UDC 519.86
JEL: C01; D53; F15
DOI: https://doi.org/10.32983/2222-4459-2023-12-128-134

COINTEGRATION AND CAUSALITY RELATIONSHIP OF THE USA STOCK MARKET WITH SELECTED WORLD MARKETS

©2023 **HUSEYNOVA S. M., GAMBARLI U. A.**

UDC 519.86
JEL: C01; D53; F15

Huseynova S. M., Gambarli U. A. Cointegration and Causality Relationship of the USA Stock Market with Selected World Markets

This article, based on data from 1995 to 2022, considers the commercial and economic processes between the USA, Japan and China and stock indexes indicators of these countries. In the course of research, the authors have created multiply regression model, adequacy of the model was determined using the Fisher's F-test, Student's t-test, and the stability of the parameters of the regression model was checked using the CUSUM test. Stationarity of the time series was checked by the Dickey-Fuller test. As a result, econometrically sound recommendations are developed, which allows to conduct dynamic analyses to effectively regulate economic processes, integration and international trade, foreign investment operations between the three countries. The Granger causality of the relationship was investigated. Johansen tests were implemented to find the cointegration space, after which a vector error correction model was constructed that describes the long-term equilibrium relationship between the studied indicators and the path to return to the equilibrium trajectory in case of deviation from it. During the modelling, all necessary statistical procedures were used to identify and evaluate the parameters of the model and check its adequacy, accuracy of short-term and long-term forecast values using Eviews 8 tools. The results show that not only for the countries studied here, but also for each country, conduction of monitoring by the governments by using the methodology of the vector model of error correction is very important in order to ensure effective regulation of foreign trade and to participate in regional and global integration processes.

Keywords: *the USA, Japan, China, stock market, indexes, Nastaq_USA, NIKKEI_225_JAPAN, SHANGHAI_CHINA.*
Fig.: *1.* ***Tabl.:*** *8.* ***Formulae:*** *4.* ***Bibl.:*** *9.*

Huseynova Sara Mubariz *– PhD (Economics), Senior Lecturer of the Department of Economics of International Relations, Baku State University (23 Academician Zahid Khalilova Str., Baku, AZ1148, Azerbaijan)*
E-mail: *sarahuseynova@gmail.com*
ORCID: *https://orcid.org/0000-0002-0516-9468*
Gambarli Uzeyir Azer *– Student, Faculty of Economics, Department of Economics of International Relations, Baku State University (23 Academician Zahid Khalilova Str., Baku, AZ1148, Azerbaijan)*
E-mail: *ugambarli@gmail.com*
ORCID: *https://orcid.org/0009-0004-5662-3060*

УДК 519.86
JEL: C01; D53; F15

Гусейнова С. М., Гамбарлі У. А. Коінтеграція та причинно-наслідковий зв'язок фондового ринку США з обраними світовими ринками

У цій статті на основі даних з 1995 по 2022 роки досліджено торгово-економічні процеси між США, Японією та Китаєм і показники фондових індексів цих країн. Критерій Фішера, t-критерій Стьюдента та стабільність параметрів регресійної моделі перевіряли за допомогою критерію CUSUM і критерію CUSUM-квадратів. Стаціонарність часового ряду була перевірена за допомогою тесту Дікі – Фуллера. У результаті розроблено економетрично обґрунтовані рекомендації, які дозволяють проводити динамічний аналіз для ефективного регулювання економічних процесів, інтеграції та міжнародної торгівлі та іноземних інвестиційних операцій між трьома країнами. Розглянуто причинність Грейнджера. Для знаходження коінтеграційного простору реалізовано тести Йогансена, після чого побудовано векторну модель корекції помилок, що описує довготривалий рівноважний зв'язок між досліджуваними показниками та шлях повернення до рівноважної траєкторії в разі відхилення від неї. Під час моделювання були використані всі необхідні статистичні процедури для ідентифікації й оцінки параметрів моделі та перевірки її адекватності, точності короткострокових і довгострокових прогнозних значень за допомогою засобів Eviews 8. Результати показують, що не лише для досліджуваних держав, але й для кожної країни моніторинг з боку урядів із застосуванням методології векторної моделі корекції помилок є дуже важливим для забезпечення ефективного регулювання зовнішньої торгівлі та участі в регіональних і глобальних інтеграційних процесах.

