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An Application of Econophysics to Investigate the Relationship between Trading Volume and Stock Returns in Tehran Stock Exchange

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EXTENDED ABSTRACT

INTRODUCTION

The relationship between trading volume and stock price has been the focus of financial and economic researchers since the 1960s. In general, the price-time chart and the trading volume chart are the two main technical analysis tools for predicting the price trend in the financial markets. Achieving the maximum efficiency and increasing the liquidity of stocks are among the basic goals of investors in the stock market, and these two goals are related to the stock price and the trading volume, respectively.

So far, extensive studies have been conducted on the relationship between trading volume and stock price (return) and various methods have been proposed. In this study, using daily data, detrended cross-correlation analysis (DCCA) has been used to examine the correlation between the of the total return index and the trading volume in the Tehran Stock Exchange market. Unlike the previous methods, according to this method, it will be possible to change both the amount and the direction of correlation due to the change in time and scale.

METHODOLOGY

DCCA is an econophysical approach that was first proposed by Podbenik and Stanley (2008) and has been used in other fields, including finance, in addition to physics.

This index is in the range of [+1 and -1]. If its value is equal to zero, the time series are not correlated with each other; If it is greater than zero, the time series are positively correlated. If it is smaller than zero, it also indicates a negative correlation between the time series.

The time frame of the research period was 2009-2021 and the number of observations was 3136 (13 calendar years) according to the number of working days of the Iranian stock market in the mentioned period. Due to the fact that at some times the trading volume suddenly jumped due to block transactions, in order to eliminate its effect, the volume of block transactions was subtracted from the total transaction volume and only the volume of normal transactions was examined and evaluated.

In this study, the DCCA method is implemented based on sliding windows with variable sizes and rolling. For a more detailed analysis and comparison, the results obtained from the windows with 20, 60 and 241 observations (based on the approximate number of working days in each month, season and year after excluding holidays) have been analyzed and compared.

FINDINGS

According to the results, when the window length is equal to 20, the highest (positive) correlation is related to the beginning of the period and in 2011(about 19%) and the lowest (negative) correlation is in 2013 (about -2%). The average changes of the cross-correlation index over time also show that except for 2013, the average correlation coefficient between the return of the total index and the trading volume was positive in other periods. Among this, only in 2011 the correlation between these two variables was shown above 10%. In 2013, the average correlation coefficient was negative but close to zero.

By changing the length of the windows from 20 to 60, the cross correlation values between the price return and the trading volume in the Iranian stock market change slightly. The main difference is related to the direction of the correlation, which has changed from positive to negative over many years. In the investigated time period, the cross-correlation index was in the negative area until 2018 (except for 2011). But almost simultaneously with the growth of the market, the average of this index has changed to positive values. However, with the increase in the length of the windows from 20 to 60, the correlations are still low, so that the highest amount was in the year 2021 and was approximately 7%.

Correlation coefficient analysis for windows with a scale of 241, which roughly corresponds to the days of a working year, includes more observations and allows the evaluation of correlation changes for a long-term period. The results of measuring the cross-correlation index in this case show almost different results compared to the windows with shorter length and less

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number of observations, so that in the investigated time period, until 2018, for the correlation between the return of the stock index and The trading volume is positive and in 2020 and 2021 this relationship was negative. The average correlation coefficients were above 50% in 2009 and 2010, but then decreased and fluctuated between 10 and 20% between 2011 and 2018.

CONCLUSION

In this research, the results for rolling windows consisting of 20, 60 and 241 observations during a 13-year period including 3136 working days were extracted and analyzed in order to compare the correlation coefficients between stock index returns and trading volume growth for the short-term, medium-term and long-term periods. Accordingly, when the window length is equal to 20 and 60, the behavior is almost close, so that the correlation values are very low and in many years they are close to zero. But with the significant increase in the number of observations and considering the windows of length 241, the intensity of correlation has increased far and has been positive in most years with a downward trend. This means that it is not possible to give a precise and decisive assessment about the type and degree of correlation between the trading volume and the price index in the Iranian stock market, because the pattern of time changes observed around the correlation coefficient between these two variables indicates that this relationship is dependent on the length of the rolling windows and the number of observations.

