The Study of Non-Stationary or Random Walk at Tehran Stock Exchange during the Years (2001-2011)

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ABSTRACT

Based on the macro-economic theories, economic growth rate is associated with investment and investment is associated with saving. Stock exchange is one of the sources of gathering savings and investments supplying, so the role of stock exchange has a special importance in the economic growth and development. Stock exchange is one of the indexes of economic development. When it has efficiency and required transparency, through it, the great volume of capitals lead to the cycle of production and industry. In third world countries, due to the lack or defect of information system and also weakness in economic structures, stock exchange is either inefficient or maybe in weak form of efficiency. The aim of this research is to investigate Tehran stock exchange from the view of non-stationary or efficiency in the weak form. So the statistical population (accepted companies) in Tehran stock exchange were investigated in two form of tepix and tedpix. The research method is descriptive – analytical method and considered data are exceeded than 5172 for 11 years (2001-2011) taking directly from the stock exchange website. In the statistical analysis, EVIEWS software for hypothesis testing and SPSS software for determining descriptive statistics indexes was used. To determine the circumstance of non-stationary or efficiency in the weak form, Dickey-fuller and Variance ratio test was used. The results of both tests show that Tehran stock exchange had non-stationary movement and is inefficient even in the weak form. This denotes that Tehran stock exchange is lacking in the required information process and does not have characteristics of perfect competitive market.

KEY WORDS: Non-stationary, Random walk, Efficiency, Tepix, Tedpix.

1-INTRODUCTION

The conducted studies show that stock exchange in the third world countries has been strong and semi-strong efficient and does not follow a random walk which is due to manufacturing plants and industrial structure and failure in informing system. For the efficiency of stock market, in addition to efficient and robust integrated information system, sectors and companies and accepted industries in the stock exchange must be in good performance and capability (mansoori, 2009). One of the issues that always come up in stock market is the hypothesis of stock exchange efficiency which arises as a foundation for many financial models. This hypothesis is also based on investment strategy for many investors and companies. In other words, the acceptance or rejection of this hypothesis may influence the decision to invest in this market (Palan, 2004). Efficient Market Hypothesis lies on how stock prices react to new information described in competitive markets. To Fama’s opinion, efficiency of the capital market which takes place in the setting of market prices over time use data effectively (Fama, 1965). Before the advent of efficient market hypothesis, a group of stock exchange members believed that the study of stock market history shows us that the process cost contains useful information for predicting future prices. Believers are known as Chartists because they focus on the prices chart (Jensen, 1978).Findings show that there are two movements in stock exchange markets. Stationary moving or static one, which is known as mean reversion, in this case, stock prices generally fluctuate around a straight line; Sometimes increases and then decreases to reach a minimum and then rises again soon, so it will move on indicating an abnormality and instability, and lack of confidence in this market (Fama 1970). Other stock movement is non-stationary which is also known as the random walk implies that stock prices cannot be predicted. This price is subject to accidents and incidents that occur due to various reasons and cannot be predicted. Non-stationary movement is an unforeseen, regulatory obeying market economic mechanisms and principles that has implications for the efficient market hypothesis (Fama and French, 1988). It is expected that the efficient market allocate resources to the function properly. Shareholders and market makers make their decisions based on the random walk in terms of market mechanisms, competition and economic conditions and the information which is obtained from the state policies (Grossman and Astyglyz, 1980). According to the efficient

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market hypothesis that stock prices follow a random walk process. Efficient markets stock cannot be predicted on the basis of the past prices changes (Pooterba and Samers, 1988). According to the researches and studies which authorities declare about the performance of the stock exchange in countries such as Iran, the need to investigate the performance of Tehran stock exchange can be examined once again over long periods in more details. This review has considered several important benefits: 1) to clarify whether Tehran stock exchange is stationary and faces abnormalities or is a non-stationary movement which follows a rational process and performance 2) the effectiveness of this research for future studies and identification of the Tehran stock exchange 3) Identifying the movement of stock exchange give useful information to investors to make decision correctly and ensure the future of your investment. Regarding to what was said about the performance of the stock market, the question is whether the process of Tehran stock exchange is non-stationary and will follow a random walk or is stationary tending to return to the mean. This is a question that must be answered and the purpose of this study is also to answer this question.

