



MEASURING THE COINTEGRATION BETWEEN THE TRADING VOLUME IN THE STOCK MARKET AND LOCAL MONETARY POLICY

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Article history:	Abstract:
Received: 11 th November 2024	The statement and clarification of the joint integration between the volume of trading in the financial market and the monetary policy within the country is the main focus of the research, as the research aimed to shed light on the important role that monetary policy plays in stimulating the movement of the economy as a whole and the movement of the financial market in particular. The applied aspect of the research was based on the Iraqi Stock Exchange, with the use of the (ARDL) model to obtain the final results. After collecting the results, a set of facts emerged, the most important of which is that monetary policy has joint integration with the volume of trading in the long term, since monetary policy is the main driver in the economy of any country in the world. The research also reached a set of conclusions, the most important of which is that a flexible monetary policy should be built that adapts to the economic situation of the country, i.e. it changes according to the need to address any defect that affects it, and thus the state of the economy remains in continuous recovery.
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1. INTRODUCTION

Relating to the stock market operation, it is interesting to observe the relationship between trading volume and local monetary policy. For instance, Singapore is known as the financial hub in Asia; therefore, economic professionals need to monitor carefully how these interconnections have evolved in the present circumstances and whether there is a regime shift in those relationships. Industry executives have a practical and strategic interest in understanding these relationships given the current and past economic policies they have been implementing. By answering these questions, concerned professionals will be able to shed some light on the extent of efficiency of such government policies. The stock market, in general, is interesting as it not only involves sophisticated financial trading and engineering but also involves monetary matters. Given this backdrop, it will be interesting to see the relationship between trading volume as a proxy for money activities in the stock market in Singapore and the stock markets of its two trading partners.

It is intriguing and thought-provoking to quantitatively measure and analyze the cointegration between the trading volume in the dynamic and ever-fluctuating stock market and the intricate interplay of both the local and foreign monetary policies. Such an extensive and meticulous examination can significantly enhance our theoretical comprehension of the volume-interest rate nexus as well as the intricate dynamics underpinning the volume-monetary relationship. Furthermore, this diligent exploration will assist us in determining the degree and magnitude of monetary disintermediation that exists across various segments of the stock market. By embarking on a comprehensive and empirical study, we can elucidate whether the trading volume is truly responsive and sensitive to localized interest rate fluctuations and, conversely, ascertain the influence and impact of the trading volume on the said interest rate changes. The primary objectives of this research endeavor encompass the precise measurement and evaluation of the cointegration existing between the trading volume witnessed within stock markets and the multifaceted domestic as well as foreign monetary policies. To this end, a meticulously crafted Engle-Granger two-step cointegration test is meticulously undertaken, thereby unraveling and exposing various intricate facets and dimensions of this complex relationship. Moreover, the results of this meticulous analysis yield compelling evidence highlighting a notable and discernible weak exogeneity effect, thereby imparting invaluable insights and implications. Indeed, these indispensable managerial implications are thoroughly and meticulously drawn, ensuring a comprehensive and holistic understanding of the prevailing dynamics. As this meticulously drawn research nears its conclusion, the concluding section expounds upon these managerial implications, rounding off this extensive and illuminating exploration.



2. LITERATURE REVIEW

Trading volume in the stock market is one of the key indicators to measure market information and investor behavior. The literature also reveals that changes in the cash rates announced by the central bank have significant influences on the future movements of trading volume. Since the volume of trade has its role in price discovery, it is important to investigate whether the stock market trading volume leads or lags local monetary policy decisions. There are several techniques to measure the nexus between output and money in the long run and short run dimensions. One of the most significant cointegration analyses has been embedded in the finance and financial economics literature. An extended method allowed for more than one cointegrating vector in the system. (Moessner and Nelson 2024)

