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An Extraction and Analysis of the Return Risk of Real Estate Industry, (Based on Value at Risk Based on Markov Approach)

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Abstract: Today, any attempt to invest in any economic activity, requires the knowledge and access to some components of its activities. One of the important components of investment is knowledge about investment risk according to the expected return in that activity. One of the main areas of investment in the country is investment on housing, which could take place directly or indirectly (through financial markets). In this regard, the importance of awareness of the risk in indirect investment on the housing sector considering to the nature of the financial markets is more necessary. But despite the importance of knowledge about risk, quantification methods developed for the past few years have not had much development. Therefore in this research we proposed a new model for measuring the share return risk of companies in real estate industry. This model is not only able to cover much of the shortcomings of current methods, but also able to extract the risk of stock returns in different states. The present model has been designed based on the "value at risk" and using the Markov process on parametric methods. This mechanism, in addition to taking into account the risk regime transfers is designed based on a set of models that they have got a variety of normal and abnormal distribution functions based on symmetric and asymmetric behavior. The results showed that the return of the company's stock in housing sector follows form regime transfers and has got the GED distribution based on asymmetrical models.

Key words: GARCH family risk, Markov chain process, Real estate industry
JEL Classification: R31, R39, O33, R32

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1- Introduction

Today, investing in the housing sector is one of the key areas for investment in the country. This investment can be made directly through individual or collective participation (by aggregating funds in a cooperative company, an investment fund or any legal entity) for the purchase and construction of the building. Moreover, individuals who are willing to invest in the industry to benefit from it can invest in assets of companies active in the realm of real estate acquisition through their financial intermediaries such as the stock market, or through the supply of initial, increased stock or buying and selling, have shares of these companies and benefit from their investment interests. Investing in each area (including real estate, industrial production, commerce, services, etc.) requires knowledge of the major components of the field, in order to identify the components, to adopt an appropriate investment strategy. The most important components needed to invest are fixed and current costs of the plan, future earnings, market situation, competitors, business space, various risks and so on (Zolfaghari, 2015). One of the important components in the direction of investment is the awareness of the risk of investment in each industry in terms of expected returns. Investors tend to invest in schemes that have the least risk in terms of expected returns. Therefore, the first step in adopting an investment strategy among different activities is to be aware of the small amount of the industry's major risks (Beaubrun-Diant & Maury, 2016). Considering the importance of the issue of risk from the perspective of investors in recent years, different ways of measuring risk in different areas (including market risk, credit risk, operational risk, etc.) are presented by researchers in terms of the importance of each of the risks in the relevant industry. In the area of indirect investment in the mass production industry, real estate through stock markets and over-the-counter markets is the most important risk of this kind of investment, the risk of stock price fluctuations or the risk of return on the stock of companies active in the mass-build industry, real estate (Sahabi et al., 2015). Due to the type of risk involved, some measurement methods have been developed in recent years. Nevertheless, many of these methods have significant deficiencies, from the point of view of economic and financial experts. Some of these deficiencies include relying solely on statistical methods, ignoring the type of time series distribution functions (which in most cases assume on their normalization), the lack of attention to the asymmetric reactions of stock prices to good and bad news and to the disregard for the Mode ary behaviors of stock prices of the companies (Barzegar, 2014). Therefore, in view of the importance of the awareness of the amount of risk on the one hand and the shortcomings in current methods, the present research has tried to provide a new model to address not only all the shortcomings, but also the features: considering the effects of feedback, leverage effects, Mode ary transitions, etc., we took into account the risk of return on the stock index of companies active in the mass production industry, real estate. This mechanism was designed using VaR method and using Markov's approach to modeling GARCH family. The data of the indexes were extracted from Tehran Stock Exchange database and including a six-year period from the beginning of 2009 to 2015. This the first study to extract the risk of the real estate industry index of return on the basis of Mode ary transitions in terms of a range of normal and abnormal distributions, in which the effects of feedback and leverage are considered, which can be expressed in terms of innovation in this research.

2- Literature Review

An investigation of domestic and foreign studies showed that limited studies were conducted on risk measurement using parametric models based on the risk-based value criterion in financial markets using the Markov Switching Approach, which has been real estate in areas other than the real estate industry. However, some of the studies close to the subject of the current research on risk measurement have been further discussed.

a) Foreign Researches

Binay Kumar (2003) selected the value at risk for daily returns by selecting GARCH model (1.1) and distributing the T-Student as a modified model. Some studies concluded that the use of asymmetric distributions instead of symmetric ones for standardized residues produced better predictions of VaR, for example, Giot & Laurent (2003) concluded that the asymmetric models with the distribution of t compared to other methods, the provide better results in estimating VaR within and outside the sample.

Andreou & Ghysels (2006) concluded that distribution of t and skewed t estimates the value of excessive risk, and thus other distributions such as normal distribution may be more appropriate for standardized residuals.

Ardia & Hoogerheid (2014), in a study on the effect of VaR fluctuations on US stock market returns using GARCH models in the one-day, weekly, monthly and seasonal periods, concluded that the effect of daily and weekly fluctuations is somewhat different with the effect of monthly and seasonal fluctuations.

Assaf (2015) measured value exposure to MENA countries by using ARCH Conditional Asymmetric Distributions and long tail. The results of this modeling showed that VaR estimates based on GARCH family models have appropriate results. However, adding family switching family models in the GARCH family of models could enhance its study results.

Benavides (2007) using the MS-GARCH model, investigated the stock price fluctuations in the US and European stock markets based on the distribution function t. The results of his study indicate the effects of Mode on the behavior of stock prices in different markets.

b) Iranian Researches

Barzegar (2014) emphasized the importance of considering Mode ary transitions in the modeling of GARCH series models and VAR structural models in his thesis. By reviewing the stock price transfers of petrochemical companies, the stock index of many industries in the country's financial market follows the Mode ary changes.

Faghihiyan (2015), in a study on the status of stocks of companies operating in the food industry and comparing the industry index with the whole market index, using the ARCH model, has emphasized this issue that the behavior of market index fluctuations and food industry index follow the Hamilton switching pattern. By reviewing two recent studies using the switching approach, the authors used GARCH symmetric models based on normal distribution. This is if in the present study six symmetric and asymmetric GARCH models are based on three normal distributions, t and GED (which is a total of 36 models). Real estate has been used to derive the risk of the productivity of the mass production industry index. In addition, the effects of feedback and leverage effects along with the probability of inter-period transfers are also considered.

