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Comparing the Moving Average Convergence Divergence Method (MACD) and Buy-and-Hold Strategy in the Tehran Stock Exchange

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ABSTRACT

Background: One of the requirements for investors in the stock markets is to have information about the favorable of stocks Buy and Hold method. The most important point is the selection of proper stocks (Portfolios) for buying and selling stocks and selecting the best method for being confident of the most productivity [13]. **Objective:** Technical analysis probably is the only technique of prediction for an investor who can utilize it. Fundamental analysis, due to its requirement to a large size of information and also the required time, needs to access all fundamental factors which mostly is time consuming and costly for micro investors. On the other hand, the micro investors' lack of access to the secret information can provide poor competitive edge [5]. **Results:** Among the technical analysis methods, the Moving Average Convergence-Divergence Method is a method used for analyzing stock markets. In the present study, this method is introduced and its efficiency in the Iranian Capital Market is investigated through comparing it with the buy-and-hold method. **Conclusion:** The obtained results indicated that there was not significant difference between the investment productivity obtained from the two methods. In addition, this issue was investigated that whether quantitative features of stocks can influence the mean value and standard deviation of the productivity obtained from MACD and Buy-and-Hold methods. The results indicated that the features of stocks influence the mean obtained from the MACD method, but about other features, there is no firm claim as such.

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INTRODUCTION

One of the first applications of computers in economics in 1950's was to analyze time series. Career Cycle Theories believe that tracing the transformation of several economic variables during the time can predict the economic processes during the periods of recession and bankruptcy. Among the cases which can be considered for analyzing is the behavior of the price of stock markets during the time.

Predicting the direction of the future stock prices is the topic of a comprehensive research in many fields including business, finance, statistics and computer. The objective of such analyses is to predict future prices for buying and selling the stock which will have benefits for the future. Professional dealers typically use fundamental or technical analyses for analyzing stocks and adopting investing decisions. Fundamental analysis is a method for analyzing markets in which main features of firms such as revenues and costs, market situations, the annual growth rate and etc. are investigated [9]. Technical analysis, on the other hand, is based on the study of price volatility in the past. In fact, technical analysis studies the price graphs for price patterns and uses the price data in price volatility in the future [11]. As a result, it can be concluded that technical analysis can be used for determining theentry and exit time to markets via the existence of the dependency between prices and the company [8].

The Moving Average Convergence Divergence Method (MACD) is among the technical methods which used for analyzing stock markets. In the present study, this method is introduced and its efficacy is investigated in Iran Capital Market. In addition, in the present study, this method and the Buy-and-Hold method is investigated.

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Theoretical framework:

Predicting the direction of the future stock prices is the topic of a comprehensive research in many fields including business, finance, statistics and computer. The objective of such analyses is to predict future prices for buying and selling the stock which will have benefits for the future. Professional dealers typically use fundamental or technical analyses for analyzing stocks and adopting investing decisions. Fundamental analysis is a method for analyzing markets in which main features of firms such as revenues and costs, market situations, the annual growth rate and etc. are investigated [9]. Technical analysis, on the other hand, is based on the study of price volatility in the past. In fact, technical analysis studies the price graphs for price patterns and uses the price data in price volatility in the future [8]. As a result, it can be concluded that technical analysis can be used for determining the entry and exit time to markets via the existence of the dependency between prices and the company [7].

Capital Markets:

Securities with maturities greater than one year are being sold in the stock markets. In fact, the capital market is a bridge by which the savings economic units having surplus are transferred to investing units requiring it. Since the savings and investments are vial elements for economic growth, the existence of the capital market can be considered as the necessities of economic growth [3].

Analyzers of capital markets and investors of the stock market usually, by considering particular techniques invest in markets. Therefore, investors can be divided into different classes including fundamental analyzers, franchise buyers, chartists, basic data dealers, market opportunists and investors with insight into market performance.

Fundamental Analysis:

Fundamental Analysis was discussed in 1930's, but its scientific form was expanded by Graham and Dodd. The objective of the fundamental analysis of the stocks is that all economic variables influencing the future of the benefits of financial properties be identified. The main issue is that in fundamental analysis, the analyzer is to predict the future pries using previous ones and in this investigation, uses variables which can influence the market. In addition, it is possible that the prices be dependent on cases not measurable and this issue influences the fundamental price. In such cases, they cannot predict the future appropriately and cause that the market never be balanced. The poorness due to fundamental analysis resulted in the fact that the intention toward technical analysis increased [8].

