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Comparison of New Models to Predict Prices and Stock Returns

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ARTICLE INFO	ABSTRACT
<p>Article History: Received 6 November 2018 Received in revised form 12 December 2018 Accepted 2 March 2019 Available online 10 March 2019</p>	<p>During the twentieth century, numerous financial professionals introduced various models and analytical frameworks for forecasting share prices and supporting investment decision-making. The central objective of this study is to develop a comprehensive pricing behavior chart and to analyze the effects of inflation on stock market dynamics. Understanding the sensitivities of long-term market behavior and projecting future trends are crucial for identifying investment opportunities and mitigating financial risk. This research focuses on the perspective of technical analysts, or chartists, who emphasize the analysis of price movements through graphical representations and time-series data. These analysts argue that price fluctuations are primarily driven by the forces of supply and demand, which, in turn, are influenced by a complex set of economic and behavioral factors. By examining historical price trends and transaction volumes, they attempt to detect recurring patterns that may signal future price movements. Unlike fundamental analysts, technical analysts believe that long-term price behavior can be better understood through empirical observation of past data rather than through macroeconomic or accounting-based indicators.</p>
<p>Keywords: Share Price, Stock Return, Predict Models, future prediction</p>	

1. INTRODUCTION

Artificial Neural Networks/ methods have a wide range of applications [1-7]. At the beginning of this century a group of financial experts with experience in the evaluation of securities believed that we can offer an image for the future prediction of stock return via studying and analyzing past data of price and return on equity variables. The group believed that identifying of relationship between the past data and the return on equity in the previous periods, and recognize patterns of these changes and discover their secrets, can easily determine future stock returns. This group, known as the Chartists, predict price and stock returns through of studying charts of price changes and stock returns. These methods still enjoys a special position in the global capital markets. This perspective can also be called technical analysis [8].

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More scientific studies with an emphasis on the behavior of the price established trend to the valuation models. Then they paid attention to characteristics and structure of the capital market that the results of these studies led to the capital efficient market hypothesis.

During the first half of the twentieth century, several studies were conducted on the capital markets and the stock price, but in the second half of this century, studies with more aggressively pursue and the results of these researches was led to theories about the capital market. In continue we discuss about some these models [9].

2. BASIC APPROACH AND BASIC-ORIENTATION

One of approach of monetary analysis is categorizing them in basic – orientation and technical analyzers group. basic analysts look at future and pay attention to making profit and future divide profit . Indeed technical analysis pay attention to past and information related to share buy and sell, making profit and past divide profit. Technical information note to market study. Since these in divides don't pay attention to foreign factors in market and they completely pay attention to number related to share transaction volume and rice level. Basically in this models pay attention to intrinsic value of every share. In this model pay attention predict share output and monetary and non-monetary variables. Calculated intrinsic value comparison to current price they based on this for bond buy, sell or maintain. They state basic analysis design for question what.

3. APPROACH BASE ON MONETARY MODERN NOTIONS

Life of monetary modern notions is half a century. These notions are bases for monetary properties value calculation price tried to describe investment market. These views have basic differences with past investigations. Investment markets agents extensively use them after Second World War. Peter Bernstein for the first time state technology complication and not possibility for draw figure and understand market inflations. This views lead to theorisians investigate hypothesis and price randomly moved. This concept called random circulation artificial nervous networks and their theoretical base. we saw continuous movement of theory researches to application research during recent years , especially in information process or problem with no solution . We saw interest in developed free smart dynamic system of model base on theory model. Artificial nervous systems are including this group of dynamic systems and transmitted law, knowledge or hidden discipline. So these are smart systems. These systems are based on calculation intelligence tried to modeling human brain neuron synaptic structure . Halbert white for the first time stated nervous networks application in monetary and economic predictions in 1988. In this study value of nervous systems state and solve share market puzzles. this research try to discovered hidden discipline in IBM and use company share daily output and statistical methods and learning methods in nervous networks stated as 2 supplementary elements [10].

We see artificial nervous networks success in management and monetary discussions during recent decades. several papers state in this field and education for solving complex patterns recognition problems is challenge for university researchers. Nervous networks are one intelligence tool for extensive field of management domain and change organization view method to between data communication and company strategies. Nervous networks are simple calculation tool for data test and making model of data structure.