Sobhani et al., (2015) in a study to calculate the risk value of the two metal and metal ore extraction industries; they used two approaches to the simple GARCH models and the GARCH wavelet analysis model. The results showed that the wavelet-GARCH model has better and more efficient performance than its rival model. In fact, the quasi-parametric approach presented in terms of accuracy and reliability compares with the GARCH parametric method at higher levels of confidence, the mean square error and the failure rate is less and more realistic.

3- Theoretical Background

In economic studies, each investment has a degree of risk, some of which are under control, and some are outside the control of the investor. In the investment decisions, two risk statements and expected returns are presented against each other. In a general definition of risk, there is potential measurable loss of investment that can be calculated on an asset or basket of assets, but expected returns represent the expected return on investment or return on investment (Marty, 2015). Several economists have defined the risk of investment as the dispersion of returns. Keynes defined the risk of investment as a potential deviation from the average return. According to Keynes, a person who invests in an asset whose returns are heavily scattered must receive a premium for the risk tolerated (Sheikh, 2015). There are two distinct views on investment risk. In the first perspective, risk is considered as any possible fluctuation in future economic returns, and in the second view, risk is used as potential negative fluctuation in future economic returns. In this regard, one of the most famous financial theories about investment risk is the modern portfolio theory, presented by Markowitz (1959). In this theory, the risk is defined according to the first view as a deviation from the average return. In other words, high and low fluctuations are also significant, and variance and standard deviation are considered numerical indicators for risk measurement. In this view, the default of the use of variance and standard deviation is the existence of a normal distribution for the variable. In the following, the assumptions of the Markowitz model are expressed:

- Investors are risk averse and have an expected increase in utility, and the ultimate utility curve for their wealth is decreasing.
- Investors choose their capital portfolio based on the average-expected yield variance; therefore, their indifference curves are a function of the expected rate of return and variance.
- Each investment option can be divided up to an infinite amount. Investors have a one-year horizons and this is the same for all investors.
- Investors prefer a higher return on a certain level of risk, and vice versa, investors consider two factors in their choices: 1. Expected high returns that are desirable. 2. Extreme efficiency, which is an undesirable factor.

In contrast to the modern theory of portfolios, the postmodern theory of portfolios has arisen, which, contrary to the previous theory, assumes that abnormal distribution of probability is yielded. The concept of risk changes in this theory; risk is defined as unfavorable deviations from the average or target return rate, so that fluctuations are above the average (or target return rate), and only fluctuations below the average (or target return rate) are undesirable. Unfavorable risk as an indicator of risk measurement involves a negative fluctuation in future economic returns (consistent with the second view of risk) (Marty, 2015).

The risk of investing and optimizing Markowitz, when the number of investment assets and market constraints is low, is solvable by mathematical models, but when the real world conditions and constraints are considered, it will be difficult. For years, solving such complicated problems, advanced mathematics and computers has come to the aid of human beings in order to help him eliminate the conditions of ambivalence and ambiguity (Bayat & Asadi, 2017). Structural failures in statistics, which indicate the existence of Mode ary transitions in the behavior of variables, cannot be calculated in simple risk-measurement models, and the need for complex calculations and its implications in parametric models of risk measurement. In the meantime, the value of risk as a standard approach to measure the risk of an investor has the ability to consider the variables' transitional behaviors. This method is one of the undesirable risk indicators of a standard for measuring the maximum potential loss of the asset basket, which was presented by Weather Stone in 1994. Value at risk measures the risk slightly and is currently one of the key tools in risk management. By definition, the value at risk is the maximum loss that the depreciation of the basket of assets for a given period in the future with a certain degree of certainty does not increase (Asgharpour et al., 2013). By combining Markov switching models and parametric models (which require relatively complex processing), we can extract the value of time series risk in different Modes. In this paper, the risk of investing in selected industry stocks is derived from this model.

The stages of extraction of the risk of return on the real estate aggregate industry index are shown in Figure 1.