Technical Analysis:

Technical analysis is a method which is used for determining the price patterns of financial instruments (goods, foreign exchange, stocks and etc.) to provide signs in the future [1]. The logic of technical analysis is using price behaviors in the past and/or in other market data, such as size, for helping decision maker in capital markets. These decisions mostly is made by the application of existing simple laws in price data in the past. Atechnical trading law, for example, may suggest that a foreign exchange should be bought whose price has increased by at least 1% compared to 5 days ago. The dealers in the stock, foreign exchange or goods markets uses such laws frequently [11].

Technical analyzers believe that this method allows individuals to make benefits of the available changes in the market. Prings discusses something which verifies this issue. He states that "technical method for investors is the reflection of this idea that prices change in the processes, which this issue tends towards the changes in the forces of economy, money, politics and psychology by the changes in the efforts of investors. Since the technical method is based on this theory that price is a reflection of collective psychology, it tries to change the future prices based on this issue that collective psychology changes among fear, apprehension, and pessimism on the one hand, and confidence, optimism and greed on the other hand[12].

The books of the technical method by Murphy and Prings have presented three general principles in the technical analysis. The first is that market performance (prices and exchanges volume) reduces all things. In other words, the record of the price of properties includes all information and there is no need to predict or do research about the foundation of properties any more. The second principle is that the price of properties have some processes. This is the necessity of the success of technical analysis because the processes signify the capability of predicting and make the dealers capable to make benefit through buying (or selling) properties in case that the price is increasing (or decreasing). The third principle of the technical analysis is that the past will be repeated. Using this three principles, technical analyzers try to identify the processes and their return [12,11].

Different types of technical analysis:

There are different types for technical analysis and many methods for designing the present and future of prices and the data size for deciding to exchange. Traditionally, technical analyzers apply generally two methods of analyzing for investigating the long and short term volatility including charting and mechanical (indexing)

methods. Charting method refers to drawing data charts to understand the future path of the data. Charting method is a thematic system which requires analyzer to use laws and skills to perceive and interpret the future models. Mechanical laws or indices, on the other hand, imposes order and compatibility to the technical analyzers through necessitating them to use laws based on mathematical functions of previous and present prices of exchanges rates. To avoid the thematic characteristics of charting method, economists practically use mechanical principles. Mechanical principles used by the analyzers include filter method, moving average method and channel method. In the filter method, abuy (sell) signal is indicated when the price rate is higher (lower) than one percent at its lowest (highest) recent values. In the principle of the moving average of a high or low moving average of the previous prices are compared and a buy signal (sell) is obtained in case that the low moving average cuts the high moving average. The channel instrument inundates that a property is bought (sold) when its process trespasses the maximum (minimum) value n of the previous day [15]. In addition to these, new indices are presented by analyzers which uses mathematic functions for determining the time of buying and selling stocks. Some of these principles are Relative Strength Index, exponentially weighted moving average, Moving Average Convergence-Divergence, and change rates.

- ✓ *Simple Moving Average:*

Simple moving average attributes same weight for all observations. This issue is done by adding price data for a certain number of time periods [8]. The simple moving average is defined as the proportion of the total price during the time per time periods.

- ✓ *Exponential moving average:*

Exponential moving average attributes weights to the observations which exponentially reduce, which this issue results in the fact that the recent observations be more meaningful and have more effect on the average. The weight factor produces a value between 0 and 1 in such a way that the higher values decrease the importance of the older observations as quick as possible [1]. The value of exponential moving average is defined in the form of linear combination form the price and value of the moving average in the previous period.