Ключові слова: *США, Японія, Китай, фондовий ринок, індекси, Nastaq_USA, NIKKEI_225_JAPAN, SHANGHAI_CHINA.*
Рис.: *1.* ***Табл.:*** *8.* ***Формул:*** *4.* ***Бібл.:*** *9.*

Гусейнова Сара Мубаріз *– кандидат економічних наук, старший викладач кафедри економіки міжнародних відносин, Бакинський державний університет (вул. Академіка Західа Халілова, 23, Баку, AZ1148, Азербайджан)*
E-mail: *sarahuseynova@gmail.com*
ORCID: *https://orcid.org/0000-0002-0516-9468*
Гамбарлі Узеїр Азер *– студент, економічний факультет, кафедра економіки міжнародних відносин, Бакинський державний університет (вул. Академіка Західа Халілова, 23, Баку, AZ1148, Азербайджан)*
E-mail: *ugambarli@gmail.com*
ORCID: *https://orcid.org/0009-0004-5662-3060*

In modern times, the analysis of trade relations plays a major role in the development of economic relations between countries. One of the main priority directions of foreign economic strategy is modern active participating in the world savings processes, developing in global geoeconomic space, it consists, among other things, of reacting appropriately to new tendencies. The dynamic relationships between analyses of stock market have drawn the attention of numerous economists, both for theoretical and empirical reasons, because they play crucial roles in influencing the development of a country's economy. The relationships between stock markets have frequently been utilized in predicting the future trends for each other by fundamentalist investors.

Literature Review. Recent publications of foreign literatures show that the process of increasing the export and import potential was also investigated by some authors with the influence of the relationship between the stock market indexes. Stock market indexes are aimed at meeting the demand of the economy directly in the world market, which also has a great impact on economic development. P. Evrim-Mandaci and E. Ç. Çağli investigated the relationships between the US stock market and eleven stock markets in Europe at different development levels [2]. Analysis of daily data for 2005–2012 showed similar market performance without confirming any benefits of international diversification. Avdulaj, Barunik analysed the profitability of portfolio diversification for the Czech index PX and the German DAX. P. Sekuła examined relationships between selected stock market indices in Western Europe, Central Europe, and the United States [3]. The results show that relationships between the stock indices in the developed countries were more numerous and durable than between the stock indices in Central Europe but they were subject to some fluctuations. The study by R. R. K. Sidhik states that there is cointegration between Indonesia Stock Exchange and macro economies [4]. In recent years, a number of articles have been published devoted to the study of integration processes. It can be considered as an important instrument in the State regulation of import-export operations, taking into account other influencing factors to ensure the long-term sustainable growth of appropriate inclusive parameters by providing dynamic analyses in conducting balanced import and export transactions between countries in accelerating economic integration. While analysing interrelation of the inclusive indicators of Azerbaijan, Russia and Kazakhstan from a macroeconomic orientation, the interrelation between GDPs per capita between these countries are interpreted. Interrelation of GDPs per capita of these three countries determines the relevance of the econometric study of integration processes at the macro level with the economic consequences of cross-country cooperation. The multi-vector and balanced external economy of these three countries demonstrates the progress of the co-integrated trade processes of interrelation between Azerbaijan, Russia and Kazakhstan. GDP per capita is the most significant indicator for the analysis of turnover dynamics of mutual trade in the environment [6].

The research [5] applies the Johansen cointegration test, vector-error-correlation-model (VECM) and variance-decomposition (VDC). The vector-error-correlation-model (VECM) adequacy is tested cert. The result was further substantiated by the tests based on Johansen cointegration and VECM procedures, showing significant long-run economic relations.

In the research [7] of the vector error correction model (VECM) in a system of seven equations, we find that the Japanese stock market is cointegrated with a group of six macroeconomic variables. The signs of the long-term elasticity coefficients of the macroeconomic variables on stock prices generally support the hypothesized equilibrium relations. The author's findings are robust to different combinations of macroeconomic variables in six-dimension systems and two sub-periods. Also, the VECM consistently outperforms the vector autoregressive model in forecasting ability.