References

Abbasi, E., Dehghan Nayeri, L., & Poordadash Mehrabani, N. (2016). Surveying the Relation among Volume, Stock Return and Return Volatility in the Tehran Stock Exchange: A Wavelet Analysis. *Journal of Asset Management and Financing*, 4(4), 99-114. Doi: 10.22108/amf.2016.21115 [In Persian]

Ajayi, R., Mehdian, S., & Mougoue, M. (2006). The Empirical Relation between Price Changes and Trading Volumes: Further Evidence from European Stock Markets, *Alliance Journal of Business Research*, 1(1), 3-20.

Alodari, Q., Moghadam, J., Rezvanifard, S., & Moghadam, M. (2011). Investigating the Simultaneous and Dynamic Relationship between Volume of Transactions and Stock Returns using Autoregressive

Vector Models. *Quarterly Journal of Securities Exchange*, *4*(15), 27-41. [In Persian]

Ansari Samani, H. & Aminian Dehkordi, M. (2022). Investigating the Relationship between Information Risks with Bubble Price Probability in Companies Listed in Tehran Stock Exchange**,** *Quarterly Journal of Quantitative Economics (JQE)*, 19(2), 37-65. Doi: 10.22055/jqe.2020.31565.2167 [In Persian]

Assogbavi, T., Schell, J., & Fagnisse S. (2007). Equity Price-Volume Relationship on the Russian Stock Exchange. *International Business and Economics Research Journal*, 6(9), 107–116.

Assogbavi, T., & Osagi, J.E. (2006). Equity Valuation Process and Price-Volume Relationship on Emerging Stock Markets, *International Business and Economics Research Journal*, 5(9), 7-18.

Chen, z., & Daigler, R. (2008). An Examination of the Complementary Volume–Volatility Information Theories. *The Journal of Futures Markets*, 28(10), 571-594.

Ciccone, S. (2003). Does Analyst Optimism About Future Earnings Distort Stock Prices? *The Journal of Behavioral Finance*, 4(2), 59-64.

Clark, P. K. (1973). A Subordinated Stochastic Process Model with Finite Variance for Speculative Prices. *Econometrica*, 41(1), 135-155.

Copeland, T. E. (1976). A Model of Asset Trading under the Assumption of Sequential Information Arrival. *Journal of Finance*, 31, 1149-68.

De Long, J., Shleifer, A., summers, L., & Waldman, J. (1990). Noise trader risk in financial markets. *Journal of Political Economy*, 98(4), 703–738.

Dhaoui, A., Bourois, S., & Byacioglu. M. (2013). The Impact of Investor Psychology on Stock Market: Evidence from France. *Journal of Academic Research in Economic*, 1, 35-59.

Davallou, M., & Heidari. T. (2018). Comparison of Stock Index Forecasting Using Hybrid Models Based on Genetic Algorithm and Harmonic Search with Artificial Neural Network, *Quarterly Journal of Quantitative Economics (JQE)*, 15(3), 105-127. Doi: 10.22055/jqe.2018.22921.1695 [In Persian].

Epps, T. W., & Epps, M.L. (1976). The Stochastic Dependence of Security Price Changes and Transaction Volumes: Implications for the Mixture-of-Distributions Hypothesis, *Econom*trica. 44(2), 305-321.

Esnaashari, H., & Sajadi, S. A. (2018). The Effect of Size and Information Environment on the Relationship between Stock Returns and Trading Volume. *Accounting and Auditing Research*, *10*(40),59-74.

Shahid Chamran University of Ahvaz
Quarterly Journal of Quantitative Economics
(former Economic Studies)

Granger, C. W., & Morgenstern, O. (1963). Spectral Analysis of New York stock Market Prices, *Kyklos*, 16(1), 1-27.

Hiemstra, C., & Jones, J. D. (1994). Testing for Linear and Nonlinear Granger Causality in the Stock Price-Volume Relation. *Journal of Finance*, 49(5), 1639-1664.