- ✓ *Moving Average Convergence Divergence:*

Moving Average Convergence Divergence indicating the correlation between two prices of exponential moving average was designed by Gerald Appel. Although this index on the chart has two lines, in fact for designing it, the calculation of three lines is required. The quicker line known as MACD is the difference between the exponential smoothing moving average (usually 12 and 26 day periods). The slower line is called the Warning Line, usually is an exponential smoothing moving average of 9 periods of MACD. According to the common methods, the warnings of real buy and sell are issued in the time of the intersection of two lines. The upright passage of MACD is quicker than the slower line is considered as the buy signal and the reverse of this form is considered as the sell signal. The values of MACD fluctuate between the higher and lower zero line and therefore, this index acts as an oscillator. The correlation between these two prices indicates the exponential moving average [14].

Buy-and-Hold Strategy:

In this method, stocks are bought in the first time period of activity (investment) and are held to the end of the period of activity and then are sold. All advantages received during the period and with the difference between the first stock price and that of the end of the period is the basis of calculating the productivity of the Buy and Hold method [4].

Review of literature:

Waheedand Asmah, in a research titled as"Moving Average Convergence Divergence analysis as a tool for the exchange of shares in the stock market of Karachi" evaluated the efficiency of the Moving Average Convergence Divergence Method as a tool for decision making of buying and selling stocks in the City of Karachi of Pakistan. By selecting 11 firms active in the stock market during 2007 to 2009, compared the efficiency of the MACD method and buy-and-hold method based on sharpe ratio. The results indicated that the MACD index is a significant tool for exchanging the stocks in the Market of Karachi[15].

Neely and Weller, in a research titled as "Technical analysis in the foreign exchange market" investigated the importance of using technical methods in the foreign exchange market. They, using data analysis, indicated that the inefficiency of technical analysis in some cases can be due to the external factors affecting the degree of the productivity[11].

Isako and Marti, in a study titled as "Trading strategies and the temporal ability of the market" evaluated the principles of technical analysis. In their research, they pursued three objectives; first of al. they evaluated the exchange systems which were not limited to short-term processes. Secondly, they introduced temporal tests of a new market for investigating exchange strategies and thirdly, they investigated the effect of exchange strategies

with financial importance. They selected the time period from 1990 to 2000 and indicated that the complicated moving averages are able to created long-term advantages[2].

Erlzlend and Norman, in a research titled as "Above average? This moving average technical trading rules" evaluated this issue that whether the moving average technique can be used as a suitable tool for goods exchange. The results of the research indicated that the moving average strategies generally are not suitable and even using this method, there remains some profit of which the buyer and the seller would be deprived. The results were tested statistically by the Bootstrap Technique and indicated that a lot of made exchanges were statistically significant. In addition, the results indicated that using the moving average in emerging markets is not suitable for selecting exchanges[3].

Marshall *et al*., in a research titled as"Is the technical analysis suitable for being used in American Stock Market considering the size, liquidity, or other properties of the Market" using an instance in 1990 to 2004, found out that these principles in smaller markets and stocks with low liquidity have little efficiency. In their research, there was no evidence indicating any bias in applying these principles and also using these principles results in making benefits particularly in the times of long-term exchanges[10].

Pourzamani *et al*., in a research titled as" Comparing the long-term investment strategy of buying and selling stock using the filter, buy and hold, and the moving average market methods" compared three filter, buy and hold, and the moving average market methods for predicting prices in the stock market for a long-term period from 2001 to 2008 for companies accepted in Iran's Stock Exchange. The results of the research indicated that the productivity of the stocks calculated using the filter method in the long-term period is more than the Buy and Hold and the moving average methods of the market and the productivity of the Buy and Hold method is more than the moving average method[13].

Razmi *et al*., in a research titled as"Evaluating the effectiveness of technical analysis in the Tehran Stock Exchange" investigated the profitability of common technical analysis rules and identification of desired parameters of these rules in Tehran Stock Exchange. In this study, by investigating 46 exchange principles including types of short- and long-term moving average, the limits of Support and Resistance, Bollinger Bands, Stochastic oscillators, The Relative Strength Index, and Moving Average Convergence / Divergence on 22 companies overactive in exchanging of the Tehran Stock Exchange, it was observed that among them, the moving average index enjoys more favorable ability of predicting in the Tehran Stock Exchange. Further, considering the Volatility of prices, the short-term exchange rules has created more benefits than longer-term rules, to administrating statistical tests, considering the non-normality of the series, the Bootstrap technique was used[8].

