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Structural Failure, Modelling and Forecasting of Stock Return Volatility by GARCH Models (Case Study: Tehran Stock Exchange)

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ABSTRACT: considering the importance of financial markets and especially the stock market in financing support of companies, and the role and importance of volatility in the stock market, also the occurrence of numerous financial crises in the world economic environment and the probable impact of crises in the stock market, this research take the volatility modeling and its prediction, also the impact of financial crisis as the main issue on the stock market. So the research seeks to answer these questions to either return volatility Tehran Stock Exchange price index structure has been broken? And whether the prediction power of the GARCH models increase with regard to the structural?

Therefore, using daily data of 05.01.2008 to 31.03.2014 and the ICSS algorithm First the days that the volatility pattern of structural failure have been round were identified. Then, to estimate the amount of the likely impact of the identified failure of the volatility pattern, on the number of virtual variable failure D_{10} ….D_{1} were defined where the virtual variable on the break day and the days after it choose number 1 and the days before a failure have choose the zero. Then variables were put in the variance equation model ARFIMA-FIGARCH and the ARMA-FIGARCH that the results show that it is used in both models ARMA-GARCH And the ARFIMA-FIGARCH variables are only allowed for variables D2 and the D3 Which indicates the presence of structural breaks in the pattern of oscillations that are up in the days of 03/20/2008 and 02/05/2008.

The difference was not statistically significant, and other purposing variables permitted by the terms of statistical have a high significant level. So, the null hypothesis of a base model of the return volatility though the price index of Tehran Stock Exchange has a structural failure, cannot be rejected. Also, the results of the research on the assumption that the second direction of the research and the efficiency between the results of the research show that it is taking the failure in the pattern of volatility lead to improve performance criteria. So the assessment criteria for the forecasting performance in models ARMA-GARCH and the ARFIMA-FIGARCH Given the failure take less amount than time that the point is not considered as a failure.

KEYWORDS: Structural failure, modeling and forecasting, returns and volatility, ICSS, AFRIMA-FIGARCH.

1 INTRODUCTION

This fact that volatility is an inseparable component of stock market especially in developing countries, have been demonstrated in numerous empirical studies. There are several reasons for the necessity of the volatility modeling in the stock market. Increased volatility may be considered as a risk investment and therefore lead to investment maintenance increase and reduce the cost of it. In order to maintain risk management of different assets, there should be proper information about the portfolio value increasing or decreasing [2]. Also, investors in order to prevent losses due to volatility in the future, are interested to be aware of the current period volatility impact on the volatility of future periods. Asset

management is also possible to model the volatility to sell all or part of the asset before having more volatility. In addition, agents may increase your commission rate volatility increase. On the other hand, the volatility of stock returns may damage the financial system movement and negatively affect the economy performance. An effective volatility channel on the economy performance, is its effect on spending cost. Volatility may also have a major impact on the business investment and, therefore, directly impair economic growth. Also, Economic history of the Nations has experienced several financial crisis itself. Change in the structure of the European monetary system in the years 1993-1992, the crisis of the collapse of Mexico psoi in 1995-1994, the financial crisis in South-East Asia in 1997-98 and.... Terrorist attacks on September 11, 2001, the recent West financial crisis in 2008, that its effects are remained in the industrial countries so far. Although our country due to the poor economic relationship apparently has with world, has been less affected by the crisis economically compared to industrial countries and emerging economies such as the East Asia countries. However, the precise outcomes study about the global financial crisis, and identification of opportunities resulting from the aforementioned crisis for the economy of Iran are very important and it is necessary that economic scholars and experts with a comprehensive evaluation of factors in this crisis, identify and offer the fundamental solutions to deal with them, Therefore, with regard to the importance of financial markets and especially the stock market, in the provision of corporate financial management, the role and importance of the volatility in the stock market , the numerous outbreak of the financial crisis in the history of the world economy, and the possible effects of crisis on the stock market .This study consider the prediction and volatility modeling, as well as effect of the financial crisis on the stock market as the main issue. Accordingly, the present study tested the following hypotheses: the first hypothesis: Tehran Stock Exchange volatility output price index structure has been failed. The second hypothesis: the power between the GARCH models considering the structural failure points will be increased.

