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TECHNICAL ANALYSIS STRATEGY AND ABNORMAL RETURNS IN TEHRAN STOCK EXCHANGE (2008-2014)

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Summary. Nowadays, with the great progress in financial science, one of the most common methods that investors use, to make investment decisions, is technical analysis strategy that uses price background knowledge and related data to forecast future prices. Generally, according to various opinions, there are three different methods for investing in stock: Fundamental analysis, technical analysis, buy and hold strategy. This study evaluates the profitability of technical analysis strategy in obtaining abnormal returns using RSI, MFI, CCI, MACD, RFI indicators. Therefore, trading signal returns done by these four has been evaluated. In this study, business data of all companies accepted in Tehran stock exchange were collected, and in the period "between 2007 to 2013" by deletion of those companies that lack the essential information, the exams of this study have been done on the basis of related data of 25 companies by referring to transaction costs. The results revealed the positive returns according to technical analysis and indicator returns of technical analysis is significantly more than Risk-free interest rate. According to the results, RSI, CCI, MACD, MFI have, in sequence, more returns and all their returns were more than Risk-free interest rate.

Анотація. На сучасному етапі значного прогресу у фінансовій науці одним з найбільш поширених методів, який використовують інвестори, щоб прийняти інвестиційне рішення, є стратегія технічного аналізу, яка використовує знання передумов цін та пов'язані дані для прогнозу майбутніх цін. Загалом відповідно до різних думок існує три різних метода інвестування в акції: фундаментальний аналіз, технічний аналіз та стратегія купівлі й утримання. Це дослідження оцінює рентабельність стратегії технічного аналізу в отриманні аномального прибутку, використовуючи показники RSI (показник відносної сили), MFI (індекс грошового потоку), CCI (індекс товарного каналу), MACD (сходження/розходження змінних середніх), RFI (індекс відносної сили). Тому, оцінено прибутки торгового сигналу, здійсненого завдяки цим чотирьом показникам. У даному дослідженні були зібрані бізнес дані всіх компаній, прийнятих на фондову біржу Тегерану, та в період «між 2007 та 2013 роками» шляхом видалення тих компаній, які не мали суттєвої інформації, випробовування цього дослідження було здійснене на основі відповідних даних 25 компаній, посилаючись на вартість угоди. Результати виявили позитивні прибутки відповідно до технічного аналізу; прибутків показників технічного аналізу є значно вищими, ніж безризикова процентна ставка. Згідно з результатами, RSI, CCI, MACD, MFI мають в послідовності більше прибутків, та всі їх прибутки були вищими, ніж безризикова процентна ставка.

Аннотация. На современном этапе значительного прогресса в финансовой науке одним из самых распространенных методов, который используют инвесторы, чтобы принять инвестиционное решение, является страте-

гия технического анализа, которая использует знания предпосылок цен и связанные данные для прогноза будущих цен. В общем в соответствии разных мнений существует три различных метода инвестирования в акции: фундаменталь-

ный анализ, технический анализ и стратегия покупки и содержания. Это исследование оценивает рентабельность стратегии технического анализа в получении аномальной прибыли, используя показатели RSI (показатель относительной силы), MFI (индекс денежного потока), CCI (индекс товарного канала), MACD (схождение / расхождение скользящих средних), RFI (индекс относительной силы). Поэтому, оценена прибыль торгового сигнала, осуществленного благодаря этим четырем показателям. В данном исследовании были собраны бизнес данные всех компаний, принятых на фондовой бирже Теге-

рана, и в период «между 2007 и 2013 годами» путем удаления тех компаний, которые не имели существенной информации, испытания этого исследования было осуществлено на основе соответствующих данных 25 компаний, ссылаясь на стоимость сделки. Результаты выявили положительные прибыли в соответствии с техническим анализом; доходы показателей технического анализа значительно выше, чем безрисковая процентная ставка. Согласно результатам, RSI, CCI, MACD, MFI имеют в последовательности больше прибыли, и все их доходы были выше, чем безрисковая процентная ставка.