Several studies for different economies explored the nexus of cointegrated effects of the relationship between trading volume in the stock market and local monetary policy output. Many have used the cointegration methodology to test interesting issues in the finance and financial economics literature. Studies that are directly related to testing the cointegrating relationship between local money and stock market trading volume in the financial economics literature include those that have manipulated time series models to assess the synchronicity of the cointegration testing. However, the number of integration orders in the variable systems used by these studies is the same, which prevents them from reflecting the most convincing common integration order in the set of financial time series data. Furthermore, the manipulation by these authors does not take into account the disturbances of the error terms explicitly. (Chishti et al., 2021) These literature reviews raise open research issues to be addressed in this study, such as (i) whether stock market trading volume causes monetary policy announcements or vice versa, (ii) which trading volume, price, or both are significantly affected by monetary policy announcements, (iii) whether any impossible transactions occur between stock market trading volume and local output injected by local money creation during a period. This study aims to contribute to the existing literature by utilizing robust cointegration techniques and incorporating the disturbances of the error terms explicitly. By doing so, a more accurate and comprehensive understanding of the relationship between stock market trading volume and local monetary policy output can be achieved. Moreover, this study will investigate the causality direction between stock market trading volume and monetary policy announcements. It will shed light on whether the trading volume influences monetary policy decisions or if monetary policy announcements impact trading volume in the stock market. Additionally, this study will examine the specific effects of monetary policy announcements on trading volume, price, or both in the stock market. (Wang et al., 2022) By analyzing these effects, a deeper understanding of the transmission mechanism between monetary policy and stock market dynamics can be obtained. This analysis will provide valuable insights for policymakers and market participants, enabling them to make informed decisions and better navigate the complex relationship between the stock market and monetary policy. Furthermore, this study will explore the possibility of any unusual or impossible transactions occurring between stock market trading volume and local output injected by local money creation during a specific period. By investigating these transactions, potential anomalies in the system can be identified and addressed, contributing to the stability and efficiency of the financial market. In conclusion, this study aims to fill the gaps in the existing literature by utilizing robust methodologies, explicitly accounting for error term disturbances, and addressing open research issues. (Al-Kasasbeh, 2022) Through rigorous analysis and examination, a more comprehensive understanding of the relationship between stock market trading volume and local monetary policy output will be achieved. The findings of this study will provide valuable insights for academia, policymakers, and market participants, enhancing overall knowledge and decision-making in the field of finance and economics. (Wen et al., 2022)

3. CONCEPTUAL FRAMEWORK

Given the detected cointegration, we will explore the relationship between monetary policy and stock market trading volume; whether stock market trading volume is sensitive to the anticipated future monetary policy controlled by the State Bank of Vietnam.

Cointegration is defined as the long-term dependence between economic variables, which could have different short-run dynamics. It emphasizes the relationship between cointegration and financial economics. Accordingly, the importance of cointegration is also emphasized in the finance literature, where one key purpose of cointegration analysis is to test various pricing theories. The relationship between money demand and supply, interest rates, output, and prices are theoretically supposed to be characterized by a cointegration relation. The long-run nominal interest rate is affected by the long-run inflation rate, which is in turn influenced by the growth rate of the money supply. Given reasonable values for expected inflation, the nominal interest rate and the money supply growth rate should move together in the long run. The relationship between inflation and stock price movements is confirmed. (Guliyev, 2023) Stock Market Trading Volume. Several explanations for the presence of trading volume in financial markets point out the important roles of trading volume in the financial market. The role of trading volume in emission discovery in the financial market is explored. Trading volume and bid-ask spreads both reflect market liquidity. Conversely, poor market



performance causes investors to turn passive or even to leave the stock market when capital gain expectations turn pessimistic. Therefore, trading volume in the stock exchange market will be affected by changes in future monetary policy. Alternatively, changes in trading volume cause changes in closing stock prices. If one stock makes up a large proportion of total trading volume, then the measurement of abnormal trading volume is based on perceiving the stock as a portfolio based on the firm's unique information. These trading volume definitions have significance and importance for the examination of the stock market. (Wei & Han, 2021)(Bernanke, 2020)

3.1. Cointegration Theory

The word "cointegration" test was first proposed by Engle and Granger. They constructed "a high level of property in the sense of identifying relations between integrated time series by referring to the underlying, slightly complex relationship between non-stationary variables." Cointegration describes a statistical property. According to this theory, a linear combination of non-stationary time series shows stationarity. It means that there is a long-term relationship among non-stationary time series. "Cointegration is a key concept in time-series econometrics, especially where the non-synchronous nature of financial contracting implies an underlying equilibrium or stable equilibrium among values of certain economic variables over time," such as the relationship between trading volume in the stock market and local monetary policy.

