Return and Volatility in Tehran Stock Exchange

Seyed Hossein Miri, Ph.D.

Department of Accounting, Islamic Azad University, Semnan Branch, Semnan, Iran

Abstract: The aim of this paper is considering the relationship between return and volatility in Tehran Stock Exchange. We have used the daily data of price index of TSE during 2009-2010. The data are available on website of TSE. We have estimated ARMA (1, 1)-GARCH (1, 1) model for estimation volatility of Tehran stock exchange. Results indicate that there is a negative relationship between volatility and rate of return in TSE. The correlation coefficient between volatility and return is -0.00182. The hypothesis of "return does not Granger Cause volatility" has rejected. Also, the hypothesis of volatility does not Granger because return has not rejected.

[Seyed Hossein Miri. **Return and Volatility in Tehran Stock Exchange**. *Life Sci J* 2013;10(1):1255-1259] (ISSN:1097-8135). http://www.lifesciencesite.com. 191

Keywords: Return, Volatility, Tehran Stock Exchange

1. Introduction

There are many studies about Tehrann Stock Exchange (TSE) as Fasanghari, M., & Montazer, G. A. (2010), Fasanghari, M., & Montazer, G. A. (2010), Foster, K. R., & Kharazi, A. (2008), Albadvi, A., Chaharsooghi, S. K., & Esfahanipour, A. (2007), Ebrahimpour, R., Nikoo, H., Masoudnia, S., Yousefi, M. R., & Ghaemi, M. S. (2011) and Yahyazadehfar, M., Abounoori, E., & Shababi, H. (2006). Rahmani, Sheri & Tajvidi (2006) have tested Beta for the prediction of stock return in order to recognize the variables which are better capable of predicting the stock return in Tehran Stock Exchange (TSE). Independent variables were tested against the dependant variable (return) on an annual basis for the years 1997-2003.[Rahmani, Sheri & Tajvidi (2006)]. Further, multi-variable models were tested, both annually and pooled cross sectional. In single variable tests, a significant relationship was observed between the stock return and sale-to-price ratio, earnings-to-price ratio and size (stock market value) in 4 consecutive years. [Rahmani, Sheri & Tajvidi (2006)]. The book-to-market ratio demonstrated great dispersion in results. However, since the results of different years varied greatly, no stable relationship was observed between Beta and stock return as predicted in the CAPM model. Further, no relation was observed between debt-to-equity ratio and the stock return. Considering the potential effect of statistical models on the findings, complementary tests were carried out in portfolio level based on Beta and book-to-market ratio variables. [Rahmani, Sheri & Tajvidi (2006)]. Three portfolios were formed taking into consideration the magnitude of each variable. The findings of these tests substantiated that, in the years 2000, 2002 and 2003, portfolios with higher Beta proved to have higher return compared to the ones with lower Beta. With respect to the portfolios formed on the basis of book-to-market ratio, the findings proved compatible with the regression models [Rahmani, Sheri & Tajvidi (2006)]. Seyyed, Abraham and Al-Hajji (2005) have used a GARCH specification and data for the Saudi Arabian stock market – now the largest stock market in the Muslim world – they have documented a systematic pattern of decline in volatility during Ramadan, implying a predictable variation in the market price of risk. An examination of trading data showed that this anomaly appears to be consistent with a decline in trading activity during Ramadan. Evidence of systematic decline in volatility during Ramadan has significant implications for pricing of securities especially option-like products and asset allocation decisions by investors in the Islamic countries [Seyyed, Abraham and Al-Hajji (2005)]. Dey (2005) has studied how growth affects liquidity of global stock exchanges and how liquidity determines cross-sectional returns on those stock exchange index portfolios [Dey (2005)]. He measured portfolio liquidity by turnover ratio computed as value of shares traded over the market capitalization. He obtained data from FIBV, an association of global stock exchanges. In a multiple regression model for turnover ratio, he