The results report [8] a long-run and significant relationship between these variables. In particular, the VAR model indicates that fluctuations in the KSE-100 index are significantly affected by the money supply and exchange rate but not the interest rate. Moreover, money supply has a positive relationship with the stock market and a negative relationship with interest rates and exchange rates. Interest rates have a weak and mixed relationship with all other variables. The dynamic relationships should aid policy-makers in understanding the effects of monetary policy changes.

In the study, a multifactor regression model of selected stock market indexes was built. Based on the statistical indicators of stock indexes over the last 25 years, an econometric approach of dependence was conducted in the period of 1998–2022 [9]. Adequacy of the model was determined using the Fisher's F-test, the Student's t-test, the stability of the parameters of the regression model was checked using the CUSUM test [1]. Stationarity of the time series was checked by the Dickey-Fuller test. Here are the causal relationships between the selected market indexes in the world. Causal relationships between the selected market indexes was checked by the Granger test. Integration process of NASDAQ (USA) and China, Japan is investigated by means of cointegration analyses. Cointegration analyses of stock indexes show that, taking into account the international trade potential, the vector error correction model focuses upon that that the Chinese and Japanese markets are highly cointegrated with the USA market and the increased volatility signifies global contagion. This research also uses variance decomposition and impulse response function to forecast stock index in future.

Not only high-tech companies' shares are listed on the NASDAQ exchange, and therefore a whole system of indices has emerged, each of which reflects the situation in the relevant sector of the economy. Currently, there are thirteen indices based on the current prices (quotations) of securities traded in the electronic system of the NASDAQ stock exchange. NASTAG is known for having about half of its constituent companies as high-tech companies, it also consists of stocks from the financial, trade, industrials, and biotech sectors. It includes not only companies from the USA, but also from Japan, China and other countries. Indexes are good indicators of performance investments relative to market averages.

Based on the statistical information of the World Bank from 1998 until 2022, we have analysed the statistical data of the selected stock indexes indicators. *Tbl. 1* shows us descriptive statistics of the indicators analysed.

Table 1

Estimation of descriptive statistics elements

	NASTAQ_ USA	NIKKEI_225_ JAPAN	SHANGHAI_ CHINA
Mean	4428.271	15831.67	2429.698
Median	2728.150	15460.43	2649.480
Std. Dev.	3487.725	5637.398	856.2497
Skewness	1.557172	0.679659	0.150786
Kurtosis	4.475732	2.658363	1.946019
Jarque-Bera	12.37180	2.046313	1.251899
Probability	0.002058	0.359458	0.534753
Sum	110706.8	395791.8	60742.46
Sum Sq. Dev.	2.92E+08	7.63E+08	17595926
Observations	25	25	25

Source: developed by the authors.

A qualitative assessment of the closeness of the relationship between factors is revealed using the Chedokka scale. Based on this scale, if the value of an element of this matrix is between 0.5 and 0.7, then the closeness of the relationship between the corresponding factors is considered noticeable, and if the value of the element is in the interval (0.7; 0.9), then the closeness of the relationship between the corresponding steam is accepted as high (*Tbl. 2*).

Table 2

Correlation Matrix

	NASTAQ USA	NIKKEI_225 JAPAN	SHANGHAI CHINA
NASTAQ USA	1.000000	0.905995	0.767119
NIKKEI_225 JAPAN	0.905995	1.000000	0.627366
SHANGHAI CHINA	0.767119	0.627366	1.000000

Source: developed by the authors.

We have created linear multiply regression model for analysing how the NASTAQ impacts the Japanese and Chinese stock markets. The estimated least squares multiple regression model, implemented using the custom software Eviews, is described in the *Tbl. 3*.