Key words: *Technical Analysis, Money Flow Index, Moving Average, Commodity Channel Index, Abnormal Return.*

Ключові слова: *технічний аналіз, індекс грошового потоку, змінні середні, індекс товарного каналу, аномальний прибуток.*

Ключевые слова: *технический анализ, индекс денежного потока, скользящие средние, индекс товарного канала, аномальный прибыль.*

Introduction. When the investors decided to invest in the capital markets, need to know all the variables that effect their investments and whether this investment is profitable or not. During last year's investors use "buy and hold strategy" based on fundamental analysis to analyze the investments. Technical analysis uses the past prices and related statistics to forecast investments. Technical analysis in compare to fundamental analysis has some Advantages and Disadvantages. One of these advantages is finding the best trading prices that are not possible to find that with buy and hold strategy. Finding these trading prices help the investors that trade timely and consecutively in the markets by increasing and decreasing the price speculation, therefore within a specific interval can earn abnormal returns in compare to buy and hold strategy or others trading strategy. The available findings indicate some of the trades based on technical analysis strategy that have an abnormal return, which is not justified by the financial statements and fundamental analysis.

Literature Survey. The technical analysis origins back to Charles Dow research in early twentieth on industrials Dow Jones Averages index. His research on the market caused him realize that market trends and speculations do not simply follow financial statements and information and there are some other factors that affect the market. Those researches made a great development on the market price forecast methods. Dow Theory emerged from a collection of his articles in Wall-street journals "from (1851) to (1902)". The Dow Theory on stock price movement is a form of technical analysis that includes some aspects of sector rotation and mainly focuses on mar-

ket trends. Dow Theory basis conclude that the fact prices are affected by all the information and events in the markets. All the available knowledge to market participants, including investors or fund managers affects the price. Early studies that assess the effectiveness of technical analysis considered very simple rules called filter rules. These rules involve buying a security, if it has been increased by x% on the last period or selling it, if its price has been decreased by x% on the last period. These techniques remain however very simplistic, more elaborate rules are provided by technical analysis. Some critics see technical analysis as a form of black magic. In fact, technical analysis has only recently begun to enjoy some mainstream credibility. While most analysts on Wall Street focus on the fundamental side, just about any major brokerage now employs technical analysts as well. Much of the criticism of technical analysis has its roots in academic theory - specifically the efficient market hypothesis (EMH). This theory says that the market's price is always the correct one – any past trading information is already reflected in the price of the stock and, therefore, any analysis to find undervalued securities is useless. This is one of the reasons why academics have looked at these techniques with contempt. Several other facts have contributed to this situation. The main reason is that technical analysis violates one of the basic principles of financial theory: the efficient market hypothesis, which claims that it is impossible to predict future prices from the observation of past prices. Another reason is that a major part of these techniques cannot be tested as they are purely graphical and they do not have precise rules.

Ghobadi (2014) test the Profitability of Technical Analysis Indicators to Earn Abnormal Returns in International Exchange Markets from 2008 through 2013. They conclude that the positive returns according to technical analysis indicator returns and these returns is significantly more than London Interbank Offered Rate. They observe that the Stochastic Oscillator, Relative Strength Index, Money Flow Index, Commodity Channel Index, Simple Moving Average indicators produces the best results, followed by the London Interbank Offered Rate.

Isakov and Hollistein (1998) report abnormal returns using technical trading rules in the Swiss stock market. Though transaction costs eliminate most of the technical trading profits, they suggested conditions where large investors may profit from moving average trading rules.

Manzur and Chew (2002) test the performance of the moving average method and the Relative Strength Index (RSI), a common counter-trend indicator, on the Singapore STII from 1974 through 1994. They conclude that technical indicators can play a useful role in the timing of stock market entry and exits. They observe that the single moving average produces the best results, followed by the dual moving average and the RSI. They note that technical analysis give returns more attractive to the trading members of the stock exchange since transaction costs may tend substantially lower the gains.

Fama (1960) developed this concept into three forms of market efficiency, or the market responds to given information set. Empirical research of weak-form efficiency of the market categorized as the tests of trading strategies using historical data. These statistical tests examine the correlations between historical prices changes and run testing.

Ben R Marshall and Jared M. Cahan (2006) evaluated the profitability of CRIMACD technical trading system. They collect information of companies on CRSP database in the period of January1, 1976 to December31, 2003 including 200 days of past closing prices and 20 days of past volume. They examine both long and short CRIMACD filter rules in this study and found that even the system generates some profit but not consistently.

Sharif and soltanzali (2007) in a research about profitability of technical analysis indicators evaluated the Moving Average Strategy on the Tehran stock exchange markets “between (1992) to (2004)”. These statistical tests examine that Moving Average Strategy is profitable, and simulation of this method can forecast the future prices.