2- RESEARCH LITERATURE

Capital market efficiency hypothesis, first proposed in 1965 by Fama. The idea of the project was to answer the question: "Does the stock market fully function in data processing? ". The effectiveness of the capital market in economic management was introduced and later was extended to all areas of financial expertise. An efficient market is a market where data influence on stock prices with high speed and their prices are adjusted according to the information. In an efficient market, investors are aware of the same information, so the efficient market is a market that reflects the information that is available in the market and guide the investors. Efficient market concept is based on the premise that investors' decisions is associated with all of their information in the stock price in their exchange and the stock price will be a good indicator of the value of the investment (Fama, 1970).

The empirical history and background of this research has been done and more studies conducted to evaluate the performance of the stock exchange and these studies targeted more at the weak form of efficiency of capital markets. In the advanced countries, stock exchange in the form of strong, semi-strong is efficient and weak-form efficiency does not apply in their case. In the following we will discuss some of the research:

Haber (1997) examined stock market with low volumes of information or evidence insufficient at Austrian stock exchange market using multiple variance ratios in stock exchange of Vyiana and came to the conclusion that random walk theory cannot be denied. Kung and et al (1997) concluded that by surveying of the long-term memory of stock of the four-Pacific stock markets including Australia, Hong Kong, Singapore and Japan, did not find any evidence for the indexes of long-term memory in the four market performance. Kim and Nelson (1998) examined a sample of NYSE stocks for the period 1936 to 1995. They confirmed the mean reversion phenomenon, but this phenomenon is attributed to the period before World War II. Greep and Riz (1999) examined random walks in stock prices in Brazil and Mexico for the period 1995-1988 using variance ratio test. They found strong evidence of mean reversion in both countries. Shvyvgyang and Barnes (2001) examined the weak form of efficient market hypothesis of stock markets in Shanghai and Shen-Zin, and came to the conclusion that Fama criteria to measure the performance of equity markets in China may be poor, but in comparison with countries such as Germany's poor performance is lacking in efficiency. Vertynpton and Higgs (2003 ) examined the poor performance of stock markets in Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela showing that none of the stock markets in these countries do follow a random walk and the they also have poor performance. Narayan and Prasad (2007), by surveying the mean reversion of 17 European countries for the period 2003-1988 found that the share price for the 17 European countries showed a unit root and is in compliance with the efficient market hypothesis. Foster and KHarazi (2008) examined stock output in the Tehran stock exchange and have been efficient for the period 2002-1997. Chen and Kim (2008) surveyed nonlinear mean reversion in stock markets of emerging Asian nations and concluded that the non-linear approach in test is due to the existence of mean reversion. Chen and Kim's results showed that there are characteristics of nonlinear mean reversion in stock prices. Lim (2009), by studying stock markets in the Middle East and Africa, concluded that Middle East and Africa output for both stocks of components is predictable. We conclude that the market is inefficient in these countries. Smith and Jeffries (2010), in a study entitled the weak-form of efficiency in the stock markets in African countries, showed that in these countries stock markets are in the weak form of efficiency, but there is no evidence of sustainability of the efficient market hypothesis. Posou and Bytavadorus (2011) compared the mean reversion in stock prices between countries and the results showed that the actual stock prices would not follow a random walk. Gorishankar and et al (2012) examined the behavior of stock output in the two markets, Mumbai and National stock exchange of India. The results showed a combination of random and non-random walks.
Research has also been conducted in Iran as following:


3- METHODOLOGY

The research method goal is to follow the results which can be applied to the social expectations of stock market performance and improvement of stock exchange markets and help to meet its failures. This research is a non-experimental and descriptive - analytical research which, in addition to describing Tehran Stock Exchange, survey and analyze the procedure of indexes of this market. This study examined non-stationary presence or absence of data in the weak form in Iran with Tehran Stock Exchange-oriented market and a general data on two variables tepix and tedpix has been obtained from Stock Exchange Organization Site. Method of data collection is library or documentary method which has been collected from libraries, the stock exchange site and other information centers by relying on the information and statistics.

3-1 - Population and sampling

The data in this study are the accepted companies in Tehran Stock Exchange- those companies which their stocks are exchanging through the stock exchange during the years 2001 - 2011. To the better analysis and to reach an acceptable outcome, sampling has not been performed and total population data (5172 data) during the past 11 years are considered and are examined in the form of time series. The data on the total population have been enumerated and discussed, because the general tepix and tedpix data on these two variables is determined by Tehran Stock Exchange. If we remove them or choose them a few days, not only it will be meaningless but also data analysis in the form of time-series will be faced with problem and we cannot surely comment on the stationary or non-stationary of the stock exchange. Firstly, the data for each year and then for the entire period are analyzed.

