



# Performance Evaluation of the Technical Analysis Indicators in Comparison with the Buy and Hold Strategy in Tehran Stock Exchange Indices

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## ABSTRACT

Technical analysis is one of the financial market analysis tools. Technical analysis is a method of anticipating prices and markets through studying historical market data. Based on the factors studied in this type of analysis, indicators are designed and presented to facilitate decision-making on buy and sell stress and then buy and sell action in financial markets. This research evaluates performances and returns of 10 conventional technical analysis indicators based on the strategies set on the total stock exchange index, the total index of OTC market and 8 other (non-correlated) industry indices by using Meta Trader software from 2008 to 2018. Also, the significance of the difference between the returns of the ten indicators is tested using the buy and hold strategy. The results show a significant difference between the returns using some of the technical analysis indicators in some indices and buy and hold strategy. The effectiveness of technical analysis strategies varies across industries and EMA and SMA with respectively 6 and 5 repetitions, are the best strategies and BB with just one repetition has the least repetition. The investment industry index with the most repetition is the industry in which the strategies used in this study have been able to provide an acceptable return.

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## 1 Introduction

The capital market is one of the most important pillars of the country's economy, where people's deposits are directed towards production and large-scale economic projects. This market is a safe place for corporates financing and a place for savings holders to invest their deceased account. Investors who invest in the capital market need sufficient information on how to manage their capital in order to achieve their desired return. In general, there are two types of price predicting analysis for capital management in the stock market, namely fundamental analysis and technical analysis. Fundamental analysis focuses on the intrinsic stock value. Technical analysis, however, anticipates the stock price in the light of past trends in stock prices. In other words, technical analysis is a tool for studying market behavior using charts. Also, after determining the power of buyer and seller based on how this

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power shows itself in the price, the trade volume and time can determine the price target of the charts as well as the target time for the charts. Technical analysis tools can help traders in different time periods (long term, medium term and short term) [15]. Traders who trade on the basis of fundamental analysis, however, traded mainly on a long-term asset. The effectiveness and efficiency of using technical analysis tools to maximize returns as well as minimize the risk of trade is a challenge for researchers to deal with. Sometimes, the results of using different indices in the technical analysis of a price chart are different, in these circumstances, the analyst is in doubt and they confused the predicted results of which indicator of technical analysis to rely on. Therefore, the analyst should not only focus on the outcome of one index and they must consider several different indicators together. This complicates the task of a technical analyst. In addition, some technical analysis tools may have their own performance in each industry.

In the first step, investors also need to identify the direction of the respective industry trends in order to choose their share. In this regard they can use technical analysis tools. It is necessary to help investors make the right choice on their favorable industry for trading. Therefore, this research is on the analysis of securities and decision-making on buying and selling, which is a subdivision of portfolio formation and investment portfolio revision [2]. The necessity of developing a proper trading system led us to choose a trading system based on technical analysis. To address the complexity of selecting the appropriate technical analysis tools, the mentioned tools are tested for the first time in this paper for each industry's uncorrelated indices separately as well as for total index. The innovation of the present paper is to evaluate the performances of 10 conventional industry indicators separately. Therefore, the importance of this research is to accurately predict stock prices by considering both technical analysis tools and their performances in the stock of the concerned industry.

In summary, this study seeks to test the difference between the returns of the use of technical analysis tools (indicators) and the buy and hold strategy [23]. Innovation refers to the return of buy and hold strategy as the returns from purchasing at the beginning of the test period and maintaining it until the end of the test period without any action. Also, by the return on technical analysis tools we mean the return on the use of indicators and oscillators related to this type of analysis to enter the transaction (buying in the Iran's stock market) and then exit. In fact, entry and exit of a transaction is determined by the technical analysis tools. As a result, the difference between the returns from the technical analysis tools and the returns related to the buy and hold strategy is statistically tested.