View of the multiply regression equation:

$$\begin{aligned} NASTAQ\_USA = {} & 0.520144554114 \cdot NIKKEI\_225JAPAN + \\ & + 0.504033544592 \cdot SHANGHAICHINA + \\ & + 0.410841518636 \cdot RESIDS - 5031.13636876. \end{aligned} \quad (1)$$

As can be seen from the results given in Tbl. 3, the general formal model is the most accurate, the determination coefficient has a higher value of 96%. This means that the variance of the corresponding regression equation is the result of a factor that explains 96%. By the Fisher – Snedecor criterion we can define importance of regression model, the significance level criterion, degrees of freedom $\kappa_1 = 2$, $\kappa_2 = 22$ and F-table = 3.4. From Tbl. 3, F-statistic = 183.7507. In result F-statistic = 183.7507 > F-table = 3.4, and the model is considered significant. Autocorrelation was tested using Durbin – Watson d-statistics. According to the table of critical values of d-statistics for the number of observations 25, the number of explanatory variables is 2 and the given significance level is 0.05, the values of d_lower = 1.04 and of d_upper = = 1.56, which divide the segment [0.4] into five regions, the observed value d_obs = 1.1. In result 1.04 < dobs = = 1.1 < 1.56, the observed value falls into the zone then nothing can be said about the presence of autocorrelation using the Durbin – Watson test. The CUSUM test define the stability of parameters of regression model. The *Fig. 1* shows the result of the CUSUM test.

The Fig. 1 shows, that the location of the blue line between the red lines means that the hypothesis *H* about the stability of the parameters is accepted. The CUSUM test shows that linear multivariate regression model is stable.

The stationarity of the time series of modelling variables was checked using the extended Dickey – Fuller test. The testing results showed that the original series and their first differences are not stationary, but the second-order difference operators are stationary. The test results are shown in the *Tbl. 4*, the results of the Granger test are shown in the *Tbl. 5*.

In the *Tbl. 6*, all 5 variants are analysed: $H_2(r)$, $H_1^{\square}(r)$, $H_1(r)$, $H^{\square}(r)$, $H(r)$, respectively, meaning: $H_2(r)$ – the data do not have a deterministic trend, the cointegration equation does not contain either a trend or a free term; $H_1^{\square}(r)$ – the data do not have a deterministic trend, the cointegration relation contains a free term and does not contain a trend; $H_1(r)$ – the data contain a deterministic trend, the cointegration equation contains a free term and does not contain a trend; $H^{\square}(r)$ – the data have a deterministic linear trend, the cointegration relationship has both a trend and a free term; $H(r)$ – the data contain a deterministic quadratic trend, the cointegra-

Table 3

Multiply regression model

Dependent Variable: NASTAQ_USA				
Method: Least Squares				
Date: 01/12/23 Time: 09:31				
Sample: 1998, 2022				
Included observations: 25				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
NIKKEI_225__JAPAN	0.520145	0.030439	17.08788	0.0000
SHANGHAI__CHINA	0.504034	0.200408	2.515042	0.0201
RESIDS	0.410842	0.047375	8.672163	0.0000
C	–5031.136	492.1820	–10.22211	0.0000
R-squared	0.963303	Mean dependent var		4428.271
Adjusted R-squared	0.958060	S.D. dependent var		3487.725
S. E. of regression	714.2564	Akaike info criterion		16.12601
Sum squared resid	10713406	Schwarz criterion		16.32103
Log likelihood	–197.5751	Hannan-Quinn criter.		16.18010
F-statistic	183.7507	Durbin-Watson stat		1.134205
Prob(F-statistic)	0.000000			

Source: developed by the authors.

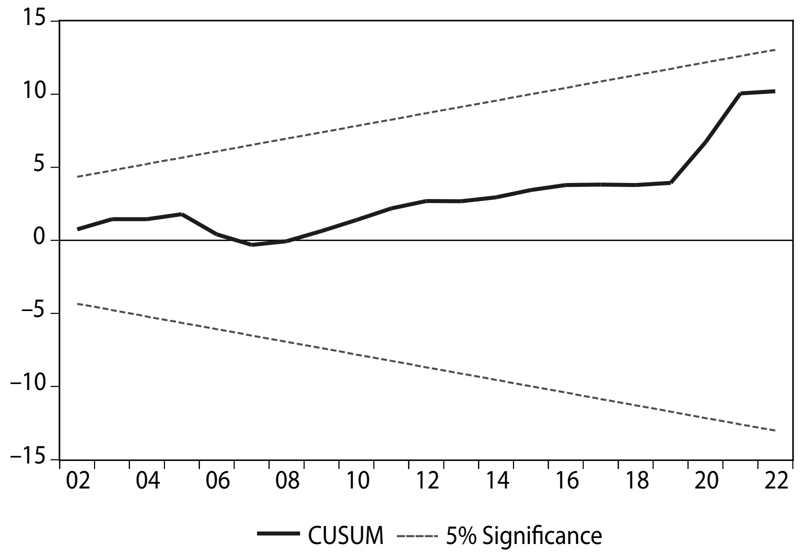

Fig. 1. Result of the CUSUM test

Source: author's work based on Eviews packet.