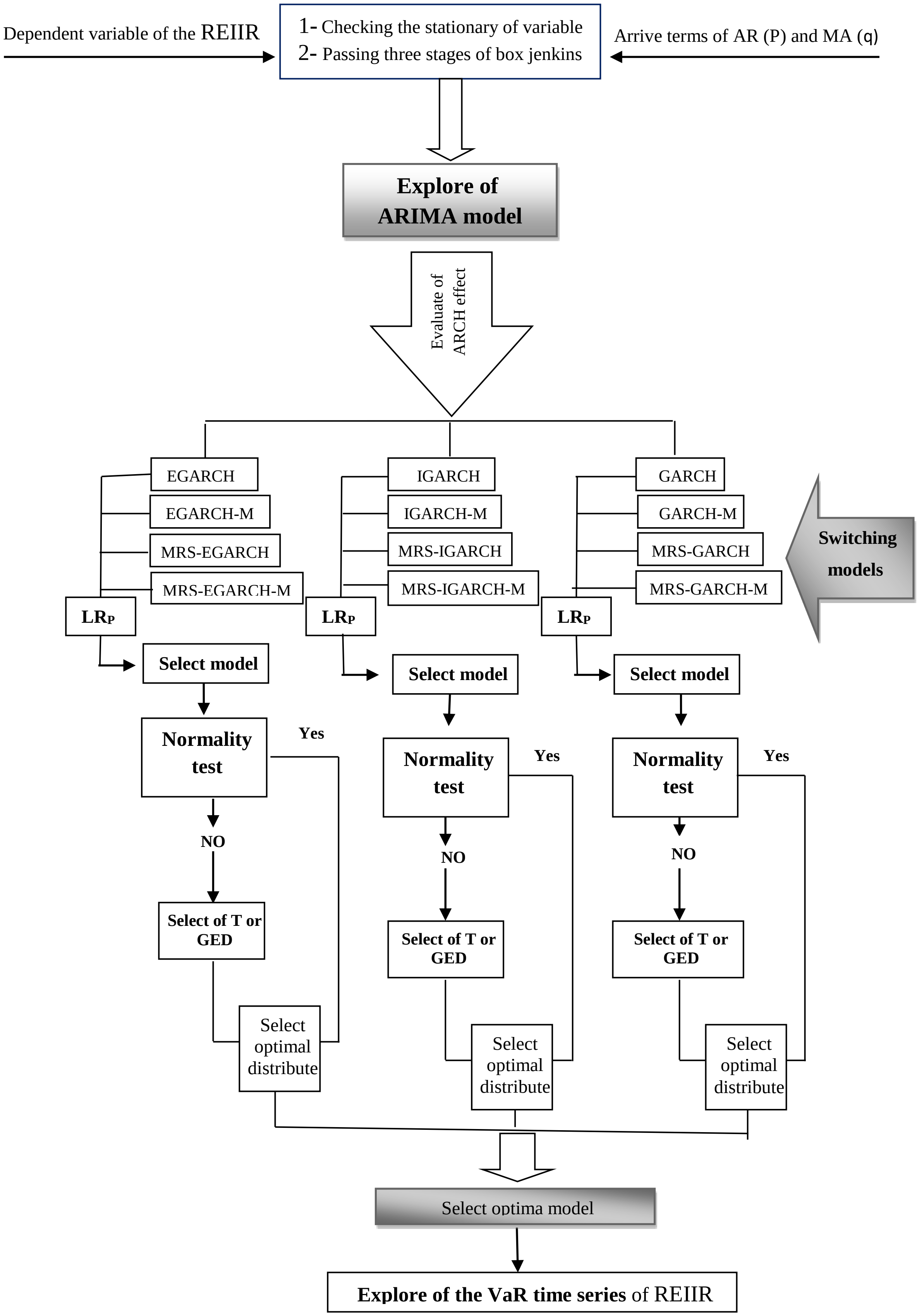

Fig1. Process of extracting the VaR of REIIR

4- Research Method

This research is applied and in terms of purpose, and, analytical-descriptive and correlational in terms of entity. In addition, in order to reach the research goal and the possibility of testing the hypotheses, information about the daily data of the insurance industry index has been extracted from the Tehran Stock Exchange's database and includes a six-year period from the beginning of 2009 to 2015. In this study, the risk measurement of the productivity of the mass production industry, real estate is based on the following six steps:

- Estimation ARIMA Average Model
- Estimation of GARCH family models
- Estimation of Markov switching family models
- Choosing Optimal Models (Switching and Non- Switching)
- Normal test
- Choosing an Optimal Model and Measuring Value at Risk (VaR).

5- Results

The process of extraction of the time series of the risk factor of the productivity of the mass production industry, real estate, includes the following steps:

Extracting the mean model and conditional variance of the productivity index of the mass production industry, real estate

First, after extracting the time series of the real estate real estate return efficiency, its validity was generalized based on Augmented Dickey-Fuller test statistic and Phillips Perron was investigated. The results of these two statistics showed that the desired time series was at a level of stagnation. After sampling, the number of autoregressive sentences (p) and the mean number of moving sentences (q) were calculated using autocorrelation (AC) and autocorrelation (PAC) functions based on the Box-Jenkins steps. Then, according to Hannan-Quinn criteria, it was revised. The final average model for the mass production industry is real estate as the following ARMA (1.0) equation:

$$y_t = \text{۰۰۱/۰} + \text{۴۱/۰} y_{t-\text{۱}} \quad (\text{۱})$$

(۱.۷۲) (۴۷/۱۵)

Equation (1) shows that the productivity of a mass production industry, real estate is merely a function of its past day, which has a positive and significant effect.

After extracting the mean equation using the ARCH effect test, the heterogeneity analysis of the variance component of the disturbance was investigated. The results of the disparity analysis of variance of the disrupted component indicate that the value of F and χ^2 statistics yields the real estate estate aggregate industry index less than Table 1. (Likely to be less than 5%) and have an ARCH effect. Therefore, the result of this test can be interpreted as the time series of this industry does not have the same variance, but since the time series models are generally based on the assumption that the variances are consistent, in order to estimate the process of time series with anomalous variance, models should be used to consider anomalous conditions in fitting these types of time series (Ebrahimi, 2006). The most famous of these models are GARCH family models. So, the real estate real estate industry index based on six models of the GARCH family including simple GARCH, GARCH average, simple EGARCH, EGARCH average was estimated based on three normal distributions, t and GED. In total, 18 models were presented in Table 1.