Data for making models called educational data. While nervous networks use educational data for learning present data can apply them for reaching to different outputs function results artificial nervous networks have some feature and are: estimations prediction, pattern recognition, control, robotic, learning, extending ability, parallel process and stability. Nervous network models diversity and their learning algorithms state opportunities for their different applications. theoretical literature of market indexes output prediction several research done about market indexes output with different variables these researches evaluated possible effect of accounting information on price or share output one of accounting features is their efficiency in prediction. Accounting information should help to user past evaluation and predicted future activities of economical unit value of accounting information is depend on their abilities to predict futures economical events [11].

In most research about predict share output with accounting they assumed there is on linear relationship between accounting ratios and share output . and these kinds of information have one normal distribution .

This research succeeds in short-term predictions, while 3 decent decades determined relative efficiency of linear models in next day prediction and don't efficiency in long-term prediction. These model sensitivity is very high relative to earlier state and these models are notable to revive related process dynamic and are not useful for long-term prediction. modeling and prediction by linear models have not favorite performance because they have non-linear identity term prediction are not favorite. One of words in globalization age state is competitive ability to have is process that every companies and organizations tried to have better performance of other and generally referred to description of. Every company has better performance for maintain market share and competitive situation to increase economical ability and market share.

Artificial nervous networks are most important and efficient method for improve these methods and we saw significant progress in these monetary decisions quality. Self-organizing nervous networks are include most important networks in data mining and analysis complex spaces. Kohen for the first time introduced these networks and used practically for recognition voice and converted it to text in 1984 basic philosophy of this networks are design high aspect spaces to 2 or 3 aspects spaces .Minimum of information lost and hidden information is discoverable. This ability make with produce non-linear writing between information's on 2 or 3 aspects neurons. Every map consisted set of neurons and they orderly designed beside each other.

4. SELF-ORGANIZING WRITING

This use for data complex spaces analysis basic performance of these networks is converting one input space to one space with less aspect. This kind of networks considered as aspect decreasing tool. final purpose of these writing is obtain this simple model of earlier data for decrease calculation and complexity for data the most Important applications are categorizing, pattern recognition, picture analysis, noises and recognize errors and are special kind of Kohen networks, Kohen self-organizing writings topologies. These plans have one 2 layers structure with one input layer and one output layer. Output layer include set of neurons and are in one flat layer. These foreign layer neurons defined network output with respect to its neighbor, their mutual behavior. Number of neurons in output layer is depending to study case and user determined then.

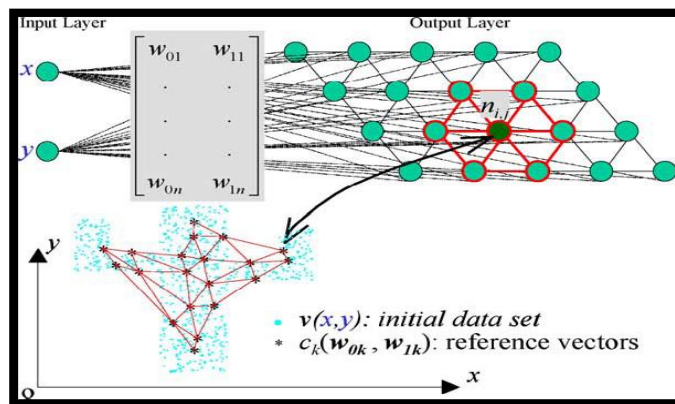


Fig. 1. Self – Organizing Structure [12]

Input neurons connected to output layer neurons, by connected weights. Every output unit called reference vector weighting by their specification in output plate so neurons weight changes by educational algorithm. Action base of neuron search weights moved to input pattern. Final result of these move is information packing determine these space. Algorithm for self-organizing writing learning. This algorithm is non-supervisor kind and we can determine first order equations. These equations describe how network weights coordinate to time or repeated state. We use one. We can summarize this algorithm below phases.

(1) Beginning phase: in this phase weigh of every neuron is as one random number, hen one input pattern $x=(x_1, x_2, x_3, \dots, x_d)$ apply to network.

(2) Determine winner neuron, in this phase winner neuron determine base on network similarity scale. We can apply this scale in self–organizing but they commonly use oqlidos distance in these kinds of networks.

$$\|X - W\| = \left(\sum_{i=1}^d (X_i - w_i)^2 \right)^{1/2} \tag{1}$$

Now concurrently input $x = (x_1, x_2, x_3, \dots, x_d)$ comparison to all elements in network. Winner neuron is minimum neuron between all reference patterns of input data.