2 THEORETICAL PRINCIPLES OF RESEARCH

Economic history of the Nations has experienced numerous financial crisis. Some of the crisis in the stock market, the crisis on years (2013), some of the crisis on credit market (2008),some in the foreign exchange market and the market of goods has been occurred. These crises, sometimes influence a country, group of countries, and the whole world. When two entire world crisis of 1929 and 2008 occurred, influence the whole of world, that the first one with a stock market crash were started and the second with credit markets drop. The similarities of the recent crisis and the crisis of the 1930's root, is a partly double standard. Both the crisis, has been caused by the formation of a bubble so that was observed in the 1930's crisis bubble in the stock market and in the recent crisis and in the real estate market crisis. Economic crisis due to the adoption of any improper policies monetary and financial affairs of managers and operators of economy, impose fear among the shareholders, investors and the general public. According to the world's financial markets with the profound link rely upon liberalist, any shock or drop in a market also quickly effect on other world markets. The economic crisis in America was started after the attack on the towers of the World Trade Organization in September 2001 and suddenly made a great shock to the financial markets that was mainly mental and due to a lack of confidence in the future. [5]

2.1 THE ECONOMIC CRISIS AND THE PROFITABILITY OF LISTED COMPANIES

Listed companies on the stock exchange as well as other economic actors in the country have been damaged by the lack of liquidity problem. The reasons for the lack of liquidity are mainly due to contractile policy adopted by the Central Bank, although these policies to curb inflation is inevitable.

On the one hand the world's financial crisis, make the Iranian banks accessory to foreign sources harder .the Banks in order to be away of possible risks are less interested to provide financial facilities. On the Inflationary recession many productive units has encountered with selling problem that On the one hand is leading to reduce the price of their products, and on the other hand, the volume of customers' orders of the productive have decreased. And companies have attempted to purchase more based on their daily needs. As a result, the sellers company will be forced to keep lots of their product volume on the warehouses so their warehouse cost and their demands will be increased.

Foreign trade is a double-sided equation. If the value of exports of goods and services will be decreased, then the price of imported goods would be encountered. The imported goods can be divided into two categories to this comment: The first batch consists of raw materials, capital and intermediate and consumer goods is the second batch. From the perspective of the opportunities on the premises, it can be used to reduce the price of raw materials, energy and technology needed for Iranian companies that make possible with lower price.

As well as reducing the rate of international interest, in the absence of international sanctions, would have positive effect on the company external financing Iran. In addition, the drop in oil prices could lead to lower prices, of the carrier of energy and therefore reduce the cost of shipping.

The effect of the financial crisis on the company's total profit in the 4 following industrial group is visible:

- The Raw Materials exporter Company: this company include petroleum, petrochemical and mineral companies that export major part of their products.
- Company which determined their products based on world prices. Such as copper and steel producing companies, petrochemical companies and which that supply their product inside the country.
- Participation that are approved but with reduced pressure price reduction on behalf of the buyers and the imported price. Like iron ore producing companies
- Investment and holding companies, which is a part of the above groups' assets.

Reduction of liquidity is one of the factors that have effect on Tehran's stock exchange. Because the volume of money entered the market due to the reduction of the capital investment company and on the country's popularity is decreased, and in addition to the reduction in price of shares of the existing company, the accepted (listing) and new companies supply is also faced with the problem.

