

# Dynamics of the Market for Shares of Medium-Sized Enterprises in the Cluster of US Food Companies with a Minimum Market Capitalization

Oleksandr Bilotserkivskiy<sup>1</sup>, O.S. Kaganovskyy<sup>2</sup>, Vyacheslav Lyashenko<sup>3</sup>

<sup>1</sup>Business, Trade and Logistics Department, National Technical University «Kharkiv Polytechnic Institute», Ukraine

<sup>2</sup>Department of Management and Business, Semen Kuznets Kharkiv National University of Economics, Ukraine

<sup>3</sup>Department of Media Systems and Technology, Kharkiv National University of Radio Electronics, Ukraine  
e-mail: lyashenko.vyacheslav@gmail.com

**Abstract:** *The functioning and development of business is closely related to the concept of security. Such security applies both to the direct conduct of certain activities and to the content surrounding the enterprise. Food security is of particular importance in this aspect. This type of security largely determines the economic aspects of the stable activity of various areas in ensuring sustainable interaction between business entities, countries and the population. Therefore, the analysis of the activities of enterprises from the cluster of food companies occupies a special place and is important in making appropriate decisions. Among the various characteristics of the activities of enterprises, attention should be paid to the dynamics of the prices of its shares. This allows you to analyze how the functioning of the business entity itself, and to obtain comparative aspects of such activities in comparison with other companies. In the article, on the example of a number of individual enterprises, a cluster of US food companies is considered. A feature of this consideration is the analysis of the activities of companies with a minimum market capitalization. The work presents a lot of drawings and diagrams. This allows us to understand the course of the study, to consider the activities of medium-sized businesses.*

**Keywords—**data; dynamics; stock market; cluster; capitalization; medium business; statistical analysis; statistical estimates

## 1. INTRODUCTION

Economic dynamics as an object of study is constantly in the field of view of practitioners and scientists. This is due to the fact that such studies help to understand the current trends and trace such dynamics in the future [1]-[4]. It is also important to emphasize the peculiarity of conducting an appropriate analysis, which involves consideration of a specific area of research and its specifics. In this way, we can receive specific proposals for individual solutions.

Among the various areas of study of economic dynamics, a special place is occupied by studies related to security and, in particular, food security. Achieving stability in the production and supply of food ensures the continuous functioning of all sectors of the economy, the life of the country as a whole, individual households and the population [5]-[10]. Food security is the basis for the formation and development of security in general [11]-[13]. This, ultimately, determines the relevance of the chosen research topic and its practical significance.

Among the subjects that ensure the achievement of food security, the primary role is given to large enterprises and companies. At the same time, it is important to take into account the activities of medium-sized firms, which are more flexible and capable of preventing and preventing the occurrence of unforeseen situations [14], [15]. The mobility of middle-class enterprises can be considered:

as a deterrent in the development of crisis situations,

as a trigger for the search for new solutions in further development.

To generalize and determine the role of business entities in a particular cluster, it is advisable to consider the dynamics of shares in a number of companies. Such indicators reflect the change in supply and demand for the goods of the respective companies in the form of value for their securities [16]-[18]. This can be done on the basis of studying the parameters of the stock market where such securities are in circulation. The exchange market makes it possible to assess the stability of the functioning of firms, enterprises, companies in a number of parameters. We can also conduct a comparative analysis, which is an important element in assessing the current situation and making decisions.

To analyze the dynamics of data, you can use various methods, approaches, techniques, which are both classic market analysis tools and special ones that allow you to consider hidden factors and trends [19]-[27]. An important aspect of such an analysis is the proper interpretation of the results obtained the possibility of conducting a mutual cross-sectional study.

Thus, the main purpose of this article is to study the dynamics of the share market of a number of enterprises in the cluster of food companies. To do this, we will directly consider the dynamics of such data, as well as conduct their mutual analysis.

## 2. RELATED WORKS

An analysis of related papers along separate lines of general research objectives helps to understand such topics and identify some specific issues for their subsequent generalization. In this aspect, among such separate areas of generalization of related literature, one can distinguish: the importance of food security, the role and importance of medium-sized businesses in this process, methods for conducting an appropriate analysis.

The importance of food security is a key aspect of many studies [28]-[32].

For example, E. M. Berry, S. Dernini, B. Burlingame, A. Meybeck and P. Conforti explore the relationship between food security and sustainability [30]. To do this, the authors consider a significant amount of literature and various discussions on this topic. The analysis of various fundamental legal documents is also carried out. As a result, the authors conclude that sustainability is a logical continuation of the process of achieving food security. This ultimately determines the importance of access to food for the general population.

