

EXPLORING PROFITABLE OPPORTUNITIES: ANALYSING TECHNICAL INDICATORS COMBINATIONS FOR PROFITABLE TRADING

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Abstract

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This study investigates the effectiveness of three technical indicators, namely Simple moving average (SMA), On-balance volume (OBV), and Commodity channel index (CCI), in identifying profitable trading opportunities. Drawing inspiration from the work of Naved and Srivastava (2015b), this research uses historical price data from 50 undervalued companies in comparison with the returns of NIFTY 50 companies. To assess the long-term feasibility of these indicator combinations, a performance analysis is carried out over 10 years, encompassing a sizable 8,50,209 trades. The analysis focuses on trade count, total return percentage, average profit per trade, and the Sharpe Ratio. The results highlight five indicator combinations that consistently generate more positive returns than negative returns, with fewer trades. The results highlight five indicator combinations consistently generating more positive returns than negative returns, with the best strategy achieving an average return per trade distributed between 0 to 30 percent (50 percent of trades), 30 to 70 percent (25 percent of trades), and less than 25 percent of trades incurring negative returns of up to -10 percent. CCI emerges as the most effective indicator for profitability, followed by OBV and SMA. This research equips market participants with valuable insights for well-informed investment decisions, emphasizing both potential returns and risk management.

Keywords: Equity Trading Strategies, Technical Indicators, Simple Moving Average, On-Balance Volume, Commodity Channel Index, Financial Engineering

Authors' individual contribution: Conceptualization — A.M.H.; Methodology — A.M.H.; Software — A.M.H.; Validation — A.M.H., and V.V.S.K.R.; Formal Analysis — A.M.H., and V.V.S.K.R.; Resources — A.M.H., and V.V.S.K.R.; Writing — A.M.H.; Visualization — A.M.H.; Supervision — V.V.S.K.R.

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1. INTRODUCTION

Financial markets have always fascinated investors and traders with their potential for generating profits. With the advent of advanced technology and the availability of vast amounts of financial data, traders have increasingly relied on technical analysis to make informed decisions. Technical indicators play a crucial role in analyzing historical price and volume data to identify potential trading opportunities. This research paper aims to address the existing literature gap by comparing the effectiveness of various trading strategies based on the combination of technical indicators, specifically the Simple moving average (SMA), On-balance volume (OBV), and Commodity channel index (CCI).

The study draws upon insights from esteemed researchers in the field of technical indicators. The work of Naved and Shrivastava (2015a) on moving averages serves as a foundational reference for this research analysis of the SMA. Chio's (2022) research on the Moving average convergence divergence (MACD) indicator and the contributions of Kuzman et al. (2021) regarding the influence of technical indicators, particularly MACD, inform the methodological approach.

Despite the abundance of technical indicators, traders and investors often struggle to identify which combination of indicators is most effective for optimizing their investment performance. A significant gap exists in comprehensive research that rigorously evaluates different indicator combinations and their long-term impact. The primary objective of this study is to provide valuable insights into the strengths and weaknesses of various indicator combinations and their influence on trading strategies. It addresses the following research questions:

RQ1: How do specific technical indicator combinations, such as SMA, OBV, and CCI, affect financial market trading strategies?

RQ2: What criteria can be used to assess the success of these strategies, and how do they compare across different indicator combinations?

This research assesses trading strategies using criteria like trade count, return (%), average return per trade, and Sharpe ratio. It offers a thorough evaluation of the effectiveness of SMA, OBV, and CCI indicator combinations. The main contributions include guiding traders and investors in selecting and optimizing indicators for profitable trading, as well as providing insights into the pros and cons of various combinations, empowering more strategic and informed trading decisions in financial markets.

The objectives of the study are as follows:

1) Explore combinations of indicators that offer higher profits with fewer trades;

2) Assess market applicability by analyzing selected technical indicators (SMA, OBV, CCI) in the context of NIFTY 50 companies and comparing returns with undervalued companies.

3) Evaluate long-term performance: assess the sustainability and robustness of indicator combinations over 10 years.

The rest of the paper is structured as follows. Section 2 reviews relevant literature, summarizing key findings on technical indicators and trading strategies. Section 3 presents the detailed methodology, including data collection, indicator

selection, and levels. Section 4 offers comprehensive research results, demonstrating the performance of various trading strategies. In Section 5, discussions interpret findings and explore practical implications. Finally, Section 6 provides a conclusive summary, highlighting the study's main contributions and underscoring the importance of considering risk-adjusted returns in evaluating trading strategies.

2. LITERATURE REVIEW

Technical indicators are pivotal in financial markets, offering traders and investors valuable insights into price trends, momentum, and potential market reversals. Numerous studies have investigated the development, application, and assessment of technical indicators. This literature review synthesizes and scrutinizes key works on technical indicators, emphasizing their efficacy, limitations, and applications.

Investor sentiment and market volatility are key factors in shaping risk profiles and trading strategies. Research by So and Lei (2015) explores the intricate relationship between investor sentiment, the volatility index, and trading volume, shedding light on how market sentiment and volatility directly impact trading strategies. The understanding of this interplay is instrumental in assessing the risk and effectiveness of trading strategies when utilizing technical indicators. Pandey (2012) applied the Markowitz model to analyze risk and return in stock portfolios offering a valuable framework for understanding risk within financial markets.

Naved and Shrivastava (2015a) evaluated the performance of various moving averages, including simple, exponential, triangular, variable, and weighted. The results of their study showed that short-term simple moving averages were more profitable with lower drawdown compared to other types. Chio (2022) sought to validate the effectiveness of the MACD indicator. The study revealed that the MACD had a win rate of less than 50%. However, by incorporating trading volume and daily price volatility, the MACD's win rate significantly improved. Kuzman et al. (2021) employed technical and economic analyses, utilizing the adaptive neuro-fuzzy inference system (ANFIS) to guide stock trading decisions. This study highlighted the substantial impact of technical indicators, particularly the MACD, on trading choices. Additionally, the relative change after smoothing the 15-day federal rate emerged as a critical economic indicator.

Fernando (2014) scrutinized the effectiveness of technical trading strategies compared to a buy-and-hold approach, with a focus on forecasting stock prices and generating excess returns in the Colombo Stock Exchange (CSE). Mitra (2011) reported that trading rules based on short-term moving averages were adept at identifying trends but incurred higher transaction costs due to frequent trading. Consequently, minimizing transaction costs is vital for technical traders. The research conducted by Naved and Shrivastava (2015b) concluded that CCI oscillators, in combination with indicators like SMA and relative strength index (RSI), exhibited better profitability. However, the CCI outperformed other indicators, offering higher average profit with fewer trades. Lv et al. (2023) underscored the variability of stock movements among different industries. To address this, the authors proposed a multi-

criteria decision-making process for recommending industry-specific stock trading models. Chandar (2022) introduced a stock trading model called TI-CNN, which integrates technical indicators (TIs) and convolutional neural networks (CNNs).

Bashir and Aslam (2022) examined the influence of input window length and forecast horizon on predictive model performance. In a related context, Ali et al. (2023) presented a smart trading system that incorporated a wide array of technical indicators from leading, lagging, and volatility categories. Furthermore, Pramudya and Ichsan (2020) aimed to identify the most effective indicators, such as MACD, Bollinger Band, and RSI, for generating precise buy and sell signals for the Jakarta Stock Exchange LQ45 Index. Simultaneously, Klados (2013) underscored the enhanced performance achieved through the combination of multiple technical indicators within trading strategies. The research conducted by Metghalchi et al. (2012) observed the predictive power derived from the fusion of technical indicators in the Taiwanese stock market. Additionally, Fajareon and Sornil (2019) introduced a technique for evolving indicator parameters and integrating various technical indicators to develop trading strategies that consistently outperformed other techniques.