Research hypotheses:

Main research hypothesis:

There is a significant difference between the mean productivity resulting from MACD method and the Buy-and-Hold method.

Peripheral research hypotheses:

1. There is a significant correlation between the quantitative features of stocks (pries and exchange size) and the mean productivity of the MACD method.
2. There is a significant correlation between the quantitative features of stocks (pries and exchange size) and the standard deviation of the productivity of the MACD method.
3. There is a significant correlation between the quantitative features of stocks (pries and exchange size) and the mean productivity of the Buy-and Hold method.
4. There is a significant correlation between the quantitative features of stocks (pries and exchange size) and the standard deviation of the productivity of the Buy-and Hold method.

Methodology:

To conduct each study, designing plans and strategies of the research is a vital issue. The research strategy refers to a method based on which the research is managed [2]. Regarding the fact that each research starts with a problem and objective; therefore, according to the nature of the presented issue and the objective, the research can be divided into different types. In classification based on the objective, the degree of the direct application of findings and the generalizability in similar conditions are emphasized [15]. In general, the research strategy can be stated into qualitative and quantitative forms.

Quantitative method is concerned with collecting and analyzing quantitative data and uses statistical methods for evaluating the data [7]. With this type of research, the relationship between theory and the research is indicated inductively [3].

Along with presented strategies, another method called case study is available. According to what [15]. presented, this method is suitable when the research question is presented with how questions. Therefore, based on what stated, the method of the present study is a combination of qualitative research and case study because

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it investigates the significance of the MACD method in Iran's Capital Market and to test the hypotheses, it uses statistical tests.

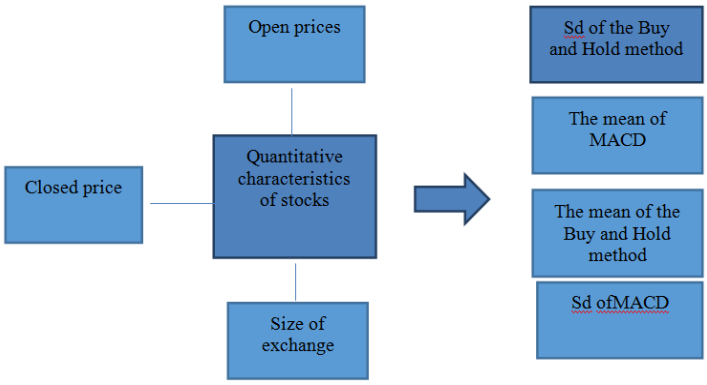
The population of the present study includes the accepted companies in the Tehran Stocks Exchange. To investigate the significance of MACD method, a sample including superior active companies accepted in the Iran Stocks Exchanges was selected.

The temporal scope of the research includes June 2011 to September 2013 and the spatial scope includes the Tehran Stocks Exchange.

In the present study, to collect data and to register the scientific points, library research was used and to collect data and to investigate the accuracy of the research hypotheses, field study was employed.

Research conceptual model:

In the present study, the effect of the quantitative features of stocks on the mean and standard deviation of the productivity resulting from the MACD method and the Buy-and-Hold method is investigated. Therefore, the independent variable includes the quantitative features of stocks which are as follows: open share price, closed share price, and the exchange size; and the dependent variables include standard deviation of the Buy-and-Hold method, standard deviation of MACD method, the mean of the Buy-and-Hold method, and the mean of MACD method.



Data analysis:

For analyzing the data, Meta Stock software program version 11, Excel and SPSS version 16 were used. The value of the productivity resulting from using the MACD method and the mean and standard deviation values for exchange per different stock symbols are indicated in table 1.

Table 1: The value of the productivity of using MACD strategy.