P. J. Ericksen, J. S. Ingram and D. M. Liverman consider possible economic changes in the context of food security [31]. The authors emphasize that many factors influence the achievement of food security. These factors are largely determined by economic conditions. At the same time, it is important to pay attention to the various threats to which food security is exposed. It is also necessary to be able to adapt to such threats, to have methods for predicting and minimizing them. All this is important for making current and global decisions.

O. Ecker and C. Breisinger use a systematic approach to disclose this area of research [32]. At the same time, the need to possess information and have a search behavior is emphasized, which in general ensures the adoption of effective decisions in the field of food security. One source of such information is food prices, logistics and processing. All of this can be a reflection of the stock prices of the respective firms and companies. Therefore, the importance of stock market analysis becomes undeniable.

In his study, K. M. Demmler reveals in detail the importance of small and medium-sized enterprises in food supply chains [33]. Firms and companies that operate in Africa are selected for analysis. The paper considers various groups of fruits and vegetables. Supply chain analysis was carried out for each group. The paper notes that from 70% to 100% of such chains are provided by small and medium-sized firms [33]. Thus, these business entities play an important role in providing the population with food. This is also important for low income consumers.

S. J. Smyth, S. R. Webb and P. W. Phillips analyze the interaction between the public sector and medium-sized businesses in providing the population with food [34]. The need for such a connection is determined by the global changes

that are currently observed (climate change, increased natural disasters, war). The authors note that it is the public-private partnership that can enhance food security. For these purposes, it is necessary to attract small and medium-sized companies, which, due to their flexibility and mobility, can achieve the necessary results.

T. Zhai, D. Wang, Q. Zhang, P. Saeidi and A. Raj Mishra analyze the risks of food supplies by small and medium-sized economic entities [35]. For these purposes, the authors use a model that is based on the author's approach to decision making. The authors consider fuzzy sets, the sum of ranks, an approach to eliminating unnecessary effects, and dominance estimation [35]. Decision-making risks are also taken into account. The authors provide empirical studies that show the feasibility of the proposed. The importance of using enterprises from the sphere of small and medium-sized businesses in the process of food supply is emphasized.

S. D. Nurmatovna and D. S. Sagdiyevna consider the issues of food security in the agricultural sector of the economy [36]. First of all, the authors draw attention to the variety of factors that affect the competitiveness of agricultural enterprises and improve food security. Attention is also paid to logistics and travel costs. For such consideration, the method of topological analysis is used in the work. All examples are given on the data for the Republic of Uzbekistan. Various vegetables, fruits, berries are considered. It is concluded that it is necessary to involve medium-sized firms and companies in such a process.

E. N. Antamoshkina and A. F. Rogachev explore a statistical model in ensuring food security [37]. The work uses cognitive economic and mathematical modeling. The corresponding statistical conclusions and their estimates are also obtained. This allows us to talk about the current level of security and modeling ways to increase it.

M. Izraelov and J. Silber provide an assessment of the Food Security Index (GFSI) [38]. Such an analysis involves studying the role and factors of influence from the point of view of individual countries and regions in terms of food security. Various statistical conclusions are used for the analysis, among which the authors single out the method of principal components. The paper also considers the analysis of efficiency.

The work of H. O. Zapata, J. D. Detre and T. Hanabuchi is devoted to the study of indicators of stock indices for food products [39]. The authors note the dominance of prices for agricultural products. Various statistical methods and estimates are used for the study.

The presented review underlines the feasibility of continuous analysis of data in the field of food supply. Various methods can be used here that allow you to reveal existing and hidden trends. It is also important to define a cluster for research. As such a cluster, we will consider medium-sized businesses from US food companies.

### 3. REPRESENTATIVES OF MEDIUM-SIZED BUSINESSES FROM THE US FOOD COMPANIES CLUSTER

For further analysis, consider a number of firms from the cluster of US food companies. Such data was taken from the site investing.com. Their feature is the different periods to be considered. This is due to the display of the data that were in the bidding process. However, this does not diminish the significance of the results obtained. Essential here is the analysis of trends that are emerging in the market.

In general, we consider the data for the period from January 2021 to August 2023 in their weekly average. In each case, we specify the period in which the data is presented.

Before analyzing such trends, let us first of all consider the general characteristics of the selected business entities.

These characteristics reflect the dynamics of the companies under study at the end of the period we analyze (at the beginning of August 2023).

Home Bistro Inc (HBIS) is a food preparation business with a small market capitalization and negative earnings per share. The average trading volume for shares is 200 shares.

Amira Nature Foods Ltd (ANFIF) also has a negligible market cap. Earnings per share is -150.99 USD. The average trading volume for three months is 1254 shares. Last month – 375 shares.