Research Hypothesis.

1. Technical analysis indicators can finds the profitable trading prices.

$$H_0: \mu > 0$$

$$H_1: \mu \leq 0$$

2. Technical analysis indicators have correlations to finds trading signals.

3. Returns based on technical analysis strategy are more than London Interbank Offered Rate. (**Abnormal Returns**)

$$H_0: \mu > 0.004$$

$$H_1: \mu \leq 0.004$$

Variables

Relative Strength Index. The Relative Strength Index (RSI) is a momentum oscillator that measures the speed and change of price movements. RSI oscillates between 0 and 100. Traditionally, and according to Wilder, RSI considered overbought when above 70 and oversold when below 30. Signals can also be generate by looking for divergences, failure swings and centerline crossovers. RSI can also use to identify the general trend. RSI considered overbought when above 70 and oversold when below 30. These traditional levels can also adjust to fit the security or analytical requirements.

Money Flow Index. The Money Flow Index (MFI) is an oscillator that uses both price and volume to measure buying and selling pressure. Created by Gene Quong and Avrum Soudack, MFI is also known as volume-weighted RSI. MFI starts with the typical price for each period. Money flow is positive when the typical price rises (buying pressure) and negative when the typical price declines (selling pressure). Typically, MFI above 80 is considered overbought and MFI below 20 is considered oversold. Strong trends can present a problem for these classic overbought and oversold levels. MFI can become overbought (>80) and prices can simply continue higher when the uptrend is strong. Conversely, MFI can become oversold (<20) and prices can simply continue lower when the downtrend is strong.

Moving Average Convergence-Divergence. The Moving Average Convergence-Divergence (MACD) indicator is one of the simplest and most effective momentum indicators available. The MACD turns two trend-following indicators, moving averages, into a momentum oscillator by subtracting the longer moving average from the shorter moving average. As a result, the MACD offers the best of both worlds: trend following and momentum. The MACD fluctuates above and below the zero line as the moving averages converge, cross and diverge. Traders can look

for signal line crossovers, centerline crossovers and divergences to generate signals. Because the MACD is unbounded, it is not particularly useful for identifying overbought and oversold levels. Signal line crossovers are the most common MACD signals. The signal line is a 9-day EMA of the MACD Line.

Commodity Channel Index. Developed by Donald Lambert and featured in *Commodities* magazine in 1980, the Commodity Channel Index (CCI) is a versatile indicator that can use to identify a new trend or warn of extreme conditions. Lambert originally developed CCI to identify cyclical turns in commodities, but the indicator can successfully applied to indices, ETFs, stocks and other securities. In general, CCI measures the current price level relative to average price level over a given period. CCI is relatively high when prices are far above their average. CCI is relatively low when prices are far below their average. In this manner, CCI can use to identify overbought and oversold levels. As noted above, the majority of CCI movement occurs between -100 and +100. A move that exceeds this range shows unusual strength or weakness that can foreshadow an extended move.

Think of these levels as bullish or bearish filters. Technically, CCI favors the bulls when positive and the bears when negative.

Relative Strength Index.

$$1. RSI = 100 - \frac{100}{1 + RS}$$

$$2. RS = \text{Average Gain} / \text{Average Loss}$$

$$3. \text{Average Gain} = [(\text{previous Average Gain}) \times 13 + \text{current Gain}] / 14$$

$$4. \text{Average Loss} = [(\text{previous Average Loss}) \times 13 + \text{current Loss}] / 14$$

Money Flow Index

$$1. \text{Typical Price} = (\text{High} + \text{Low} + \text{Close})/3$$

$$2. \text{Raw Money Flow} = \text{Typical Price} \times \text{Volume}$$

$$3. \text{Positive Money Flow} = \text{Sum of positive Raw Money Flow over 14 periods.}$$

$$4. \text{Negative Money Flow} = \text{Sum of negative Raw Money Flow over 14 periods.}$$

$$5. \text{Money Flow Ratio} = (\text{Positive Money Flow})/(\text{Negative Money Flow})$$

$$6. \text{Money Flow Index} = 100 - 100/(1 + \text{Money Flow Ratio})$$

Commodity Channel Index

$$1. CCI = (\text{Typical Price} - 20\text{-period MACD of TP}) / (.015 \times \text{Mean Deviation})$$

$$2. \text{Typical Price (TP)} = (\text{High} + \text{Low} + \text{Close})/3$$

$$3. \text{Constant} = .015$$

Abnormal Return

$$1. \text{Abnormal return} = \text{Actual return} - \text{Expected return}$$

Filters

1. "Between 2007 to 2013" we have 6 years. Every year have 220 trading days. Totally, for 6 years we have 1440 trading days. The companies that number of trading day is lower than 1008 days or 70 % of trading days have been delete from the calculations.

