



Evaluation of Weak-Form Efficiency of Tehran Stock Exchange (Using VAR Method)

Aziz Arman, Ashkan Bazrafkan and Salar ghorbani
Faculty of Economy, ShahidChamran University, Ahvaz, Iran.

ARTICLE INFO

Article history:

Received: 5 July 2017;

Received in revised form:
2 August 2017;

Accepted: 12 August 2017;

Keywords

Efficiency,
Efficiency information,
Dickey Fuller,
VAR

ABSTRACT

The efficiency of capital market is one of the most controversial issues in the capital market over the past three decades in financial literature. Today, the capital market in developing countries is considered as a means to increase investment and economic growth and since efficiency is the main and most important characteristic of capital market in each country, it has become one of the most controversial areas of finance and economy research. In this study, performance of Tehran Stock Exchange is examined in the period (Persian date April 2001 to March 2010) on a daily basis, using VAR method. This study is distinct from similar domestic research because the present research examines the efficiency of Tehran Stock Exchange simultaneously with the efficiency of four indices (total, price and dividends, finance and industry) that the results showed that Tehran Stock Exchange does not have efficiency based on four elected indices.

© 2017 Elixir All rights reserved.

Introduction

The primary focus of financial literature is on the performance of financial markets and their ability in an efficient allocation of investment in economy. For economic growth, access to funding had mainly been through the proper functioning of financial market. In recent years, stock markets in developing countries, including Iran, have received special attention. However, the stock market's ability in contributing to financial development and economic growth depends on the efficiency of this market. Market informational efficiency is divided into weak, semi-strong and strong by Fama in 1965. According to Fama, efficiency is that the information would reach quickly into the hands of people in the capital market, and everyone's share of the market would be to an extent that he cannot dominate the market. Informational efficiency means that all people have the same information and no one can achieve unusual profits by additional information. After providing this definition and classification in the field of informational efficiency, much research has been done on the efficiency of stock. Most of these studies have been conducted in developed countries and there has been some limited research in the field of efficiency in Iran. Considering the features of capital market efficiency as the most important feature of capital markets on the one hand, and failure in studying the efficiency of a number of indices simultaneously on the other hand, are the main motivations for conducting this research. By using the efficiencies of four selected indices (total, price and dividends, Finance and Industry), the present research studies the efficiency of Tehran Stock Exchange on a daily basis in the period from April 2001 to March 2010. VAR test is used to study the efficiency of capital markets. The results showed no efficiency in Tehran Stock Exchange based on four selected indices. This study is consisted of seven sections. In the second section, literature review, in the third section, literature and theoretical framework, in the fourth section, research questions and hypotheses, in the fifth section,

analysis, in the sixth section, the results, and in the last section, conclusion will be discussed.

Literature Review

While some empirical studies, conclude the efficiency of Stock Exchange, others conclude its inefficiency. Among these studies, the following can be mentioned:

Namazi and Shooshtarian (1995), evaluate the performance of stock exchange by using assumptions concerning capital market efficiency theory in weak form in order to answer the following questions.

1. Are continuous changes in stock prices independent from each other?
2. Does the distribution of percentage changes in stock prices follow the normal distribution function?
3. Can we gain more benefit than purchase-maintenance method by using business filter rule?

The results showed that continuous changes in stock prices in Iran stock exchange do not comply with the random walk model and in addition, the average stock returns by using business filter rule are more than the average returns of purchase-maintenance method. Thus, price changes are not independent and random and a certain pattern is observed in price behavior and an awareness of this pattern can help investors to gain more benefits. According to the results, the stock exchange does not have weak-form efficiency.

Sinai and Mahmoudi (2005) study the effect of stock splits and bonus shares (capital increase) on stock price. The hypothesis of this study is as follows:

"The average abnormal returns of the studied sample is zero in the community history." The study period was from 1993 to 2001. The results of this study showed that there are abnormal returns around communities and it would reject the hypothesis of the research and also the semi-strong form of the efficient market exchange in Iran.

Khani and Farahani (2008), examine the adjustment speed in stock prices by using price adjustment factor in the period from 2005 to 1999.