Romana Food Brands Corp (RFBC) has a mid-August 2023 market cap of \$523. The average trading volume is 1002 shares.

Steakholder Foods Ltd (STKH), with a market capitalization of \$54910 and a three-month average trading volume of 444362 shares, has negative earnings per share.

Healthy Coffee International Inc (HCEI) has a market capitalization at the beginning of August 2023 of \$118,430. The average trading volume for shares is 1,980,000 shares. However, earnings per share are negative -1.67 US dollars.

Yuenglings Ice Cream Corp (YCRM) with a market cap of \$212,370. The average trading volume for May-July 2023 is 1,854,307 shares. Earnings per share are negative (-\$0.027).

Stevia Corp (STEV) has a market cap of \$1.35 million. The average trading volume is 626,738 shares. Earnings per share are negative (-0.06 USD).

All selected firms from the food cluster are representatives of medium-sized businesses. All of them are also characterized by an insignificant level of market capitalization and have negative earnings per share.

Next, consider the dynamics of prices for the shares of selected companies and some of their statistical characteristics.

### 4. STOCK QUOTES OF SELECTED COMPANIES FROM THE US FOOD CLUSTER

The first figure shows the dynamics of Home Bistro Inc shares from January 3, 2021 to August 6, 2023.

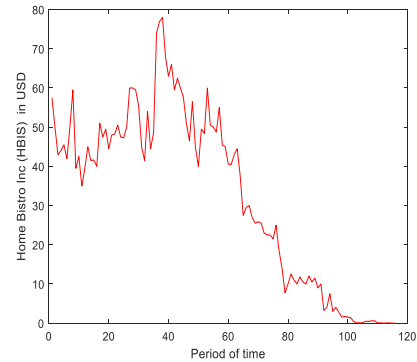


Figure 1: Home Bistro Inc stock prices

In the period from January 2021 to September 19, 2021, there is an overall increase in quotes for Home Bistro Inc. Further, until August 6, 2023, the share price of such a company is rapidly declining.

This decline comes against the backdrop of unstable trading dynamics in shares of Home Bistro Inc.

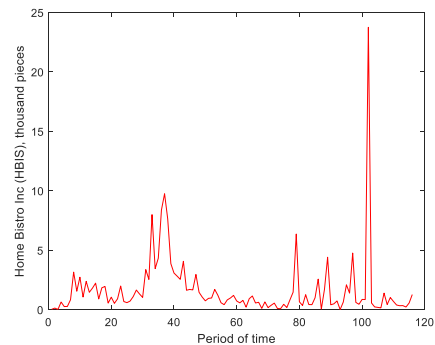
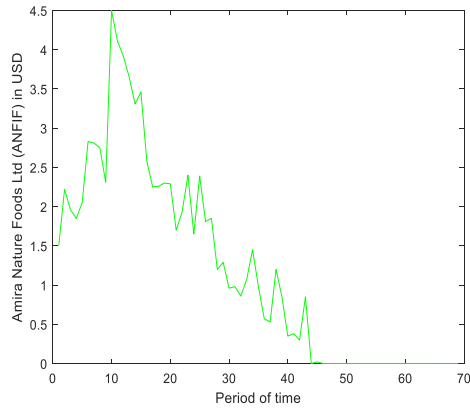


Figure 2: Home Bistro Inc stock sales volume

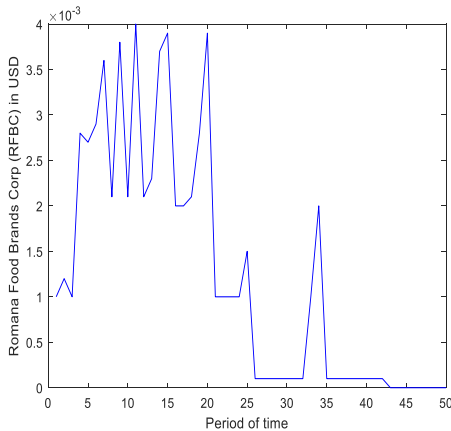
It should be noted the diverse dynamics of the sale of shares of such a company. At the same time, we see a significant surge in sales volume in December 2022, which is determined by the share price of this company,

Quotes of Amira Nature Foods Ltd also have a downward trend. At the same time, starting from December 26, 2021, the value of shares is reduced to almost zero. In this regard, we can note the similarity of the trend for Home Bistro Inc and Amira Nature Foods Ltd.