Optimal stop-loss strategies are crucial for risk management in trading, enhancing profitability, and minimizing potential losses. Several works shed light on optimal stop-loss strategies. The research of Leung and Zhang (2021) delves into the use of trailing stops in overcoming timing issues in asset buying and selling. According to Lundström (2014), optimal loss-stopping should be incorporated into money management to improve trading profitability, particularly in momentum-based returns. Di Graziano (2014) investigates the development of effective trading stops for algorithmic strategies using position Profit and Loss Statement (P&L) models based on Markov modulated diffusion. Zambelli (2016) meticulously assessed stop-loss criteria on 114 assets. While the approach was generally successful, there were certain weaknesses that indicated the need for additional parameter testing.

Existing research on technical indicators and trading strategies reveals a significant gap. Previous studies have primarily focused on individual indicators or limited combinations, neglecting comprehensive analyses that harness multiple indicators for effective trading strategies. This research addresses this gap by systematically evaluating combinations of technical indicators, specifically SMA, OBV, and CCI, to explore synergies and trade-offs. It provides insights for traders and investors seeking profitable, risk-adjusted trading strategies. The key literature gaps include:

1) Existing research primarily focuses on individual technical indicators or limited combinations. This research fills this gap by analysing a wide range of technical indicator combinations.

2) Previous studies often concentrate on specific markets or sectors. This research expands the scope to include NIFTY 50 firms and assesses returns in comparison to undervalued companies.

3) While some studies explore short-term performance, this research delves into the long-term effectiveness of trading strategies using technical indicators.

3. RESEARCH METHODOLOGY

This study employs a methodology to evaluate trading strategies using technical indicators, specifically SMA, OBV, and CCI, chosen for their practical effectiveness in real-world trading scenarios. These indicators consistently generate fewer but more reliable signals with higher returns. Historical data and simulations provide a comprehensive view of indicator performance under various market conditions, with performance metrics like trade count, total returns, and the Sharpe ratio used to measure strategy success and assess risk-adjusted returns. The research aims to guide traders and investors with evidence-based insights into indicator combinations through rigorous analysis, considering trade count, profit/loss, profit percentage, average profit per trade, and the Sharpe ratio. The methodology also analyses performance measure distribution to identify optimal indicator levels, highlighting the importance of risk-adjusted returns.

This research methodology is grounded in established financial research practices and builds upon previous work by Naved and Srivastava (2015b). It extends and deepens the exploration of CCI, SMA, and OBV, providing valuable insights for traders and investors. This methodology adds to the existing knowledge in this field and offers empirically supported conclusions on the effectiveness of these technical indicators for market participants. Table 1 categorizes the most significant technical indicators, facilitating their comprehension and application within this comprehensive approach to assessing the effectiveness of technical indicators in identifying profitable trading opportunities.

Table 1. Most used technical indicators

<i>Indicator type</i>		<i>Leading/ Lagging</i>
<i>A) Trend indicators — Measure the direction (Bullish/Bearish) and strength</i>		
1.	Moving averages (simple or exponential)	Lagging
2.	Moving average convergence divergence (MACD)	Lagging
3.	Parabolic stop and reverse (Parabolic SAR)	Leading
<i>B) Momentum indicators — Identify the speed of price movement by comparing prices over time. Also used to analyse volume</i>		
4.	Stochastic oscillator	Leading
5.	Commodity channel index (CCI)	Lagging
6.	Relative strength index (RSI)	Leading
<i>C) Volatility indicators — Measure the rate of price movement</i>		
7.	Bollinger bands	Lagging
8.	Average true range (ATR)	Lagging
9.	Standard deviation	Lagging
<i>D) Volume indicators — Measure the strength and direction based on the volume</i>		
10.	Chaikin oscillator	Leading
11.	On-balance volume (OBV)	Leading
12.	Volume rate of change (V-ROC)	Lagging

3.1. Data collection

The aim of data collection is on individual stocks within the NIFTY 50 index of India and selected undervalued companies, rather than stock indices. To assess the indicator's profitability, back-testing is conducted on these two distinct groups. The 50 undervalued companies are chosen from the authors' prior research (Mukund Harsha et al., 2023) using a random forest machine learning algorithm, based on high valuation scores derived from ten years of

fundamental data. The dataset comprises daily stock price data and trading volumes. Trade simulations are executed using Python programming. The initial analysis covers 47 combinations over 365 historic trading days, with further evaluation of the top 5 combinations performed on 10-year historic data involving 100 selected companies.

3.2. Indicator selection

The three chosen technical indicators for this study are SMA, OBV, and CCI. These indicators have proven to be effective in identifying potential trading opportunities. The main motive for selecting the above indicators is due to their reliability in the generation of reliable signals. Leading indicators move alongside the price whereas lagging indicators show a lag in showing the price movement.

3.2.1. Commodity channel index (CCI)

CCI is a leading momentum indicator; it measures the current price level relative to its average over a specified period of time. It indicates the momentum of price movements. Price momentum changes quickly relative to other indicators like trend, volume, and volatility. The default period for calculating the CCI is typically 20 periods, but it can be adjusted to suit different trading strategies and time frames as given in Eq. (1). The CCI indicator comparatively generates few signals. CCI with

specified periods of 20 days, and 9 days when combined with other indicators has resulted in almost zero signals. To increase the signals specified period of 3 days is considered:

$$CCI = \frac{(Typical\ Price - SMA)}{(0.15 \times Mean\ Deviation)} \quad (1)$$

where:

- *Typical Price* is the average of the high, low, and close prices.
- *SMA* is the Simple moving average of the *Typical Prices* over a specified period 'p'.
- *Mean Deviation* is the average deviation of the *Typical Prices* from the *SMA* over 'p'.
- *Specified Period (p)*, a 3-day period, is considered for a shorter rolling window.
- The value 0.015 is a constant multiplier used to ensure that approximately 70–80% of *CCI* values fall between -100 and +100, thereby defining overbought and oversold levels.

3.2.2. On-balance volume (OBV)

OBV is a leading volume indicator used to measure the market's cumulative buying and selling pressure based on trading volume. It helps traders identify the strength of a price trend and potential trend reversals. The OBV is a leading volume indicator given in Eq. (2):

$$OBV = OBV_{prev} + \begin{cases} Volume, if\ close > close_{prev} \\ 0, if\ close = close_{prev} \\ -Volume, if\ close < close_{prev} \end{cases} \quad (2)$$

where:

- OBV_{prev} is the previous value of the On-balance volume.
- *Volume* is the trading volume for the current period.

3.2.3. Simple moving average (SMA)

SMA is a lagging trend indicator employed to recognize price trends and potential support and resistance levels. It computes the average price over a defined period, effectively smoothing out short-term price fluctuations. The study considered two SMAs, namely SMA_{Long} given in Eq. (3), and SMA_{Short} as given in Eq. (4), to identify price trends:

$$SMA_{Long} = \frac{\sum_1^m Closing\ Price}{m} \quad (3)$$

$$SMA_{Short} = \frac{\sum_1^n Closing\ Price}{n} \quad (4)$$

where:

- *m* is a rolling window period for a long moving average (21 days in present work).
- *n* is a rolling window period for a short moving average (9 days in present work).