found age, size, type of exchange, competition for order flow, and growth rate to be significant determinants of portfolio liquidity; however, exchange- and time-specific effects are more appropriate for modeling portfolio liquidity [Dey (2005)]. The time effects yield to three distinct regimes, while the exchange-specific effects are surrogates for the legal systems, English common law, and Civil laws of the countries [Dey (2005)]. He estimated the parameters of a multiple regression model in a two-stage GLS framework in which index return is a function of turnover [Dey (2005)]. The GLS method is preferable since a turnover ratio may have a non-stationary, random component. The significant determinants of index return are turnover and volatility, although some of the volatility effect may be a spillover from a January effect [Dey (2005)]. Investors expect higher return from high turnover markets. However, the positive turnover expected return relation was true only in emerging markets; in developed markets expected return was a function of volatility [Dey (2005)]. Its result confirmed existing empirical evidence that high turnover stock portfolios generate superior returns and further the sources and pricing of risk in emerging and developed markets were different [Dey (2005)]. Shoghi & Talaneh (2010) have analyzed the volatility behavior of Tehran Stock Exchange returns. Since volatility is an important factor in portfolio selection, asset pricing, and risk management, the main purpose of our study is to model and forecast the returns volatility of the Tehran Stock Exchange (TSE). [Shoghi & Talaneh (2010)] Using primary index data of TSE for 2003-2008, they investigated the appropriateness of several potential models of autoregressive (AR), moving averages (MA), and autoregressive moving averages (ARMA). The ARMA (2, 1) has been chosen as the best process for modeling the conditional means [Shoghi & Talaneh (2010)]. They have used EGARCH and TGARCH models to capture asymmetries in terms of negative and positive shocks and the leverage effect. The ARMA (2, 1)-TGARCH (1, 1) model was the best process to fit the data [Shoghi & Talaneh (2010)]. They have found no evidence of the presence of the leverage in the news; nor does the bad news have a larger effect on the volatility of returns than the good news. Of the three forecast performance measures, the TGARCH (1, 1) was the best model to forecast the volatility [Shoghi & Talaneh (2010)]. Abounoori & Nademi (2011) have used daily data from the Tehran stock exchange (TSE) to illustrate the nature of stock market volatility in an emerging stock market. They have estimated GJR models with both Gaussian innovations and fat-tailed distributions, such as the Student's t and the GED [Abounoori & Nademi (2011)]. Their results indicate that leverage effect exists in Tehran Stock Exchange, because in GJR models with t-student and GED distributions, the effects of bad news on volatility (α1) is larger than the effects of good news on volatility (λ) [Abounoori & Nademi (2011)]. P-Value LR Test for Leverage Effect indicates that the differences between the α1 and λ coefficients is not significant for GJR-N model but it is significant at 5% confidence level for GJR models with t student and GED distributions [Abounoori & Nademi (2011)]. Korkmaz, Çevik & Atukeren (2012) have examined the return and volatility spillovers between the CIVETS countries. The contemporaneous spillover effects are found to be generally low. They have found the presence of intra-regional return interdependence effects. The inter-regional volatility interdependence effects were also determined [Korkmaz, Çevik & Atukeren (2012)]. The aim of this paper is considering the relationship between return and volatility in Tehran Stock Exchange. This paper is organized by 4 sections. The next section is devoted to research method, section 3 shows empirical results and in final section, we conclude.

2. Material and Methods

We have used a GARCH model for estimation volatility, also we have calculated rate of return as following:

$$r_t = 100(\log P_t - \log P_{t-1})$$

Where P_t is stock price index of TSE?