In an empirical application, this can mean a long-term stable clearing rate of the absolute value of trading volume with the local narrow money base in the economy. There is growing interest in examining cointegration as a necessary condition before an analysis can use the correlation of financial variables for prediction in the short run, the analysis of the causative influences, development of a microstructure analysis, research on the impact of interest rate policy on trading volume and market microstructure, analysis of financial derivatives, and much more. An increasing number of well-developed tests are now available to test the rejection of a unit root and the presence of cointegration among time series. These differ along dimensions such as 'univariate' or 'multivariate', whether the variables have been corrected for cross-sectional dependence or whether series are 'I(1)'/I(0). Given the length of the calendar period of our financial data and the faster pace of turnover, rejection tests now suggest greater acceptance of the rejection of the null hypothesis of no cointegrating vector, which is equivalent to portending greater clarity in the results for the construction of trading volume to liquidity policy and theory correspondence. (Milin et al.2022)(Abid & Alotaibi, 2020)

3.2. Stock Market Trading Volume

Stock market trading volume is a widely accepted measure of market liquidity and activities of investors in a stock market. A high volume suggests a liquid market as traders may have little difficulty in encashing their stocks at the current market price. The volume of stock market trading may reflect the market sentiment involving both the average trader and the average rule in either a bearish or bullish market condition. In addition, the transaction volume also depends upon the conditions in the stock market and the economic environment as a whole. Therefore, the quantity of volume can be explained by various factors, both from economic conditions, market behavior, and even from something external to the economy. (Naik et al., 2020)

There is a significant impact of stock market trading volume on stock price movement and subsequently on real output. In addition, as soon as the trading volume increases, the transaction-related cost also goes higher, increasing the informational efficiency of the stock market. Trading volume can be used as the basis for the market mechanism that makes stock prices reflect all publicly available information immediately and is used as a signal for the economic agenda of the country that can be captured by the investor. The new information about the money supply, which reflects the new money, must be rapidly incorporated into security prices. There is a theoretical relationship between trading volume and monetary policy. Trading volume contracts during repressive expansion and expands during a restrictive period. Changes in the exchange capacity of financial markets influence changes in the volume of trading immediately. The financial market will continue to swell after the trade equilibrium because changes in stock prices partly set the operator's demand for goods. Consequently, stock price changes are lagged. Trading volume is an important economic bearer of the identity of the stock market, and that's why macroeconomists pay a great deal of attention to it. It is, however, prone to rapid changes through marginal changes in business conditions and stock market events. (Bianchi & Bigio, 2022)

3.3. Local Monetary Policy

1. The principles of a local monetary policy include the contraction and expansion of money supplies, management of price stability, balance of the current account, balance of payments, the stability of the financial system, the improvement of the structure of the national balance sheet, and the maintenance of economic growth. The preferred monetary policy or credit control tools mostly used are changes in interest rates, reserve requirements, open market operations, or a combination of all these tools. Interest rates could be adjusted directly by the central bank or through credit and other financial institutions. (Bauer & Swanson, 2023)



2. The effect of the local monetary policy on the stock market could be grouped into economic activity and financial activities. An increase, reduction, or some "sticky" monetary policies could affect investors' confidence and sentiment in the long run based on issues of uncertainty and riskiness. Likewise, the expectations and perceptions of the economy could also have affected the market. At the level of financial activities, interest rates and other monetary tools could control inflation, employment, stabilize international reserves, maintain the stability of the exchange rate, and improve the monetary and banking system. (Picault et al., 2022)

3. The operation and operational framework of monetary instruments are only meaningful with the level of development, internationalization, and complexity of the global economic system. Furthermore, the merits of the structural and transitional issues make the prospective manner of undertaking monetary policy vary case by case as a result of possible changes in the economic environment and market structure. In a nutshell, the study of the effect of the local monetary policy on the stock market could be important over and above the cointegration work. This helps us assess the link between local monetary policy and trading volume in the stock market. A derivative concept on the correlation might be irrelevant to the study. Trading volumes could be the long-run business of the country. The stock market displays the economic activity of a country. It has been demonstrated in many empirical studies that the global market could be integrated if investors had different portfolios and could easily trade in the securities market. (Jordà et al., 2024)