**Figure 3:** Quotes of Amira Nature Foods Ltd

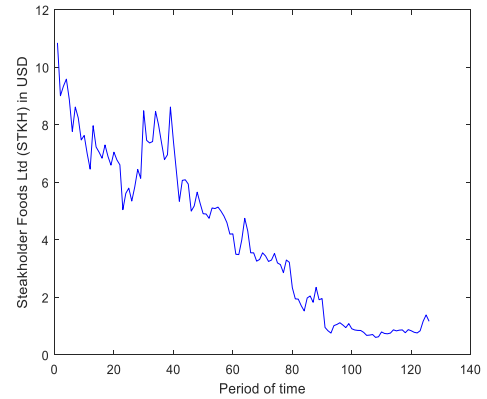
Romana Food Brands Corp (RFBC) share price dynamics is step-by-step with a change in the direction of the corresponding quotes. In recent periods, starting July 27, 2021, the share price has been approaching zero. This is also observed in the two previous cases.



**Figure 4:** Price dynamics for Romana Food Brands Corp

Somewhat different from the previously reviewed quotations for the change in prices for the shares of Steakholder Foods Ltd (STKH). Against the general background of a significant drop in prices, one can also observe some stabilization in the period from September 25, 2022 to July 9, 2023. Further, we can also talk about the growth of quotations for Steakholder Foods Ltd.

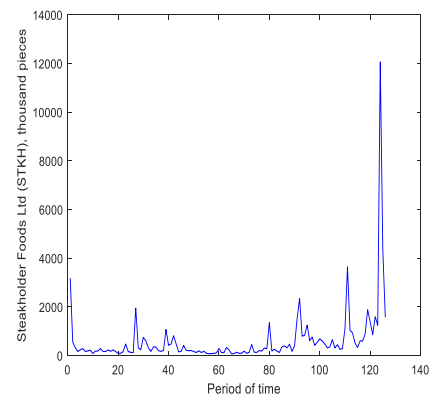
Therefore, we will also consider the dynamics of sales volumes of securities for this company.



**Figure 5:** STKH share price

We note that the sales volume of Steakholder Foods Ltd shares has been steadily increasing recently (since April 2023). This indicates an increase in demand for the products of this company.

It can be hoped that soon the shares of this business entity will begin to make a profit. This explains the increase in sales volumes.



**Figure 6:** Sales volume of shares for Steakholder Foods Ltd

The stock price of Healthy Coffee International Inc (HCEI) is trending similarly to Home Bistro Inc, Amira Nature Foods Ltd and RFBC. We see growth at first, which is then replaced by a rapid decline in quotations (see Fig. 7).

Quotations for Yuenglings Ice Cream Corp (YCRM) also follow the trends of most of the food stocks discussed earlier. However, we can note two local maximums that were observed on February 21, 2021 and May 2, 2021. Next, we see a decline in YCRM stock prices. But this decline is not drastic. Starting from January 2023, prices are reduced to almost zero (see Fig. 8).