Let R_t be the rate of return of a stock, or a portfolio of stocks from time $t-1$ to t and Ω_{t-1} be the past Information set containing the Realized value of all relevant variables up to time $t-1$. So the conditional mean and variance are $y_t = E(R_t|\Omega_t), h_t = \mathrm{var}(R_t|\Omega_t)$ respectively. Given this definition, the unexpected return at time t is $\varepsilon_t = R_t - y_t$. In order to model the effect of ε_t on returns we present ARCH models. ARCH models were Introduced by Engle (1982) and generalized as GARCH models by Bollerslev (1986). In developing GARCH (p, q) we will have to provide mean and variance Equation

$$R_t = x_t'\gamma + \varepsilon_t \qquad (1)$$

$$h_t = \omega + \sum_{i=1}^{p}\alpha_i\varepsilon_{t-i}^2 + \sum_{j=1}^{q}\beta_j h_{t-j}$$

Where ω, α_i, β_j, γ are constant parameters and x_t contains exogenous and predetermined repressors. As h_t is variance it must be nonnegative which impose the following conditions: $\omega > 0$, $\alpha_1,.......\alpha_p \geq 0$ and $\beta_1,.........,\beta_q \geq 0$. The conditional variance under ARCH (p) model reflects only information from time $t-p$ to $t-1$ with more importance being placed on the most recent innovation implying $a_i < a_j$ for $i > j$. To avoid long lag lengths on ε_t in ARCH (p) and difficulty in selecting the optional length p, and ensuring the non-negativity of coefficients of conditional variance equation (2) , Bollerslev (1986) present GARCH(P, q). A common parameterization for the GARCH model that has been adopted in most applied studies is the GARCH (1, 1) specification under which the effect of a shock to volatility declines geometrically over time. One problem with ARCH (p) and GARCH (p, q) is that good news and bad news with some absolute size have the same effect on h_t. This fact is symmetric effect. However, the market may react differently to good and bad news. It is important, to be able to test for and allow asymmetry in the ARCH type specification. Nelson (1991) proposes the exponential GARCH (EGARCH) model as a way to deal whit this problem. Under the EGARCH (1, 1) the h_t is given as:

$$\log(h_1) = \omega + \alpha\left[\left|\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}\right| - \sqrt{2/\pi}\right] + \beta \log h_{t-1} + \gamma \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \quad (3)$$

The EGARCH news Impact differs from the GARCH new Impact in four ways: (1) it is not symmetric. (2) Big news can have a much greater impact than in the GARCH model. (3) Log construction of Equation 3 ensures that the estimated h_t is strictly positive, thus non-negativity constraints used in the estimation of the ARCH and GARCH are not necessary. (4) Since the parameter of γ typically enters equation 3 with a negative sign, bad news generates more volatility than good news. The Component GARCH (CGARCH) model by Engle and Lee (1993) decomposes returns uncertainty into a short-run and a long-run component by permitting transitory deviations of the conditional volatility around a time-varying trend, q_t, modeled as:

$$\sigma_t^2 - q_t = a(\varepsilon_{t-1}^2 - q_{t-1}) + \beta(\sigma_{t-1}^2 - q_{t-1}) \quad (4)$$

$$q_t = \omega + \rho(q_{t-1} - \omega) + \phi(\varepsilon_{t-1}^2 - \sigma_{t-1}^2) \quad (5)$$

Here σ_t^2 is still the volatility, while q_t takes the place of ω and is the time varying long run volatility. The first equation describes the transitory component, $\sigma_t^2 - q_t$ which converges to zero with powers of ($\alpha + \beta$). The second equation describes the long run component q_t, which converges to ω with powers of ρ. Typically ρ is between 0.99 and 1 so that q_t approaches ω very slowly. We can combine the transitory and permanent equations and write [Engle and Lee (1993)]

3. Results

We have used the daily data of price index of TSE during 2009-2010. The data are available on website of TSE.

1.3. Empirical Results

We have estimated ARMA(1,1)-GARCH(1,1) model for estimation volatility of tehran stock exchange. Table 1 indicates the estimation results.

Table 1. The estimation results.