The results showed that the new information is reflected slowly in the share prices of listed companies in Tehran Stock Exchange during the study period. As a result, the efficiency of the stock exchange is rejected.

Noorbakhsh et al (2010), investigate the independence of the returns series (weak form of efficiency) of the shares of companies listed in Tehran Stock Exchange and their subordination to the random walk model. The study sample includes the daily price information of 50 top exchange and investment companies of Tehran Stock Exchange from 1998 to 2008. The results of nonparametric tests (Kolmogorov, Smirnov, and flow test) and parametric tests (autoregressive model, ARIMA model) showed that securities prices do not follow the random walk model and price series of investment companies are not random series. In fact, weak form of efficiency in Tehran Stock Exchange is rejected.

By using market returns and the efficiency of 130-stock companies from 2005 to 2009, Talaneh and Hejran Keshrad (2011) evaluate the efficiency of Tehran Stock Exchange in both weak and semi-strong levels. Drawing of the plot and correlation test of daily returns of the market are used for studying weak-form efficiency, and incident analysis method by focusing on more than 40 percent adjustment profit statement is used for studying efficiency on semi-strong level. Graphical plots and correlation test of daily returns of the market, based on the regression coefficients, imply the weak-form inefficiency of Tehran Stock Exchange. Also, the behavior of the cumulative abnormal returns following the incident, shows that the market reacts to the estimated profit adjustment statement with a delay. But since the price movement limits rule on trading shares of the companies, such a delay in market reaction is expected; as a result, efficiency is rejected on semi-strong level.

Sinai and Goshtasbi Maharlouie (2012), form an efficient portfolio of efficient companies by using DEA in order to earn more returns than the average returns of markets. Sinai and Goshtasbi Maharlouie (2012), form an efficient portfolio of efficient companies by using DEA (data envelopment analysis approach) in order to earn more returns than the average returns of markets. For this purpose, input axis and output axis patterns are used in terms of returns to constant scale (CCR) and returns to changing scale (BCC). The results show that by using CCR method, returns more than the market average cannot be achieved but by using BCC method, returns more than the average market can be achieved; also, in order to compare the performance of baskets, size impact criteria is used as well. The results showed that the portfolio which consists of small businesses creates more than the average market returns and has a good performance.

Dima and Risa Maylos (2009), evaluate the efficiency Romanian Stock Exchange in the period from 2000 to 2009 on a daily basis and they conclude the Romanian stock exchange has weak-form efficiency.

Hague et al. (2011), study Pakistan stock market on a weekly basis from 2000 to 2010 using serial correlation and variance ratios tests conclude that Pakistan stock market is inefficient.

Alou and Hala (2011), study Tunis stock market on a daily basis from 1997 to 2007 using R / S and AR- GARCH (1, 1) tests and conclude that Tunis stock market is inefficient.

Dangol (2012), study the efficiency of Nepal stock market in the period from 2006 to 2010 by using variance ratio test, and come to the conclusion that stock market does not have efficiency in Nepal.

Altahayor et al (2012), study the efficiency of capital markets in Malaysia using GARCH-M test and come to the conclusion that there is no efficiency.

Lorraine and William (2013), study the efficiency of capital markets in Zimbabwe on a daily and weekly basis from 2009 to 2012 by using autocorrelation function and conclude that there is a correlation between stock prices; as a result, Zimbabwe stock market does not have efficiency.

Tutu Inetimi et al (2013), examine Ghana Stock Exchange from 2007 to 2012 on a weekly basis and conclude that the Ghana stock exchange does not have weak-form efficiency.

In summing up the studies done so far, it appears that in all domestic and foreign studies, VAR method and investigating the efficiency of Stock Exchange is not used simultaneously with the returns of four or more indices. For this reason, this research can be important in this respect.

Literature and Theoretical Framework of Research

Capital market efficiency is one of the most important topics in the field of financial market. As long as a market is efficient, resources are properly allocated in the economy. According to many economic experts, the difference between developed and developing countries is the existence of financial markets in developed countries (Dragota et al., 2009).