## 2 Theoretical Literatures and Background

### 2.1 Technical Analysis Literature

Forecasting financial market indices have become a necessary operation for investors' decisions to maximize the return of their investments [9]. Technical analysis is a technique or a method that enables investors, or in other words traders in financial markets, to determine the appropriate time and price to buy or sell stocks and other tradable assets [3]. Technical analysis represents a challenge to the efficient market hypothesis (EMH), especially in its weak form [24]. In fact, this type of analysis tries to estimate the power of buyers and sellers in the financial markets by analyzing the three dimensions of price, trading volume and time [9]. In general, technical analysis is based on the following three approaches and principles [14]: 1) Everything is included in the prices, 2) Prices move based on trends and 3) History repeats in markets. It is based on these principles that if the market is at a strong performance level [8] and the random walk theory is hold, the performance of this type of analysis is

weakened [16]. According to the principles of technical analysis and the theory of performance of different financial markets at different time intervals, the strength of this analysis tool is changing [3]. Technical analysis is divided into two parts: patterns and indicators [27,28,29]. Patterns are usually presented on the basis of the form of prices, while indicators and oscillators are calculated based on price-based calculations and historical volumes of the asset in question [26].

The various schools of technical analysis include Elliot Wave School, Harmonic Pattern School, Indicators School, W. D. Gann School and Astronomy Techniques in Analysis, the Dow School, the Point and Figure Chart School, and the Eastern Techniques School [18]. This study evaluates technical analysis from the point of view of indicators school. Indicators and oscillators were formulated based on three factors of price, trading volume and time, to integrate the three dimensions based on statistics and mathematics and to facilitate decision making for active traders to enter and exit the market [5]. One disadvantage of using indicators, however, is that depending on the nature of the indicator and how it is used in different market conditions (trend market, neutral market, etc.) their performance and return will be different [24]. In other words, based on the nature and shape of the market, some indicators perform better than others. However, in other circumstances, their performance changes. Therefore, it is advisable to use indicators as a warning system or as a confirmation of trading strategy [15]. A huge part of the concept of technical analysis has been dedicated to examination of the Asia financial markets, especially the Asia-Oceania region. A study by Bessembinder and Chan [6] is among the first studies on this region markets that show the technical analysis is able to predict better Asia and Oceania markets [13,14, 20, 31, 32 and 33]. According to the literature review technical analysis and indicators are so useful instrument to forecast financial assets and indices. In this paper for the first time designed algorithmic system based on 10 indicators to predict the several indices of Tehran stock exchange and compared them with buy and hold strategy.

## 2.2 Research Background

Shin-Yun Wang et al., [30] studied the application of Marco's moving average model to the stock market from theory to empirical evidence and predicted the returns of 13 companies by the Dow Jones Index. The basis of this method is derived from the exponential moving average and the findings show the positive results of this method in the use of analysis. Kuan-Cheng et al., [17] stated, on the value of investing in technical analysis by professional investors and the buy and hold method on the Taiwan stock exchange, that the use of technical analysis method is more appropriate than that of the buy and hold method. Chan [8] pointing out that Hui's research in collaboration, showed that the strategies related to their research have a better performance than the buy and hold strategy in the indicators relevant to the East Asia region, compared in this paper, the benefits of the two presented strategies with the benefits of the buy and hold strategy. These strategies have been tested on 14 stock indices and for each share separately, from 1995 to 2013. The results show that strategies have a better effectiveness on the index and that the strategy anyway has a better performance than the buy and hold strategy. Nti et al., [24] compared the performances of the three oscillators of stochastic, stochastic relative strength index (RSI) and commodity channel index (CCI) on the Japan stock market index. The result of this study showed that the commodity channel index oscillator performed better than the other two oscillators. Nakano et al., [21] compared the returns of a synthetic neural network-based technical analysis transaction tools and Bitcoin buy and hold strategy. The results of this study showed a significant positive difference in the rate of return based on the meta-heuristic method of this research and the buy and hold strategy. Bader et al., [3] evaluated the difference of the returns of