tion equation contains a trend and a free term. In this case, the information criteria of Akaike and Schwartz respectively had low values of 51.76752 and 53.60669.

The system of integrated order 2 and cointegrated series allows representation in the form of a vector error correction model (VECM) with a lag equal to 2 and rank 1, expressing the long-term equilibrium relationship of variables and the authenticity of their correlation, allowing one to measure deviations from equilibrium in the event of occurrence shocks and the speed of its recovery. Carrying out the procedures of the Eviews 8 program, the following error correction equation was found for second-order differences in the values of NASTAQ_USA (Formula (2)).

Above, when implementing the Granger causality test, we showed that there are inverse relationships between the variables. Following the Eviews 8 software procedures, it is not difficult to obtain error correction models for the remaining variables (Formulaes (3), (4)).

Table 4

Results of the Dickey – Fuller test

Variables	Statis. l criteria	Critical value 1%	Critical value 5%	Critical value 10%	Probability
Second difference					
NASTAQ_USA	–6.018536	–4.467895	–3.644963	–3.261452	0.0004
NIKKEI_225_JAPAN	–5.981667	–4.440739	–3.632896	–3.632896	0.0004
SHANGHAI_CHINA	–5.709535	–4.467895	–3.644963	–3.261452	0.0008
RESIDS	–8.100113	–4.440739	–3.632896	–3.254671	0.0000

Table 5

Results of the Granger test

m = 1	m = 2	m = 3
DNIKKEI_JAPAN and DNASTAQ_USA, DNASTAQ_USA and DNIKKEI_JAPAN, DNASTAQ_USA and DNIKKEI_JAPAN has cause-and-effect relationships are found, where Δ denotes the difference operator of the corresponding variable	DSHANGHAI_CHINA does and DNASTAQ_USA, DNASTAQ_USA and Granger Cause DSHANGHAI_CHINA has cause-and-effect relationships are found, where Δ denotes the difference operator of the corresponding variable	DNIKKEI_JAPAN and DNASTAQ_USA has cause-and-effect relationships are found, where Δ denotes the difference operator of the corresponding variable

Table 6

Results of the Johansen cointegration test

Data Trend:	H_2 (r)	$H_1^{□}$(r)	H_1 (r),	$H^{□}$(r)	H (r)
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	2	1	3	1	1
Max-Eig	2	1	1	1	1
*Critical values based on MacKinnon – Haug – Michelis (1999)					
Data Trend:	None	None	Linear	Linear	Quadratic
Rank or	No Intercept	Intercept	Intercept	Intercept	Intercept
No. of CEs	No Trend	No Trend	No Trend	Trend	Trend
0	–484.2746	–484.2746	–483.9305	–483.9305	–482.8601
1	–459.5669	–455.1651	–454.8397	–454.7915	–454.4509
2	–453.6479	–448.2103	–448.1332	–447.9470	–447.9462
3	–451.7169	–446.0627	–446.0627	–445.2692	–445.2692
0	53.81838	53.81838	54.09795	54.09795	54.30107
1	51.84915	51.49106*	51.66734	51.76752	51.94221
2	51.85767	51.49582	51.59297	51.78390	51.88907
3	52.28599	52.00660	52.00660	52.23886	52.23886
0	55.16048	55.16048	55.58917	55.58917	55.94141
1	53.48949	53.18111*	53.45681	53.60669	53.88079
2	53.79625	53.53382	53.68068	53.97102	54.12590
3	54.52282	54.39255	54.39255	54.77393	54.77393

Source: author’s work based on Eviews packet.