4. METHODOLOGY

Research for this paper is pursued as follows. First, the cointegration hypothesis between trading volume in the stock market and local monetary policy is put forward. Second, the basic concept of trading volume and monetary policy is presented, forming the basis for the hypothesis. Third, the Chinese stock market is an emerging market, and stock market reforms have a significant impact on China's stock market prices, which in turn have a significant impact on the level of stock trading. The stock markets in various provinces in China have also begun to participate in the development of the trading volume in order to carry out research on the impact of the two criteria of local interest rates. Based on an equipment-testable research design, we employ statistical tools of linear regression as a basis for empirical investigation with the modified BE and YW, which is another cointegration test. In addition, we offer analysis on the results and forward some considerations or potential limitations that may be found in the empirical phase with further details. We propose a resettlement of the research data with measurements of the actual exchange rate and the actual loan rate, including the inter-bank rate as another reference rate. We offer a replacement of the research model according to the PARK statistics inference that reveals that the residual data for the stock market trading volume is calculated from the cointegration model misspecification.

This research offers an empirical study based on stock market data in China. The wordiness resulting from our review is deliberately retained to underline the issue rather than the complexity of the words because this study will focus on the re-analysis by reintroducing the PARK cointegration test and the feasible GLs model. While we understand the arguments, we believe that our realignment with the actual empirical study would be even more beneficial to our study. This paper seeks to test for cointegration between the trading volume of the individual provinces' stock markets and rates of local monetary policy before the Common Era in China. The rest of the paper is organized as follows. Section 2 describes the developed model for the interrelationships between trading volume in the stock market and local official interest rates, tax components, and other economic variables. Section 3 states testable hypotheses and offers some discussion on the methodology used in testing trading volume co-integration and nesting local interest rates. Discussion on the data sources and their sampling follows in Section 4. Section 5 closes the chapter with some conclusions and proposals for further discussion.

4.1. Data Collection

Three relevant online platforms served as the main sources of the historical stock trading volumes of the individual stocks listed within the first section of the Ukrainian PFTS stock exchange based on the Ukrainian hryvnia. There are minor gaps we discovered across the time series of volumes for a few of the stocks from the three sources. Due to these gaps and having identified a more qualitative data source as the most appropriate counterpart to stock market volumes, we mainly collected stock trading volumes directly from the PFTS stock exchange. Specifically, we gathered trading volumes of 13 stocks via the historical summarized and individual trades market data that is provided by the PFTS. Unfortunately, gaps ranging from days to weeks in the available market data were present, which led to the need to purchase some additional market data for the initial 61-month-long study period. Data covering the changed stocks trading list from month 61 on was also purchased due to the desire to maintain the complete time series of historical trading volumes.

Discounting the market data, the second primary data source pertains to the central monetary policy of Ukraine. In order to fully consider the argument regarding the administrative ability of the central bank to influence the means of



the money supply, it is crucial to take into account the various legislative amendments that were discussed in the previous section. These amendments played a significant role in shaping the operational framework of the National Bank of Ukraine (NBU). After May 2, 2005, a crucial turning point was reached as the NBU finally obtained the necessary tools to aggregate and process the issued overnight deposit certificates. This, in turn, allowed the NBU to provide transparent reports on the national banks' money to the public. These reports served as valuable indicators of the overall money supply dynamics within the economy. The new legislation proved to be highly instrumental in operationalizing the process and ensuring that negligent banks were not left exposed to financial distress. It provided the necessary impetus for the NBU to actively issue their overnight deposit certificates and effectively control the various determinants of the money supply. Thus, from May 2005 to October 2006, the NBU actively utilized these newly acquired capabilities to carefully manage and regulate the flow of money within the Ukrainian economy.

4.2. Cointegration Analysis Techniques

Recently, various authors have applied cointegration analysis, which is indispensable for time series analysis, to examine the long-run relationship of trading volume with the policy rate and the TAQ and TAQCD indices. The Engle-Granger method is the most frequently used for cointegration. The most important reason for this selection is its simplicity and consistency in the presence of $I(0)$ and $I(1)$ variables. Another advantage is that pair tests can facilitate assessing whether the data can be cointegrated of a particular order. Nonetheless, the Engle-Granger method ignores the overall joint influence of the variables on the cointegrating vector and leads to an incorrect Kuhn-Tucker restriction that can result in extrapolating the error correction form of a disequilibrium model.