Table1. The conditional mean and variance models for the REIIR

Conditional variance	**Conditional mean**	**Distributions**	**model**
$\sigma_t^2 = .001 + 0.11\varepsilon_{t-1}^2 + 0.88\sigma_{t-1}^2$ (۲/۶) (۶/۴) (۵/۵)	$y_t = .001 + 0.38y_{t-1}$ (۴/۲) (۵/۱۴)	Normal	**GARCH**
$\sigma_t^2 = .001 + 0.13\varepsilon_{t-1}^2 + 0.88\sigma_{t-1}^2$ (۱/۲) (۵/۵) (۲/۴۷)	$y_t = .001 + 0.38y_{t-1}$ (۸۹/۰) (۸/۱۴)	t	
$\sigma_t^2 = .001 + 0.12\varepsilon_{t-1}^2 + 0.88\sigma_{t-1}^2$ (۴/۲) (۳/۵) (۴۴/۴)	$y_t = .001 + 0.38y_{t-1}$ (۸۶/۰) (۱/۱۵)	GED	
$\sigma_t^2 = .001 + 0.11\varepsilon_{t-1}^2 + 0.88\sigma_{t-1}^2$ (۱/۴) (۱/۷) (۱/۵۸)	$y_t = .001 + 0.36y_{t-1} - 0.002\sigma$ (۴۴/۱) (۵/۱۴) (-۰۲/۰)	Normal	**GARCH-M**
$\sigma_t^2 = .001 + 0.13\varepsilon_{t-1}^2 + 0.88\sigma_{t-1}^2$ (۲/۰۶) (۵/۴) (۴۸/۲)	$y_t = .001 + 0.38y_{t-1} - 0.03\sigma$ (۰/۹) (۱۴/۹) (-۰/۴۱)	t	
$\sigma_t^2 = .001 + 0.11\varepsilon_{t-1}^2 + 0.88\sigma_{t-1}^2$ (۳/۲) (۳/۵) (۹/۴۵)	$y_t = .001 + 0.38y_{t-1} - 0.05\sigma$ (۹/۰) (۳/۱۵) (-۶۴/۰)	GED	
$ln\sigma_t^2 = -0.42 + 0.21\left\|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right\| + 0.03\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + 0.97ln\sigma_{t-1}^2$ (-۸/۶) (۹/۷) (۱/۲) (۷/۱۹۳)	$y_t = .001 + 0.37y_{t-1}$ (۳/۳) (۵/۱۴)	Normal	**EGARCH**
$ln\sigma_t^2 = -0.27 + 0.21\left\|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right\| + 0.04\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + 0.99ln\sigma_{t-1}^2$ (-۱/۴) (۰۵/۶) (۱/۲) (۱/۱۹۰)	$y_t = .001 + 0.38y_{t-1}$ (۴۱/۱) (۲/۱۵)	t	
$ln\sigma_t^2 = -0.34 + 0.21\left\|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right\| + 0.03\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + 0.98ln\sigma_{t-1}^2$ (-۴/۴) (۱/۶) (۵۳/۱) (۷/۱۵۷)	$y_t = .001 + 0.38y_{t-1}$ (۰۵/۱) (۲/۱۵)	GED	
$ln\sigma_t^2 = -0.41 + 0.21\left\|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right\| + 0.02\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + 0.97ln\sigma_{t-1}^2$ (-۷/۶) (۶۵/۷) (۰۳/۲) (۳/۱۹۰)	$y_t = .001 + 0.37y_{t-1} - 0.05\sigma$ (۶/۲۲/۶) (۵/۱۴) (-۶۱/۰)	Normal	**EGARCH-M**
$ln\sigma_t^2 = -0.27 + 0.2\left\|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right\| + 0.04\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + 0.99ln\sigma_{t-1}^2$ (-۱/۴) (۹/۵) (۰۷/۲) (۹/۱۹۷)	$y_t = .001 + 0.38y_{t-1} - 0.05\sigma$ (۵/۱) (۳/۱۵) (-۷۲/۰)	t	
$ln\sigma_t^2 = -0.32 + 0.2\left\|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right\| + 0.03\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + 0.98ln\sigma_{t-1}^2$ (-۴/۴) (۸/۵) (۴۶/۱) (۱/۱۶۶)	$y_t = .001 + 0.38y_{t-1} - 0.07\sigma$ (۴/۱) (۵/۱۵) (-۹۷/۰)	GED	
$\sigma_t^2 = 0.07\varepsilon_{t-1}^2 + 0.93\sigma_{t-1}^2$ (۱/۱۲) (۱/۱۴۴)	$y_t = .001 + 0.39y_{t-1}$ (۹/۴) (۶/۱۹)	Normal	**IGARCH**
$\sigma_t^2 = 0.09\varepsilon_{t-1}^2 + 0.91\sigma_{t-1}^2$ (۵/۸) (۹/۹۰)	$y_t = .001 + 0.38y_{t-1}$ (۹۵/۰) (۰۲/۱۷)	t	
$\sigma_t^2 = 0.09\varepsilon_{t-1}^2 + 0.91\sigma_{t-1}^2$ (۳/۸) (۲/۹۵)	$y_t = .001 + 0.4y_{t-1}$ (۹۱/۰) (۷/۱۷)	GED	
$\sigma_t^2 = 0.08\varepsilon_{t-1}^2 + 0.92\sigma_{t-1}^2$ (۴/۱۱) (۱/۱۳۹)	$y_t = .001 + 0.39y_{t-1} - 0.1\sigma$ (۱۱/۶) (۳/۱۹) (-۹۸/۱)	Normal	**IGARCH-M**
$\sigma_t^2 = 0.08\varepsilon_{t-1}^2 + 0.92\sigma_{t-1}^2$ (۲/۸) (۳/۹۱)	$y_t = .001 + 0.38y_{t-1} - 0.06\sigma$ (۴/۱) (۱/۱۷) (-۰۳/۱)	t	
$\sigma_t^2 = 0.08\varepsilon_{t-1}^2 + 0.92\sigma_{t-1}^2$ (۹/۷) (۱/۹۵)	$y_t = .001 + 0.39y_{t-1} - 0.09\sigma$ (۵/۱) (۱/۱۸) (-۶۴/۱)	GED	

The numbers in parentheses are t-statistic.

By examining the conditional average coefficients, the productivity of the industry of mass production, real estate is affected only by the return of its past period, and the return fluctuations, which indicate the effect of feedback, are in none of the GARCH-M, EGARCH-M, IGARCH models -M is not significant. In fact, the averaged average structure of the industry's performance returns from the AR (1) structure.

Looking at the estimated models based on the six models of the GARCH family in terms of normal distribution functions, t and GED, the efficiency of the real estate aggregation industry index is observed. The conditional variance of all industries follows the GARCH structure. In fact, due to the ARCH effect on the index efficiency, the effect of the conditional variance of the returns on its past values and the square of the distorted values are confirmed. The following is a summary of the estimated results of the stated models.

GARCH: There is no significant difference between the coefficients of the average model and the conditional variance based on the three normal distributions, t and GED, and all the coefficients are significant.

GARCH-M: All coefficients of mean models and conditional variance (except for standard deviation) are significant. The unnecessary standard deviation means that the feedback effect[1] is not observed.

EGARCH: Most model coefficients based on distribution functions are meaningful. In addition, due to the significance of the coefficient $\frac{\varepsilon_{t-1}}{\sigma_{t-1}}$ of the aggregate industry, real estate exhibits asymmetric response to external shocks and has leverage effect[2].

EGARCH-M: Most of the coefficients of the models are significant. The standard deviation is not significant for the conditional mean model, which means that the effect of feedback is not observed, but based on all functions, there is a leverage effect distribution.

Estimation of Markov Switching Family Models

Before estimating the model based on the Markov switching approach, it is necessary to provide a brief description of the structure of this model and the nature of the selected Modes therein.

The Markov chain is a mathematical system that transfers from one state to another in a sequence, and the number of possible states is counted and limited. Markov's characteristic states that the distribution of conditional system probabilities in the next step (and in fact at all future stages) depending on its mode of operation, depends only on the current state of the system and not on the state of the system in the previous stages. A set of all modes and transmission probabilities completely determines the Markov chain. According to the contract, it is assumed that all possible scenarios and transfers are included in the definition of the processes, and therefore always there is a

1 The feedback effect was introduced by Pindic (1984). According to the feedback effect, fluctuations in returns have a significant effect on stock returns. In explaining the effect of feedback, it can be said that, according to Markowitz's theory, there is a direct relationship between risk and return, so that with increasing risk, returns increase.

2 Leverage Effect suggests that index efficiency has different responses to good and bad news. If the coefficient of the relevant variable is significant and positive, the effect of bad news is more than good news on the return on the index, and if the coefficient of this variable is significant and negative, the good news effect is more than bad news on the impact of the index.

subsequent stage and the process continues continuously.