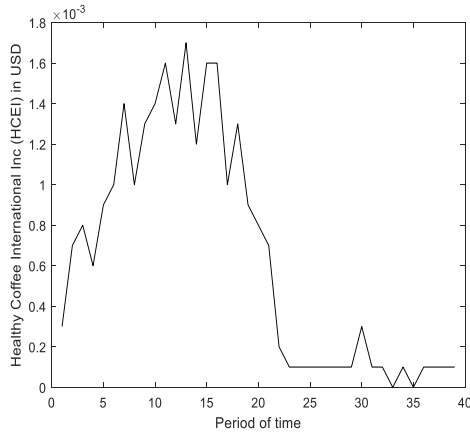


Figure 7: Share price for HCEI

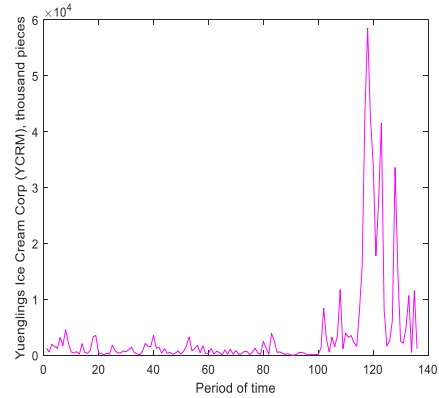


Figure 9: Sales dynamics for Yuenglings Ice Cream Corp

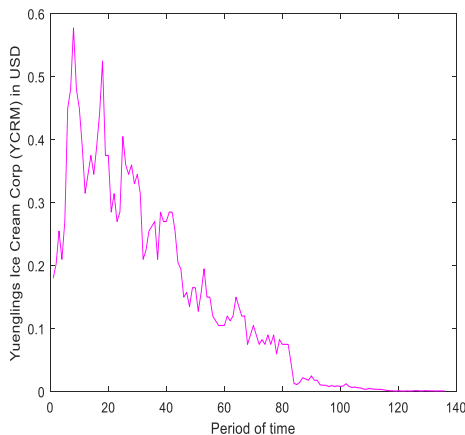


Figure 8: Quotes for YCRM

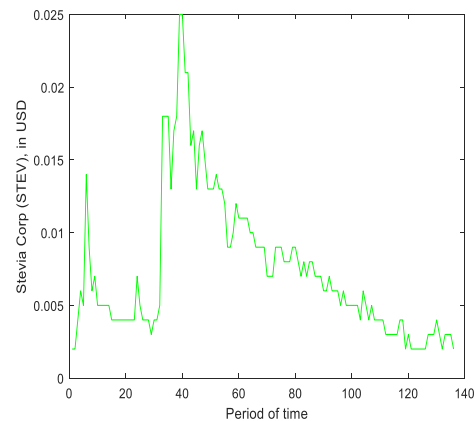


Figure 10: STEV stock price

Against the backdrop of such a decline, one should highlight the growth in sales of shares of Yuenglings Ice Cream Corp. A surge in this growth has been observed since March 2023. But since May 2023, sales growth has fallen.

In some ways, the dynamics of Yuenglings Ice Cream Corp share sale volumes is similar to Steakholder Foods Ltd (see Fig. 6 and Fig. 9 for comparison). This suggests the need for a comparative analysis of some data for the business entities that we are researching.

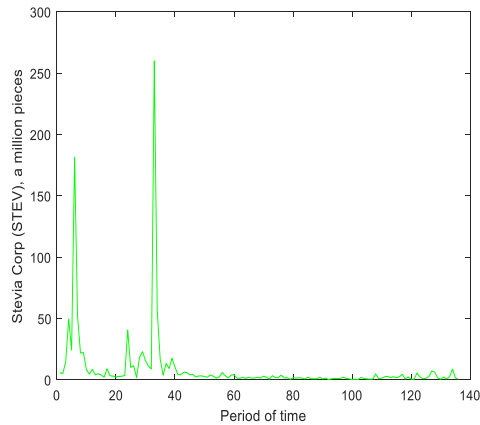
Now consider the data for Stevia Corp (STEV). In its essence, the dynamics of quotations for STEV is not much different from that discussed above.

On Fig. 10 should also highlight the global maximum (September 26, 2021), after which there is a significant decline in stock prices.

But we can see more significant price variability even compared to Yuenglings Ice Cream Corp. This is evidenced by the influence of the same factors on the activities of companies from the food cluster. At the same time, such influence does not depend on the type of activity of such firms. In other words, the choice of products is not essential here.

The COVID-19 pandemic should be cited as such a factor. This affected the mobility of the population and, as a result, the drop in sales of goods of the respective enterprises. In the future, this experience should be taken into account when developing a management strategy for business entities from the cluster of food companies.

Next, we also pay attention to the change in the trading volume of Stevia Corp shares. Such dynamics is also characterized by a decrease in trading volumes and differs from those discussed earlier. Although in the last three months we can see some positive changes (see Fig. 11).



**Figure 11:** Sales dynamics of Stevia Corp shares

In general, we see general trends in price changes for the shares of medium-sized food companies that we have considered. At the same time, COVID-19 is a significant factor influencing their activities.

#### 5. ANALYSIS OF MUTUAL TRENDS FROM A CLUSTER OF MID-SIZED FOOD COMPANIES

As noted above, an important point in data analysis is the consideration of mutual dynamics. For these purposes, you can use the classical apparatus of correlation analysis. But a more effective method should be considered the methodology of wavelet coherence estimates [40], [41].

This approach has worked well for the analysis of economic data [42]-[47].

Here you can consider both the mutual dynamics between individual indicators for one enterprise, and analyze between the indicators of different business entities.

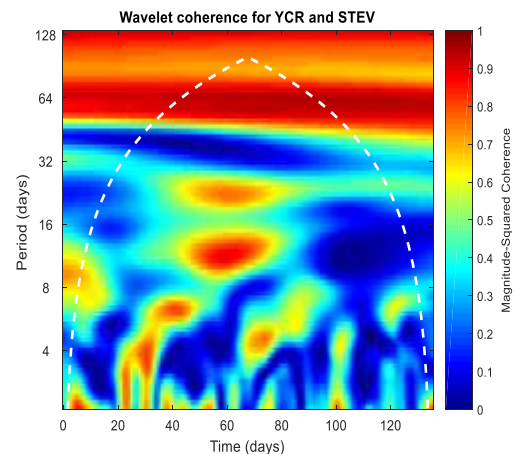
Consider the applicability of this approach in our case for companies such as Yuenglings Ice Crea Corp (YCR) and Stevia Corp (STEV).