Capital market at the moment for its role in facilitating the exchange of funds between savers and investors around the world, has a strategic position in economic growth (Putu Nikita and Sukarno, 2011).

Capital markets have two essential functions

1. This is a long-term capital market that investment is transferred from savers to investors who need it.
2. This market allows investors to buy and sell shares and bonds.

Today, capital market in developing countries is a means to increase investment and economic growth; since the main and the most important feature of the capital market in any country is its efficiency, this is one of the most controversial topics in the field of financial and economic research.

In a nutshell, the importance of capital market is due to the following reasons:

1. The optimal allocation of funds between savers and investors.
2. Increasing the amount of investment in every country.
3. Increasing the economic growth of every country.

Different Levels of Efficiency

1. Informational efficiency: this efficiency is achieved when all people have the same information and no one can achieve unusual profits by additional information (Fama, 1965).
2. Allocative efficiency: the market achieves allocative efficiency when savings that are transferred from savers to investors is allocated to projects that have the highest returns (Inojoe Samuel and Osophona Oka, 2010).
3. Operational efficiency: the market achieves operational efficiency when brokers transfer savings from savers to investors with the lowest possible cost (Inojoe Samuel and Osophona Oka, 2010).

Fully Efficient Market Features

Features of a fully efficient market consist of (Rossa Borges, 2008).

1. The absence of sales and purchasing inhibiting factors such as tax or transaction costs.
2. All participants have expectations in relation to asset prices, interest rates, and other economic factors.
3. Entry and exit is open to and from the market.

4. Information is freely available to everyone without any cost.
 5. There are a lot of buyers and sellers that none of them overcome the market.

Since you cannot say a market is fully efficient or not efficient at all, different levels of informational efficiency are proposed. These different levels of informational efficiency are used in research.

Different Levels of Informational Efficiency

1. Weak-form efficiency: This efficiency is achieved when stock prices fully reflect all information related to the stock market, including exchange rates, the volume of transactions, and any other information relevant to the market. In an efficient market, you cannot predict future prices by using past prices (Blaga, 2012). If the stock price is affected by past information, there is weak-form efficiency. This means that only past information is used to determine the stock prices and investors cannot infer future prices based on past prices (Dima and Risa Maylos, 2009).

2. Semi-strong efficiency: This efficiency is achieved when future stock prices cannot be inferred by using general information about company wealth, dividends, stock distributions, stock market and so on (Blaga, 2012). A market is efficient if the information is generally reflected in the market. With the emergence of this information, by changes in supply and demand, equilibrium price is created (Dima and Risa Maylos, 2009).

3. Strong-form efficiency: This efficiency is achieved when future stock prices cannot be inferred by using trade and confidential information; in fact, information has been made available to everyone (the Blaga, 2012). A market is efficient if all the information about the value of a share is quickly and accurately reflected in the market price (Dima and Risa Maylos, 2009).

Research Questions and Hypotheses

1. Research Questions: According to the research discussed in the previous section, and with regard to the importance of efficiency of Tehran Stock Exchange, the aim of this study is to investigate informational weak-form efficiency in Tehran Stock Exchange. Therefore, basic questions of this study can be formulated as follows:

1. Does Tehran Stock Exchange have weak-form efficiency by using total price returns index?
2. Does Tehran Stock Exchange have weak-form efficiency by using price and dividend returns indices?
3. Does Tehran Stock Exchange have weak-form efficiency by using financial returns index?
4. Does Tehran Stock Exchange have weak-form efficiency by using industry returns index?

2. Research Hypotheses

H0: Tehran Stock Exchange has weak-form efficiency.

H1: Tehran Stock Exchange does not have weak-form efficiency.