4 - Research Questions
4.1 – Does the process of tepix of Tehran Stock Exchange follow a random walk?
4.2 - Does the process of tedpix of Tehran Stock Exchange follow a random walk?

5 – Research hypotheses
5.1 - Tepix of Tehran Stock Exchange is not non-stationary and does not follow a random walk.
5.2 – Tedpix of Tehran Stock Exchange is not non-stationary and it does not follow a random walk.

6- Findings
Here, to achieve better results in the test hypothesis, Dickey - Fuller test and variance ratio is used for the presence or absence of non-stationary in Tehran Stock Exchange. To prove non-stationary or random walk we compare z and \( t \) obtained through statistical tables. If obtained \( t \) were smaller than \( t \) in Dickey- Fuller table, the time series is stationary otherwise it would be non-stationary.

6-1 - The first hypothesis (Dickey – Fuller test)
Tepix of Tehran Stock Exchange follow a random walk: H0
Tepix of stock costs in Tehran Stock Exchange is not non-stationary and does not follow a random walk: H1
The results for the considered years are obtained from software Eviews and Dickey - Fuller test in the following table. Considering the Test Dickey – Fuller, if the results are more than the critical value (at the level 1 per cent equal to -3.46 and at the level 5% equal to -2.87), time series or index of non-stationary follows the random walk otherwise it is stationary.

Table 1. Dickey – Fuller test for the tepix at 1% critical value (-3.46)

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</thead>
<tbody>
<tr>
<td>Obtained T</td>
<td>-15</td>
<td>-10/4</td>
<td>-10/5</td>
<td>-8/1</td>
<td>-8</td>
<td>-10/5</td>
<td>-10/5</td>
<td>-8/27</td>
<td>-8/3</td>
<td>-8/8</td>
<td>-8/8</td>
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</table>

As Table (4-1) shows because the obtained T through Dickey - Fuller test are all smaller than the critical value of t (-3.46), so with probability of 99% tepix of stock costs in Tehran Stock Exchange is not non-stationary and does not follow a random walk. So Tehran Stock Exchange is not at efficient level. The diagram in recent years which is shown below, also imply the existence of abnormalities and irregular fluctuations in the market. This diagram shows how Tehran Stock Exchange is in turbulence and volatility.


As you can see the trend is moderate and upward until 2005, from 2005 to 2006 rises sharply and in the year 2005 reaches to the highest. After these years, recession and volatility emerges in Tehran Stock Exchange as at the end of 2011 reaches to the lowest. Consequently, Tehran Stock Exchange fluctuates from time to time over these years with no clear trend.

6-2 - The first hypothesis (variance ratio test)
The results of the variance ratio test in the table below also confirm stationary of Tehran Stock Exchange.

Table 2. Variance ratio test for the variable tepix in the stock exchange market.

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<td>260</td>
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<td>259</td>
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<tr>
<td>1/41</td>
<td>1/4</td>
<td>1/3</td>
<td>1/3</td>
<td>1/4</td>
<td>1/4</td>
<td>1/3</td>
<td>1/3</td>
<td>1/55</td>
<td>1/55</td>
<td>Va.ratio</td>
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<tr>
<td>0/22</td>
<td>3/84</td>
<td>3/8</td>
<td>4/6</td>
<td>4/6</td>
<td>3/87</td>
<td>3/87</td>
<td>2/34</td>
<td>2/34</td>
<td>5/2</td>
<td>5/2</td>
</tr>
<tr>
<td>0/83</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0/02</td>
<td>0/02</td>
<td>0</td>
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<tr>
<td>0/04</td>
<td>0</td>
<td>0</td>
<td>0/06</td>
<td>0/06</td>
<td>0/1</td>
<td>0/1</td>
<td>0/11</td>
<td>0/11</td>
<td>0/1</td>
<td>0/1</td>
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</table>

according to the results of the variance ratio test and comparison between the obtained indexes z and pro at the table (4,2) shows that in all the years the first hypothesis is rejected with a confidence level of 99%. Thus, the tepix in all these years does not follow the random walk, it means that Tehran Stock performance is too weak.
6-3 - The second hypothesis (Dickey – Fuller test).
H0: Tedpix of stock price follows a random walk on Tehran Stock Exchange
H1: Tedpix of stock price does not follow a random walk on Tehran Stock Exchange

Table 3. Dickey Fuller test for tedpix at 1 percent of the critical value (-3.46)

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</thead>
<tbody>
<tr>
<td>Obtained T</td>
<td>-11/1</td>
<td>-8/1</td>
<td>-6/5</td>
<td>-13/6</td>
<td>-7/7</td>
<td>-9/1</td>
<td>-8/7</td>
<td>-8/3</td>
<td>-8/4</td>
<td>-9/2</td>
<td>-10/6</td>
</tr>
</tbody>
</table>

The results of the analysis of data on the price tedpix in the above table shows that, because all the obtained t are smaller than the critical value t, so the trend of the index does not follow the random walk with confidence level of (99%) and follows the reversion to the mean. Accordingly, Tehran Stock Exchange market performance is also lacking in efficiency. The diagram obtained in these years shown below indicates the irregular fluctuations and stationary in the market.