The figure below shows estimates of the wavelet coherence between Yuenglings Ice Crea Corp (YCR) and Stevia Corp (STEV) stock prices.

We see that the resulting estimates are fragmented both in the entire time axis when our study is conducted (from January 2021 to August 2023) and in the depth of possible relationships between the data.

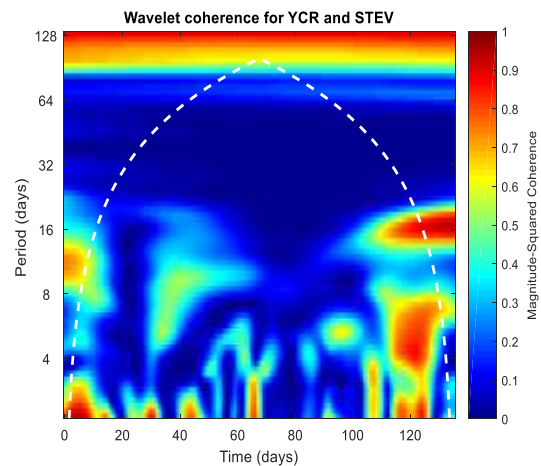
On the one hand, this can be explained by the fact that the companies in question operate with various products in their activities.

On the other hand, we can talk about the presence of the same factors of influence on these representatives of the food cluster. Among such factors is COVID-19, the food crisis caused by the war, and so on.



**Figure 12:** Wavelet coherence of stock price for YCR and STEV

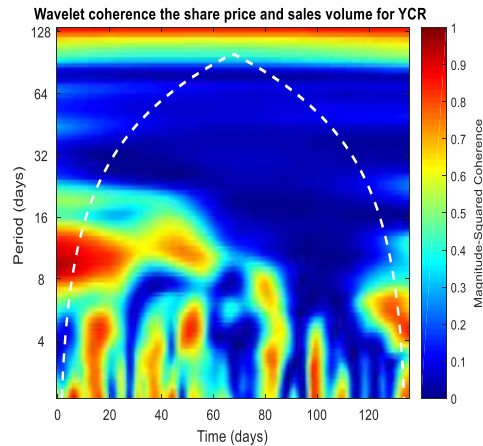
Below is a calculation of the wavelet coherence between the dynamics of the volumes of sold shares of Yuenglings Ice Crea Corp (YCR) and Stevia Corp (STEV).



**Figure 13:** Evaluation of consistency by YCR and STEV share volumes traded

Here we see even less wavelet coherence between such data. At the same time, starting from April 2023, this consistency is increasing. This fully corresponds to the dynamics shown in Fig. 9 and Fig. 11, which shows an increase in sales of the corresponding companies from the US food cluster.

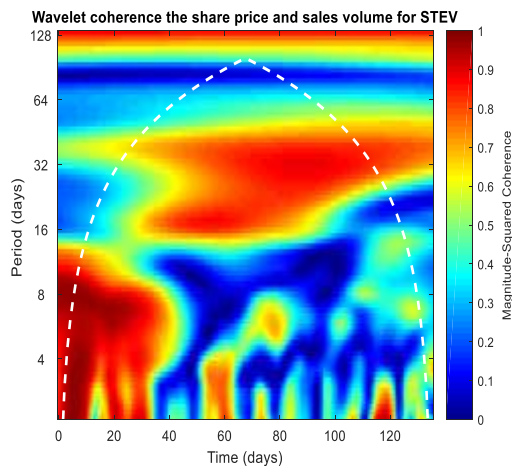
Now consider the dynamics of the correspondence between the share price and sales volume for each of the companies (YCR and STEV) separately.



**Figure 14:** Wavelet coherence for YCR data

It should be noted, although fragmented, but significant consistency for the data of the enterprise Yuenglings Ice Cream Corp. This allows you to deliberately enter the stock market and develop the enterprise.

Stevia Corp also has significant consistency between stock prices and sales volume. This consistency is most significant in the first four months of 2021.



**Figure 15:** Correspondence between share price and sales volume for STEV

From the point of view of Stevia Corp, one can also talk about a well-thought-out entry into the stock market.

## 6. CONCLUSION

The article deals with the key issues of the functioning of medium-sized businesses. Some firms of the US food companies cluster were selected as the base for the study. The analysis is based on an assessment of the dynamics of the share market of such business entities. At the theoretical level, the

necessity and expediency of carrying out an appropriate analysis is substantiated.