Analysis

1. Model Introduction

By studying topic literature and literature review in the field of Tehran Stock Exchange efficiency, we realize that many factors can affect the efficiency of Tehran Stock Exchange. For this reason, the following indices are used in this study:

Rt: Total price returns index

Rp: price and dividend returns index

Rf: financial returns index

Ri: industry returns index

One of the properties of VAR model is that each variable can be a function of another variable. In fact, in this model, it is does not matter whether the function of variables exist in reality or not. In other words, every four variable used in this study can be a function of each other. As a result, we have:

$$R_t = F(R_p, R_f, R_i)$$

$$R_p = F(R_t, R_f, R_i)$$

$$R_f = F(R_p, R_t, R_i)$$

$$R_i = F(R_p, R_f, R_t)$$

Returns of each index is calculated as follows:

$$R = ((P_t - P_{t-1}) / P_{t-1}) * 100$$

Pt: price index on day t

Pt (-1): yesterday price index

Statistics related to four selected indices (total, price and dividends, finance and industry) of the organization of Tehran Stock Exchange is obtained.

2. Generalized Dickey Fuller Test

Stationary data are those with fixed mean, fixed variance and themselves fixed covariance. When a shock is applied to the stationary time series, its effect on the variable is damping and gradually fades. In contrast, non-stationary data are such that the durability of the effect of shocks is unlimited. The use of non-stationary data could lead to false regression and therefore, the test results are not reliable. Hypotheses are as follows:

H0: there is a unit root (non-stationarity)

H1: there is no unit root (stationarity)

3. VAR test

In this study, in order to evaluate the weak-form efficiency of Tehran Stock Exchange in the period from 2001 to 2010 VAR method is used. In autoregressive vectors, each variable is considered as a function of its intervals and other variables. simple form of a VAR model in bivariate mode is shown below

$$Y_t = b_{10} - b_{12} z_t + \gamma_{11} y_{t-1} + \gamma_{12} z_{t-1} + \epsilon_{yt}$$

$$Z_t = b_{20} - b_{21} y_t + \gamma_{21} y_{t-1} + \gamma_{22} z_{t-1} + \epsilon_{zt}$$

ϵ_{yt} and ϵ_{zt} has the desired properties or the so-called white noise. Since Z_t is correlated with ϵ_{yt} and Y_t is correlated with ϵ_{zt} , the above equations cannot be directly estimate; Because the use of estimating econometric equation methods involves the assumption that there is no relationship between explanatory variables and disturbing elements. For this reason, by replacing Z_t from the second relation to the first, and by placing Y_t from the first relation in the second, the following equations can be concluded.

$$Y_t = \alpha_{10} + \alpha_{11} y_{t-1} + \alpha_{12} z_{t-1} + c_{1t}$$

$$Z_t = \alpha_{20} + \alpha_{21} y_{t-1} + \alpha_{22} z_{t-1} + c_{2t}$$

In which we have:

$$e_{1t} = (\epsilon_{yt} - b_{12} \epsilon_{zt}) / (1 - b_{12} b_{21})$$

$$e_{2t} = (\epsilon_{zt} - b_{21} \epsilon_{yt}) / (1 - b_{12} b_{21})$$

Since ϵ_{zt} and ϵ_{yt} properties are desirable, it can be concluded that e_{1t} and e_{2t} components also have a similar behavior. It should be noted that in above equations, only the first lag of variables is considered and in this regard, appropriate tests must be used in order to determine the number of optimal lags.

4. The number of optimal lags

For using VAR test, the number of optimal lags of variables should be specified based on criteria such as Bayesian Schwarz and Hannan Quinn.

Based on the results, since the error probability level for all variables in this study is less than 0.05; as a result, the null hypothesis on non-stationarity of variables is rejected and all the variables of this study are stationary.

Research Results

Results of Generalized Dickey Fuller Test

Table 1. Results of Generalized Dickey Fuller Test for price returns index.

-	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-9.13	0.0000
Test critical values: 1% level	-3.4	-
Test critical values: 5% level	-2.8	-
Test critical values: 10% level	-2.5	-

Source: researcher calculations

Table 2. Results of Generalized Dickey Fuller Test for price and dividend returns index.

-	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-54.2	0.0001
Test critical values: 1% level	-3.4	-
Test critical values: 5% level	-2.8	-
Test critical values: 10% level	-2.5	-

Source: researcher calculations

Table 3. Results of Generalized Dickey Fuller Test for financial returns index.