On this basis, the time series y_t is a function of all the information of past periods and the type of Mode (up to m), respectively, in equation (2).

$$f(y_t|s_t, S_{t-1}, Y_{t-1})),$$
$$Y_{t-1} = y_{t-1}, y_{t-2 \ldots\ldots},$$
$$S_{t-1} = s_{t-1}, s_{t-2 \ldots\ldots, s_{t-m}} \quad (۲)$$

In the above equation, S_i is equal to different Modes based on an unspecified hidden variable. In the Markov chain, the likelihood of going from a Mode or a state to a Mode n or another state is called the possibility of transfer. We assume that there are two modes, i, which are represented by the hidden variable S_t. This variable selects two values depending on the state of the economy: 1 and 2. Transitions between states under the first-order Markov process[1] can be explained as follows:

$$P(s_t = 1 . s_{t-1} = 1) = p_{11}$$
$$P(s_t = 1 . s_{t-1} = 2) = 1 - p_{22}$$
$$P(s_t = 2 . s_{t-1} = 1) = 1 - p_{11}$$
$$P(s_t = 2 . s_{t-1} = 2) = p_{22} \quad (۳)$$

P, is the possibility that the economy at time t switches from mode 1 (or 2) to state 2 (or 1). It is customary to summarize these transfer possibilities in the following matrix:

$$\begin{bmatrix} p_{11} & p_{21} \\ p_{12} & p_{22} \end{bmatrix} = \begin{bmatrix} p_{11} & 1 - p_{22} \\ 1 - p_{12} & p_{22} \end{bmatrix} \quad (۴)$$

The logistic function is used to define the likelihood of a transfer of Mode as follows:

$$p_{11}^{t} = pr(s = 1) = \frac{\exp(\theta_0 + \sum_{i=1}^{\alpha} \theta_i x_{it-1})}{1 + \exp(\theta_0 + \sum_{i=1}^{\alpha} \theta_i x_{it-1})}$$

$$p_{22}^{t} = pr(s = 2) = \frac{\exp(\partial_0 + \sum_{i=1}^{\alpha} \theta_i x_{it-1})}{1 + \exp(\partial_0 + \sum_{i=1}^{\alpha} \theta_i x_{it-1})} \quad (5)$$

In the modeling of Mode ary transitions under the Markov approach in the capital market, usually two distinct Modes (S_i) are identified. The first Mode, with low expected returns and high volatility, called stock recession and a second Mode n, with high expected returns and low volatility, called stock flourishing. In many financial studies and researches such as Saranj (2014) and Zolfaghari (2015), these two Modes are used under the name of the Mode of recession and boom or Mode 1 and 2. Hence, in the present study, those with high index fluctuations and low efficacy are classified in the Mode n Mode (Mode n 1) and in those with low index fluctuations and high efficacy in the boom Mode group (Mode n 2).

After estimating GARCH family models, each of the indexed models was estimated by the Markov switching Mode n. Table 2 shows the average models and estimated variance of the mass production industry index real estate in terms of the Markov switching Mode n.

In Table 2, the columns related to μ_1 and μ_2 show the average equation for the Mode n 1 and 2. The columns for λ_1 and λ_2 represent the effect of feedback on GARCH-M, EGARCH-M, IGARCH-M models. In these models, all the coefficients of these two parameters are significant. Due to the compression of the coefficients in two Modes, there was no possibility to add t-statistic in the table.

With confirmation of the effect of feedback, it can be said that one of the factors influencing index efficiency is the index yield fluctuations, which is based on the Markowitz theory, a simple approximation

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1 This means that the current diet (st) depends only on the regime of the previous period (s_ (t-1)).

of risk. In other words, the direct relationship implies that, with increasing risk, there is a risk-taking expectation of an expected increase in expected returns. However, in some cases, this is an inverse relationship that does not support the theory.

Parameters related to b_{01} and b_{02} are related to the values of the origin of the conditional variance model in the two Mode s 1 and 2. In addition, the parameters for b_{11} and b_{12} in the four models (GARCH, GARCH-M IGARCH, IGARCH-M) are related to the squares of the previous sentence disruption ε_{t-1}^2 conditional variance model in two Modes 1 and 2. These parameters in two models (EGARCH, EGARCH-M) are equal to the variable coefficients $\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right|$. Also, the parameters for b_{21} and b_{22} in four models (GARCH, GARCH-M IGARCH, IGARCH-M) are related to conditional variance values of the previous period σ_{t-1}^2 conditional variance model in two Modes 1 and 2.

These parameters in the two models (EGARCH, EGARCH-M) are equal to the coefficients of the variable $\frac{\varepsilon_{t-1}}{\sigma_{t-1}}$, which indicates the leverage effect. Considering the coefficients of this variable, it can be argued that the publication of good and bad news has different and asymmetric effects on the index efficiency. In other words, based on the results of the above table and meaningful b_{21}, b_{22}, b_{11} and b_{12}, bad news has a more negative effect than positive news. Finally, the parameters for b_{31} and b_{32} correspond to the conditional variance logarithms of the previous period $ln\sigma_{t-1}^2$of the conditional variance model in two Modes 1 and 2. This indicates the impact of the variance of the component of disruption of variance as a disturbance of its previous period and represents a serial correlation in the variance of the models. The p_{11} and p_{11} columns relate to the possibility of transferring the indicator's return from mode to other modes. If the mode space (i) contains j= 1,2, the probability of a one-step transition from the model is as follows:

$$P = \begin{bmatrix} p_{11} & p_{21} \\ p_{12} & p_{22} \end{bmatrix}$$

Normal Test and Select Optimal Model

After estimating GARCH family models and Markov switching families (a total of 36 models), at this stage, using Jarque-Bera test, the normal distribution of the index of return performance is tested in each of the estimated models. In the event that the time series compliance is confirmed, the return of the index from the normal distribution in the estimated models, these models will be transmitted to the next step. Otherwise, the appropriate distribution (between t and GED) is the index efficiency in the models chosen in terms of the Garcia and Perron likelihood test (LRPG) test. The results of Jarque-Bera test for the normalization of the wastes of the estimated models by the normal distribution for the index efficiency in all six models with the assumption of normal distribution were rejected. The test results of the models, taking into account the effect of switching, also confirmed this. Therefore, to select the optimal model, the LRPG proposed by Garcia and Peron (1996) was used. They used Davies (1987) upper limit approach for their proposed test. By defining L_0 as the value of the logarithm of likelihood under the hypothesis zero and L_1 as the value of the logarithm of motivated under the alternative hypothesis, its test statistic is $\mathrm{LR_{PG}} = 2 \times(\mathrm{L_1} - \mathrm{L_0})$.