	Stock symbol						
	Parsan	Fakhuz	Shapna	Femli	Fulad	Ghadir	Akhaber
	-71.87	96.68	-82.07	-86.84	-37.77	-20.02	10.97
	-69.31	-91.95	-11.05	-86.67	-35.89	4.63	-5.85
	6.33	-87.43	7.63	-83.63	-33.33	29.04	-1.46
	37.50	-83.11	14.14	-81.09	-31.02	48.88	2.67
	59.41	-73.53	53.83	-76.68	-27.65	67.49	6.05
	74.10	-65.55	93.87	-72.12	-23.34	78.21	8.71
	83.01	-59.36	109.007	-91.51	-18.79	84.56	11.46
	79.64	-34.95	116.72	-101.74	-20.18	87.18	14.76
	24.85	-74.07	14.89	-54.65	-17.20	23.30	25.17
Mean	36.94	-71.24	49.87	-81.01	-25.92	52.91	7.68
sd	49.26	29.25	50.15	30.01	10.88	34.11	9.47

The value of the productivity resulting from using the Buy and Hold method for exchange per different stock symbols are indicated in table 2:

Table 2: The value of the productivity of using the Buy and Hold method.

	Stock symbols						
	Parsan	Fakhuz	Shapna	Femli	Fulad	Ghadir	Akhaber
	-219.52	-259.30	-334.79	-76.48	-61.29	-132.35	-26.82
	-204.73	-250.03	-303.36	-78.85	-58.73	-120.30	-27.12
	-183.84	-240.04	-262.71	-80.50	-56.16	-105.02	-26.09
	-158.57	-229.62	-225.23	-81.39	-53.46	-87.25	-24.17
	-131.23	-219.00	-192.80	-81.57	-50.70	-68.43	-21.60
	-104.14	-207.26	-157.84	-80.82	-47.70	-49.07	-18.66
	-78.74	-195.03	-120.85	-79.29	-44.33	-30.88	-15.60
	-55.92	-182.85	-87.29	-81.93	-40.62	-14.55	-12.43
	-37.65	-171.15	-58.01	86.07	-37.83	-0.48	-9.07

Mean	130.48	217.14	193.65	80.76	50.09	67.59	20.17
sd	65.78	30.45	96.18	2.61	8.12	47.12	6.63

To compare the productivity of the two methods, statistical methods are used.

Firstly, the normality of the data was tested usingKolmogorov-Smirnov test. The results of the test are presented in table 3:

Table 3: The results of Kolmogorov-Smirnov test.

	Method the MACD							the Buy and Hold method						
Test	Parsan	Fakhuz	Shapna	Femli	Fulad	Ghadir	Akhaber	Parsan	Fakhuz	Shapna	Femli	Fulad	Ghadir	Akhaber
The test statistic	.853	.554	.644	.383	.861	.849	.467	.546	.450	.500	.490	.734	.533	.543
Significance	.460	.918	.801	.999	.449	.466	.981	.927	.987	.964	.970	.654	.939	.930

Since the observations are normal, to compare the means, t-test (student) was used. The results are presented in table 4:

Table 4: The results of the mean comparison t-student test.

Method		Levine's test for equality of variances		Mean comparison Test		
		F	Sig.	t	df	Sig.
Buy and Hold	Equality Terms of variances	.104	.754	.933	9	.375
	inequality of variances			.973	8.549	.357
MACD	Equality Terms of variances	.151	.707	-.764	9	.464
	inequality of variances			-.763	8.587	.466

Regarding the fact that the test is not significant, it can be understood that there is no significant difference between the mean productivity of the two methods.

By investigating the relationship between the property prices and the mean productivity of the properties resulting from the MACD method, the correlation test was used. Since the investigated variables are normal, to investigate the correlation, Pearson correlation test was used. The results obtained from the calculation of this coefficient are summarized in table 5:

Table 5: The results of Pearson correlation test for the relationship between the mean productivity of the MACD method and the stock price and size.

Variable	Open price	Size	Closed price
Test statistic	0.170	0.004	0.170
Sig.	0.715	0.994	0.715

The results mentioned in table 5 indicated that there is no significant difference between the mean productivity of the MACD method and the stock price and size.

To investigate the correlation between the property price and standard deviation of the productivity of the properties resulting from the MACD method, the correlation test was used. Since the investigated variables are normal, to investigate the correlation, Pearson correlation test was used. The results obtained from the calculation of this coefficient are summarized in table 6:

Table 6: The results of Pearson correlation test for the relationship between the standard deviation of the productivity of the MACD method and the stock price and size.