-	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	54.2-	0.0001
Test critical values: 1% level	-3.4	-
Test critical values: 5% level	-2.8	-
Test critical values: 10% level	-2.5	-

Source: researcher calculations

Table 4. Results of Generalized Dickey Fuller Test for industry index.

-	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	54.2-	0.0001
Test critical values: 1% level	3.4-	-
Test critical values: 5% level	2.8-	-
Test critical values: 10% level	2.5-	-

Source: researcher calculations

2. VAR test results to determine the number of optimal lags

Table 5. Determining the optimal lag number for returns of four selected indices.

Lag	FPE	AIC	SC	HQ
0	12494049	69228.27	27.70195	27.69580
1	10221128*	49148.27	27.53985	27.50908
2	10244988	27.49381*	27.58089*	27.52549*
3	10303819	27.49953	27.62531	27.54530
4	10346544	27.50367	27.66815	27.56352
5	10463134	27.51488	27.71806	27.58881

Source: researcher calculations

As Hanan Queen (HQ), Akaike (AIC) and Bayesian Schwartz (SC) criteria show, the optimal lag is the second lag. The asterisk above the numbers, in fact, shows determining the optimal lag. As it is specified, the asterisk is on the second lag.

3. VAR Test Results

In the definition of efficiency, we have

Efficiency means that on the basis of past returns and prices, future prices and returns cannot be predicted. Efficiency means that on the basis of past returns and prices, future prices and returns cannot be predicted.

If B (lag coefficient of returns on previous day) that is in fact the connecting ring between past and present returns is significant, it means that based on past returns, present returns can be predicted. In fact, there is a relationship between the returns and this means that Tehran Stock Exchange does not have weak-form efficiency.

Hypothesis of Stock Exchange Efficiency Based on Total Price Returns Index

Based on the results, the T-Student statistic for the first and second lags of efficiency coefficient of total price index is obtained 18.7883 and 5.11995 that suggests the significance of the mentioned lags and shows that based on past lags of total returns index, the present total returns can be predicted, this result shows that Tehran Stock Exchange does not have efficiency based on total price returns index.

Hypothesis of Stock Exchange Efficiency Based on Price and Dividend Returns Index

Based on the results, the T-Student statistic for the first and second lags of efficiency coefficient of price and dividend returns index is obtained -4.91322 and -0.48196 that suggests the significance of the first lag of price and dividend returns index and shows that based on past lags of price and dividend returns index, the price and dividend returns index can be predicted, this result shows that Tehran Stock Exchange does not have efficiency based on price and dividend returns index.

Hypothesis of Stock Exchange Efficiency Based on Financial Returns Index

Based on the results, the T-Student statistic for the first and second lags of efficiency coefficient of financial returns index is obtained -4.90558 and -0.46494 that suggests the significance of the first lag of financial returns index and shows that based on past lags of financial returns index, the present financial returns index can be predicted, this result shows that Tehran Stock Exchange does not have efficiency based on financial returns index.

Hypothesis of Stock Exchange Efficiency Based on Industry Returns Index

Based on the results, the T-Student statistic for the first and second lags of efficiency coefficient of industry returns index is obtained -4.91352 and -0.48011 that suggests the significance of the first lag of industry returns index and shows that based on past lags of industry returns index, the present industry returns index can be predicted, this result shows that Tehran Stock Exchange does not have efficiency based on industry returns index.

Conclusion

This study examines the weak-form efficiency of Tehran Stock Exchange in the period from 2001 to 2010. For this purpose, in the variables of the model, daily time series data of the year 2001 to 2010 and VAR method are used. The results of estimating the model (Table 6), indicate the inefficiency of Tehran Stock Exchange based on returns of four selected indices. In other words, based on past returns of all four selected indices, we can predict the present returns of all four selected indices.

Table 6. VAR test results for studying the hypothesis of Tehran Stock Exchange efficiency.