![Figure 3. fluctuations of tedpix in Tehran Stock Exchange from 2001 to 2011](image)

Tehran Stock Exchange during the period is fixed until 2004 and the Stock Market after this year will fluctuate by the end of the year 2011.

6-4 - The second hypothesis (variance ratio test).
The stationarity of Tehran Stock Exchange is also confirmed by the variance ratio test. The results are shown in the table below.

Table 4. The variance ratio test for the variable tedpix of stock prices

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<tr>
<td>Index</td>
<td>260</td>
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<tr>
<td>DF</td>
<td>1/36</td>
<td>1/53</td>
<td>1/52</td>
<td>1/2</td>
<td>1/2</td>
<td>1/52</td>
<td>1/43</td>
<td>1/26</td>
<td>1/26</td>
<td>1/52</td>
<td>1/52</td>
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<tr>
<td>Z</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0/02</td>
<td>0/02</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pro</td>
<td>0/08</td>
<td>0/15</td>
<td>0/15</td>
<td>0/05</td>
<td>0/05</td>
<td>0/14</td>
<td>0/13</td>
<td>0/1</td>
<td>0/1</td>
<td>0/11</td>
<td>0/11</td>
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<tr>
<td>Std.error</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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The results of the variance ratio test for efficiency of tedpix in the above table also shows that the second hypothesis is rejected with 99% confidence and the movement of this index is also stationary and has a tendency to reverse to the mean. In fact, Tehran Stock Exchange does not work efficiently and the volatility of prices on it is somewhat predictable and does not follow the random walk.
7. Conclusion

Stock exchange, due to the importance of resource allocation and economic growth, has always been of interest to economists and financial experts and refer to it as an indicator of development. Importance and role of stock market in the economy is influenced by the function and efficiency of stock market and the investors exchange their stocks regarding to the function. This study examines the random walk or non-stationary of Tehran Stock Exchange and its results suggest that Tehran Stock Exchange has not a good performance and is lacking even in the weak form of efficiency. When stock exchange does not follow a random walk and have a stationary movement it implies that not only in fundraising and the allocation of resources does not perform well but its role as a marker development is also faded. So the process of Tehran Stock Exchange whether moving through tepix or tedpix stock price or through Dickey – Fuller test or the variance ratio test show that Tehran Stock Exchange is stationary with confidence level of 99% during these years and does not follow the random walk and is inefficient even in its weak form. Inefficiency in the weak-form refers to the point that Tehran Stock Exchange has not been successful in determining the price or valuation of stocks. Inefficiency in stock exchange means that stock prices do not reflect new information constantly. Information is also collected data about the companies and their securities and the efficient market prices should be influenced by this information. In other words, according to these results, Tehran Stock Exchange has not efficiency even for processing of information. Also, regarding to the definition of Fama (1965) and Jensen (1978) about capital market efficiency and inefficiency in Tehran Stock Exchange, we can conclude that, regarding to the information existing in the market, investors can earn abnormal expected return and collect transactions made on the basis of this information, as well as obtain economic benefits. It can also be said that inefficiency even in the weak form refers to the rules which can be designed to achieve high efficiency.

8- Proposals for research

1) The obstacles of informing in Tehran Stock Exchange should be removed by the state as soon as possible to increase performance by transparency of information.
2) Economic and political constraints of the government should be removed to build up perfect competition to prevent any deviation and unconventional profits or losses brought to the investors in the stock market.
3) The results of the research showing the process of (stationary or non-stationary) indexes in Tehran Stock Exchange market could be useful and fruitful for the capital market analysts, actual and potential investors, banks and creditors.
4) Some researches should be performed to design a comprehensive model in order to maximize returns by using trading rules.
5) Further research should be performed to identify barriers to the performance of stock exchange market to find the market in the state economy.

ACKNOWLEDGMENT

The authors declare that they have no conflicts of interest in the research.

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