3.3. Indicator levels

The three chosen technical indicators (CCI, OBV, and SMA) have the following levels.

The CCI levels:

- If the CCI level is above 100, it indicates an uptrend and is coded as '1'.
- If the CCI is between -100 and 100, indicating a trend-neutral state, it is coded as '0.5'.
- If the CCI level is below -100, it indicates a downtrend and is coded as '0'.

The OBV levels:

- Four out of five days with increasing OBV represent an uptrend and are coded as '1'.
- Three out of five days with increasing OBV indicate a trend-neutral state, it is coded as '0.5'.
- Two or fewer days with increasing OBV signal a downtrend and are coded as '0'.

The SMA levels:

- If $SMA_{Short} > SMA_{Long}$ it indicates an uptrend and is coded as '1'.
- If $SMA_{Short} < SMA_{Long}$ it indicates a downtrend and is coded as '0'.

Table 2. List of indicator combinations

No.	Indicator combination	Entry condition		
		CCI	OBV	SMA
1	(CCI Trend = 0.5)	Neutral	NA	NA
2	(SMA Trend = 0)	NA	NA	Downtrend
3	(OBV Trend = 0)	NA	Downtrend	NA
4	(SMA Trend = 1)	NA	NA	Uptrend
5	(OBV Trend = 0.5)	NA	Neutral	NA
6	(OBV Trend = 1)	NA	Uptrend	NA
7	(CCI Trend = 0)	Downtrend	NA	NA
8	(CCI Trend = 1)	Uptrend	NA	NA
9	(CCI Trend = 0.5) & (SMA Trend = 0)	Neutral	NA	Downtrend
10	(CCI Trend = 0.5) & (OBV Trend = 0)	Neutral	Downtrend	NA
11	(OBV Trend = 0) & (SMA Trend = 0)	NA	Downtrend	Downtrend
12	(CCI Trend = 0.5) & (SMA Trend = 1)	Neutral	NA	Uptrend
13	(CCI Trend = 0.5) & (OBV Trend = 0.5)	Neutral	Neutral	NA
14	(OBV Trend = 0) & (SMA Trend = 1)	NA	Downtrend	Uptrend
15	(OBV Trend = 0.5) & (SMA Trend = 1)	NA	Neutral	Uptrend
16	(OBV Trend = 0.5) & (SMA Trend = 0)	NA	Neutral	Downtrend
17	(CCI Trend = 0.5) & (OBV Trend = 1)	Neutral	Uptrend	NA
18	(OBV Trend = 1) & (SMA Trend = 1)	NA	Uptrend	Uptrend
19	(CCI Trend = 0) & (OBV Trend = 0)	Downtrend	Downtrend	NA
20	(OBV Trend = 1) & (SMA Trend = 0)	NA	Uptrend	Downtrend
21	(CCI Trend = 0) & (SMA Trend = 0)	Downtrend	NA	Downtrend
22	(CCI Trend = 1) & (SMA Trend = 1)	Uptrend	NA	Uptrend
23	(CCI Trend = 1) & (SMA Trend = 0)	Uptrend	NA	Downtrend
24	(CCI Trend = 1) & (OBV Trend = 0.5)	Uptrend	Neutral	NA
25	(CCI Trend = 0) & (SMA Trend = 1)	Downtrend	NA	Uptrend
26	(CCI Trend = 1) & (OBV Trend = 1)	Uptrend	Uptrend	NA
27	(CCI Trend = 1) & (OBV Trend = 0)	Uptrend	Downtrend	NA
28	(CCI Trend = 0) & (OBV Trend = 0.5)	Downtrend	Neutral	NA
29	(CCI Trend = 0) & (OBV Trend = 1)	Downtrend	Uptrend	NA
30	(CCI Trend = 0.5) & (OBV Trend = 0) & (SMA Trend = 0)	Neutral	Downtrend	Downtrend
31	(CCI Trend = 0.5) & (OBV Trend = 0) & (SMA Trend = 1)	Neutral	Downtrend	Uptrend
32	(CCI Trend = 0.5) & (OBV Trend = 0.5) & (SMA Trend = 1)	Neutral	Neutral	Uptrend
33	(CCI Trend = 0.5) & (OBV Trend = 0.5) & (SMA Trend = 0)	Neutral	Neutral	Downtrend
34	(CCI Trend = 0.5) & (OBV Trend = 1) & (SMA Trend = 1)	Neutral	Uptrend	Uptrend
35	(CCI Trend = 0.5) & (OBV Trend = 1) & (SMA Trend = 0)	Neutral	Uptrend	Downtrend
36	(CCI Trend = 0) & (OBV Trend = 0) & (SMA Trend = 0)	Downtrend	Downtrend	Downtrend
37	(CCI Trend = 0) & (OBV Trend = 0) & (SMA Trend = 1)	Downtrend	Downtrend	Uptrend
38	(CCI Trend = 1) & (OBV Trend = 0.5) & (SMA Trend = 1)	Uptrend	Neutral	Uptrend
39	(CCI Trend = 1) & (OBV Trend = 1) & (SMA Trend = 1)	Uptrend	Uptrend	Uptrend
40	(CCI Trend = 1) & (OBV Trend = 0.5) & (SMA Trend = 0)	Uptrend	Neutral	Downtrend
41	(CCI Trend = 1) & (OBV Trend = 1) & (SMA Trend = 0)	Uptrend	Uptrend	Downtrend
42	(CCI Trend = 1) & (OBV Trend = 0) & (SMA Trend = 0)	Uptrend	Downtrend	Downtrend
43	(CCI Trend = 1) & (OBV Trend = 0) & (SMA Trend = 1)	Uptrend	Downtrend	Uptrend
44	(CCI Trend = 0) & (OBV Trend = 0.5) & (SMA Trend = 1)	Downtrend	Neutral	Uptrend
45	(CCI Trend = 0) & (OBV Trend = 0.5) & (SMA Trend = 0)	Downtrend	Neutral	Downtrend
46	(CCI Trend = 0) & (OBV Trend = 1) & (SMA Trend = 0)	Downtrend	Uptrend	Downtrend
47	(CCI Trend = 0) & (OBV Trend = 1) & (SMA Trend = 1)	Downtrend	Uptrend	Uptrend

Note: NA — not available.

3.4. Trade signal generation

Trading signals are generated based on entry conditions. Exit conditions employ a 10% margin Trailing Stop loss strategy, triggering when the price drops to 90% of the entry price or when a book profit signal is generated. This book profit signal is activated when the price falls to 90% of the highest price after reaching new highs due to a trend shift, preventing further capital depreciation. The sequential buy-sell condition, tailored for small-cap investors, is applied. It generates a subsequent entry signal only if an exit condition is met, completing a trade. Sample trades are detailed in Table 3.

3.5. Performance evaluation

The performance measures are examined to find combinations that provide higher returns with fewer trades. The graphs shown in Figure 1 and Figure 2 compare the performance metrics of the NIFTY 50 stocks and the undervalued 50 stocks. Trades for a single stock are summarized in Table 4, with 365 trading day's duration. A total of 100 stocks were analysed for 365 trading days and the results are compared to 10-year performance in the following sections.