2.2 LITERATURE REVIEW

Fernandez (2007) examined the impact of the events in the Middle East on the global stock exchange. He used ICSS algorithm and wavelet analysis to determine the structural break in the volatility of returns, on some countries in the Middle East, Africa, Asia and developed countries for the period April 2000 to March 2005 monthly. The results show that the structure of return volatility in the Middle East and other Asian developing countries, has been occurred. Gregory James and Michail Karoglou, (2009) examined the effect of financial liberalization on the volatility of stock market returns of Indonesia. Authors conclude that structural changes in output volatility has coincided with major political events. The main results of this paper show that: (a) after the entry of foreign investors, the volatility has been significantly reduced. (B) Changes in the East Asian financial crisis has been significantly increased. A: In the year before the stock market liberalization and freedom of foreigners, there has been a significant increase in the volatility of returns. Hun Kang et al., (2010) in an article evaluated sudden changes in variance and volatility in the foreign exchange market continued Asian countries for the period 1990 to 2008. They showed with the help of ICSS algorithm that sudden changes in the volatility of returns generally is associated with international factors, especially the East Asian crisis of 1997 and the 2008 financial crisis. They also showed that by taking the change, the continuing volatility efficiency is reduced. Therefore, estimation and prediction of variance with regard to the failure is treated more carefully. Alfreedi et al (2012) analyzed in a study of the efficiency of Persian Gulf countries, including Bahrain, Qatar, UAE, Kuwait and Oman by ICSS algorithm and asymmetric GARCH models include GJR, EGARCH for the period 2003 to 2010 .The results indicate that there are failure in these countries is stock return volatility. Kumar and Mahsewaran (2012), began the paper that the sudden changes in volatility in Indian stock markets. They used the technique introduced by Enclin Tiao (1994) and Sen Argo and Karyun (2004) and concluded that structural changes to the ICSS algorithm oscillation pattern are strongly affected by changes in the domestic and global economy. They also concluded that the stability and asymmetric of volatility will be decreased for considering the effect of volatility pattern changing.

3 THE RESEARCH METHODS

In this paper for modeling return volatility the short-term and long-term generalized conditional dissimilar variance models were used. One of the characteristics of financial markets is long memory. FIGARCH models logic is based on this concept that is not necessarily an integer difference parameter but can be non-integer numbers. According to the efficient market hypothesis proposed by Fama (1970), in a productive financial market, the efficiency has random walk behavior and the future returns by the past returns are not predictable. However, if the return is a financial asset that has a long memory. The future returns on financial assets by its past returns can be predicted. This is also true for the return volatility, so in this case the efficient market hypothesis, will lose its effectiveness. As a result, according to the characteristics of long memory in volatility modeling and performance forecasting, the deficit accumulated conditional variance models to simulate and predict of the return volatility will be used.

3.1 UNIVARIATE DEFICIT ACCUMULATED CONDITIONAL VARIANCE MODELS

Long memory is defined through characteristics of the autocorrelation function. Autocorrelation function has been defined as $\rho_k = \text{cov}(x_t, x_{t-1})/\text{var}(x_t)$ for k integer. For the time series covariance reliability $\lim_{k\to\infty} \rho_k = 0$ is expected . Many time series autocorrelation function decreases very rapidly and exponentially .i.e $\rho_k \approx |m|^k$ where $|m| < 1$. This feature is true for reliable processes such as $ARMA(p,q)$. However, for processes with long memory, the autocorrelation function is not as rapid and exponential but with a very low rate and the rate of hyperbolic will be decreased. This process is compatible with $\rho_k \approx c_1 k^{2d-1}$ where k is increasing with no restriction on and c_1 is a constant number and d is the Long memory parameters that must be estimated.

There are numerous studies that show the effects of shocks on volatility, but not as rapidly and exponentially also slowly over time is declining[1]. So discussing about $I(0)$ or $I(1)$ of these process has to be delivered. In a $I(0)$ process Shocks with exponential rate are declining, which is said to be a series of short-term memory, whereas in a $I(1)$ process Shocks remain in a very long period that is said that the series does not have mean reversion. But with $0 < d < 1$ assumption Shocks decrease over time with very little hyperbolic rate, it means that there is a long-term memory.

Baillie Bollerslev and Mikkelsen (1996) to measure the effects of long memory in volatility, introduce the non-conditional variance model in which the ratio β_j has an accumulated deficit hyperbolic rate, that is additive, and provides a single root condition. Model FIGARCH (p, d, q) is as follows:

$$\phi(L)(1-L)^d \varepsilon_t^2 = \omega + [1-\beta(L)]\upsilon_t \qquad (1)$$

Where all the roots $\phi(L)$ and $[1-\beta(L)]$ are outside the unit circle. The presented FIGARCH model above, can be formed by substituting the operator instead in equation (1):

$$h_t = \underbrace{\omega[1-\beta(L)]^{-1}}_{\omega^*} + \underbrace{\left\{1-[1-\beta(L)]^{-1}\phi(L)(1-L)^d\right\}}_{\lambda(L)}\varepsilon_t^2 \qquad (2)$$

$$h_t = \omega^* + \lambda_i(L^i)\varepsilon_t^2 = \omega^* + \lambda(L)\varepsilon_t^2$$