Variable	Open price	Size	Closed price
Test statistic	0.799	-0.669	0.800
Sig.	0.031	0.100	0.031

The results mentioned in table 6 indicated that there is no significant difference between the standard deviation of productivity of the MACD method and the stock price and size. But there is a positive and significant correlation between the standard deviation of the MACD method and open and closed prices of the stocks.

To investigate the correlation between the property price and the mean productivity of the properties resulting from the Buy-and-Hold method, the correlation test was used. Since the investigated variables are normal, to investigate the correlation, Pearson correlation test was used. The results obtained from the calculation of this coefficient are summarized in table 7:

Table 7: The results of Pearson correlation test for the relationship between the mean productivity of the Buy-and-Hold method and the stock price and size.

Variable	Open price	Size	Closed price
Test statistic	-0.823	0.715	-0.559
Sig.	0.023	0.071	0.192

The results mentioned in table 7 indicated that there is no significant difference between the standard deviation of productivity of the Buy-and-Hold method and the stock price and size. But there is a negative and significant correlation between the standard deviation of the Buy-and-Hold method and open and closed prices of the stocks.

To investigate the correlation between the property price and the mean productivity of the properties resulting from the Buy-and-Hold method, the correlation test was used. Since the investigated variables are normal, to investigate the correlation, Pearson correlation test was used. The results obtained from the calculation of this coefficient are summarized in table 8:

Table 8: The results of Pearson correlation test for the relationship between the standard deviation of the productivity of the Buy-and-Hold method and the stock price and size.

Variable	Open price	Size	Closed price
Test statistic	-0.823	0.715	-0.823
Sig.	0.023	0.071	0.023

The results mentioned in table 8 indicated that there is no significant difference between the standard deviation of productivity of the Buy-and-Hold method and the stock price and size. But there is a positive and significant correlation between the standard deviation of the Buy-and-Hold method and open and closed prices of the stocks. Therefore, it can be concluded that as the open and closed prices of the stocks increase, the standard deviation of the productivity of the Buy-and-Hold method

Conclusion:

In the present study, to investigate the accuracy of the research hypotheses, the first step is to select the best test for confirming or rejecting the hypotheses. To select the best method, firstly, the normality of observations was tested using Kolmogorov-Smirnov test. Due to the normality of the observations, to compare the mean productivity, t-test was used. In investigating the relationship between the productivity of the MACD method and the Buy-and-Hold method and the value of open prices, closed prices and the exchanges size, and also due to the normality of the data, Pearson correlation test was used.

The obtained results indicated that there is no significant difference between the productivity of investing obtained from the two MACD and Buy and Hold methods. Further, in investigating this issue whether quantitative characteristics of stocks can influence the mean value and standard deviation of the MACD andBuy and Hold methods. The results indicated that the characteristics of the stocks influence the mean value obtained from the MACD method, but about other characteristics, one cannot firmly claimed.

The results obtained from the test indicated that although there is a difference between the values of productivity of the two MACD and Buy and Hold methods, there is no significant difference between the mean productivity obtained from the two methods. This is while in the previous research, it is confirmed that the MACD method is more efficient than other methods. Therefore, it can be said that to investigate a model appropriately, it is better to use a localized model and it should be designed regarding the distribution of the data. In other words, it can be said that since the distribution of in different markets, one cannot surely speak of the total efficiency of a model in other models because a model may have acceptable capability, but it has not compatibility with the structure of other markets.

In addition, regarding the influence of quantitative characteristics of the data on mean and standard deviation of the productivity of MACD and Buy-and-Hold methods, it can be said that these methods are not stable and may be changed with a small variation in the degree of stock price. Further, since the Buy-and-Hold method's being influence is more than that of the MACD method, it can be said that the Buy-and-Hold method is more instable than the MACD and the MACD method does not act better in this regard. As a result, in markets which the price volatility of the stocks, using the MACD method is preferred to Buy-and-Hold methods. The present study is consistent with the research done by [15]. Waheedand Asmah investigate the efficiency of the Moving Average Convergence Divergence method as a tool for decision making of buying or selling of the stock in the City of Karachi. By selecting 11 firms active in the stock market during 2007 to 2009, compared the efficiency of the MACD method and buy-and-hold method based on sharpe ratio. The results indicated that the MACD index is a significant tool for exchanging the stocks in the Market of Karachi.

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