Table 3. Sample trade data for an indicator combination

Date of entry	Entry price	Date of exit	Exit price	Profit/Loss
17-05-2022	2492.84	02-06-2022	2688.82	195.08
29-06-2022	2551.70	18-07-2022	2405.04	-145.76
29-07-2022	2489.36	11-08-2022	2585.95	96.59
12-09-2022	2593.53	13-09-2022	2616.82	23.29
28-10-2022	2506.87	25-11-2022	2608.20	101.33
30-12-2022	2555.10	02-01-2023	2567.70	12.6
14-02-2023	2361.22	15-02-2023	2414.05	52.83
06-03-2023	2411.10	31-03-2023	2300.73	-101.37
12-04-2023	2348.17	24-04-2023	2362.30	14.13
05-05-2023	2446.37	08-05-2023	2466.57	20.2

Table 4. Performance report for each indicator combination for single stock (365 days)

Indicator combination No.	Trade count	Total return (%)	Average return/trade (%)	Sharpe ratio	Indicator combination No.	Trade count	Total return (%)	Average return/trade (%)	Sharpe ratio
1	144	-31.52	-0.22	-0.02	25	6	-5.86	-0.98	-0.06
2	82	48.32	0.59	0.03	26	11	-72.45	-6.59	-0.41
3	76	0.4	0.01	0	27	3	-42.2	-14.07	-0.87
4	100	-22.56	-0.23	-0.02	28	2	22.66	11.33	0.7
5	57	104.11	1.83	0.11	29	0	0	0	0
6	49	2.14	0.04	0	30	34	25.21	0.74	0.04
7	16	84.44	5.28	0.32	31	24	23.44	0.98	0.06
8	21	41.64	1.98	0.12	32	24	-63.9	-2.66	-0.17
9	66	43.69	0.66	0.04	33	23	-80.36	-3.49	-0.22
10	59	43.07	0.73	0.04	34	29	116.35	4.01	0.24
11	45	-1.91	-0.04	-0.01	35	9	-7.31	-0.81	-0.05
12	78	-0.89	-0.01	0	36	9	17	1.89	0.11
13	47	84.22	1.79	0.11	37	5	-87.51	-17.5	-1.08
14	31	-48.12	-1.55	-0.1	38	5	-39.27	-7.85	-0.49
15	31	25.61	0.83	0.05	39	8	-43.72	-5.46	-0.34
16	26	-61.87	-2.38	-0.15	40	2	-44.78	-22.39	-1.39
17	38	116.06	3.05	0.19	41	2	129.08	64.54	3.98
18	38	-22.1	-0.58	-0.04	42	1	-60.55	-60.55	-3.74
19	14	66.86	4.78	0.29	43	1	5.79	5.79	0.35
20	11	125.06	11.37	0.7	44	1	-0.65	-0.65	-0.04
21	10	65.43	6.54	0.4	45	1	-49.22	-49.22	-3.04
22	15	45.55	3.04	0.18	46	0	0	0	0
23	6	20.64	3.44	0.21	47	0	0	0	0
24	7	108.68	15.53	0.96					

3.5.1. Trade count

A box plot graph is used to visualize the total number of trades executed by each combination. Figure 1 displays the distribution of total trades over 365 days, while Figure 2 presents the distribution of total trades spanning a period of 10 years.

Figures 1 and 2 reveal an interesting trend: as the rarity of indicator signals increases and the number of indicators used in combination rises, a noticeable reduction in the number of trades becomes evident.

Figure 1. Distribution of total trades per company for each indicator (365 days)

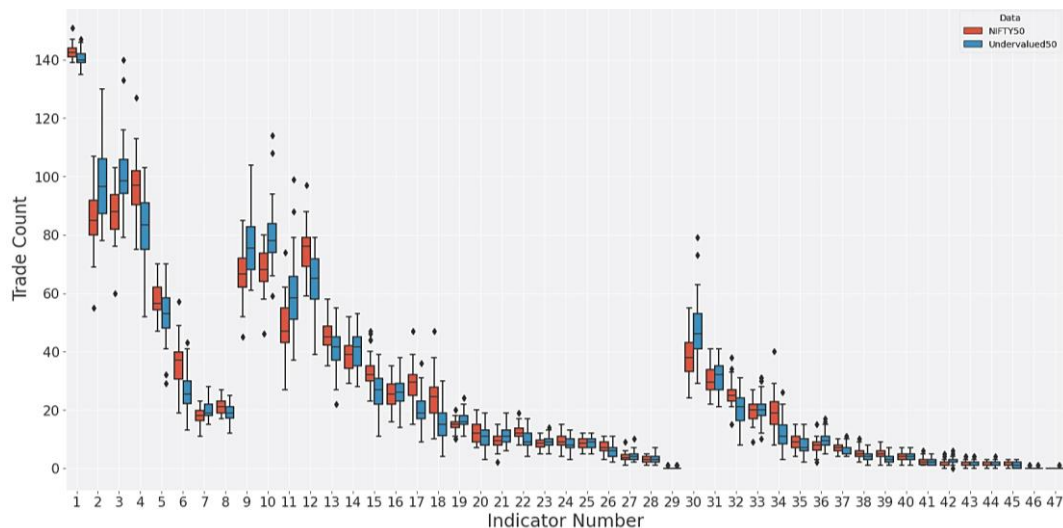
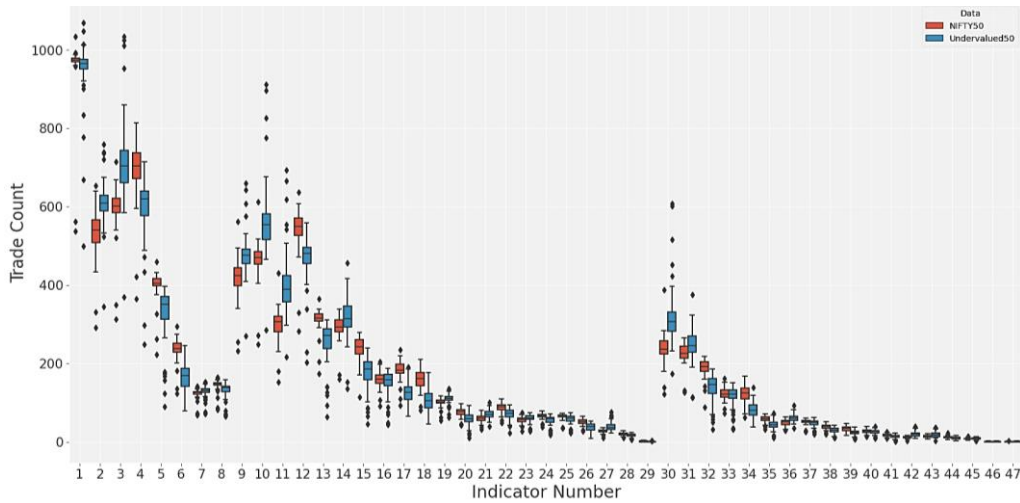


Figure 2. Distribution of total trades per company for each indicator (10 years)