22 technical analysis-based strategies for the China, Hong Kong, Indonesia, Japan, Malaysia, Philippines, Singapore, Taiwan and Thailand stock exchange indices with the return of buy and hold strategy, in the time interval of 1995-2015. The result shows a significant and increased return on technical analysis compared to the buy and hold strategy in the financial markets of countries with poor performance. In this study, correlation of return on stock market indices of the mentioned country is also considered. Markets of low correlation are used to deliver results. The strengths of this study include the use of 22 indicators as representatives of technical analysis tools in addition to the temporal and spatial domain. Emami et al., [10] among national researchers, studied the profitability of technical analysis laws including short-term and long-range moving averages, oscillators, and the resistance and support limits. Results showed that, among the observed indices, the moving averages performed better because they are the follower indices and have a proper efficiency in the long-term. Long-term moving averages are less profitable in comparison to oscillators and short-term moving averages, although they are more profitable in comparison to buy and hold strategy. The results also showed that the Tehran stock market has the potential to apply technical indices. Barzideh and Allah Gholi [4], compared the return of the Bollinger band composite indicator and the relative strength index to the return of the buy and hold strategy. The result of this study showed that the buy and sell strategy based on Bollinger band and the relative strength index could not yield more returns than that of the buy and hold strategy. Heibati and Rahnamay Roodposhti [12] studied the relationship between the two stock pricing approaches (technical analysis and fundamental analysis) in Tehran Stock Exchange. The results of the hypothesis test over a 5-year period (2004-2008) show that there is a positive and significant relationship between the calculated returns (using 5 technical indices) and the actual market returns as well as the returns obtained from the asset pricing model with the actual market returns.

The other results of the test show that there is a positive and significant relationship between expected returns of dual moving average indices, relative strength index, money flow index and return on asset pricing model, but there is no significant relationship between exponential moving average return, convergent/divergent average moving index and return on asset pricing model. Abbasi et al., [1] optimized the indicators using multi-objective particle group method and neural fuzzy adaptive inference system. The results showed that the optimized indicators have a better performance than that of the conventional ones as well as the buy and hold strategy method. Raei and Hosseini [25] evaluated the fuzzy decision-making approach and optimizing and decision-making of the fuzzy genetic hybrid method of buying and selling in the Iran stock market using technical analysis indicators. The results of this study showed that the fuzzy and fuzzy genetic methods have more significant and increased returns than the buy and hold method. Fathi and Parvizi [11] studied the profitability using technical analysis by combining oscillators and moving averages in the form of 6 analytical strategies. The results of this study show higher returns than risk-free returns when using the mentioned tools. Pourzamani and Rezvani Aghdam [25] compared the technical strategies of the strength index of moving size and the exponential moving average in the upward and downward markets with the buy and hold strategy. The result of this study shows that when the market is upward, the buy and hold strategy has higher return and when the market is downward, the strategy based on the two mentioned tools has a better return. This study used only two indicators to decide on the efficiency of technical analysis. It also provides more returns for this strategy if we calculate the return based on the difference in price at the beginning and the end of the period.

### 3 Research Methodology

Considering theoretical foundations and the history of literature, the present paper hypotheses are as follows:

Hypothesis 1: There is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy on the total stock index.

Hypothesis 2: There is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy on the total OTC index.

Hypothesis 3: There is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy on the bank industry index.

Hypothesis 4: There is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy on the Computer products index.

Hypothesis 5: There is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy on the sugar index.

Hypothesis 6: There is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy on the insurance retirement index.

Hypothesis 7: There is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy on the and investment index.

Hypothesis 8: There is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy on the car industry index.

Hypothesis 9: There is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy on the petroleum index.

Hypothesis 10: There is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy on the cement index.

This research is a descriptive-correlational one and it is applied in terms of purpose, because it aims to apply the results in the capital market. The method used for data collection is a documentary research method. Considering the purpose of the research, which is to test the significance of difference between the strategies related to the technical analysis tools and the return on the buy and hold strategy in the Iran's capital market, information was collected on the total stock index, the total OTC index, and the 8 industry indices.

**Table 1:** Time Domain and Indicators Used in the Research

Row	NO.	Time Period	Variable Name	Index Name
1	2462	November 26, 2008 to February 27, 2019	TEPIX	Total Stock Index
2	2462	July 6, 2013 to February 27, 2019	OTC index	Total OTC Index
3	2462	October 10, 2009 to February 27, 2019	Insurance	Insurance and Retirement Index
4	2462	November 26, 2008 to February 27, 2019	Computer	Computer Index
5	2462	November 26, 2008 to February 27, 2019	Bank	Bank Index
6	2462	November 26, 2008 to February 27, 2019	Invest	Investment Index
7	2462	November 26, 2008 to February 27, 2019	Cement	Cement Industry Index
8	2462	November 26, 2008 to February 27, 2019	Sugar	Sugar Industry
9	2462	November 26, 2008 to February 27, 2019	Car	Car Index
10	2462	November 26, 2008 to February 27, 2019	Petroleum	Petroleum products Index

Table 1 provides information on the market indices studied in this research, the time interval and the number of corresponding data. Daily final price is given in each time interval. The final prices for

each of the above indices were collected and integrated using TseClient software. The daily final price of each index was used according to formula (1) to calculate the return of buy and hold strategy.