Kamath, R. (2008). The Price-Volume Relationship in the Chilean Stock Market. *International Business & Economics Research Journal*, 7(10), 7-14.

Karpoff, J. M. (1987). The Relation between Price Changes and Trading Volume: survey. *Journal of Financial and quantitative Analysis*, 22(1), 109-126.

Kashi, M., Roshan, R., & Donyaei, M. (2014). Investigate The Causal and Contemporaneous Relations of Stock Returns, Trading Volume and Tehran Stock Exchange Return Volatility: Application of Var-Grj-Garch and Grj-Garchdcc Multivariate Models. *Financial Engineering and Protfolio Management*, 17(4), 61-86. https://www.sid.ir/paper/197766/en [In Persian]

Khajavi, Sh., Ghasemi, M. & Alahyari Abhari, H. (2009). The Empirical Relationship between Stock Returns, Return Volatility and Trading Volume in the Tehran Stock Exchange Using GARCH and ARCH Modeling. *Journal of Accounting Advances*, 1(1), 45-68. http://ensani.ir/file/download/article/ 20120325151930-1041-3.pdf [In Persian].

Kumar, B., Singh, P. & Pandey, A. (2009). *The Dynamic Relationship between Price and Trading Volume: Evidence from Indian Stock Market*. W.P. No. 2009-12-04.

Lee, B., & Rui, O. M. (2002). The Dynamic Relationship between Stock Returns and Trading Volume: Domestic and Cross – Country Evidence, *journal of Banking & Finance*, 26(1), 51-78.

Li, J., & Wu, C. (2006). Daily Return Volatility Bid-Ask Spreads and Information Flow: Analyzing the Information Content of Volume. *Journal of Business*, *79(5)*, 2697–2739.

Lo, A. W. (2004). The adaptive markets hypothesis. *Journal of Portfolio Management*, 30(5), 15-29.

Lo, A. W. (2005). Reconciling Efficient Markets with Behavioral Finance: the Adaptive Markets Hypothesis. *Journal of investment consulting*, 7(2), 21-44.

Moslemi, B., (2018). *Investigating the Relationship between Profit News Release and Stock Returns in Companies Listed on the Tehran Stock Exchange*, Raja University Non-Profit Thesis. (In Persian).

Najarzadeh, R., & Zivdar, M. (2006). The Empirical Relation Ship between Trading Volue, Return and Volatility on the Tehran Stok Bx Cheng. *Journal of Economic Research*, 41(3), 273-299. (In persian)

Ning, C., & Wirjanto, T. (2009) Extreme Return–Volume Dependence in East-Asian Stock Markets: A Copula Approach. *Finance Research Letters*, 6(4), 202-209.

Pascual, L., Romo, J. & Ruiz, E. (2006). Bootstrap Prediction for Returns and Volatilities in GARCH Models, *Computational Statistics and Data Analysis*, 50(9), 2293-2312.

Podobnik B. & Stanley H. E. (2008) Detrended Cross-Correlation Analysis: A new method for analyzing two nonstationary time series. *Physical Review Letters*, 100(8), 084102.

Rodriguez, E. & Alvarez-Ramirez, J. (2021). Time-varying Cross-Correlation between Trading Volume and Returns in US Stock Markets, *Physica A*, 581(1): 126211.

Shalen, C. T. (1993). Volume, Volatility, and the Dispersion of Beliefs, *Review of Financial Studies*, 6(2), 405-434.

Sajjad, R. & Nowrozi, M. (2011). Investigating the Relationship between Return and Volume in the Iranian Market Using Copula functions and in Critical Conditions. *Financial Engineering and Portfolio Management*, 3 (13):91-102 [In Persian].

Talaneh, A. R., Mahmoodi, M., & Sharafy, K. (2013). The Informational Content of Abnormal Trading Volume of Shares Listed at Tehran Stock Exchange. *Financial Research Journal*, *15*(1), 1-16. Doi: 10.22059/JFR.2013.35429 [In Persian]

Ying, C. C. (1966). Stock Market Prices and Volumes of Sales, *Econometrica*, 34(3), 676-686.