Table 7

Results of the Trace test

Hypothesis	Alternative hypothesis	Trace-statistics	Critical value 1%	Probability
H_0: r = 0*	H_A: r > 0	77.32271	42.91525	0.0000
H_0: r = 1	H_A: r > 1	19.04460	25.87211	0.2782
H_0: r = 2	H_A: r > 2	5.355737	12.51798	0.5461

Table 8

Result of the Max-Eigen value test

Hypothesis	Alternative hypothesis	Max-Eigen value statistics	Critical value 1%	Probability
H_0: r = 0*	H_A: r > 0	58.27811	25.82321	0.0000
H_0: r = 1	H_A: r > 1	13.68886	19.38704	0.2757
H_0: r = 2	H_A: r > 2	5.355737	12.51798	0.5461

$$\begin{aligned} D(DNASTAQ\_USA) = &-0.0610219781599 \cdot (DNASTAQ\_USA(-1) - 2.70453127966 \cdot DNIKKEI\_JAPAN(-1) + \\ &+ 24.4637667523 \cdot DSHANGHAI\_CHINA(-1) - 0.35848480077 \cdot DRESIDS(-1) + 753.492325337) + \\ &+ 0.25844208242 \cdot D(DNASTAQ\_USA(-1)) - 0.223156793206 \cdot D(DNASTAQ\_USA(-2)) - \\ &- 0.709085305686 \cdot D(DNIKKEI\_JAPAN(-1)) - 0.454249297557 \cdot D(DNIKKEI\_JAPAN(-2)) + \\ &+ 0.481484961116 \cdot D(DSHANGHAI\_CHINA(-1)) + 0.0227420705148 \cdot D(DSHANGHAI\_CHINA(-2)) - \\ &- 0.46092509882 \cdot D(DRESIDS(-1)) - 0.338449083387 \cdot D(DRESIDS(-2)) - 139.357707357. \end{aligned} \quad (2)$$

$$\begin{aligned} D(DNIKKEI\_JAPAN) = &-0.274394738488 \cdot (DNASTAQ\_USA(-1) - 2.70453127966 \cdot DNIKKEI\_JAPAN(-1) + \\ &+ 24.4637667523 \cdot DSHANGHAI\_CHINA(-1) - 0.35848480077 \cdot DRESIDS(-1) + 753.492325337) + \\ &+ 3.6458369574 \cdot D(DNASTAQ\_USA(-1)) + 0.900612062151 \cdot D(DNASTAQ\_USA(-2)) - \\ &- 2.30408541571 \cdot D(DNIKKEI\_JAPAN(-1)) - 1.66472792784 \cdot D(DNIKKEI\_JAPAN(-2)) + \\ &+ 3.14453371296 \cdot D(DSHANGHAI\_CHINA(-1)) - 0.993201061293 \cdot D(DSHANGHAI\_CHINA(-2)) - \\ &- 0.434338725296 \cdot D(DRESIDS(-1)) - 1.04725480075 \cdot D(DRESIDS(-2)) - 309.803858755. \end{aligned} \quad (3)$$

$$\begin{aligned} D(DSHANGHAI\_CHINA) = &-0.162191384893 \cdot (DNASTAQ\_USA(-1) - 2.70453127966 \cdot DNIKKEI\_JAPAN(-1) + \\ &+ 24.4637667523 \cdot DSHANGHAI\_CHINA(-1) - 0.35848480077 \cdot DRESIDS(-1) + 753.492325337) + \\ &+ 0.594651752979 \cdot D(DNASTAQ\_USA(-1)) + 0.23884412845 \cdot{}^{*}D(DNASTAQ\_USA(-2)) - \\ &- 0.463694566817 \cdot D(DNIKKEI\_JAPAN(-1)) - 0.351760388225 \cdot D(DNIKKEI\_JAPAN(-2)) + \\ &+ 1.65109742956 \cdot D(DSHANGHAI\_CHINA(-1)) + 0.290934628121 \cdot D(DSHANGHAI\_CHINA(-2)) - \\ &- 0.0681061815878 \cdot D(DRESIDS(-1)) - 0.179153200866 \cdot D(DRESIDS(-2)) + 46.840265012. \end{aligned} \quad (4)$$

CONCLUSIONS

1. The long-term equilibrium relationship is stable in that, being disrupted in the short term, it is restored. By combining statistical long-term and dynamic short-term relationships between variables in one line, relations (3) and (4) allow us to measure deviations from equilibrium in the event of shocks and the speed of its recovery.