So $0 \le d \le 1$. Phrase $(1-L)^d$ When $0 < d < 1$ Is Fractional delay operator and its amount of the reduction rate shocks depends to the conditional volatility. Its value can be added by the above function geometrically as follows:

$$\begin{aligned}(1-L)^d &= \sum_{k=0}^{\infty} \frac{\Gamma(d+1)}{\Gamma(k+1)\Gamma(d-k+1)} L^k \\ &= \sum \binom{d}{k}(-L)^k = 1 - dL - \frac{1}{2}d(1-d)L^2 - \frac{1}{6}d(1-d)(2-d)L^3 - \ldots \\ &= 1 - \sum_{k=1}^{\infty} c_k(d)L^k \end{aligned} \qquad (3)$$

That $c_1(d) = d$, $c_2(d) = \frac{1}{2}d(1-d)$ and……

[1] *As an example chewik and Koorkmaz studies, aostoch (2009) as well as Casman and toran (2007), Christensen and Nielsen (2009) Coonrad, Zhiang Carasoonas (2003) can be referenced.*

3.2 ICSS ALGORITHM

As previously discussed, the purpose of the present study was to determine whether the financial crisis, has changed or not the stock market return volatility pattern Tehran? And, if so, whether considering such a failure increase the prediction accuracy of the model of volatility. Accordingly the used technique in this study is the ICSS algorithm. Icss Algorithm was presented[2] by Inclan Tiao that in this method the variation for multiple changes in a series of multiple observations was developed. ICSS Algorithm, use the sum of the repeated square root to find the failures on a regular research series of different pieces.

ICSS algorithm is based on this assumption that the variance in the initial till the period of the oscillation pattern is constant. Again, the variance is constant until a crisis or other event change the pattern of volatility. This procedure was repeated over time to provide a time series of observations to provide one or more failure.

Now it is assumed that $\{\varepsilon_t\}$ is an independent time series with normal distribution with mean zero and unconditioned variance of σ_t^2 . That variance in the distance τ_j^2 was $j = 0.1. \ldots . N_T$at whichN_T is the total number of changes that have occurred in the total variance of T observations. It means that on $1 < t_1 < t_2 < \cdots < t_{N_T} < T$ it is a set of observations that happened changes in the variance. The variance in the distance is equal to:

$$\sigma_t^2 = \begin{cases} \tau_0^2 & 1\langle t\langle t_1 \\ \tau_1^2 & t_1\langle t\langle t_2 \\ & \cdots \\ \tau_m^2 & t_{N_T}\langle t\langle T \end{cases}$$

To estimate the number and location of the failure the cumulative sum of squares ε_t is used. Therefore, it is assumed that $C_k = \sum_{t=1}^{k} \varepsilon_t^2$, $k = 1,2,.,T$ .that is the sum of cumulative squares from the initial point of series until the last minute of observation. Based on these the $D_k$statistics is defined as follows:

$$D_k = \frac{C_k}{C_T} - \frac{K}{T}, \quad K = 1,2,...T, \qquad D_0 = D_T = 0$$

If the D_k statistic distribution is greater than the critical value, the null hypothesis that there is no single point of failure at a certain level of risk has been rejected and therefore there is a clear break at that point. Therefore, if the $D_k$maximum absolute value is greater than the critical value, the null hypothesis that there is no single point of failure is rejected. Now it is assumed that the k^* is the value of k at which $\max_k|D_k|$occurs. If $\max_k\sqrt{(T/2)}|D_k|$ is greater than the critical value, k^* is an estimate of the point where the structural failure had been occurred. Factors of $\sqrt{(T/2)}$ is used to standardize distribution. This method will help researcher to identify random failure on variance.

Under the null hypothesis that the variance is the same in period, the critical value at the 5% error for Asmpotik distribution $\max_k\sqrt{(T/2)}|D_k|$ is equal to 1.36.

The above steps are repeated whereas the number of failure does not change (wang.2006). Finally the identified failure by dummy variables is put in the equation given the significant variation coefficient of the dummy variable, it can be said that the alleged failure has no significant effect on the pattern of volatility. In the GARCH (1,1) model variance is explained as follows:

$$h_t = c + \sum_{i=0}^{p} \alpha_i \varepsilon_{ti}^2 + \sum_{k}^{q} \beta_k h_t + a_1 D_1 + \cdots + a_n D_n$$

[1] *Iterated Cumulative Sum of Squares (Icss)*

Where the dummy variables D_1 to D_n *are* the places where structural failure occurred in variance and select for the after-failure number of 1 and to provide a zero for the remaining days.