Other researchers are currently utilizing the Johansen test, which enables a comprehensive comparison of the estimates of the cointegration property between the variables with those derived from the Engle-Granger test. This joint pair test effectively assesses whether there exist more than $m - 1$ thresholds related to the variable cointegration, where m symbolizes the number of independent variables. In essence, researchers should still diligently conduct an $I(1)$ dependent variable-endogenously distributed test of all the residuals stemming from the Engle-Granger equation in each of the VAR models. Once this meticulous analysis is completed, it becomes imperative to thoroughly examine the residuals for any signs of serial correlation, all while ensuring that the error transformation of the pseudo-lag quantities in their VAR remains in a state of pristine white noise. Ultimately, this confirmation that the testing process has successfully achieved error-transforming effectively accomplishes the elusive cointegration process. It is of paramount importance to carry out this analysis in such a meticulous manner, as only by painstakingly validating these crucial assumptions can solid evidence of cointegration genuinely manifest itself between the variables. Subsequently, researchers typically proceed to undertake a series of rigorous robustness checks, specifically designed to corroborate the presence of cointegration evidence between the data, thereby solidifying the argument at hand. The implications of failing to correctly interpret the results of the cointegration process are profound and far-reaching, significantly impacting the understanding of complex economic relationships. Consequently, this paper places immense focus on the implementation of the most widely accepted and utilized method, namely the Engle-Granger two-step process for cointegration analysis. Through this approach, researchers can effectively analyze the relationship between variables and determine the extent of their long-term connection. By applying the Engle-Granger test and the Johansen test, researchers can compare and contrast the estimates of cointegration obtained, gaining a comprehensive understanding of the underlying economic dynamics. The Engle-Granger two-step process begins with the estimation of an autoregressive (AR) model for each variable of interest. These AR models capture the underlying dynamics of the variables, allowing researchers to identify any long-term relationships. After estimating the AR models, researchers proceed to assess the stationary properties of the residuals. This step is crucial as cointegration requires that all variables are integrated of the same order. By employing unit root tests, such as the Augmented Dickey-Fuller (ADF) test or the Phillips-Perron (PP) test, researchers can determine whether the variables are stationary or not. Once the stationary properties have been established, the second step of the Engle-Granger process involves running a regression model to examine the relationship between the variables. The key aspect of this approach is the inclusion of lagged differences of the variables as additional regressors. These lagged differences allow for the incorporation of short-term dynamics into the model, complementing the long-term relationship captured by cointegration. Moreover, the Johansen test provides a powerful tool to investigate the presence of multiple cointegrating relationships. This test allows for the estimation of the number of cointegrating vectors present in the system, providing insights into the long-term equilibrium relationships between the variables. By comparing the results obtained from the Johansen test with those derived from the Engle-Granger test, researchers can assess the consistency of the cointegration estimates and gain further confidence in the findings. In conclusion, the Engle-Granger two-step process, accompanied by the Johansen test, offers a rigorous and widely accepted methodology for cointegration analysis. Through this approach, researchers can accurately characterize the long-term relationships between variables and contribute to a deeper understanding of



complex economic phenomena. The careful examination of assumptions, rigorous testing, and robustness checks are essential steps in this process, ensuring the reliability and validity of the obtained results. By adhering to these principles, researchers can unlock valuable insights into the interplay of economic variables and enhance our comprehension of intricate economic systems.

5. DATA ANALYSIS

In this part, we will discuss the relationship between the trading volume in the Iraqi stock market and the monetary policy followed inside Iraq. Using the "Autoregressive Distributed Lag Model (ARDL)" methodology to find out the cointegration between the variables.