Table2.The conditional mean and variance models for the REIIR under MRS method

Log_like	p_{22}	p_{11}	b_{32}	b_{31}	b_{22}	b_{21}	b_{12}	b_{11}	b_{02}	b_{01}	λ_2	λ_1	μ_2	μ_1	distributions	Type	Model
-1515.4872	0.81	0.82	-	-	0.6784	0.9763	0.2582	0.0237	0.0010	0.0369	-	-	-0.0648	0.7338	Normal	simple	GARCH
-1507.0481	0.83	0.84	-	-	0.6794	0.9228	0.2630	0.0607	0.0060	0.0225	-	-	-0.0510	0.9352	t		
-1509.8839	0.89	0.86	-	-	0.9373	0.7434	0.0355	0.2025	0.0001	0.0134	-	-	1.2043	-0.0302	GED		
-1528.0849			-	-	*1.0000	0.5114	0.0000	0.0000	0.0079	0.0097	1.0442	0.1637	0.2272	-0.1107	Normal	mean	
-1486.8466	0.91	0.87	-	-	0.7832	0.3079	0.2152	0.2504	0.0001	0.2075	-0.2748	1.8111	0.0725	-0.5220	t		
-1488.7368	0.80	0.79	-	-	0.2114	0.8162	0.2357	0.1501	0.3008	0.0022	2.3872	-0.3782	-1.1927	0.1283	GED		
-1522.7947	0.74	0.78	0.8001	0.5195	0.9923	0.9865	0.0153	-0.075	0.4632	0.2003	-	-	-0.0547	0.3473	Normal	simple	EGARCH
-1515.4678	0.72	0.91	0.9487	0.7302	0.9900	0.9765	-0.075	-0.292	0.5001	0.5096	-	-	-0.0579	0.9661	t		
-1515.2889	0.76	0.87	0.9657	0.7215	0.9765	0.9865	-0.073	-0.215	0.4696	0.4093	-	-	-0.0381	1.1764	GED		
-1489.9855	0.84	0.82	0.9659	0.7513	0.4997	-0.247	-0.175	-0.102	-0.279	0.0769	2.9077	-2.8139	-1.3407	2.7521	Normal	mean	
-1478.4713	0.87	0.71	0.9341	0.6388	-0.224	0.2814	0.0449	0.2125	-0.175	-0.2876	-0.7638	2.3652	0.3320	-1.2083	t		
-1470.2442	0.99	0.98	0.4039	0.0534	0.4017	0.0378	0.1531	0.0166	-0.666	0.7122	2.4651	13.6629	-1.4854	-3.6785	GED		
-1576.2345	0.83	0.91	-	-	0.9232	0.6019	0.0768	0.3981	0.2354	0.1298	-	-	0.2987	-0.0345	Normal	simple	IGARCH
-1499.3452	0.81	0.92	-	-	0.8755	0.4571	0.1245	0.5429	0.1376	0.04571	-	-	0.1354	0.2134	t		
-1496.3241	0.85	0.86	-	-	0.7424	0.3766	0.2576	0.6234	0.0238	0.0948	-	-	0.0896	0.0987	GED		
-1519.1445	0.79	0.H94	-	-	۹۵۱۵/۰	0.5117	0.0485	0.4883	0.1626	0.0095	-1.3059	0.0986	0.2720	-0.0871	Normal	mean	
-1491.4746	0.87	0.97	-	-	۸۲۳۱/۰	0.5746	0.1769	0.4254	0.0045	0.0748	-0.2744	1.0326	0.0765	-0.1545	t		
-1501.2056	0.76	0.87	-	-	0.7609	0.5692	0.2391	0.4308	0.0068	0.0428	-0.2430	0.8774	0.0703	-0.0102	GED		

* Given the variance coefficient of the conditional variance of the past period, the model is not defensible.

Table3.The results of LR_{PG} likelihood ratio for GARCH and the MRS- GARCH family models

IGARCH						EGARCH						GARCH						
Mean			Simple			Mean			Simple			`Mean			Simple			**GARCH family models without switching effect**
Test	GED	t	Test	GED	t	Test	GED	t	Test	GED	t	Test	GED	t	Test	GED	t	
1.778	**4090.72**	**4089.83**	**1.778**	**4090.72**	**4089.8**	**1.778**	**4090.72**	**4089.839**	**1.778**	**4090.72**	**4089.83**	**1.778**	**4090.72**	**4089.83**	**1.778**	**4090.72**	**4089.839**	
MSIGARCH						MSEGARCH						MSGARCH						
Mean			Simple			Mean			Simple			Mean			Simple			**GARCH family models with switching effect**
Test	GED	t	Test	GED	t	Test	GED	t	Test	GED	t	Test	GED	t	Test	GED	t	
5.7	**-1509.9**	**-1507**	**5.7**	**-1509.9**	**-1507**	**5.7**	**-1509.9**	**-1507**	**5.7**	**-1509.9**	**-1507**	**5.7**	**-1509.9**	**-1507**	**5.7**	**-1509.9**	**.-1507**	

According to Table 3, the selected model in both groups is related to the EGARCH asymmetric model, with the exception that the switching effect group is a simple EGARCH model with t distribution, which merely represents the Leverage Effect. While in the switching group, the selected model is the EGARCH model with GED distribution, which shows both the effect of feedback and Leverage Effect. Therefore, in a general interpretation, it can be stated that in two switching and non-switching modes, the returns of the indicated indicator are good news and bad asymmetric effects.

After estimating GARCH family models and Markov switching families and selecting the optimal model for each of the groups, at this stage, using the Garcia and Peron likelihood ratio test (LRPG), the final model of the index was selected among the selected switching models without switching. The results of Garcia and Peron likelihood tests are presented in Table 4.