Analysis of stock prices for a number of food companies showed the impact on their activities of the same factors. One such factor is the COVID-19 pandemic. As a result, the shares of food companies are rapidly falling in price. Based on estimates of wavelet coherence, an analysis of the mutual dynamics of the data was carried out. It is shown that such estimates reflect the dynamics of stock prices and their sales volumes. This allows you to build effective strategies for entering the market and managing the company.

## 7. REFERENCES

- [1] Kuzemin, A., & et al.. (2008). Analysis of Spatialtemporal Dynamics in the System of Economic Security of Different Subjects of Economic Management. *International Journal Information Technologies and Knowledge*, 2(3), 234–238.
- [2] Kalecki, M. (2011). *Theory of Economic Dynamics*. NYU Press.
- [3] Erumban, A. A., Das, D. K., Aggarwal, S., & Das, P. C. (2019). Structural change and economic growth in India. *Structural Change and Economic Dynamics*, 51, 186–202.
- [4] Ляшенко В. В. (2007). Интерпретация и анализ статистических данных, описывающих процессы экономической динамики. *Бизнес Информ*, 9(2), 108–113.
- [5] Mbow, C., & et al.. (2020). Food Security (No. GSFC-E-DAA-TN78913). IPCC.
- [6] Prosekov, A. Y., & Ivanova, S. A. (2018). Food security: The challenge of the present. *Geoforum*, 91, 73–77.
- [7] Alonso, E. B., Cockx, L., & Swinnen, J. (2018). Culture and food security. *Global food security*, 17, 113–127.
- [8] Rosegrant, M. W., & Cline, S. A. (2003). Global food security: challenges and policies. *Science*, 302(5652), 1917–1919.
- [9] Zhong, T., Si, Z., Crush, J., Scott, S., & Huang, X. (2019). Achieving urban food security through a hybrid public-private food provisioning system: the case of Nanjing, China. *Food Security*, 11, 1071–1086.
- [10] Chowdhury, M. A. (2009). Sustainability of accelerated rice production in Bangladesh: technological issues and the environment. *Bangladesh Journal of Agricultural Research*, 34(3), 523–529.
- [11] Hettne, B. (2010). Development and security: Origins and future. *Security Dialogue*, 41(1), 31–52.
- [12] Baskerville, R. (1993). Information systems security design methods: implications for information systems development. *ACM Computing Surveys (CSUR)*, 25(4), 375–414.
- [13] Stewart, F. (2013). Development and security. In *Security and Development* (pp. 43–70). Routledge.