-	R_t If the variable is dependent	R_p If the variable is dependent	R_f If the variable is dependent	R_i If the variable is dependent
t-statistic (-1)	18.7883	-4.91322	-4.90558	-4.91352
t-statistic (-2)	5.11995	-0.48196	-0.46494	-0.48011

References

1. Aloui, Chaker and Hela, Ben Hamida. (2011). "Hurst's exponent behaviour, weak-form stock market efficiency and financial liberalization: the tunisian case", *Economics bulletin*, Vol, 31, No,1, PP, 830-843.
2. Blaga, Lucian. (2012). "Testing the financial market informational efficiency in emerging states", *Review of applied socio- economic research*, Vol, 4, PP, 181.
3. Dangol, Jeetendra. (2012). "Stock market efficiency in nepal", *International journal of multidisciplinary research*, Vol, 2.
4. Dima, Bogdan and Raisa Milos, Laura. (2009). "Testing the efficiency market hypothesis for the romanian stock market", *Annales universitatis apulensis series oeconomica*, 11(1).
5. Dragota, Victor, Stoian, Andreea, Traian Pele, Daniel, Mitrica, Eugen and Bensafta, Malik. (2009). "The development of the romanian capital market: evidences on information efficiency", *Romanian journal of economic forecasting*.
6. Eltahir Elshareif, Elgilani, Boon Tan, Hui and Foong Wong, Mei. (2012). "Volatility shifts and efficiency of emerging stock market: The case of malaysia", *Business management dynamics*, Vol, 1, No, 10, PP, 58-66.
7. Eneajo Samuel, Sunday and Uzoefuna Oka, Richard. (2010). "Efficiency of the nigerian capital market: Implications for investment analysis and performance", *Transnational corporations review*, Vol, 2, No, 1, PP, 42-51.
8. Fama, Eugene F. (1965). "The behavior of stock market prices", *Journal of Business*, No, 38, PP, 34-105.
9. Hague, Abdul, Chun Liu, Hung and Un-Nisa, Fakhar. (2011). "Testing the weak form efficiency of pakistani stock market (2000-2010)", *International journal of economics and financial issues*, Vol, 1, No, 4, PP,153-162.
10. Khani, A. and Farahani, D. (2008). "Evaluating the Efficiency of Tehran Stock Exchange by Price Adjustment Coefficient", *Journal of Isfahan University (Humanities)*, Volume 31, Issue 3, Pages 55-72.
11. Laurine, Chikoko and William, Muparuri. (2013). "Zimbabwe stock exchange and efficiency in the multiple currency exchange rate regime", *Journal of business and economic management* 1(3): 041-047.
12. Namazi, M and Shooshtarian, Z. (1995). "The Efficiency of Iran Stock Exchange Market", *Journal of Research (Financial Research)*, the No. 7 and 8, page 82-104.
13. Noorbakhsh, A., Asgari, Q. Nassiri, R. (2010). "The performance in Emerging Markets: Empirical Evidence from Tehran Stock Exchange", *Accounting and Auditing Reviews*, Volume 17, Number 62, Pages 103-116.
14. Putu Nikita, Mirah and Soecarno, Subiacto. (2011). "Testing on weak form market efficiency: The evidence from indonesia stock market year 2008-2011", 2nd international conference on business, Economics, Management and behavioral sciences.
15. Rosa Borges, Maria. (2008). "Efficient market hypothesis in european stock markets", *Department of Economics*.
16. Sinai, H. and Goshtasb Maharlouie, R. (2012). "Assessment of Relative Efficiency and Performance of Companies with DEA to Form a Portfolio", *Journal of Accounting*, Issue 11, Pages 105-132.
17. Sinai, H. Mahmoudi, E. (2005). "The effect of stock splits and bonus shares on stock returns in of Tehran Stock Exchange", *Accounting and Auditing Reviews*, Issue 39, Pages 77-96.
18. Talanh, A. and Hejran Keshrad, H. (2011). "Weak-form and Semi-strong efficiency of Tehran Stock Exchange" *Accounting and Auditing Research*, pages 88-111.
19. Tutu Ayentimi, Desmond, Ekow Mensah, Anthony and Naa-Idar, Francis. (2013). "Stock market efficiency of ghana stock exchange: An objective analysis", *International journal of management, economics and social sciences*, Vol, 2, PP, 54-75.