$$\|X - m_c\| = \min_i \{ \|X - m_r\| \} \tag{2}$$

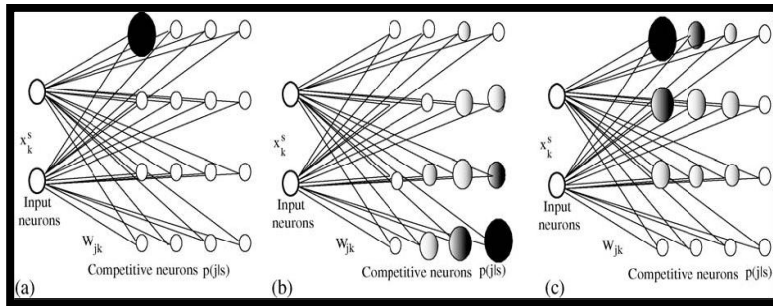


Fig. 2. Select Winner Neuron among Reference Pattern

(3) Determined neighbor neurons, set of winner neurons of winner neuron neighbor neuron determined. Some different neighbors present in figure 3.

These values change is in 2 different states. In the first state one certain radius select around cell. In this method all neurons moved to input trend with one stable coefficient. In the second method all neurons in network moved with unequal coefficient to entrance. This unequal coefficient should have maximum winner neuron and its value decrease with move of winner neuron [13].

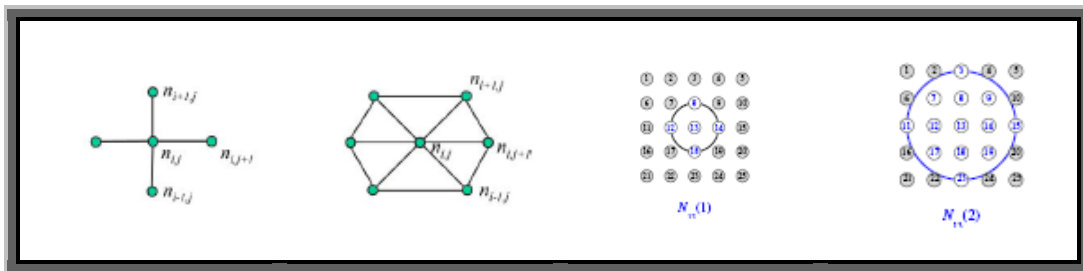


Fig. 3. All kinds of neighbors in self–organizing writing

(4) Weights modification, finally weights related to winner neuron and neighbors should modified base on network input. These changes are based on below equation.

$$m_r(t + 1) = m_r(t) + \alpha(t) \cdot h_{cr}(t) [x(t) - m_r(t)] \tag{3}$$

$X(t)$ is input in t time, $m_r(t)$ is r reference pattern in t time, $\alpha(t)$ is learning ration in t time and $h_{cr}(t)$ is neighbor subordinate that define base on cornel subordinate.

$$h_{cr}(t) = \exp\left(-\frac{\|k_c - k_r\|^2}{2\sigma(t)^2}\right). \tag{4}$$

$k_c, k_r \in \mathfrak{R}^d$ state winner neuron and its reference pattern neighbor $s(t)$ is corned function radius in t time. Result of these case weights modification and moved these neurons toward educational sample. $a(t)$ is parameter for control algorithm and is depend to repeat. They mean network stability $0 < a(t) < 1$ and decrease base on t . They need more time for learning educational pattern.

Apply self-organizing writing for multi-aspect spaces analysis and show after educating n next weight vector obtain base on selected neurons for network and every of them show part of space analysis. If we properly select neuron, network aspects and network proper education, weighting vectors analysis show this space. All values show with color range of dark blue to dark red. RGB are of standard formats for defined colors and every color obtained by major color value and composition. So very neuron color determined depends on every color characteristic we can investigate mutual relationship between specifications and correlation test. Education without supervision is then supervision state and need more time to learning educational patterns.

After educate a self-organizing network, next n weight vectors obtained and every of them show analysis space. We can analysis space by select proper number of neuron, network aspects and educate network. So one color considered for one vector, all values shows by color range RGB are of standard formats of colors definition. We can evaluate mutual relationship between specifications and correlation test by specifications maps.

As an example while two part of vector have same color, show relation and correlation with every specification. Level of relation and correlation value between two variables evaluated of different parts of space. Also it is possible strictness and kind of relationship between two specifications is different and affect by other specifications and all of them shows by some maps [14].

5. AUTO REGRESSION LINEAR PREDICTION MODEL

We speak about predict y dependent variable base on x independent variable. Correlation measured dependent value between 2 variables. ρ correlation value measured correlation value of two variables. Index for measure two x, y variable is Pearson correlation coefficient and change between ± 1 . Meaningful estimation and test base on 2 variable societies is normal. This society completely clears by 5 variables like $x\mu, y\mu, \sigma_x, \sigma_y, \rho$.