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (1)$$

Also, the arithmetic mean of the daily return was used to apply the average return on this strategy (buy and hold strategy) [3]. The indicators specified in Table 2 were used to evaluate the performance of the technical analysis tools based on the strategy presented.

**Table 2:** Table of Indicators and Buy and Sell Strategies

Row	Transaction Strategy	Indicator/ Oscillator Name
1	If the lowest price drops below the lower band, the position of purchase and price target of the position will be to reach the 20-day average line.	Bollinger Bands
2	If the CCI value was observed to be below -100, the position of purchase will be taken for that asset. This position has no profit and loss limits and the above position will be closed if the CCI observes the number +100.	Commodity Channel Index (CCI)
3	When the intersection of the two simple moving averages 12 and 26 is upward, it is considered as the purchase position. This position has no profit and loss limit and if the intersection of weight moving averages 12 and 26 is downward, the purchase position will be closed.	Simple Moving Average (SMA)
4	When the intersection of the two weight moving averages 12 and 26 is upward, it is considered as the purchase position. This position has no profit and loss limit and if the intersection of weight moving averages 12 and 26 is downward, the purchase position will be closed.	Weighted Moving Average (WMA)
5	The intersection of the two exponential moving averages 12 and 26 upwards is considered as a purchase position. This position has no profit and loss limit and if the intersection of exponential moving averages 12 and 26 is downward, the purchase position will be closed.	Exponential Moving Average (EMA)
6	When the intersection of the two Tenkan Sen and Kijun Sen lines is upward, it is considered as the purchase position. This position has no profit and loss limit and if the intersection of Tenkan Sen and Kijun Sen is downward, the purchase position will be closed.	Ichimoku
7	Upon intersection of MACD and signal lines upward, the purchase position on the target asset opens. This position has no profit and loss limit and will be closed at the opposite point (downward intersection of MACD and signal lines).	Moving Average Convergence Divergence (MACD)
8	If the RSI value is below 30 and then you see the value of 30, the purchase position opens. This position has no profit and loss limit and if you see the RSI value of 70, the above position will be closed.	relative strength index (RSI)
9	Upon intersection of k% and D% lines upward, the purchase position opens. This position has no profit and loss limit and the taken purchase position will be closed if the intersection of k% and D% lines is downward.	Stochastic
10	If the R% line is below -80% and then you see this value, the purchase position opens. This position has no profit and loss limit and the above position will be closed if R% sees the value as -20%.	Williams R%

Each of the strategies outlined in Table 2 of buy and sell operations (entry and exit) will get returns on the indicators specified in Table 1. By return, we mean the amount of profit that is allocated to the primary source for buying and selling, using these strategies. Depending on the number of days passed from the transaction, the average daily return from each of the above strategies can be calculated.

The average return of each strategy= Average return of the strategy/ number of days (2)

After the above calculations, it is time to perform t-student statistical test to test the significance of the difference between the return of each strategy and the return of buy and hold strategy. The null hypothesis of this test is that there is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy. we suppose an opposite state.

$$H_0: R_{Str i} - R_{B\&H} = 0$$

$$H_1: R_{Str i} - R_{B\&H} \neq 0$$

By  $R_{Str i}$ , we mean the average of daily return on the i'th strategy. It is worth mentioning that 13 strategies are introduced in this study. Also, by  $R_{B\&H}$  we mean the average daily return obtained from buy and hold of each index, separately. The t-test statistic value is obtained according to formula (3) as follows:

$$t = \frac{R_{Str i} - R_{B\&H}}{\sqrt{\frac{\sigma_{R_{Str i}}^2}{N_{R_{Str i}}} + \frac{\sigma_{R_{B\&H}}^2}{N_{R_{B\&H}}}}} \quad (3)$$

In the above statistic, N is the number of data and  $\sigma_{R_{Str i}}^2$  and  $\sigma_{R_{B\&H}}^2$  are the variances of the daily return data of each of the strategies and the buy and hold strategy, respectively. Regarding the statistic value, if its positive numerical value (its absolute value) is greater than 2, the null hypothesis of the test of no difference between the return of the two approaches is rejected with a confidence level of 95%, which indicates that they have a significant difference. The hypothesis of this study is that there is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy. This hypothesis is tested using t-test.