3.3 COMPARISON OF THE DIFFERENT MODELS PREDICTION ACCURACY

In this study, the studied period includes Stock Exchange Price Index observations from 05/01/2008 to 31/03/2014 which is divided into two periods: the first period 1.5.2008 to 10.05.2012 which is 70% of the sample and the second period includes remaining volume of the sample. To estimate the first term and the second term, it is intended to evaluate the predictive models. To evaluate the predictive model, the mean square error (MSE), root mean square error (RMSE), theil inequality coefficient (TIC) and median errors (MedSE), the mean absolute error (MAE) are used. [3]

4 DATA ANALYSIS

In this section the existence of a crisis that has led to a structural break in the pattern of return volatility of the price index of Tehran Stock Exchange by the ICSS algorithm is detected. We will define the dummy variable for these failure, to investigate its effect on the pattern of volatility and with short-term and long-term GARCH models, returns and return volatility will be predicted and the models will be assessed with different parameters. First, the characteristics of the data can be described as follows.

$$\phi(L)(1-L)^d \varepsilon_t^2 = \omega + [1-\beta(L)]\upsilon_t \qquad (1)$$

Where all the roots $\phi(L)$ and $[1-\beta(L)]$ are outside the unit circle. The presented FIGARCH model above, can be formed by substituting the operator instead in equation (1):

$$h_t = \underbrace{\omega[1-\beta(L)]^{-1}}_{\omega^*} + \underbrace{\left\{1-[1-\beta(L)]^{-1}\phi(L)(1-L)^d\right\}}_{\lambda(L)}\varepsilon_t^2 \qquad (2)$$

$$h_t = \omega^* + \lambda_i(L^i)\varepsilon_t^2 = \omega^* + \lambda(L)\varepsilon_t^2$$

So $0 \le d \le 1$. Phrase $(1-L)^d$ When $0 < d < 1$ Is Fractional delay operator and its amount of the reduction rate shocks depends to the conditional volatility. Its value can be added by the above function geometrically as follows:

$$\begin{aligned}(1-L)^d &= \sum_{k=0}^{\infty}\frac{\Gamma(d+1)}{\Gamma(k+1)\Gamma(d-k+1)}L^k \\ &= \sum\binom{d}{k}(-L)^k = 1-dL-\frac{1}{2}d(1-d)L^2-\frac{1}{6}d(1-d)(2-d)L^3-\ldots \\ &= 1-\sum_{k=1}^{\infty}c_k(d)L^k\end{aligned} \qquad (3)$$

That $c_1(d) = d$, $c_2(d) = \frac{1}{2}d(1-d)$ and……

[3] *To evaluate the predictive model of forecast errors or functions are usually used. One of the statistics that have traditionally been used as a measure of the accuracy of the prediction model, the variance of the prediction error.*

4.1 RESEARCH DATA

Used Data in this study according to the hypothesis, the price index of Tehran Stock Exchange TEPIX And the used time period ,and the index for the period 01.05.2008 to 03.31.2014 daily data contains 1503 observation. Obtained data from the official website of the Stock Exchange of Tehran[4] were prepared and study of the diagram indicates that the variable is unrelaiable[5] . Also, what is the plot of the logarithm of the differential index return series indicates that, there is the volatility of the return series and the consequent effects on the arch. This means that the low volatility with low volatility and high volatility associated with high volatility. Unlike the TEPIX series the return series reliability is evident from its chart.