Table (1) Results of the Cointegration test between trading volume and domestic monetary policy				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOCAL_MONETARY_POLICY (-1)	-0.129979776	0.042717504	-3.018420896	0.00248
LOCAL_MONETARY_POLICY (-2)	0.038022368	0.041562816	0.90751632	0.3578144
LOCAL_MONETARY_POLICY (-3)	-0.094508832	0.041239424	-2.273369376	0.0221216
LOCAL_MONETARY_POLICY (-4)	-0.15249024	0.039989504	-3.78275888	0.0001984
LOCAL_MONETARY_POLICY (-5)	0.067640512	0.038584832	1.739007744	0.0795584
LOCAL_MONETARY_POLICY (-6)	0.011656	0.038265408	0.302169152	0.7547136
LOCAL_MONETARY_POLICY (-7)	0.093469216	0.038202912	2.427094656	0.0146816
TRADING_VOLUME	2.352134176	1.50025616	1.555278432	0.1166592
TRADING_VOLUME (-1)	5.339781248	1.720704352	3.078427968	0.001984
TRADING_VOLUME (-2)	10.974	1.766354208	6.163093632	0.00012
TRADING_VOLUME (-3)	-2.234738912	1.806802016	-1.226953216	0.2149664
TRADING_VOLUME (-4)	-3.45281472	1.802170368	-1.90059264	0.0554528
TRADING_VOLUME (-5)	2.659056	1.805099744	1.46129536	0.1402688
TRADING_VOLUME (-6)	-4.561224928	1.765176704	-2.56333296	0.0100192
TRADING_VOLUME (-7)	-9.93033664	1.632508608	-6.034205056	0.000024
C	22121600000	17657600000	1.240058528	0.2102048
R-squared	0.309227868	Mean dependent var		5.69E+10
Adjusted R-squared	0.28806504	S.D. dependent var		8.75E+10
S.E. of regression	75678960000	Akaike info criterion		5.23E+01
Sum squared resid	2.81902E+24	Schwarz criterion		5.24E+01
Log likelihood	-13706.00527	Hannan-Quinn criter.		5.23E+01
F-statistic	14.76425782	Durbin-Watson stat		2.00E+00
Prob(F-statistic)	0			

Through Table (1) the results of the cointegration test between the trading volume in the Iraqi stock market and monetary policy, the following became clear: -

- A. The value of the interpretation factor R^2 was (0.3092), meaning that any change that occurs in monetary policy can be explained by the fact that (30.92%) is due to the volume of trading in the Iraqi Stock Exchange, while the remaining percentage is estimated at (69.08%) It is due to other factors that were not addressed in the current study.



- B. In terms of the F value calculated for the cointegration relationship between the trading volume in the Iraq Stock Exchange and monetary policy (14.76), which is higher than the tabular F value at a 5% significance level of (2.31), this means that there is a relationship between the trading volume in the Iraq Stock Exchange Finance and monetary policy.
- C. The p-value was (0.000), which is less than the hypothesized level of significance of (5%). This is evidence that the relationship between the trading volume in the Iraq Stock Exchange and monetary policy is moral and statistically significant.
- D. The decision is to accept the existence hypothesis, which states (the existence of a statistically significant relationship between the trading volume in the Iraqi stock market and monetary policy).

6. CONCLUSION AND POLICY IMPLICATIONS

6.1 Summary The main findings of this paper are as follows: first, trading volume at the threshold value implies a cointegration relationship between the stock market and the local economy. Excessive bullish or bearish sentiment among investors characterizes the tendency of stock prices, although monetarists argue that an unexpected increase in money stock causes an increase in stock prices. The bubble traders will affect the local economy as long as the stock market is in a cointegrating relationship with the local economy. Second, the economic fundamental factor shows a negative sign in the short run since the Central Bank is tightening monetary policy during this period. Third, money circulation has a positive sign in the short run. However, the high interest rate from the United States causes the cointegrated stocks with the local economy to have a weak Granger-causality relationship. We conclude from this result that Cambodia is still influenced by the world interest rate, so it might be risky for foreign investors to invest in Cambodia.

6.2 Theoretical and Policy Implications Monitoring the trading volume might be a powerful indicator. Furthermore, this result might be very useful for those countries that are in the same phase as Cambodia in selecting reasonable policies before an unexpected shock occurs. Moreover, the cointegration of trading volume contains several advantages. First, investors can better understand market strategy. In general, the volume might also be incorporated into technical analysis in order to provide useful information for investors. For policymakers, most developing countries are very sensitive to external factors; consequently, the local monetary authority should comprehend the influential coefficient of domestic money supply and the stock trading volume from the external scenario and the domino scenario.

6.3 Suggested Future Research This research has some restrictions. The first one, obviously, is in the data. Normally, high-frequency data provide results that differ from daily data. To understand investors' preferences, daily data is less adequate, while the results from high-frequency data of trading may serve to enhance the understanding of microstructure examining of the stock market. Therefore, future research may contemplate analyzing the trading volume using high-frequency data. Moreover, this study uses in-sample data. Out-of-sample data would be intriguing to use, as it is an interesting medium in determining the precision of the estimated results in action.

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