Table4. The results of the Garcia and Peron exponential correlation test for optimal model selection

LR_{PG}	MRS-GARCH		ARMA-GARCH models		Index
	L_1	Conditional Variance/ Distribution	L_0	Conditional Variance/ Distribution	
-۷/۱۱۱۲۵	-۲/۱۴۷۰	EGARCH-M / GED	65.4092	EGARCH / t	Model

As shown in Table 4, L_1 is considered as the value of the logic of likelihood of selected variance models considering the effect of switching and L_0 as the logarithm value of the likelihood of selected variance models without considering the switching effect. The final column shows the LRPG test statistic which for both indicators is less than χ^2 at 5% level. Therefore, the conditional variance model was chosen considering the switching effect as the optimal model. Therefore, the final model of indicator returns industry, real estate is as follows:

Mode (1) $$y_t = -\frac{3}{67} + \frac{13}{66\sigma}$$

$$ln\sigma_t^2 = 0.71 + 0.02\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| + 0.04\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + 0.05ln\sigma_{t-1}^2$$

Mode (2) $$y_t = -\frac{1}{48} + \frac{2}{46\sigma}$$

$$\ln\sigma_t^2 = 0.66 + 0.15\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| + 0.41\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + 0.417\ln\sigma_{t-1}^2$$

In this equation, in case of being in Mode 1, the effect of feedback is positive and significant, and also in the Mode 2, the positive effect is significant. The leverage effect in both Modes shows the asymmetric impact of the total index returns from good and bad news, so that the effect of bad news is the sum of the coefficients $\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right|$ and $\frac{\varepsilon_{t-1}}{\sigma_{t-1}}$ is more than good news $\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right|$. The transition probability matrix is as follows:

$$P = \begin{bmatrix} 0.98 & 0.01 \\ 0.02 & 0.99 \end{bmatrix}$$

If the efficiency of the mass production industry is real estate in Mode 1, it will be 98% probable p_{11} in the next period also in Mode 1. Also, the expected time for the first transfer from Mode 1 to 2, provided that the system started from Mode 1, is equal to:

$$\varphi_2 = \frac{1}{1 - p_{11}} = 50\ days$$

That is, the expected duration of survival in Mode 1 (stagnation) is 50 days.

If the mass production industry is in real estate mode 2, it will probably be 97% p_{22} in the next period in Mode 2 too. In addition, the expected time for the first transfer from Mode 2 to 1 provided that the system starts from Mode n 2 is equal to:

$$\varphi_2 = \frac{1}{1-p_{22}} = 100\ days$$

That is, the expected survival time in Mode 2 (boom mode) is 100 days.

Another advantage of switching models is that these models provide conditional probabilistic mode conditions in regime 1 and 2 at time t. In this model, the pivotal probability of determining whether a mode may occur when and when it is considered is inevitable. In other words, the pseudo-probability is used to identify the mode that occurs most at any point in the entire period of the sample. The probability of smoothing is very valuable in helping to understand more of the economic interpretation previously generated using estimated parameters. In other words, the pseudo-probability is used to identify the mode that most likely occurs at any point in the entire period of the sample. The likelihood of smuggling is very valuable in contributing to a greater understanding of the economic interpretation that has already been made using estimated parameters. Therefore, in order to further support the interpretation of these two regimes, the possibility of a smooth transition generated from the above model (EGARCH-M_GED) for the time series of the efficiency of the index of aggregation, real estate is presented in Fig (1). As shown in Fig (1), the probability that the industry returns in Mode 1 is a future picture of the likelihood that the industry's returns to Mode 2.

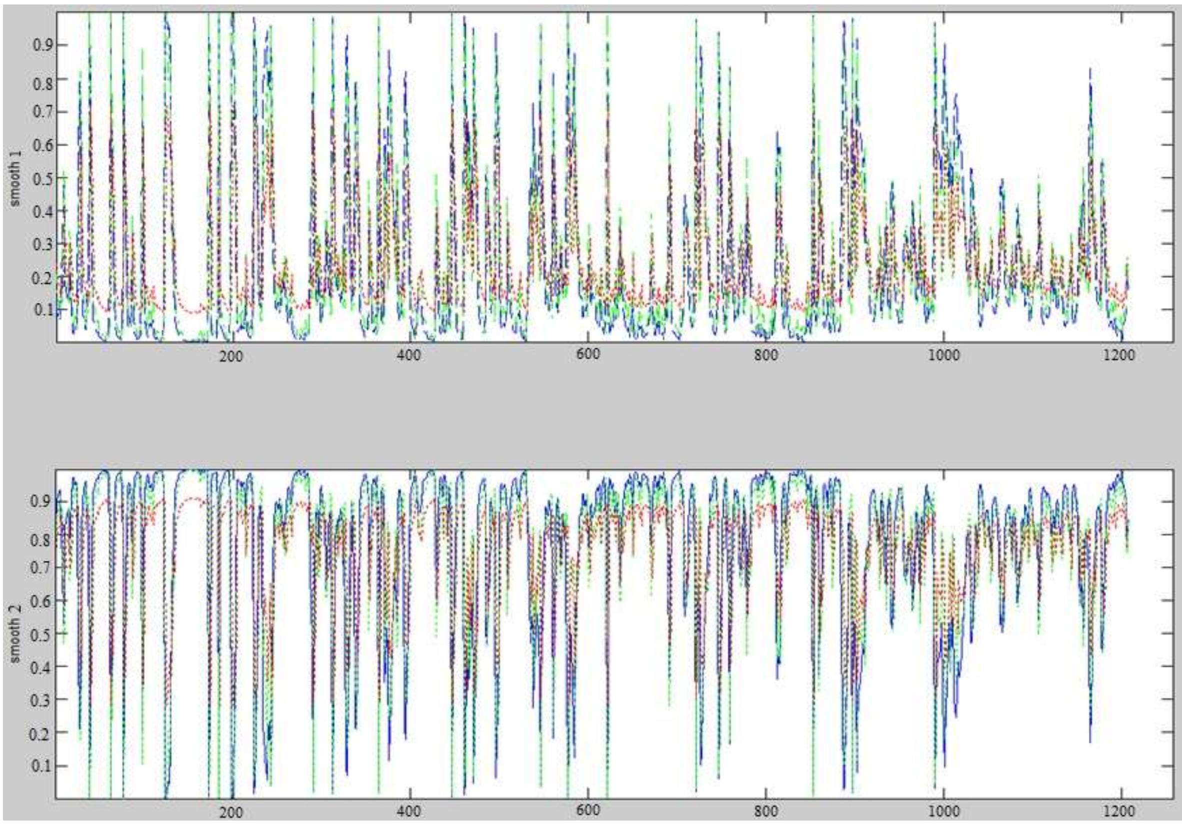

Fig1. Likely Potential Return on Mass Index Industry, Real Estate (Modes 1 and 2, respectively)

According to Figure 1, we can deduce the number of days that the return on investment in the modes 1 and 2, along with its history, contributes significantly to periodic analysis.