## 4 Research Finding

Based on the steps and method of research described in the previous section, this section tests the findings of the technical analysis strategies and the buy and hold strategy using the t-test. Given that in order to get a result on the effectiveness of the return of technical analysis tools it is necessary to test non-correlated assets, the correlation matrix along with the P-Value of returns of the selected indices in the Iran capital market are shown in Table 3.

**Table 3:** Correlation Between the Returns of the Selected Indices along with the P-value and T-test

Correlation value	Bank Index	Computer Index	Sugar Index	Insurance and Retirement Index	Investment Industry Index	Car Index	Petroleum Products Index	Total OTC Index	Cement Industry Index	Total Stock Index
Bank index	1									
Computer index	0.22 (0,00)	1								
Sugar index	0.13 (0,00)	0.15 (0,00)	1							
Insurance and retirement index	0.32 (0,00)	0.18 (0,00)	0.13 (0,00)	1						
Investment Index	0.05 (0,00)	0.32 (0,00)	0.19 (0,00)	0.40 (0,00)	1					
Car Index	0.38 (0,00)	0.19 (0,00)	0.13 (0,00)	0.32 (0,00)	0.58 (0,00)	1				
Petroleum products Index	0.17 (0,00)	0.14 (0,00)	0.42 (0,00)	0.18 (0,00)	0.32 (0,00)	0.21 (0,00)	1			
Total OTC Index	0.42 (0,00)	0.27 (0,00)	0.16 (0,00)	0.33 (0,00)	0.31 (0,00)	0.41 (0,00)	0.53 (0,00)	1		
Cement Index	0.28 (0,00)	0.23 (0,00)	0.18 (0,00)	0.31 (0,00)	0.46 (0,00)	0.31 (0,00)	0.18 (0,00)	0.36 (0,00)	1	
Total Stock Index	0.51 (0,00)	0.35 (0,00)	0.17 (0,00)	0.35 (0,00)	0.72 (0,00)	0.46 (0,00)	0.62 (0,00)	0.76 (0,00)	0.46 (0,00)	1

As shown in Table 3, there is no significant (direct or inverse linear) correlation between any of the returns. The descriptive statistic related to the return of each of the selected indices in this study are illustrated in Table 4. Descriptive statistics indicate that there is no possible normal distribution of the index return.

**Table 4:** Descriptive Statistics of Problem Data

Descriptive statistics Index	Bank index	Computer index	Sugar index	Insurance and Retirement index	Investment Index	Car Index	Petroleum products Index	Total OTC Index	Cement Industry Index	Total Stock Index
Average	0.001	0.0023	0.002	0.008	0.0016	0.011	0.0821	0.0009	0.0012	0.0011
Maximum	0.060	1/271	2/470	0/167	1/341	25/54	198/8	0.0620	0.8300	0.023
Minimum	-0.11	-0.005	-0.110	-0.146	-0.040	-0.07	-0.461	-0.078	-0.031	-0.055
Standard deviation	0.001	0.025	0.052	0.013	0.029	0.051	4/011	0.011	0.019	0.007
Skewness	-0.21	31/4	42/9	0.97	39.9	49/4	49/5	0.11	32/8	0/51
Elongation	11/82	1,296	2,030	27/71	1843	2453	2459	7/281	1415	8,713
Observations	2462	2462	2462	2462	2462	2462	2462	2462	2462	2462

The above strategies have been implemented in MQL5 using the Meta Trader software and a server connection to a useful brokerage. Table 5 shows the results of the returns of each of the strategies specified in Table 2 and the buy and hold strategy for the indices selected in Table 1 separately, along with the T test value.