Correlation coefficient of 2 random variable x, y defined base on below relation.

$$\rho = \frac{\text{cov}(X, y)}{\sigma_x \sigma_y} = \frac{E(X - \mu_x)(Y - \mu_y)}{\sqrt{E(X - \mu_x)^2} \sqrt{E(Y - \mu_y)^2}} \tag{5}$$

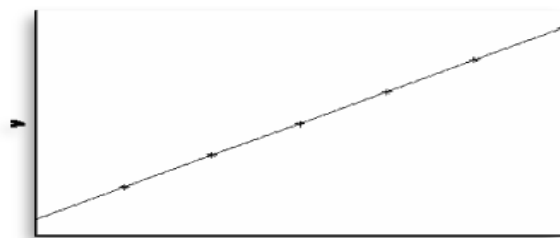


Fig. 4. Show complete correlation between x, y

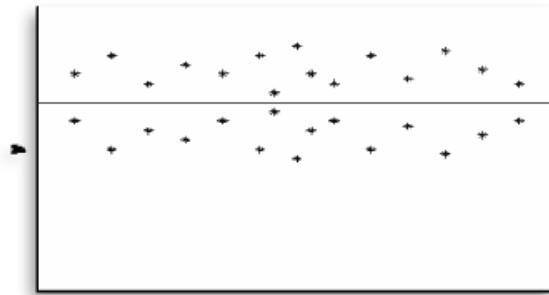


Fig. 5. Complete positive correlation -B-zero correlation

Since Y increase, X increase. There is no relation between X , Y in Complete negative correlation. In other words since X increase, Y don't change that is not predictable. So there is no correlation between X ,Y. On the other hand in figure 5 there is complete negative linear relationship between X, Y. It means that when the Y decrease, X increase. So we cannot interoperate amounts for ρ , unless 1 and -1.

For ρ as an example if correlation is 3% we cannot coefficient value of first study is B time more than second study and we should use R2. Since correlation coefficient is 9% we can explain 81% of Y changes in X. While coefficient equal to 3%, 9 percent of changes in X describe by X.

6. PRICE INDEX

Index word plot shows representative. Index is quantification representative for some similar variable and is tools for measure phenomenon that have certain identity and specification. Index calculation is possible for every company, industry or group. For calculate index they considered on years as base value then multiplied it in 100.

This number shows the index. Different indexes calculated for every group in stock exchange. For example Dawn Jones index show 30 companies, 20 transportation companies and 15 service companies. Other popular indexes are New York stock (S & P 250), that calculate for 250 companies and S & P 500 calculate for 500 companies, London, Tokyo, Amsterdam, France, German stock exchange [15].

6.1. Tehran Price Index

Tehran stock exchange calculated itself index and published its price index as TIPEX from March 1990. This index included 52 companies. This index calculates by below formula:

$$TEPIX_t = \frac{\sum_{i=1}^n P_{it} q_{it}}{D_t} \times 100 \quad (6)$$

P_{it} = company price in I time.

q_{it} = published share number of I in t time .

D_t = base number in t time that is equal to $\sum p_{i0} q_{i0}$.

P_{I0} = published share price of Ii company in origin time.

N = number of index companies.

Tehran stock exchange price index include all accepted company in mark is close or don't transacted. Number of companies published share is measuring scale in this index that has more effect on index. In this calculation base year is 1990.

This index say all value of market relative to base year is 1990 and grow for example if all price index is 12700 , it means market value 127 times more than 1990. This index calculates for 3 groups.

market price index : share price of all transacted companies is affective in its calculation .

6.2. Industries Index

Companies in Tehran stock exchange categorize in different industries. This categorizing base on ISIC method distinct 36 industry in Tehran to April 2005. Tehran stock exchange calculate price index for every industry and all of them calculate by similar formula. These companies divided to 2 monetary and industry group monetary group include all monetary mediatory groups and industry group include stock exchange companies unless monetary mediatory company.

Tehran stock exchange calculated price index for these 2 groups and 2 of them followed all price index scales in calculation and design.

6.2.1. industry index: Its calculation formula is like all index calculation and show changes In monetary mediator companies share value .

6.2.2. Index of active 50 companies: This index shows public level of 50 active companies and calculate by 2 methods. In the first method calculated 50 active companies use simple mean method and second method include TEPIX method. The most important case select these 50 companies are companies' transaction day's numbers. Tehran stock exchange say cash or companies activity is major scale for select 50 companies.