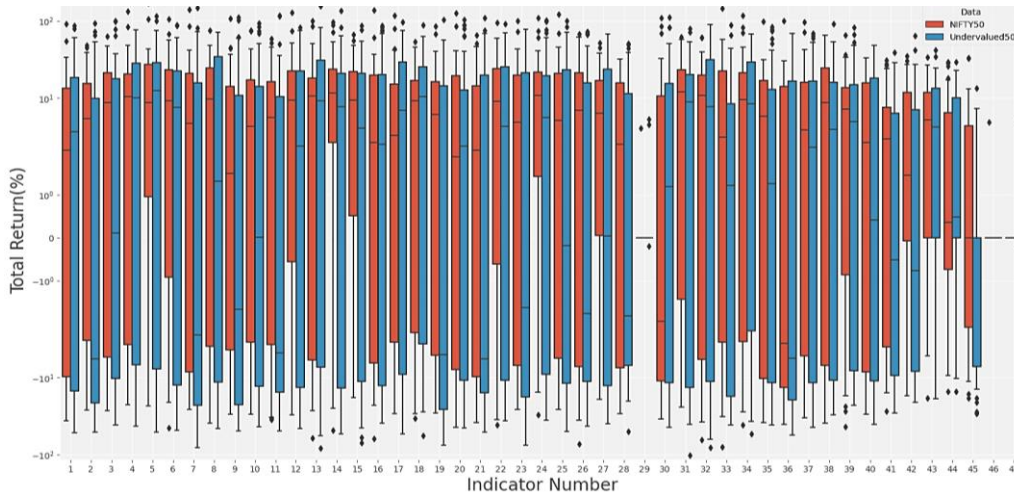


3.5.2. Total returns (%)

Figure 3 depicts the distribution of the total return percentages earned through various indicator

combinations for each company, whereas Figure 4 offers a comprehensive overview of the total return percentages spanning 10 years.

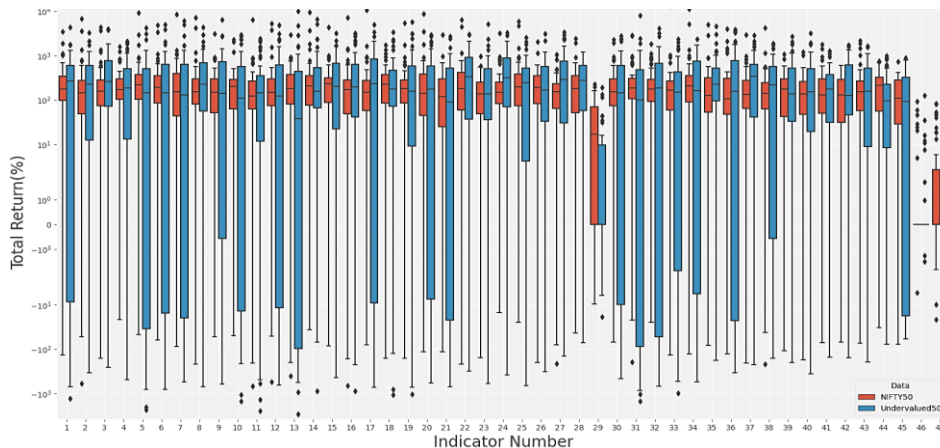
Figure 3. Distribution of total returns of indicator (365 days)



It can be observed that a few indicator combinations have fewer negative Total returns as

shown in Figure 3 for Indicator Number 43, 44 for undervalued 50 stocks, and 24, 27 for NIFTY 50 stocks.

Figure 4. Distribution of total returns of indicator (10 years)



It can be observed from Figure 4 the total returns for a 10-year period for each indicator combination, that in a longer time horizon, the negative returns for undervalued 50 stocks are higher for some indicator combinations while NIFTY 50 companies give less than 25% of instances with negative total returns (%). Here the Indicator Numbers 24, 27, 42, 43, and 44 show fewer negative returns for undervalued 50 stocks.

3.5.3. Average return (%) per trade

The distribution of average return (%) per trade for 365 days is shown in Figures 5 and 6 showing the long-term average return per trade.

Figure 5. Average return per trade (365 days)

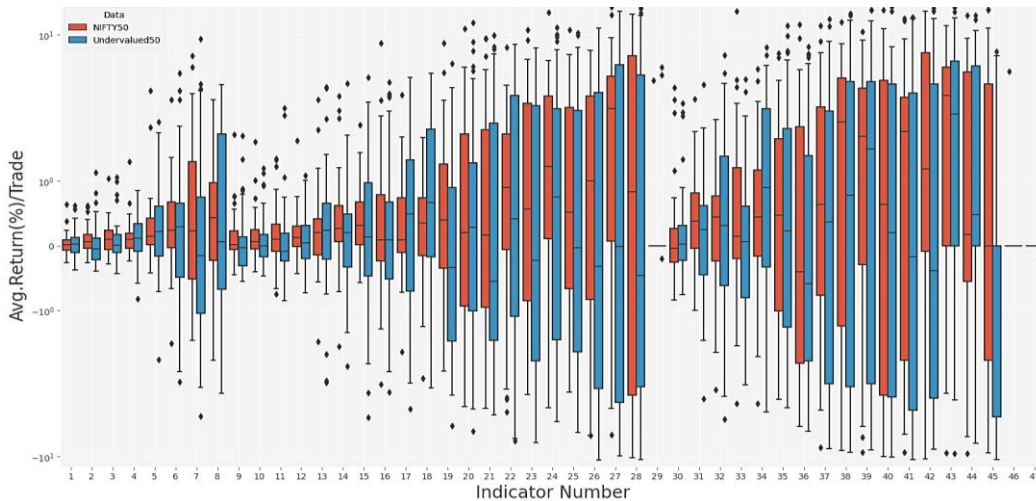
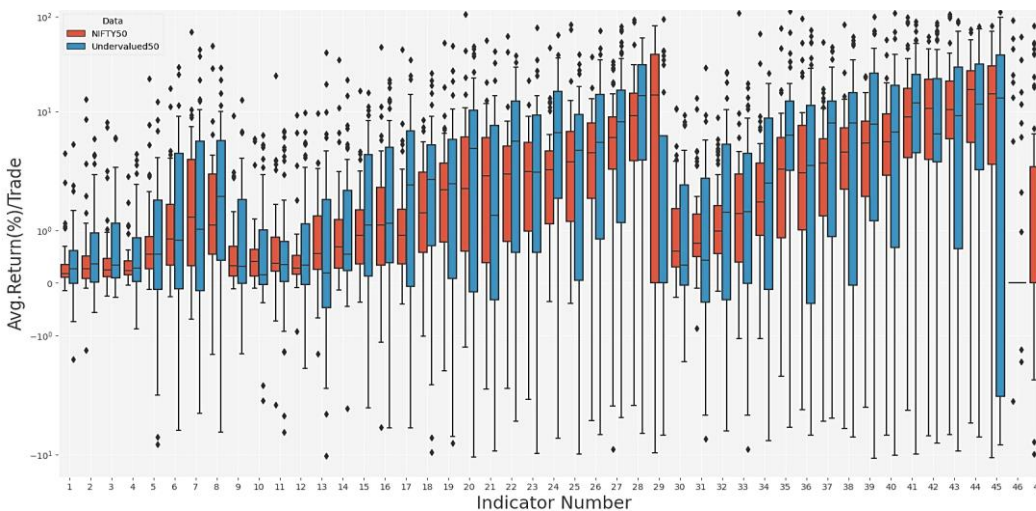


Figure 5 shows that the average negative returns are lower for Indicator Combinations 24, 27, and 42 for NIFTY 50 stocks, while 43, and 44 combinations have fewer negative returns for both NIFTY 50 and undervalued 50 stocks compared to positive returns.

Figure 6 shows that the indicator combinations that generate fewer trades, in general, have higher average returns per trade. Most of the NIFTY 50 stocks show fewer negative returns. However, undervalued 50 companies show higher positive in comparison to negative returns for a majority of indicator combinations.

