Study of Shock and Volatility Spillovers among Selected Indices of the Tehran Stock Exchange Using Asymmetric BEKK-GARCH Model

Hosseni Ebrahimabad, S. A.[1], Jahangiri, Kh.[2*], Hasan Heydari, H.[3], Ghaemi Asl, M.[4]

Abstract

The main objective of this study is to investigate shock spillovers and volatility over the selected indexes of Tehran Stock Exchange including the automotive and parts manufacturing group, banking group and oil products group in the period of 13th December, 2008 to 21th November, 2017. In order to that, MS-VAR model and Asymmetric BEKK have used. The results showed evidence of standard leverage in both regimes, as The results in the zero-order regime indicate the interaction of the Shocks and volatilities of each group on the Shocks and volatilities of other groups, and the past volatilities of each group relative to the past Shocks of that group contributed to the current volatility of that group in the zero-order regime. The results in first regime also showed that the news of the oil products group did not have any significant effect on the volatility of the automobile group, and vice versa. While Shocks transferring between banking groups and petroleum refineries, and between automobile group and banking groups are two-way. Also, the volatility of the banking group affects the volatility of the oil products group and volatility spillovers between petroleum product groups and automobile group is one-way.

Keywords: Spillovers, Shock, Volatility, Selected Indices of the Tehran Stock Exchange, Asymmetric BEKK-GARCH Model.

Jel Classification: C11, C51, E63, E32.

1. Introduction

Capital Markets and at the top of it, the stock exchange is one of the most important economic sectors in any country, whose prosperity and recession, besides the national economy, can affect the global economy. Like other financial markets, this market is under the influence of political, social, domestic, global and economic events, and these volatilities encourage investors to modify their portfolio and combine their stocks.

The ability to identify the type of relationship between markets and especially the effect of shocks and volatilities spillovers in financial markets has many

1. Ph.D. Student in Economics, Urmia University	**Email:** s.ali.hoseini1393 @gmail.com
2. Assistant Professor of Financial Economics, Urmia University	**Email:** kh.jahangiri@urmia.ac.ir
3. Professor of Financial Economics, Urmia University	**Email:** h.heidari @urmia.ac.ir
4. Assistant Professor of Islamic Economics and Banking, Kharazmi University	**Email:** m.ghaemi84@gmail.com

applications in the economy. This knowledge could help policymakers in policy development and investors in predicting volatilities and modelers in asset pricing. In addition, the spillovers effects may show the transfer of information and help in designing the risk coverage ratio. Therefore, in this study, first, nonlinear behavior of the selected indexes of the Tehran Stock Exchange including the automotive market (as the representative of the industrial sector), the banking group (as the representative of the financial sector) and the oil products group (as a representative of the oil sector), were modeled by Markov-switching vector autoregressive (MS-VAR) and then the effect of volatilities spillovers between the indicated indices for each regimen separately and with Application of the Asymmetric BEKK-GARCH model for the period of 13th December, 2008 to 21th November, 2017.

2. Background
Today, every shock or volatility in any stock or group also affects other stocks or groups. Of course, the effect can vary depending on the scope of each stock or group change. Balasubramanyan (2004) believes that there are two major reasons for the importance of understanding the effects of volatilities spillovers. First, understanding the mechanism of interdependent movements in volatilities on the distribution of the yields of an assets portfolio, is one of the main stimulants for the study of volatilities spillovers. Second, awareness of the volatilities spillovers helps policy makers to maintain market stability and to achieve policy-making processes. Based on Jebran and Iqbal (2016) idea, it is useful to transfer the turbulence between two financial markets for equity holders in order to predict the behavior of a market having another market information. Rapach and Zhou (2013) believe the volatility of the stock market is evaluated by policy makers and owners of important asset portfolios when it reflects the future of the capitalization of listed companies. Jurado et al. (2013) argued that various factors from the level of active companies in the stock exchange, financial discussions, policy uncertainty, inflation, employment and interest rates cause changes in the average and fluctuations in stock returns.

3. Method
The estimation of time-varying co-variances between asset returns is crucial for asset pricing, portfolio selection, and risk management. Yet, the development in this area is lagging significantly behind the development in the time-varying volatility area, as evidenced by the scarcity of literature on modeling time-varying covariance compared to time-varying volatility modeling. There is also no study comparing the properties and relative performance of Multivariate GARCH models, which are among the most widely used time-varying covariance models. These include the VECH model of Bollerslev, Engle, and Wooldridge (1988), the constant correlation (CCORR) model of Bollerslev (1990), the factor ARCH (FARCH) model of Engle, Ng, and Rothschild (1990),

and the BEKK model of Engle and Kroner (1995). These models have been applied to many markets and many asset pricing and investment problems. For an extensive summary, see the survey by Bollerslev, Chou, and Kroner (1992).