Risk-free interest rate. Risk-free interest is the theoretical rate of return of an investment with no risk of financial loss. One interpretation is that the risk-free rate represents the interest that an investor would expect from an absolutely risk free investment over a given period. Since the risk free rate can obtain with no risk, it is imply that any additional risk taken by an investor should reward with an interest rate higher than the risk-free rate. In practice to work out the risk-free interest rate in a particular situation, a risk-free bond is usually choose that is issued by a government or agency where the risks of default are so low as to be negligible.

Abnormal Return. A term used to describe the returns generated by a given security or portfolio over a period of time that is different from the Risk-free interest rate. Risk-free interest is the theoretical rate of return of an investment with no risk of financial loss. In stock market, trading, abnormal returns are the differences between a single stock or portfolio's performance and the expected return over a set period, Usually a Risk-free interest rate. For example if a stock increased by 10 %, but the Risk-free interest rate only increased by 6 % and the stock has a beta of 1, then the abnormal return was 4 % (10 % - 6 % = 4 %).

2. In this 1440 trading days any companies that number of trading times is lower than 1440000 or 100 times trading per day have been delete from the calculations.

3. The companies that total value of their trading in these 6 years is lower than 10000 billion IRR have been deleting from the calculations.

1. The companies that average day trading volume were lower than 1 million shares have been deleting from the calculations.

Data and Methodology. In this study, an Ex Post Facto Research methodology is used to calculate the abnormal returns of technical analysis. Statistical data of this research include 29735 daily prices of all the companies in TSE “between (2007) to (2013)”. After the modification and calculation based on data filters, we obtain 2524 daily returns of 25 company stocks.

1. T-Test: we use this test to calculate average returns of the rules. Where the average returns is more than zero means technical analysis can forecast price movements and if the average is more than 10 % Drop in previous average 14 days means that technical analysis can forecast prices crashes in capital market trading.

$$t = \frac{\bar{y}_1 - \bar{y}_2}{\sqrt{s_y^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}}$$

2. Correlation: familiar examples of dependent phenomena include the correlation between the physical statures of parents and their offspring, and the correlation between the demand for a product and its price. Correlations are useful because they can indicate a predictive relationship that can exploit in practice.

3. Analysis of Variance : ANOVA is a collection of statistical models used to analyze the differences

between group means and their associated procedures (such as “variation” among and between groups)

$$S_y^2 = \frac{\sum (y_j - \bar{y})^2}{k - 1}$$

Empirical Findings. While most analysts on capital markets focus on the fundamental side, just about any major brokerage now employs technical analysts as well. Much of the criticism of technical analysis has its roots in academic theory – specifically the efficient market hypothesis (EMH). This theory says that the market’s price is always the correct one – any past trading information is already reflected in the price of the stock and, therefore, any analysis to find undervalued securities is useless. But Dow Theory focused on stock price movement includes price background knowledge and related data to forecast future prices and mainly focuses on market trends. Similar to efficient market hypothesis, Dow Theory basis conclude that the fact prices are affected by all the information and events in the market.

The main reason is that technical analysis violates one of the basic principles of financial theory: the Efficient Market Hypothesis, which claims that it is impossible to predict future prices from the observation of past prices. Another reason is that a major part of these techniques cannot be tested as they are purely graphical and they do not have precise rules. Therefore, we have Inconsistency in Efficient Market Hypothesis and Dow Theory Assumptions.

In this study we use some technical analysis indicators and some the simplest statistical tests to show technical analysis based on dow theory can be profitable for trading in capital markets.