Figure 6. Average return per trade (10 years)



3.6. Performance analysis of top 5 indicator combinations

From the performance evaluation of the indicator combinations, five indicator combinations are identified to perform better than the rest. The indicator combination numbers 24, 27, 42, 43, and 44 are found to give better returns in fewer trades. It is also

identified that these indicators can be used to identify entry points into long-term investing in undervalued stocks. The 10-year performance of the top 5 indicator combinations is analyzed in this section. Figure 7 shows the 10-year total trade count distribution of five best-performing indicator combinations.

Figure 7. Total trade distribution per stock (10 years)

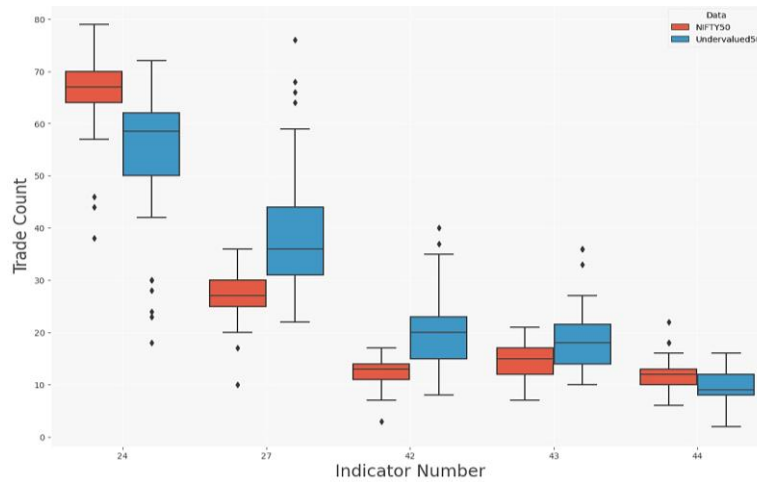
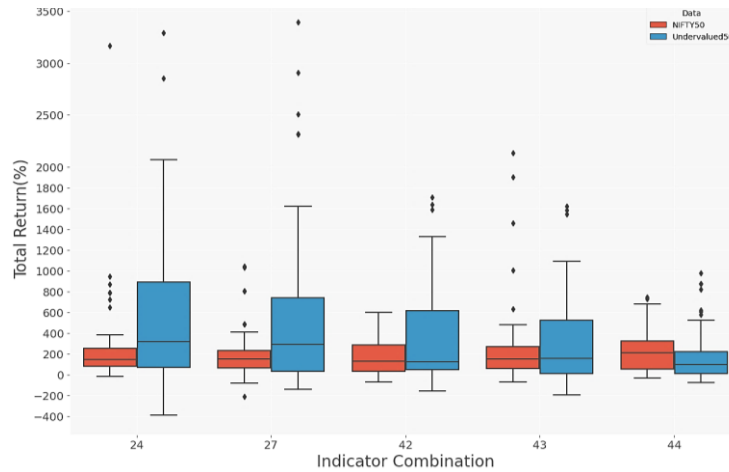


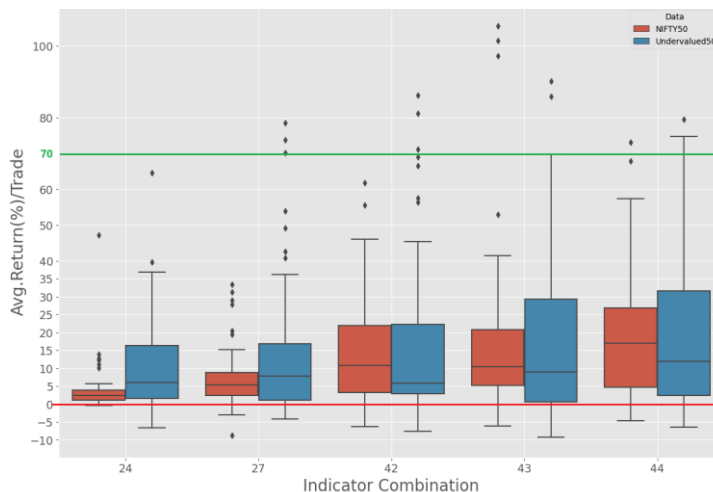
Figure 7 illustrates a greater number of trades attributed to the broader distribution of the boxplot in the undervalued 50 stocks compared to the NIFTY 50 stocks. This discrepancy can be

Figure 8. Total returns (%) distribution (10 years)



The total returns of indicator combinations from Figure 8 show that the positive returns of the undervalued 50 stocks are much higher than the positive returns of NIFTY 50 stocks. While the negative returns of NIFTY 50 stocks are lower than undervalued 50 stocks the difference is not as diverse as the positive returns.

Figure 9. Average return (%)/trade distribution (10 years)



The average return (%) per trade of the best indicators combination shows that the positive returns of undervalued 50 stocks are much higher than the positive returns of NIFTY 50 stocks. The negative returns of both NIFTY 50 and undervalued 50 companies are both present, but they are comparatively lower.

Exploring alternative technical indicators is of paramount importance to gain a comprehensive understanding of trading strategies. Different indicators have specific advantages based on varying market conditions. Researchers can diversify their methodology by considering alternative indicators such as Bollinger Bands, MACD, or RSI. Furthermore, future studies could enhance their scope by collecting data from a more extensive range of stocks, encompassing both large-cap and small-cap companies. This approach would provide valuable insights into the performance of indicator combinations across diverse market segments.

4. RESULTS

The combinations 24, 27, 42, 43, and 44 outperformed others in terms of profitability and risk-adjusted returns. The average return per trade distribution is analyzed to understand the trade-offs between positive and negative returns. The following section shows which among them is the best of all 47 combinations.

The Sharpe ratio is a measure of risk-adjusted return that helps investors evaluate the return generated by an investment relative to its volatility. A positive Sharpe ratio indicates that the investment or portfolio has generated returns above the risk-free rate. It implies that the investment has compensated investors for the risk taken. Figure 10 shows the Sharpe ratio distribution for 10 years for the considered 100 stocks.

Figure 10. Sharpe ratio distribution for top 5 indicator combinations

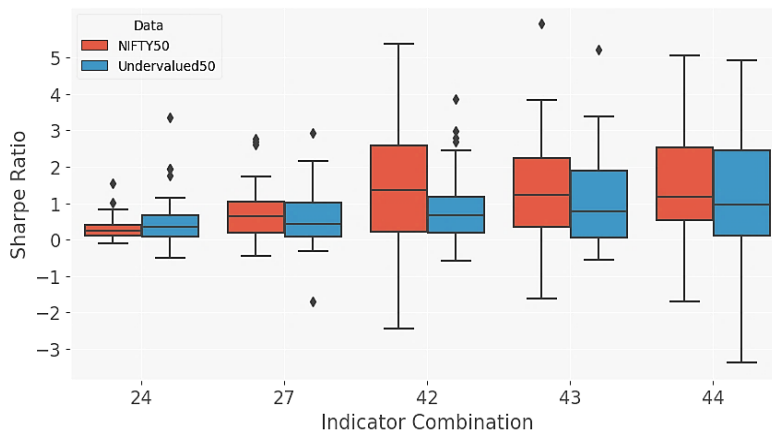


Figure 10 provides a concise visual representation of the Sharpe ratio distribution across various indicator combinations. Notably, Indicator Combination 43 stands out with a notably superior Sharpe ratio distribution, boasting a higher ratio of positive to negative Sharpe ratios compared to the other combinations. This compelling finding highlights combination 43 as an appealing choice for investors seeking a balanced blend of returns and effective risk management.