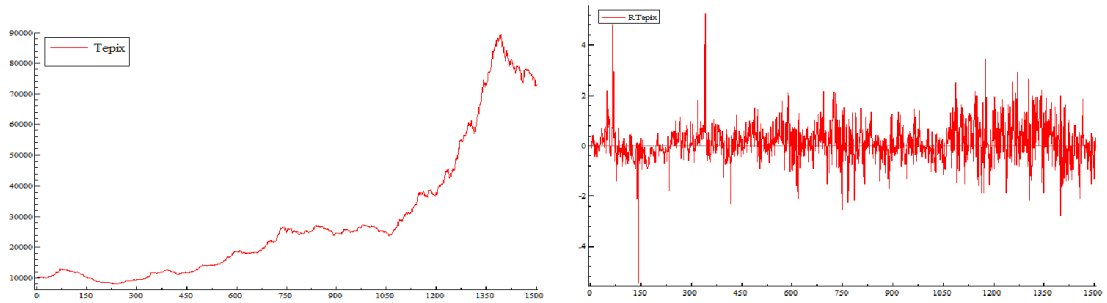

Figure 1. The general price index series and returns

The following table displays the descriptive statistics of the price index return series.

Table 1. Descriptive statistics

Variable	The mean	Middle	SD	Skewness	Strain
RTEPIX	0.131	0.068	0.758	0.260	7.954

Based on the above table, we see that the return series has the daily returns mean of 0.131and mean of 0.068 and standard deviation of 0.758. Also, the return has the Skewness of 0.260. Means that market forces are more likely to see negative returns. Returns Series Strain is 7.954 that is higher than normal distribution and, means that the market factors considered more likely abnormal returns.

4.2 RESULTS

In this section, given the research aim to recognize the possible point or points that the price index return volatility pattern of failure of Tehran Stock Exchange have been implemented, model ARMA must be extracted for return series model in the remaining series. It means that the ICSS algorithm residues ARMA model for each series that is total output price index. Given the autocorrelation plot log return series, Akaike and Schwarz criteria model ARMA (2, 1) for each set of output price index of Tehran Stock Exchange is estimated. Then the rest of the model series that is the main food of ICSS algorithm are derived for identification of structural failure caused volatility in the pattern of returns.

[4] *Www.irbourse.com*

Table 2: Sudden changes in the pattern of volatility in output by the algorithm ICSS

Year	Beginning of period	End of period	Breakpoint	Dummy variable
2008	05/01/2008	20/03/2008	20/03/2008	D1
	21/03/2008	02/05/2008	02/05/2008	D2
	03/05/2008	05/08/2008	05/08/2008	D3
2009	06/08/2008	04/05/2009	04/05/2009	D4
2010	05/05/2009	05/10/2010	05/10/2010	D5
	11/05/2010	08/02/2010	08/02/2010	D6
	08/03/2010	24/12/2010	24/12/2010	D7
2011	12/25/2010	19/05/2011	19/05/2011	D8
2012	20/05/2011	06/12/2012	06/12/2012	D9
2013	06/13/2012	13/11/2013	13/11/2013	D10
2014	11/14/2013	03/31/2014	-	

Source: *Results are calculated based on the ICSS algorithm in Excel*

In Figure 2, the series returns with positive/negative returns during periods unconditioned above three standard deviations has been inserted.

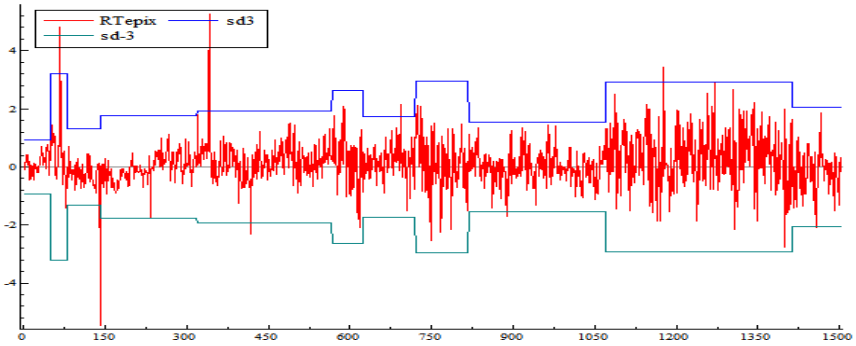

Figure 2: The series returns and three positive / negative unconditioned standard deviations

Then, to estimate the possible impact of identified volatility failure in the model, the number of dummy variable will be defined where the dummy variable in the failure day, and the number of days in the days before the failure select zero. For example, the D_1 is dummy variable that select zero on 20.03.2008 and future days and the number of days before it.