- [14] Cook, R. G., & Fox, D. R. (2000). Resources, frequency, and methods: An analysis of small and medium-sized firms' public policy activities. *Business & Society*, 39(1), 94-113.
- [15] Clercq, D. D., Sapienza, H. J., & Crijns, H. (2005). The internationalization of small and medium-sized firms. *Small business economics*, 24, 409-419.
- [16] Aggarwal, R. K., & Wu, G. (2006). Stock market manipulations. *The Journal of Business*, 79(4), 1915-1953.
- [17] Lorie, J. H., Dodd, P., & Kimpton, M. H. (1985). *The stock market*. RD Irwin.
- [18] Shah, D., Isah, H., & Zulkernine, F. (2019). Stock market analysis: A review and taxonomy of prediction techniques. *International Journal of Financial Studies*, 7(2), 26.
- [19] Слюніна, Т. Л., Бережний, С. Б., & Ляшенко, В. В. (2007). Розвиток вітчизняної мережі банківських установ: особливості та регіональні аспекти. *Вісник ХНУ ім. В. Н. Каразіна. Економічна серія*, 755. 84–88.
- [20] Baranova, V., & et al.. (2019, October). Stochastic Frontier Analysis and Wavelet Ideology in the Study of Emergence of Threats in the Financial Markets. In 2019 IEEE International Scientific-Practical Conference Problems of Infocommunications, Science and Technology (PIC S&T) (pp. 341-344). IEEE.
- [21] Lyashenko, V., & et al.. (2018). Defects of communication pipes from plastic in modern civil engineering. *International Journal of Mechanical and Production Engineering Research and Development*, 8(1), 253-262.
- [22] Tahseen A. J. A., & et al.. (2023). Binarization Methods in Multimedia Systems when Recognizing License Plates of Cars. *International Journal of Academic Engineering Research (IAER)*, 7(2), 1-9.
- [23] Jassar, A. T. A. (2023). Using 3D modeling systems to create a small portable milling machine controlled by an industrial cloude. *Journal of Theoretical and Applied Information Technology*, 101(8), 3148-3158.
- [24] Kuzemin, O., & Lyashenko, V. Microsituation Concept in GMES Decision Support Systems/A. Kuzemin, V. Lyashenko. *Intelligent Data Processing in Global Monitoring for Environment and Security* (pp. 217–238).–2011.–P, 217-238.
- [25] Dobrovolskaya, I., & Lyashenko, V. (2013). Interrelations of banking sectors of European economies as reflected in separate indicators of the dynamics of their cash flows influencing the formation of the resource potential of banks. *European Applied Sciences*, 1-2, 114-118.
- [26] Куштим, В. В., & Ляшенко, В. В. (2007). Динаміка розвитку банківського сегмента міжнародного фінансового ринку. *Фінанси України*, (12), 96-105.
- [27] Jassar, A. A. (2018). An analysis of QoS in SDN-based network by queuing model. *Telecommunications and RadioEngineering*, 77(4), 297-308.
- [28] Shapran, E., & et al.. (2023). Relationship Between Price Dynamics for Individual Agricultural Products. *International Journal of Academic Management Science Research*, 7(5), 22-28.
- [29] Babichev, A., & et al.. (2023). Wavelet Methodology for Analyzing Internet Marketing Metrics in Managing the Product Policy of the Business Entity. *International Journal of Academic Information Systems Research*, 7(5), 17-23.
- [30] Berry, E. M., Dernini, S., Burlingame, B., Meybeck, A., & Conforti, P. (2015). Food security and sustainability: can one exist without the other?. *Public health nutrition*, 18(13), 2293-2302.
- [31] Ericksen, P. J., Ingram, J. S., & Liverman, D. M. (2009). Food security and global environmental change: emerging challenges. *Environmental Science & Policy*, 12(4), 373-377.
- [32] Ecker, O., & Breisinger, C. (2012). The food security system: A new conceptual framework (No. 1166). *International Food Policy Research Institute (IFPRI)*.
- [33] Demmler, K. M. (2020). The role of small and medium-sized enterprises in nutritious food supply chains in Africa. *Global Alliance for Improved Nutrition (GAIN)*, 2.
- [34] Smyth, S. J., Webb, S. R., & Phillips, P. W. (2021). The role of public-private partnerships in improving global food security. *Global Food Security*, 31, 100588.
- [35] Zhai, T., & et al.. (2023). Assessment of the agriculture supply chain risks for investments of agricultural small and medium-sized enterprises (SMEs) using the decision support model. *Economic Research-Ekonomska Istraživanja*, 36(2), 2126991.
- [36] Nurmatovna, S. D., & Sagdiyevna, D. S. (2019). Improving the competitiveness of the agricultural sector as a factor of food security in the region. *South Asian Journal of Marketing & Management Research*, 9(8), 47-54.
- [37] Antamoshkina, E. N., & Rogachev, A. F. (2020). The model of statistical assessment of food security. *Complex Systems: Innovation and Sustainability in the Digital Age: Volume 1*, 471-479.
- [38] Izraelov, M., & Silber, J. (2019). An assessment of the global food security index. *Food Security*, 11(5), 1135-1152.
- [39] Zapata, H. O., Detre, J. D., & Hanabuchi, T. (2012). Historical performance of commodity and stock markets. *Journal of agricultural and applied Economics*, 44(3), 339-357.
- [40] Torrence, C., & Webster, P. J. (1999). Interdecadal changes in the ENSO–monsoon system. *Journal of climate*, 12(8), 2679-2690.



- [41] Heil, C.E., & Walnut, D.F. (1989). Continuous and discrete wavelet transforms. *SIAM review*, 31(4), 628-666.
- [42] Lyashenko, V., Deineko, Z., & Ahmad, A. (2015). Properties of wavelet coefficients of self-similar time series. *International Journal of Scientific and Engineering Research*, 6(1), 1492-1499.
- [43] Vasiurenko, O., & Lyashenko, V. (2020). Wavelet coherence as a tool for retrospective analysis of bank activities. *Economy and forecasting*, (2), 32-44.
- [44] Vasiurenko, O., & et al.. (2020). Spatial-Temporal Analysis the Dynamics of Changes on the Foreign Exchange Market: an Empirical Estimates from Ukraine. *Journal of Asian Multicultural Research for Economy and Management Study*, 1(2), 1-6.
- [45] Omarov, M., & et al.. (2019). Internet marketing metrics visualization methodology for related search queries. *International Journal of Advanced Trends in Computer Science and Engineering*, 8(5), 2277-2281.
- [46] Rej, S., & et al.. (2022). The role of liquefied petroleum gas in decarbonizing India: fresh evidence from wavelet–partial wavelet coherence approach. *Environmental Science and Pollution Research*, 29(24), 35862-35883.
- [47] Shahbaz, M., & et al.. (2021). Relationship between green investments, energy markets, and stock markets in the aftermath of the global financial crisis. *Energy Economics*, 104, 105655.