Table 1

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
MACD	551	.860	-.311	.549	26.902	.04882	.004722
MFI	456	1.165	-.311	.854	21.105	.04628	.005739
RSI	671	1.225	-.428	.797	37.351	.05566	.004558
RFI	631	.000	.004	.004	2.524	.00400	.000000
CCI	846	1.529	-.334	1.195	44.578	.05269	.004186

Table 2

T-Test

95% Confidence Interval for Mean						
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound
MACD	551	.0488	.11083	.00472	.0395	.0581
MFI	456	.0463	.12255	.00574	.0350	.0576

Table 2 (continuation)

RSI	671	.0557	.11807	.00456	.0467	.0646
CCI	846	.0527	.12175	.00419	.0445	.0609
RFI	631	.0040	.00000	.00000	.0040	.0040
Total	3155	.0420	.10775	.00192	.0382	.0457

Results of First Hypothesis: Technical analysis indicators can show the profitable trading prices.

1. RSI with a mean of (0.055)
2. CCI with a mean of (0.052)
3. MACD with a mean of (0.048)
4. MFI with a mean of (0.046)

The results provided strong support for the technical strategies. The returns obtained from these strategies were not consistent with four popular null models. Consistently, buy signals generated higher

returns than sell signals, and further, the returns following buy signals were less volatile than returns following sell signals. According to confidence level, percentage95 all the technical analysis indicators used in this research can find profitable trading prices and all the returns are more than zero.

Results of second Hypothesis: Technical analysis indicators have correlation to show trading signals.

Table 3

Pearson Correlation

		MACD	MFI	RSI	CCI	RFI
MACD	Pearson Correlation	1	.078	-.016	.034	. ^a
	Sig. (2-tailed)	.	.097	.699	.423	.
	N	551	456	551	551	551
MFI	Pearson Correlation	.078	1	-.034	-.027	. ^a
	Sig. (2-tailed)	.097		.470	.559	.
	N	456	456	456	456	456
RSI	Pearson Correlation	-.016	-.034	1	-.012	. ^a
	Sig. (2-tailed)	.699	.470		.763	.
	N	551	456	671	671	631
	Sig. (2-tailed)	.081	.0441	.651	.553	. ^a
CCI	N	551	456	671	543	.
	Pearson Correlation	.034	-.027	-.012	1	. ^a
	Sig. (2-tailed)	.423	.559	.763	.	.
RFI	N	551	456	671	846	631
	Pearson Correlation	. ^a	. ^a	. ^a	. ^a	. ^a
	Sig. (2-tailed)
N	551	456	631	631	631	

According to the results obtained from the sample in this research nonparametric Spearman correlation test None of the technical analysis indicators has significant positive or negative correlation with each other in their returns.

Results of Third Hypothesis: Returns of trading based on technical analysis strategy is more than London Interbank Offered Rate.

Table 4

Analysis of Variance

	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
MACD	.110830	.012	1.145	.104	3.830	.208
MFI	.122546	.015	1.731	.114	7.665	.228
RSI	.118067	.014	1.433	.094	6.166	.188
CCI	.121751	.015	2.003	.084	12.310	.168
RFI	.000000	.000

We have to compare the returns for all the filters of each stock and the returns of “risk-free interest rate”. The filter that generates the maximum return among all is calling the optimal filter for that stock. The summary of the results for this sub-period is describing that According to the results of the ANOVA Multiple Comparison in row: RSI with a mean of (0,055), CCI with mean of (0,052), MACD with a mean of (0,048), and MFI with a mean of (0,046). Each one generates an abnormal return greater than the risk-free interest rate with a mean of 0,004.

Conclusion. Profitability of technical analysis strategy is one of the serious subjects between the capital market investors. We can conclude that it is indeed profitable to make trading decisions based on technical indicators such as the moving average, even in the presence of transaction costs. It is even more profitable for the trading members (who effectively do not pay any commission) and large investors (who are charge very low commission). The results also in-

dicade that the Tehran stock market is not efficient in the weak form, since it is possible consistently secure returns greater than those of the market are by using technical trading rules. In the other part of the picture, technical trading strategies in early studies (1960-1987) were indicate to be profitable in foreign exchange markets and futures markets, but not in stock markets. Modern studies (1988-2004) indicated that technical trading strategies consistently generated economic profits in a variety of speculative markets at least until the early 1990s. Among 99 modern studies, 57 studies found positive results regarding technical trading strategies, 22 studies obtained negative results, and 20 studies indicated mixed results. However, most of these empirical studies were subject to various problems in their testing procedures, e.g. data snooping, ex post selection of trading rules or search technologies, and difficulties in estimation of risk and transaction costs.

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