4.2.1 Specifying Short-Term and Long-GARCH Models For Returns

With regard to the ARCH LM test which indicates the presence of heteroscedasticity in the residuals of the models[6], ARMA-GARCH model and AREFIMA-FIGARCH series returns with regard to the failure are implemented so some features of Tehran Stock Exchange and the failure effect of volatility in the pattern will be specified. Based on the results listed in Table 3, it can be seen that in both ARMA-GARCH model and ARFIMA-FIGARCH only from dummy variables D2 and D3, the only variable that indicates the presence of a structural break in the pattern of oscillations in days 20 /3 / 2008 to 05/02/2008 the D4 to D10 dummy variables are not statistically significant, and a dummy variable D1, is significant at the 10% confidence

[6] *To summarize, the test results were not come.*

level. Therefore, the null hypothesis cannot be rejected which is based on the pattern of volatility in output price index of Tehran Stock Exchange has a structural failure. The dummy variables that are statistically significant variables, D6, D8 and D10 has significant negative effect on the conditional volatility of return which means on 08.02.2010 and 05.19.2011 and of 11/13/2013, pattern of volatility change to decline to the rest of the days that the failure occurred in the volatility pattern changed to the volatility increasing .

In both models, the coefficients of ARCH (Phil) was highly statistically significant level, indicating that the volatility in market returns are affected by significant news shocks and the efficiency GARCH (Beta1) indicates the volatility in the current period is also affected by the turbulence of the past. Also the necessary condition for a positive conditional variance estimating based on positive Arch and GARCH coefficients is supplied and their sum is smaller than the unit.

Table 3: Estimation of ARMA-GARCH models and ARFIMA-FIGARCH

model	ARMA-GARCH		ARFIMA-FIGARCH	
	coefficient	**Statistics t**	**coefficient**	**Statistics t**
The average equation				
ω M	0.076	1.632	0.073	1.098
AR1	0.950***	37.66	0.181	0.567
MA1	-0.495***	-11.52	0.030	0.089
MA2	-0.329***	-9.279	-0.117	-1.335
d-arfima	-	-	0.254***	4.496
The variance equation				
ω V	0.038***	2.302	0.042***	2.123
D1	0.339*	1.603	0.319*	1.574
D2	-0.270	-1.315	-0.247	-1.249
D3	-0.043	-1.374	-0.047	-1.433
D4	0.057***	2.257	0.056***	2.095
D5	0.289***	2.029	0.284***	2.132
D6	-0.243***	-1.921	-0.241***	-1.885
D7	0.334***	2.413	0.324***	2.321
D8	-0.386***	-2.656	0.376***	-2.525
D9	0.420***	3.114	0.409***	3.889
D10	-0.294***	-2.632	-0.279***	-2.412
ARCHPhil	0.135***	3.391	0.496***	2.663
GARCHBeta1	0.335***	1.976	0.356***	1.960
d-figarch	-	-	-0.006	-0.436
StudentDF	6.527***	5.324	6.608***	5.319
Diagnostic statics				
Log Likelihood	-1298.437		-1298.627	
Excess Kurtosis	8.69		8.161	
Skewness	-0.695		-0.647	
J-B	4861***		4276.2***	
ARCH LM TEST	0.227		0.261	
Q(50)	38.11		39.35	
Q^2 (50)	41.04		44.18	

Note: The *numbers in parentheses are t-statistics indicate. Indicates significance at 1%, respectively. Error is 5% and 10%.*

Source: *The findings of this study, using a software package Ox / Metrics*

Diagnostic statistics show the appropriate specification model. So statistics Q (50), Q (50) were 38/934and 41/802respectively, and the difference is not statistically significant, which indicates staying beyond serial autocorrelation in the residuals and squared residue of both models and thus affirm the right model, respectively. The ARCH LM Test show that ARCH effects do not exist in the residuals of the model that shows the proper specification model.

4.2.2 MODELS ASSESSMENT TO PREDICT RETURNS AND VOLATILITY

In the second hypothesis, we seek to answer the question whether to consider the failure in the pattern volatility, if it is not considered failure, whether or not will be improved. Therefore, ARMA-GARCH models for the estimation of ARFIMA-FIGARCH are implemented and according to the forecast period, measures of return and return volatility forecasting performance of the models used in two modes with / without considering the failure were extracted and the results in Tables (4) and (5) is reflected.