Markov-Switching Vector Auto-regressions is a model designed for the econometric modeling of uni-variate and multiple time series subject to shifts in regime. It provides the statistical tools for the maximum likelihood estimation (EM algorithm) and model evaluation of Markov-Switching Vector Auto-regressions, as discussed by Krolzig (1997). A variety of model specifications regarding the number of regimes, regime-dependence versus invariance of parameters, etc. provide the necessary flexibility for empirical research and will be of use to econometricians intending to construct and use models of dynamic, non-linear, non-stationary or co-integrated systems.

4. Conclusion

The descriptive statistics related to the research variables showed that, first, the kurtosis coefficient of the normal distribution is 3, and second, the kurtosis of the price index of the three variables is higher than 3. Therefore, it is clear that their curves have a broad trail and long peaks. This way of distributing the returns of the price index suggests the existence of excessive pessimism and optimism that investors have shown in all three selected groups. The MSIAH (2) -VAR (3) model was selected as the optimal model for identifying various regimes.

The results showed that in both regimes, the volatilities of each group are influenced by their shocks and past volatilities while there is evidence of standard leverage in both regimes. The results related to the zero-order regime point to an interaction between the shocks and volatilities of each group and the shocks and volatilities of other groups, and the past volatilities of each group relative to the past shocks of that group contributed to the current volatility of that group in the zero-order regime. The results in the first regime also showed that the news of the oil products group did not have any significant effects on the volatility of the automobile group, and vice versa. Furthermore, the shocks transferring between banking groups and petroleum refineries, and between automobile group and banking groups are two-way. Also, the volatility of the banking group affects the volatility of the oil products group and volatility spillovers between petroleum product groups and automobile group is one-way. The resuls of studies show that volatility spillovers phenomenon in stock market has a great importance. Therefore, stock market volatility predictors should consider the existence of spillovers phenomenon in their own investigations. In this study, this effect was taken into account. Also, basic interactions and relationships among different groups confirm this point: if an investor invests only in a particular group, not only should s/he be aware of the status of his/er group but should have enough information about the situation of the other group,

because volatility spillovers are often related to hedging and cross-market mutual information.

Understanding the relationship between stock indexes, as discussed in the present study (volatility spillovers among selected indicators), can help officials to make appropriate decisions for reducing the fluctuations of the stock market.

References

Balasubramanyan, L. (2004). "Do Time-Varying Covariances, Volatility Comovement and Spillover Matter?". *Pennsylvania State University Paper*, 1(2). 4-28.

Bollerslev, T., Engle, R. F., & Wooldridge, J. M. (1988). "A capital asset pricing model with time-varying covariances". *Journal of political Economy*, 96(1), 116-131.

Bollerslev, T. (1990). "Modeling the coherence in short-run nominal exchange rates: a multivariate generalized ARCH model". *Review of Economics and Statistics*, 72: 498-505.

Bollerslev, T., Chou, R. Y., & Kroner, K. F. (1992). "ARCH modeling in finance: A review of the theory and empirical evidence". *Journal of econometrics*, 52(1-2), 5-59.

Engle, R. F., Ng, V. K., & Rothschild, M. (1990). "Asset pricing with a factor-ARCH covariance structure: Empirical estimates for treasury bills". *Journal of Econometrics*, 45(1-2), 213-237.

Engle, R. F., & Kroner, K. F. (1995). "Multivariate simultaneous generalized ARCH". *Econometric theory*, 11(1), 122-150.

Jebran, K., Iqbal, A. (2016). "Dynamics of volatility spillover between stock market and foreign exchange market: evidence from Asian Countries". *Financial Innovation*, 2(1), 1-20.

Jurado, K., Ludvigson, S. C., Ng, S. (2015). "Measuring uncertainty". *The American Economic Review*, 105(3), 1177-1216.

Krolzig, H. M. (1997). "Modelling, statistical inference and application to Business Cycle Analysis". *Lecture Notes in Economics and Mathematical Systems, Springer*, New York.

Rapach, D. E., Zhou, G. (2013). "Forecasting stock returns". *Handbook of economic forecasting*, 2(Part A), 328-383.