Complementing the insights from Figure 10, Table 5 offers a comprehensive summary of the top 5 indicator combinations' performance. This summary, based on percentile-wise returns, enables investors to assess the relative return potential of these combinations. Presented in a tabular format, Table 5 simplifies the comparison of the top-performing combinations, further aiding investors in making well-informed decisions when seeking profitable trading opportunities.

Table 5. Performance summary of top 5 indicator combinations (Part 1)

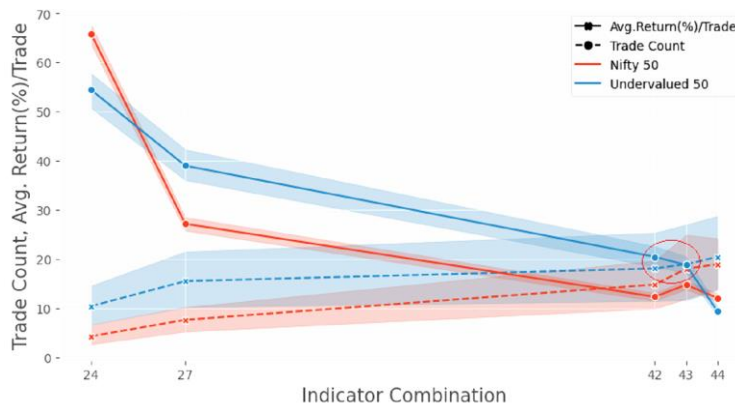
Combination No.	Percentile	Trade count	Total return (%)	Average return/trade (%)	Sharpe Ratio
Combination No. 24	Min	18	-388.35	-6.7	-0.5
	1.00	22.95	-141.32	-2.93	-0.37
	25.00	57	73.67	1.2	0.09
	50.00	63	180.39	2.98	0.28
	75.00	68	517.01	8.06	0.56
	99.00	77.02	3366.05	65.51	1.96
	Max	79	10986.33	166.46	3.36
Combination No. 27	Min	10	-462.88	-13.23	-1.71
	1.00	16.93	-214.06	-8.85	-0.45
	25.00	25	51.35	1.59	0.15
	50.00	31	181.17	6.26	0.62
	75.00	36	519.85	14.79	1.06
	99.00	68.08	3477.64	121.25	2.77
	Max	76	11663.53	507.11	2.92

Table 5. Performance summary of top 5 indicator combinations (Part 2)

Combination No.	Percentile	Trade count	Total return (%)	Average return/trade (%)	Sharpe Ratio
Combination No. 42	Min	3	-836.67	-39.84	-2.45
	1.00	6.96	-166.06	-14.12	-1.52
	25.00	12	33.38	2.7	0.18
	50.00	14	129.32	8.64	0.8
	75.00	19.25	397.84	27.07	1.91
	99.00	37.03	3498.49	299.33	5.37
	Max	40	17084.32	2135.54	5.74
Combination No. 43	Min	2	-196.6	-34.45	-4.15
	1.00	6.95	-148.06	-11.68	-1.66
	25.00	13	37.26	2.46	0.19
	50.00	16	152.77	9.81	0.86
	75.00	18	408.44	27.02	2.12
	99.00	36	2272.47	161.24	5.23
	Max	36	4173.55	189.71	5.93
Combination No. 44	Min	2	-3302.12	-660.42	-4.96
	1.00	2.99	-535.62	-132.26	-4.81
	25.00	9	30.2	3.21	0.37
	50.00	11	134.84	13.5	1
	75.00	12	341.99	31.9	2.55
	99.00	18.04	2497.66	208.37	5.06
	Max	22	3098.23	281.66	6.45

Figure 11 visually summarizes the study's analysis, offering a comparison of various indicator combinations' trade count and average return per trade. The X-axis represents the indicator combinations, while the Y-axis shows the trade

count and average return per trade. Each combination is graphically depicted, aiding viewers in identifying those combinations that provide a substantial number of trades and appealing average return per trade.

Figure 11. Trade-off graph for total trades and average return (%)/trade

The optimal entry points for the top 5 indicator combinations are as follows:

1. **Combination No. 43:** Entry signal triggers when the CCI value is above 100 (indicating an uptrend), the OBV value has decreased over the past five days (indicating a downtrend), and the SMA value is in an uptrend, with the SMA_{short} line positioned above the SMA_{long} line.

2. **Combination No. 42:** Entry signal triggers when the CCI is in an uptrend with a CCI value above 100, the OBV value is in a downtrend over the past five days, and the SMA value is in a downtrend, with the SMA_{short} line positioned below the SMA_{long} line.

3. **Combination No. 24:** Entry signal occurs when the CCI value is above 100, and the OBV value is in a neutral state.

4. **Combination No. 27:** Entry signal triggers when the CCI value is above 100, and the OBV value has decreased over the past five days.

5. **Combination No. 45:** Entry signal triggers when the CCI value is below -100 (indicating a downtrend), the OBV value is in a neutral state

over the past five days, and the SMA value is in a downtrend, with the SMA_{short} line positioned below the SMA_{long} line.

5. DISCUSSIONS

Table 5 provides a comprehensive summary of the performance of the top 5 indicator combinations in this work. Based on percentile-wise returns, this summary offers investors the means to assess the relative return potential of these combinations. Presented in a tabular format, Table 5 simplifies the comparison of the top-performing combinations, further assisting investors in making well-informed decisions when seeking profitable trading opportunities. Employing Python programming, the distribution of returns was meticulously summarized. This analysis involved excluding the top and bottom 1 percentile returns for each indicator combination, with a specific focus on the 98th percentile returns, revealing the following outcomes.

Among the 47 indicator combinations examined, the research identifies five combinations that consistently yield more positive returns than negative returns, with fewer trades. The results highlight five indicator combinations consistently generating more positive returns than negatives, with the best (combination 43) achieving an average return per trade distributed between 0 to 30% (50% of trades), 30 to 70% (25% of trades), and less than 25% of trades incurring negative returns of up to -10%, as illustrated in Figure 9. Furthermore, this study highlights the significance of risk-adjusted returns, quantified by metrics such as the Sharpe Ratio, emphasizing that trading strategies should consider both profitability and risk management. With an extensive analysis spanning a decade and involving a substantial number of trades (8,50,209), the findings exhibit robustness over a significant period.

The findings of the study highlight Indicator Combination 43 as the most promising choice, as it consistently delivers positive results based on trade count, average return per trade, and the Sharpe ratio. This combination offers an attractive balance between profitability and risk, making it an appealing option for traders. Its specific criteria, including a CCI value above 100, declining OBV over the past five days, and an uptrend in SMA with SMA_{Short} positioned above SMA_{Long} , provide valuable insights for informed decision-making.

Indicator Combination 42, on the other hand, stands out as a compelling choice for traders seeking profitable opportunities under specific market conditions. Its criteria, such as a CCI value above 100, decreasing OBV over the past five days, and a downtrend in SMA with SMA_{Short} below SMA_{Long} , can aid in identifying potential trade entries in relevant scenarios.

Notably, Indicator Combination 24, despite a neutral OBV value when the CCI is above 100, still offers promising returns, suggesting its potential in a broader range of market conditions. Indicator Combination 27, focusing on situations with a CCI above 100 and decreased OBV over the past five days, also demonstrates robust performance, catering to traders who prefer specific technical conditions.

The analysis of Indicator Combination 44 underscores the importance of understanding associated risks, as it performs well in certain instances despite significant negative returns.