**Table 5:** Results of Hypotheses

Indicator: First	Total Stock Index <b>Result of hypothesis 1</b>				
	Average return	Transactions number	T test	P Value	
MACD	2640.8%	16	1.45	0.166	
CCI	-44.1%	32	-0.25	0.804	
RSI	-502.2%	10	-1.61	0.138	
SMA	4791.0%	13	2.31	0.037	
EMA	6789.0%	6	2.84	0.029	
WMA	3527.8%	16	1.83	0.089	
Stochastic	662.5%	144	0.80	0.425	
Williams R%	141.5%	32	0.34	0.736	
Bollinger Bonds	-386.0%	20	-3.08	0.005	
Ichi muko	2990.1%	15	1.98	0.066	
B & H	0.1%	-			
Indicator: Second	Total OTC index <b>Result of hypothesis 2</b>				
	Average return	Transactions number	T test	P Value	
MACD	3.7%	29	1.42	0.166	
CCI	-13.5%	28	-6.94	0.000	
RSI	12.0%	7	4.85	0.001	
SMA	9.3%	20	1.56	0.134	
EMA	2.0%	11	1.31	0.216	
WMA	7.8%	21	1.71	0.102	
Stochastic	1.5%	152	1.14	0.256	
Williams R%	-14.2%	31	-7.18	0.000	
Bollinger Bonds	-4.2%	13	-1.37	0.198	
Ichi muko	7.0%	24	1.38	0.179	
B & H	0.1%				
Indicator: Third	Bank Industry Index <b>Result of hypothesis 3</b>				
	Average return	Transactions number	T test	P Value	
MACD	26.5%	21	1.65	0.133	
CCI	-3.5%	29	-0.52	0.607	

**Table 5:** Continue

RSI	-9.2%	11	-1.49	0.164	
SMA	38.9%	12	1.96	0.073	
EMA	25.5%	7	2.57	0.037	
WMA	21.9%	14	1.71	0.109	
Stochastic	4.4%	147	0.38	0.704	
Williams R%	2.1%	36	0.81	0.423	
Bollinger Bands	-4.4%	18	-2.97	0.008	
Ichi muko	11.6%	17	1.60	0.128	
B & H	0.1%				
Indicator: Fourth	Computer Industry Index <b>Result of hypothesis 4</b>				
	Average return	Transactions number	T test	P Value	
MACD	448.8%	18	1.25	0.227	
CCI	160.4%	30	1.28	0.210	
RSI	211.2%	12	1.51	0.156	
SMA	297.6%	14	2.67	0.018	
EMA	1004.5%	6	1.75	0.130	
WMA	159.8%	14	0.74	0.471	
Stochastic	148.8%	15	0.37	0.731	
Williams R%	114.1%	36	1.38	0.176	
Bollinger Bands	290.4%	13	2.37	0.033	
Ichi muko	954.9%	14	1.28	0.221	
B & H	0.2%				
Indicator: Fifth	Sugar industry index <b>Result of hypothesis 5</b>				
	Average return	Transactions number	T test	P Value	
MACD	-35.2%	18	-0.10	0.921	
CCI	541.2%	31	1.00	0.325	

**Table 5:** Continue

RSI	-1028.1%	8	-8.09	0.000	
SMA	2232.3%	9	2.46	0.031	
EMA	4516.3%	4	1.45	0.220	
WMA	759.3%	12	1.65	0.124	
Stochastic	881.2%	85	1.72	0.089	
Williams R%	550.3%	34	1.02	0.324	
Bollinger Bonds	-133.3%	17	-0.88	0.391	
Ichi muko	1962.9%	10	1.83	0.083	
B & H	0.3%				
Indicator: Sixth	Insurance and Retirement Index <b>Result of hypothesis 6</b>				
	Average return	Transactions number	T test	P Value	
MACD	55.8%	18	0.16	0.872	
CCI	-58.6%	36	-1.40	0.170	
RSI	-210.4%	9	-2.45	0.036	
SMA	122.6%	17	1.50	0.152	
EMA	612.4%	6	3.82	0.009	
WMA	130.5%	20	1.39	0.176	
Stochastic	12.2%	129	0.31	0.757	
Williams R%	-48.4%	36	-1.63	0.111	
Bollinger Bonds	-2.4%	22	-0.17	0.866	
Ichi muko	179.2%	14	2.28	0.038	
B & H	0.1%				
Indicator: Seventh	Investment Industry Index <b>Result of hypothesis 7</b>				
	Average return	Transactions number	T test	P Value	
MACD	55.8%	18	0.15	0.882	
CCI	46.5%	39	1.49	0.144	
RSI	60.0%	12	2.37	0.035	
SMA	196.2%	17	3.19	0.003	