Table 4: Comparison of the predicted efficiency measures

	ARMA-GARCH		ARFIMA-FGARCH	
	Regardless of failure	Given the failure	Regardless of failure	Given the failure
MSE	0.8982	**0.8942**	0.9087	**0.9017**
RMSE	0.9477	**0.9456**	0.9533	**0.9496**
TIC	0.9361	**0.9307**	0.9558	**0.9409**
MedSE	0.3787	**0.3744**	0.3862	***0.3846***
MAE	0.7474	**0.7455**	0.7514	**0.7488**

The minimum value of each parameter is shown in bold .

	ARMA-GARCH		ARFIMA-FGARCH	
	Regardless of failure	Given the failure	Regardless of failure	Given the failure
MSE	**1.86**	2.106	167.3	2.104
RMSE	**1.364**	1.451	12.93	1.451
TIC	**0.6712**	0.8038	0.8557	0.8028
MedSE	0.1662	**0.05387**	90.72	0.05454
MAE	**0.7718**	0.7838	10.45	0.7835

The minimum value of each parameter is shown in bold.

Based on the findings contained in Table 4, to predict efficiency in mind, considering the failure in the oscillation pattern is predicted to lead to improve performance criteria. So the criteria for predicting the performance of the ARMA-GARCH models and ARFIMA-FIGARCH Given the failure choose the lower value than when the break point is not considered. But rather different situation exists in predicting return volatility. So that Major criteria, all the criteria except the criterion MedSE on ARM-GARCH model with not considering the predicted points select lower values and therefore we can say that the use of the model and to predict the volatility of returns, not considering the failure in the pattern of failure prediction will be more accurate. However, in consideration of the characteristics of long memory in volatility modeling and using ARFIMA-FIGARCH, taking into consideration all the criteria except the MSE criterion of failure , provide a lower values that means the concept of power in the prediction of the failure. Finally, according to the above-mentioned range, the second hypothesis cannot be rejected that is based on the increasing in stock market volatility considering the points that it has changed the pattern.

5 CONCLUSIONS AND RECOMMENDATIONS

This study sought to evaluate the effects of the financial crisis leading to structural failure in Tehran Stock Exchange market volatility model. Accordingly, using daily data from the date of 01/05/2008 to 31/03/2014 for the Price Index, first using the ICSS algorithm day in which oscillation pattern of structural failure occurred have been identified. Then, to estimate the possible impact of identified failure in the volatility model, to the number of failure, a dummy variable were defined where the dummy variable in the failure day, and the number of days in the days before the failure select zero number.

Then variables in the variance equation are put on ARFIMA-FIGARCH model and the ARMA-FIGARCH that the results show that in both ARMA-GARCH model and ARFIMA-FIGARCH the identified structural failure of 10 points, 8 points significantly fluctuated the pattern. Accordingly, the null hypothesis cannot be rejected which is based on this fact that pattern of volatility in output price index of Tehran Stock Exchange has a structural failure.

In the second hypothesis, we sought to answer this question that, whether with considering the failure in the oscillation pattern, do the performance of the models will be improved rather than when we do not consider these failure. Based on the findings, considering the failure to predict the efficiency of oscillation pattern is predicted to lead to improve the criteria performance. So that the criteria for predicting the performance of the models among ARMA - GARCH and the ARFIMA - FIGARCH Given the failure select lower value than when the break point is not considered. But rather different situation exists in predicting return volatility. So if you use the model ARMA-GARCH to predict the return volatility, not considering the failure of oscillation pattern will have more accurate prediction. However, in consideration of the characteristics of long memory in volatility modeling, taking into consideration all the criteria predicted failure (with the exception of criteria MSE) choose lower level which means it has high power in volatility predicting.

5.1 POLITIC RECOMMENDATION AND SUGGESTION

Based on the results of the study it is recommended that not considering the occurred structural failure points in the pattern of volatility in returns for prediction of yields and volatility of stock returns on the whole price index, will be followed by misleading results. Therefore, it is recommended to consider the occurred structural failures in the parts of the identified pattern of volatility in the modeling and the volatility of returns prediction and in terms of the ratio in the model itself. It is also recommended In future studies of other identification methods of wavelet analysis failure are also used, and for the prediction of the model of the other members of the family such as EGARCH JGR, and non-linear Garch models are also used.

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