6.3. Tehran Dividend Price Index (TEDPIX)

Price index and cash output or income index calculated and published in Tehran stock exchange of March 1998. This index changes show stock exchange output. This index includes all accepted companies in stock exchange and weighting method is like all price index. Price index and Tehran stock exchange cash output calculated by below formula.

$$TEDPIX_t = \frac{\sum_{i=1}^n P_{it} Q_{it}}{RD_t} \times 100 \quad (7)$$

P_{1t} = I company price in t time.

q_{1t} = company published share number in t time.

RD_t = base of price index and cash output in t time and in origin time is equal to $p_{i0}q_{i0} \sum$.

Decrease price index base and cash output calculated by below formula.

$$RD_{t+1} = \frac{\sum_{i=1}^n P_{it} Q_{it} - \sum_{i=1}^n DPS_{it+1}}{\sum_{i=1}^n P_{it} Q_{it}} \times RD_t + \frac{RD_t}{D_t} \times (D_{t+1} - D_t) \quad (8)$$

RD_{t+1} = base of price index and cash output in t + 1 time .

RD_t = base of price index and cash output in t time.

P_{1t} = I company price in t time .

DPS_{it+1} = pay cash number of I company in t time .

D_{t+1} = base of price index in t time.

As we know these 2 formula consisted of 2 parts. First section is related to companies paid cash return and adjust index base. Second part is related to adjusting cases and it is common between total price index, price index and common cash return. It includes increase investment of cash cases. Consider companies that are paid cash dividend. In this situation D_t is equal to D_{t+1} .

$$RD_{t+1} = \frac{\sum_{i=1}^n P_{it} q_{it} - \sum_{i=1}^n DPS_{it+1}}{\sum_{i=1}^n P_{it} q_{it}} \times RD_t \quad (9)$$

RD_{t+1} is less than RD_t , and lead to increase price index and cash return. But now consider situation that increase investment of cash place. In this situation 7 formulas calculated.

$$RD_{t+1} = RD_t + \frac{RD_t}{D_t} \times (D_{t+1} - D_t) \quad (10)$$

This formula method is RD changes percent is like D . As an example if D_{t+1} , 1/2 is equal to D_t , RD_{t+1} is 1/2 times more than RD_t , and it is in situation pay cash profit is zero. In other words if cash profit don't cash value, percent of total price index base changes, price index and cash output are equal.

6.4. Cash Return Index

Cash return index show general level of companies paid cash return and its value calculate by divide all index based on price index base and cash return below formula show method of calculating cash return index.

$$TEDIX_t = \frac{D_t}{RD_t} \times 1653.80 \quad (11)$$

These indexes calculated by contractual formulas. And index show special changes.

7. CONCLUSION

Some monetary experts to investors and investment companies followed price from early 20century and share price behavior and its value gradually pay attention and their decision is on their investment. Create a pricing behavior model, look at their inflation, and identify long-term behavior. The main goal of this school is sensitivity or their prediction. Chartists, often known as technical analysts, are this group. Because they employ more curves. They contend that there are numerous potent influences on supply and demand. Never can they correctly identify it. Therefore, we should be aware of potential changes and look at pricing time series and data relating to transaction volume. They can identify prior price trends and look into historical context, both of which are crucial in predicting future share price behavior. This group thought that short-term chances should be taken advantage of and that fundamental analysis was an inappropriate scale for identifying share price behavior. One of most basic monetary analysts dividing is their technical analysts and basic – oriented analysts group. Basic analysts look at future and pay attention to benefit and future divide profit. Indeed technical analysts pay attention to past and look at information related to past share buy and sell. Technical term point to market study, since these individuals don't pay attention to foreign factors volume and price levels. In these models they basically pay attention to intrinsic value of every share. In this models pay attention to monetary and non– monetary variables for predicted share output.

Calculated intrinsic value comparison to current price and made – decision based on sell, buy or keeping. In order words this group believed there is order after discovering in order and is not discoverable by normal linear method. It means share behavior is not completely random or in order and pattern of share price behavior is non–linear and share price inflation is due to complex non – linear relation that its ability decrease with linear regression models and should use one series of relation base on nervous networks.

Today nervous networks are one of trustable tools in prediction and assimilation. These networks can recognize pattern in extensive level so use for recognize share market pattern. Nervous networks are include non – parametric relation and don't need to assumption related to distribution shape in tradition statistical methods.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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