**Table 5:** Continue

EMA	187.0%	7	4.21	0.004	
WMA	306.1%	13	2.21	0.048	
Stochastic	42.7%	83	1.15	0.253	
Williams R%	38.1%	34	1.05	0.301	
Bollinger Bands	72.6%	18	1.62	0.122	
Ichi muko	114.1%	22	2.57	0.017	
B & H	0.2%				
Indicator: Eighth	Car Industry Index <b>Result of hypothesis 8</b>				
	Average return	Transactions number	T test	P Value	
MACD	1329.9%	14	1.33	0.24	
CCI	44.9%	27	0.11	0.913	
RSI	-636.3%	10	-1.98	0.075	
SMA	493.0%	11	1.66	0.125	
EMA	601.3%	6	0.97	0.369	
WMA	1374.4%	11	1.87	0.088	
Stochastic	-134.5%	91	-1.13	0.261	
Williams R%	113.8%	37	0.37	0.713	
Bollinger Bands	35.6%	24	0.52	0.614	
Ichi muko	1091.3%	14	1.62	0.127	
B & H	1.1%				
Indicator: Ninth	Petroleum products Index <b>Result of hypothesis 9</b>				
	Average return	Transactions number	T test	P Value	
MACD	7120.9%	24	1.52	0.141	
CCI	-6314.7%	36	-2.19	0.035	
RSI	-9333.8%	13	-4.17	0.001	
SMA	8032.2%	23	2.13	0.044	

**Table 5:** Continue

EMA	8986.5%	10	3.22	0.009	
WMA	3514.7%	18	0.73	0.474	
Stochastic	6930.5%	164	0.68	0.497	
Williams R%	-3959.0%	37	-1.37	0.178	
Bollinger Bands	-886.4%	22	-0.78	0.443	
Ichi muko	-705.0%	28	-0.13	0.897	
B & H	8.2%				
Indicator: Tenth	Cement Industry Index				
	<b>Result of hypothesis 10</b>				
	Average return	Transactions number	T test	P Value	
MACD	-16.3%	15	-0.78	0.447	
CCI	1.5%	28	0.51	0.614	
RSI	24.4%	11	1.22	0.248	
SMA	98.9%	14	1.98	0.067	
EMA	124.4%	9	2.75	0.007	
WMA	52.5%	11	2.14	0.049	
Stochastic	59.1%	60	1.87	0.066	
Williams R%	2640.8%	33	2.08	0.045	
Bollinger Bands	-0.2%	23	-0.07	0.944	
Ichi muko	120.8%	12	2.21	0.047	
B & H	0.1%				

Given that the confidence level in the financial literature is typically considered to be 95%, strategies with a t-value greater than 2 represent a rejection of the null hypothesis and their return is higher than that of buy and hold strategy.

In Table 5, back tests are taken for all of the indicators specified in Table 1, according to the technical analysis strategies, respectively. The return of the buy and hold strategy is specified at the end of each section. The next column shows the number of transactions performed by the indicator. The last column also indicates the t statistic value.

## 5 Conclusions and Suggestion

Technical analysis is a method to anticipate prices and markets through studying back market data. Considering the investors' need to know the industry trends, this paper examines, for the first time, technical analysis tools in the form of 10 conventional indicators for each industry's uncorrelated indices as well as the total index of the years 2008-2018, separately. Based on the results mentioned in the Findings section, to answer the question whether there is a significant difference between the return of using strategies based on technical analysis indicators and the return of buy and hold strategy, it was proved that there is a significant difference and all research hypotheses have been rejected except Hypothesis 8 which are in line with the results of studies by Kuan-Cheng et al. [16], Chan and Jacinta [8], and Werner and Marcel [16] from abroad, as well as by the results of national researchers Emami et al. [11], Abbasi et al. [1], and Pourzamani and Rezvani Aghdam [24]. Thus, we can summarize the profitable strategies having a significant difference from the buy and hold strategy in Table 6.