Measuring Value at Risk (VaR)

After the optimal model is selected in terms of optimal distribution and following the switching effect, in this section, by producing a time series of conditional variance of the optimal model, we generate a time series of uncertainty. By producing this series h, Value at Risk (VaR) are based on the following equation:

$$VaR = \mu - 1.64\sqrt{h} \qquad (۴)$$

In the above equation, μ is the mean of industry index return and h is the time series of uncertainty of index yield. Figure 2 shows the time series of the risk index of real estate in two modes.

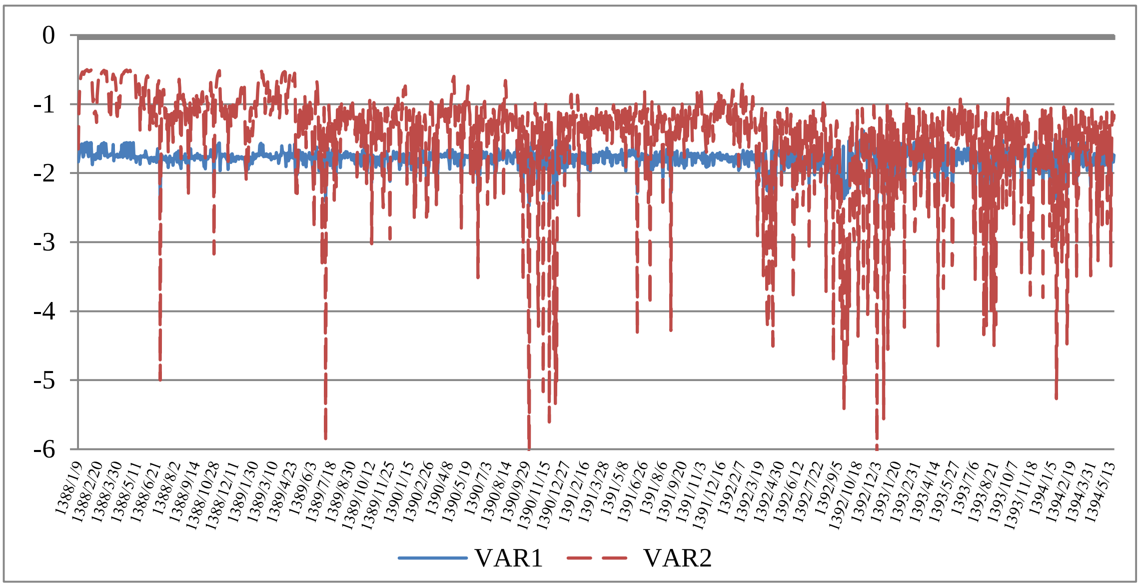

Fig2. Value at Risk Index of the Mass Production Industry, Real Estate

The risk trends of this industry over the period of the period from 2009 to 1392 in Mode 1 in most of the periods are higher than Mode 2, so that the average risk of this industry in the 1 and 2 regime, respectively, was equivalent to a loss of 7.1 and 2.1 percent respectively. Nevertheless, after June of 2013, we saw a high risk in diet 2, which continued until the end of the study period. During this period, the risk in the mode was around 6.1 percent, but the average risk in Mode 2 fluctuated in most periods at 5.1 to 5.2 percent.

6- Conclusion and Discussion

In the real economy, investment in each area is associated with risk, depending on the area of investment, there are different types of risk. In this context, it is important to measure and quantify the risks involved in adopting an appropriate investment strategy and proper risk management. In this research, we tried to provide a comprehensive model for measuring the risk of indirect investment in the housing sector through the calculation of stock return risk of active companies in the real estate aggregation industry. The structure of the designed model is based on the "value-at-risk" method and using the

Markov regime in the modeling of the GARCH family. In this process, after the extraction of the time series of the return efficiency of the industry of mass production, real estate, the conditional average model was first calculated. Subsequently, after studying the effect of heterogeneity of variance using six models of the GARCH family, the model of conditional variance of the productivity of the mass index industry, real estate in terms of three normal distributions, t and GED. Estimated results from the final model indicate that the index is returning from its past day performance (38%). In this model, the Leverage Effects were confirmed, indicating the asymmetric effects of good and bad news on the performance of the industry index. In fact, the negative effects of bad news were more than the positive effects of good news. In addition, the distribution of the efficiency of the index was abnormal and followed the distribution of t in the broad sequence. In the second stage, six models of the GARCH family were modeled according to the switching mode of the Markov regime in terms of the three distributions. The results of the estimated final model showed that not only good and bad news have asymmetric effects on the efficiency of the industry index (there is a leverage effect), but also the volatility of the indicator returns has a significant effect on the return on the index (the effect of feedback). In fact, according to Markowitz's theory, there is a direct relationship between risk and return, so that, with increasing index-return risk, its returns also increase. The distribution of the index was abnormal and followed the distribution of t in the broad sequence. In the third step, after reviewing the normalization of the estimated models, it was found that the above models do not follow the normal distribution. Therefore, the optimal model, based on the Garcia-Peron test, was chosen for two groups of models with no switching effect and no switching effect. The results showed that the optimal model based on the EGARCH model is asymmetric with GED distribution; therefore, the efficiency of the industry of mass production, real estate, in addition to the asymmetric effect of good and bad news, also influences its fluctuations. The distribution of the index was abnormal and followed the distribution of t in the broad sequence. In the following, the time series of the Risk Efficiency series was derived from real estate real estate industry index, which indicates the risk fluctuations of these indicators during the study period. The results showed that the risk of this industry during the studied period from 2009 to 1392 in mode 1 in most of the periods is higher than mode 2 and the average risk of this industry in the 1 and 2 modes is equivalent to a loss of about 7.1 and 2.1% in the oscillation. Nevertheless, after June 2006, by the end of the study period, there are very high risks in mode 2, in which the average risk of this industry in the first and second modes was equal to 6.1, 5.1 and 5.2%, respectively. Finally, considering the importance of measuring the risk of return on the industry index on the one hand, and the lack of comprehensive models for measuring it, the framework proposed in this study is to be used to understand the relative level of risk of other industries. From the practical proposals, the results of this study can be used to optimize the stock portfolio by the proposed model and the ranking of enterprises by their market risk. Finally, it is suggested that long-term memory models such as FIGARCH models should be considered in order to improve the efficiency of the designed index, and the risk of each of the accepted insurance companies in the stock exchange is calculated and based on the low risk level, respectively, companies with low return risk mostly ranked so that stakeholders with sufficient knowledge will adopt a trading strategy. In addition, insurance supervisors will pay more attention to risky companies and evaluate the performance of corporate executives.

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