Dependent Variable: R
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 01/01/13 Time: 16:57
Sample (adjusted): 7/31/2007 6/21/2010
Included observations: 755 after adjustments
Convergence achieved after 55 iterations
MA Backcast: 7/30/2007
Presample variance: backcast (parameter = 0.7)
GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*GARCH(-1)

Table1. Estimation Results of GARCH Model

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.129048	0.071332	-1.809104	0.0704
AR(1)	0.958277	0.015238	62.88824	0.0000
MA(1)	-0.687631	0.026081	-26.36564	0.0000
Variance Equation				
C	0.000879	0.000305	2.881814	0.0040
RESID(-1)^2	0.266993	0.013974	19.10611	0.0000
GARCH(-1)	0.831559	0.005110	162.7164	0.0000

R-squared	0.164282	Mean dependent var	-0.006072
Adjusted R-squared	0.158703	S.D. dependent var	0.486675
S.E. of regression	0.446389	Akaike info criterion	0.820069
Sum squared resid	149.2481	Schwarz criterion	0.856837
Log likelihood	-303.5759	Hannan-Quinn criter.	0.834232
F-statistic	29.44698	Durbin-Watson stat	2.004703
Prob(F-statistic)	0.000000		

Inverted AR Roots	.96
Inverted MA Roots	.69

Results indicate that the model is significance. All of the parameters are statistically significant.

Results from Table 2 indicate that there is a negative relationship between volatility and rate of return in TSE. The correlation coefficient between volatility and return is -0.00182.

Table 3 and 4 indicate Tabulation of volatility and return and pairwise Granger Causality tests respectively. Results indicate that

- ✓ The hypothesis of RETURN does not Granger Cause VOLATILITY has rejected

The hypothesis of VOLATILITY does not Granger Cause RETURN has not rejected.

Figure 1 and 2 indicate volatility and return series respectively. In the next step we have calculated correlation between volatility and return as in Tables 2, 3, 4.

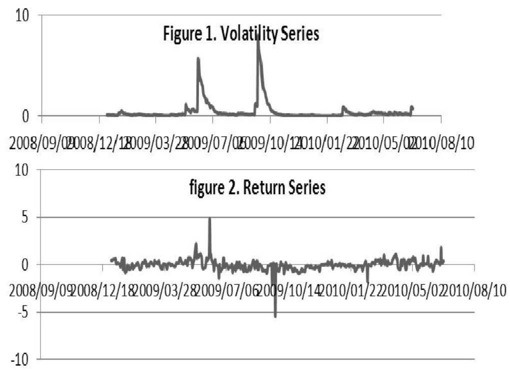

Figure 1 and 2. Volatility and return series respectively.

Table 2. Correlation Matrix

	RETURN	VOLATILITY
RETURN	1	-0.00182
VOLATILITY	-0.00182	1

Table 3. Tabulation of VOLATILITY and RETURN

Date: 01/01/13 Time: 17:16
Sample (adjusted): 1/01/2009 6/21/2010
Included observations: 383 after adjustments
Tabulation Summary

Variable	Categories
VOLATILITY	4
RETURN	3
Product of Categories	12

Measures of Association	Value
Phi Coefficient	0.072436
Cramer's V	0.051220
Contingency Coefficient	0.072247

Test Statistics	df	Value
Pearson X2	6	2.009619
Likelihood Ratio G2	6	2.101038

WARNING: Expected value is less than 5 in 83.33% of cells (10 of 12).

Count		[-10, -5)	[-5, 0)
	[0, 2)	1	184
	[2, 4)	0	3
VOLATILITY	[4, 6)	0	2
	[6, 8)	0	2
	Total	1	191

Table 4. Pairwise Granger Causality Tests
Date: 01/01/13 Time: 17:19
Sample: 1/01/2009 12/31/2010
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
RETURN does not Granger Cause VOLATILITY	381	5.52169	0.0043
VOLATILITY does not Granger Cause RETURN		2.02776	0.1331