This study underscores the significance of using multiple technical indicators and considering various market conditions to develop effective trading strategies. Combining indicators enhances the decision-making process, improving the accuracy of buy and sell signals. While this research provides valuable insights, it is crucial to acknowledge its limitations, including the reliance on historical data and past performance. Future studies may explore real-time applications and adaptability to evolving market conditions.

REFERENCES

1. Ali, I., Mahfooz, S. Z., Mehmood, N. Q., & Mehmood, M. N. (2023). Deployment of a smart trading system for intelligent stock trading. *The Nucleus*, 60(1), 1-8. <http://www.thenucleuspak.org.pk/index.php/Nucleus/article/view/1254>
2. Bashir, B., & Aslam, F. (2022). Technical indicator selection and trading signal forecasting: Varying input window length and forecast horizon for the Pakistan Stock Exchange. *The Journal of Network Theory in Finance*, 3(5). <https://doi.org/10.21314/jntf.2021.005>
3. Chandar, S. K. (2022). Convolutional neural network for stock trading using technical indicators. *Automated Software Engineering*, 29(1), 1-14. <https://doi.org/10.1007/s10515-021-00303-z>

6. CONCLUSION

This study has thoroughly examined the effectiveness of three fundamental technical indicators: SMA, OBV, and CCI. By leveraging historical data from 50 undervalued companies and comparing their returns with those of NIFTY 50 companies, the research has effectively identified profitable trading opportunities based on specific indicator conditions.

Key findings from this investigation underscore CCI as the most dominant indicator for achieving higher profitability, closely followed by OBV and SMA, confirming their efficacy in recognizing trading opportunities. However, it is important to note that CCI signals are relatively infrequent, particularly when utilizing a 20-day or a 9-day window period, this work used a 3-day window period highlighting the substantial impact of this parameter choice on signal frequency. The study also reveals the strategic importance of specific entry points, emphasizing the value of price momentum and volume trends, particularly when CCI signals an uptrend and OBV shows a neutral or downtrend. SMA, when used for price trend confirmation, provides additional confidence in trading decisions.

These findings hold significant relevance for active investors, offering them a powerful framework to enhance profit retention and minimize losses during market downturns and corrections. By providing insights into the selection and combination of technical indicators to pinpoint profitable trading opportunities, this research not only guides investors but also underscores the paramount importance of risk-adjusted returns. Understanding the precise conditions that lead to successful trades empowers market participants to make exceptionally informed investment decisions that strike a harmonious balance between the allure of potential returns and the prudence of astute risk management.

However, it is critical to recognize some limitations in this study. The ever-changing nature of market dynamics presents a degree of uncertainty, and this study did not take into account a variety of relevant elements, such as economic events and geopolitical developments. Furthermore, it is critical to acknowledge the retrospective aspect of this study, which examines past performance but does not predict future results.

The future perspectives of the research include exploring exit point analysis to identify reliable exit points for profit retention, conducting further analysis on combinations of various technical indicators, and examining the role of volatility indicators in assessing profitability, contributing to a comprehensive understanding of the factors influencing trading strategies' success.

4. Chio, P. T. (2022). *A comparative study of the MACD-base trading strategies: Evidence from the US stock market*. arXiv. <https://doi.org/10.48550/arxiv.2206.12282>
5. Di Graziano, G. (2014). Optimal trading stops and algorithmic trading. *SSRN Electronic Journal*, 8(4). <https://doi.org/10.2139/ssrn.2381830>
6. Lv, D., Gong, Y., Chen, J., & Xiang, Y. (2023). Recommendation algorithm of industry stock trading model with TODIM. *International Journal of Information Technology and Decision Making*, 3(3), 1-34. <https://doi.org/10.1142/s0219622023500402>
7. Fajjareon, C., & Sornil, O. (2019). Evolving and combining technical indicators to generate trading strategies. *Journal of Physics: Conference Series*, 1195, Article 012010. <https://doi.org/10.1088/1742-6596/1195/1/012010>
8. Fernando, P. (2014). Profitability of technical trading strategies in emerging Sri Lankan stock market. *Kelaniya Journal of Management*, 2(2), 32-50. <https://doi.org/10.4038/kjm.v2i2.6549>
9. Klados, A. (2013). Do more signals mean higher profits? In S. Ahamed, J. Piantadosi, M. Agrawal, & J. Boland (Eds.), *MODSIM2013, 20th International Congress on Modelling and Simulation* (pp. 1187-1193). <https://doi.org/10.36334/modsim.2013.f1.klados>
10. Kuzman, B., Petković, B., & Petković, D. (2021). Evaluation of optimal economic and technical indicators for agriculture stock trading decision. *International Journal of Economic Practice and Policy*, 18(2), 124-140. <https://doi.org/10.5937/skolbiz2-34986>
11. Leung, T., & Zhang, H. (2021). Optimal trading with a trailing stop. *Applied Mathematics & Optimization*, 83(2), 669-698. <https://doi.org/10.1007/s00245-019-09559-0>
12. Lundström, C. (2014). *Money management with optimal stopping of losses for maximizing the returns of futures trading* [Umeå Economic Studies No. 884]. Umeå University. <https://swopec.hhs.se/umnees/abs/umnees0884.htm>
13. Metghalchi, M., Chang, Y.-H., & Garza-Gomez, X. (2012). Technical analysis of the Taiwanese stock market. *International Journal of Economics and Finance*, 4(1), 90-102. <https://doi.org/10.5539/ijef.v4n1p90>
14. Mitra, S. K. (2011). How rewarding is technical analysis in the Indian stock market? *Quantitative Finance*, 11(2), 287-297. <https://doi.org/10.1080/14697680903493581>
15. Mukund Harsha, A., Rao, M. S., & Rao, V. V. S. K. (2023). Addressing challenges in stock selection: A financial decision support system approach. *Journal of Research Administration*, 5(2), 4497-4510. <https://journalra.org/index.php/jra/article/view/602>
16. Naved, M., & Srivastava, P. (2015a). The profitability of five popular variations of moving averages on Indian market Index S&P CNX Nifty 50 during January 2004-December 2014. *Advances in Economics and Business Management (AEBM)*, 2(1), 27-32. <http://surl.li/nxjsi>
17. Naved, M., & Srivastava, P. (2015b). Profitability of oscillators used in technical analysis for financial market. *Advances in Economics and Business Management (AEBM)*, 2(9), 925-931. <https://doi.org/10.2139/ssrn.2699105>
18. Pandey, M. (2012). Application of Markowitz model in analysing risk and return a case study of BSE stock. *Risk Governance and Control: Financial Markets & Institutions*, 2(1), 7-15. <https://doi.org/10.22495/rgcv2i1art1>
19. Pramudya, R., & Ichsani, S. (2020). Efficiency of technical analysis for the stock trading. *International Journal of Finance & Banking Studies*, 9(1), 58-67. https://econpapers.repec.org/article/rbsijfbss/v_3a9_3ay_3a2020_3ai_3a1_3ap_3a58-67.htm
20. So, S. M. S., & Lei, V. U. T. (2015). On the relationship between investor sentiment, VIX and trading volume. *Risk Governance and Control: Financial Markets and Institutions*, 5(4-1), 114-122. <https://doi.org/10.22495/rgcv5i4c1art1>
21. Zambelli, A. (2016). *Determining optimal stop-loss thresholds via Bayesian analysis of drawdown distributions*. arXiv:1609.00869. <https://doi.org/10.48550/arXiv.1609.00869>