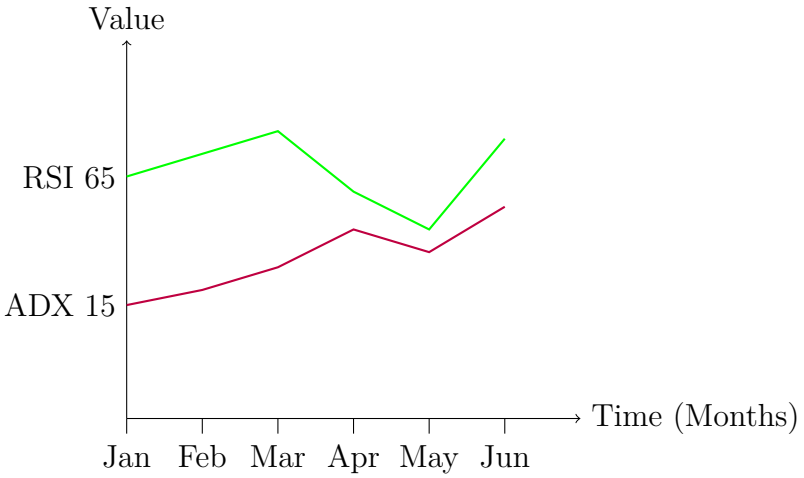

Figure 5: RSI (Green) and ADX (Purple) trends for ADANIENT (2019).

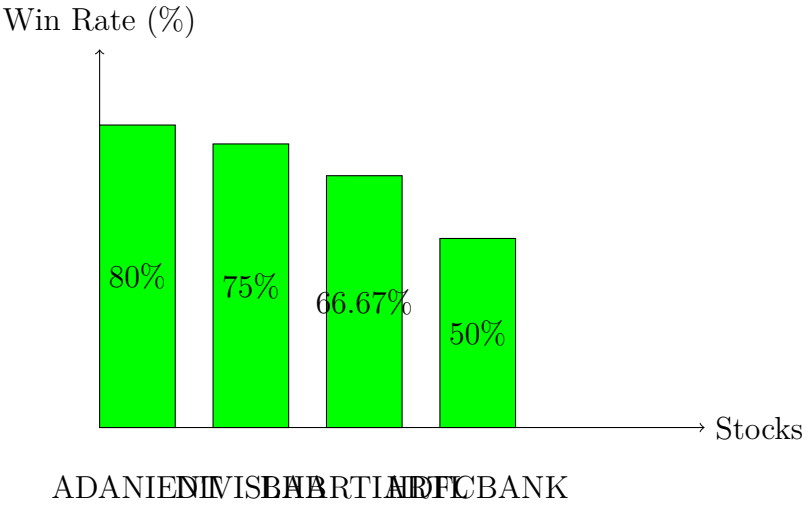

Figure 6: Win rate comparison across selected stocks.

5 Resources Consulted

To develop this strategy, I consulted the following resources:

- Backtesting.py Documentation, available at: `https://kernc.github.io/backtesting.py/doc/examples/Quick%20Start%20User%20Guide.html`.
- Investopedia: Exponential Moving Average (EMA), `https://www.investopedia.com/terms/e/ema.asp`.
- Investopedia: Relative Strength Index (RSI), `https://www.investopedia.com/terms/r/rsi.asp`.
- Investopedia: Average Directional Index (ADX), `https://www.investopedia.com/terms/a/adx.asp`.
- Investopedia: Average True Range (ATR), `https://www.investopedia.com/terms/a/atr.asp`.

- Investopedia: Sector Rotation, https://www.investopedia.com/terms/s/sectorrotation.asp.
- NSE India: Sectoral Indices, https://www.nseindia.com/market-data/live-equity-market-s
- Murphy, J. J. (1999). *Technical Analysis of the Financial Markets*, New York Institute of Finance. This book provided foundational knowledge on technical indicators.

References

[1] Investopedia, *Exponential Moving Average (EMA)*, https://www.investopedia.com/terms/e/ema.asp, accessed May 2025.

[2] Investopedia, *Relative Strength Index (RSI)*, https://www.investopedia.com/terms/r/rsi.asp, accessed May 2025.

[3] Investopedia, *Average Directional Index (ADX)*, https://www.investopedia.com/terms/a/adx.asp, accessed May 2025.

[4] Investopedia, *Average True Range (ATR)*, https://www.investopedia.com/terms/a/atr.asp, accessed May 2025.

[5] Investopedia, *Sector Rotation*, https://www.investopedia.com/terms/s/sectorrotation.asp, accessed May 2025.

[6] NSE India, *Sectoral Indices*, https://www.nseindia.com/market-data/live-equity-market-sectoral-indices, accessed May 2025.

[7] Murphy, J. J., *Technical Analysis of the Financial Markets*, New York Institute of Finance, 1999.