**Table 6:** Significant Positive Return Strategies Compared to Buy and Hold Return for Each of the Capital Market Indices

Row	Index Name	Strategy Name	T statistics	P Value	Result of Hypothesis
1	Total Stock Index	SMA	2.31	0.037	Hypothesis 1 is rejected
2	Total Stock Index	EMA	2.84	0.029	
3	Total OTC Index	RSI	4.85	0.001	Hypothesis 2 is rejected
4	Bank Industry Index	EMA	2.57	0.037	Hypothesis 3 is rejected
5	Computer Industry Index	SMA	2.67	0.018	Hypothesis 4 is rejected
6	Computer Industry Index	Bollinger Bands	2.37	0.033	
7	Sugar industry Index	SMA	2.46	0.031	Hypothesis 5 is rejected
8	Insurance and Retirement Index	EMA	3.82	0.009	Hypothesis 6 is rejected
9	Insurance and Retirement Index	Ichi muko	2.28	0.038	
10	Investment Industry Index	RSI	2.37	0.035	Hypothesis 7 is rejected
11	Investment Industry Index	SMA	3.19	0.003	
12	Investment Industry Index	EMA	4.21	0.004	
13	Investment Industry Index	WMA	2.21	0.048	
14	Investment Industry Index	Ichi muko	2.57	0.017	
15	Petroleum products Index	SMA	2.13	0.044	Hypothesis 9 is rejected
16	Petroleum products Index	EMA	3.22	0.009	
17	Cement Industry Index	EMA	2.75	0.007	Hypothesis 10 is rejected
18	Cement Industry Index	WMA	2.14	0.049	
19	Cement Industry Index	Williams R%	2.08	0.045	
20	Cement Industry Index	Ichi muko	2.21	0.047	

Note: The null hypothesis rejected at the 5% level

As it was showed in Table 6 all of the hypotheses are rejected, except hypothesis 8 so There is no significant difference between the return of the use of strategies based on technical analysis indicators and the return of buy and hold strategy on the car index. According to the strategies outlined in Table 6, it can be pointed out that; the effectiveness of technical analysis strategies varies across industries. EMA and SMA with respectively 6 and 5 repetitions, are the best strategies and BB with just one repetition has the least repetition. Investment industry index with the most repetition is the industry in which the strategies used in this study have been able to provide an acceptable return. Given that the

Iran's capital market depends on the Dollar-Rial exchange rate and in the long run it has an upward trend, trend-based strategies such as moving averages performed better. The highest return on EMA is in the investment industry. Considering the applicability of the EMA-based strategy, the results of this study are consistent with the results of Shin-Yun Wang et al. [31], Emami et al. [10], Rahnamay Roodposhti and Heibati [12] and Pourzamani and Rezvani [24], because EMA is a follower indicator and performs well in the long term. Given the remarkable effectiveness of the RSI-based strategy, the results of this study are in line with the results of Barzideh and Allah Gholi [4] and Rahnamay Roodposhti and Heibati [12]. In the most of the studies in this field, one or two indicators are tested for financial asset but the contribution of this study is designing algorithmic system based on 10 indicators to predict the several indices of Tehran stock exchange and compared them with buy and hold strategy separately and it was determined which indicators are useful for each indices. Given that the research has a pragmatic and practical approach, recruitment of technical analysis experts by investment companies and other financial institutions active in the field of stock to take advantage of the capabilities of this method of analysis, as well as the use of the results of this research is recommended in order to the shareholders to get greater benefit. In addition, the aforementioned institutions and investors can design smart trading systems based on the obtained results and profitable indicators of each industry. By considering that the return is meaningful alongside the risk, this study proposes to add risk measures such as value at risk alongside the results of this study. These strategies can also be generalized further. Therefore, in general the following suggestions are offered to continue this research:

- Add risk measures alongside returns.
- Adding new strategies.
- Compare the meta-heuristic algorithms with the strategies presented in this study.
- Use optimization algorithms to optimize parameters and inputs for each strategy.

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