4. Discussions

The volatility of financial markets has been the object of numerous developments and applications over the past two decades, both theoretically and empirically. Portfolio managers, option traders and market makers all are interested in the possibility of forecasting volatility, with a reasonable level of accuracy. That is so important, in order to obtain either higher profits or less risky positions. In this respect, the most widely used class of models is that of GARCH models (see e.g. Bollerslev, Engle, and Nelson (1994) for an overview). The aim of this paper is considering the relationship between return and volatility in Tehran Stock Exchange. We have used the daily data of price index of TSE during 2009-2010. The data are available on website of TSE. We have estimated ARMA(1,1)-GARCH(1,1) model for estimation volatility of Tehran stock exchange. Results indicate that there is a negative relationship between volatility and rate of return in TSE. The correlation coefficient between volatility and return is -0.00182. The hypothesis of RETURN does not Granger Cause VOLATILITY has rejected. Also, the hypothesis of VOLATILITY does not Granger because RETURN has not rejected

Acknowledgements:

Author is grateful to Department of Accounting, Islamic Azad University, Semnan Branch for financial support to carry out this work.

Corresponding Author:
Seyed Hossein Miri Ph.D
Department of Accounting,Islamic Azad University,Semnan Branch,Semnan, Iran

References

1. Abounoori, E., & Nademi, Y. The Asymmetric Effect of News on Tehran Stock Exchange Volatility.
2. Albadvi, A., Chaharsooghi, S. K., & Esfahanipour, A. (2007). Decision making in stock trading: An application of PROMETHEE. European Journal of Operational Research, 177(2), 673-683.
3. Bollerslev, T., (1986) “Generalized autoregressive conditional heteroskedasticity.” Journal of Econometrics 31, 307–327.
4. Bollerslev, T., R. Engle, and D. Nelson (1994) “ARCH Models," in Handbook of Econometrics, ed. by R. Engle, and D. McFadden, chap. 4, pp. 2959-3038. North Holland Press, Amsterdam.
5. Dey, M. K. (2005). Turnover and return in global stock markets. Emerging Markets Review, 6(1), 45-67.

6. Ebrahimpour, R., Nikoo, H., Masoudnia, S., Yousefi, M. R., & Ghaemi, M. S. (2011). Mixture of MLP-experts for trend forecasting of time series: A case study of the Tehran stock exchange. International Journal of Forecasting, 27(3), 804-816.
7. Engle, R., (1982) "Autoregression conditional heteroskedasticity with estimates of the variance of the UK inflation." Econometrica 50, 987–1007.
8. Engle, R., Lee, G., (1993) "A permanent and transitory component model of stock return volatility." Discussion paper 92-44R, University of San Diego.
9. Engle, R.F., Ng, V.K., (1993) "Measuring and testing the impact of news on volatility." Journal of Finance 48, 1749–1778.
10. Fasanghari, M., & Montazer, G. A. (2010). Design and implementation of fuzzy expert system for Tehran Stock Exchange portfolio recommendation. Expert Systems with Applications, 37(9), 6138-6147.
11. Foster, K. R., & Kharazi, A. (2008). Contrarian and momentum returns on Iran's Tehran Stock Exchange. Journal of International Financial Markets, Institutions and Money, 18(1), 16-30.
12. Korkmaz, T., Çevik, E. İ., & Atukeren, E. (2012). Return and volatility spillovers among CIVETS stock markets. Emerging Markets Review.
13. Nelson, D.B., (1991) "Conditional heteroskedasticity in asset returns: a new approach." Econometrica 59, 347– 370.
14. Rahmani, A., Sheri, S., & Tajvidi, E. (2006). Accounting Variables, Market Variables and Stock Return in Emerging Markets: Case of Iran. Market Variables and Stock Return in Emerging Markets: Case of Iran (November 21, 2006).
15. Seyyed, F. J., Abraham, A., & Al-Hajji, M. (2005). Seasonality in stock returns and volatility: The Ramadan effect. Research in International Business and Finance, 19(3), 374-383.
16. Shoghi, M. P., & Talaneh, A. (2010). An Analysis of Emerging Markets Returns Volatility: Case of Tehran Stock Exchange. Working Paper Series.
17. Yahyazadehfar, M., Abounoori, E., & Shababi, H. (2006). Days-of-Week Effect on Tehran Stock Exchange Returns: An Empirical Analysis. Iranian Economic Review, 11(6).

1/8/2013