2. The contributions to the dispersion of forecast errors from changes in the own dispersion of the resultant factor and the dispersion of other variables are determined.

3. Stock market modelling using the methodology described above allows you to predict trade flows. Estimates obtained from correction mechanisms (3), (4) allow for dynamic analyses for effective government regulation of stock market transactions between the three countries to improve the corresponding stock indexes parameters of the long-term sustainable economic growth of these countries. ■

BIBLIOGRAPHY

1. Engle R. F., Granger C. W. J. Co-integration and Error Correction: Representation, Estimation, and Testing, *Econometrica*. 1987. Vol. 55. No. 2. P. 251–276. DOI: https://doi.org/10.2307/1913236
2. Evrim-Mandaci P., Çağli E. Ç. Relationships between the US and European stock markets during the recent financial turmoil: Evidence from the VARFIMA model. *Applied Economics Letters*. 2012. Vol. 19. Iss. 17. P. 1697–1701. DOI: https://doi.org/10.1080/13504851.2012.667539
3. Sekuła P. Causality Analysis Between Stock Market Indices. *Financial Sciences*. 2019. Vol. 24. Iss. 1. P. 74–93. DOI: https://doi.org/10.15611/fins.2019.1.05
4. Sidhik R. R. K. Analisis Hubungan Jangka Panjang Variabel Makroekonomi Terhadap Indeks Harga Saham Gabungan (IHSG) Di BEI periode 2006–2016. Depok: Universitas Indonesia, 2017. URL: https://lib.ui.ac.id/detail?id=20472536&lokasi=lokal
5. Huseynova S. Cointegration Analysis of Economic Growth Parameters Between Russia and Azerbaijan. *Sciences of Europe*. 2023. Vol. 110. P. 26–31. DOI: https://doi.org/10.5281/zenodo.7618240
6. Hüseynova S. The Econometric Analysis of the Interrelation Between the Inclusive Indicators of Azerbaijan, Russia and Kazakhstan. *TURAN-SAM*. 2022. Vol. 14. Iss. 56. P. 118–124. URL: https://www.ceeol.com/search/article-detail?id=1084314
7. Mukherjee T. K., Naka A. Dynamic Relations Between Macroeconomic Variables and the Japanese Stock Market: An Application of a Vector Error Correction

Model. *Journal of Financial Research*. 1995. Vol. 18. Iss. 2. P. 223–237.
DOI: https://doi.org/10.1111/j.1475-6803.1995.tb00563.x

8. Abbas G., McMillan D. G. Interaction among stock prices and monetary variables in Pakistan. International *Journal of Monetary Economics and Finance*. 2014. Vol. 7. No. 1. P. 13–27.
DOI: https://doi.org/10.1504/IJMEF.2014.063839
9. The World Bank. URL: https://www.worldbank.com

REFERENCES

Abbas, G., and McMillan, D. G. "Interaction among stock prices and monetary variables in Pakistan". *International Journal of Monetary Economics and Finance,* vol. 7, no. 1 (2014): 13-27.
DOI: https://doi.org/10.1504/IJMEF.2014.063839

Engle, R. F., and Granger, C. W. J. "Co-integration and Error Correction: Representation, Estimation, and Testing". *Econometrica*, vol. 55, no. 2 (1987): 251-276.
DOI: https://doi.org/10.2307/1913236

Evrim-Mandaci, P., and Cagli, E. C. "Relationships between the US and European stock markets during the recent financial turmoil: Evidence from the VARFIMA model". *Applied Economics Letters*, vol. 19, no. 17 (2012): 1697-1701.
DOI: https://doi.org/10.1080/13504851.2012.667539

Huseynova, S. "Cointegration Analysis of Economic Growth Parameters between Russia and Azerbaijan". *Sciences of Europe*, vol. 110 (2023): 26-31.
DOI: https://doi.org/10.5281/zenodo.7618240

Huseynova, S. "The Econometric Analysis of the Interrelation Between the Inclusive Indicators of Azerbaijan, Russia and Kazakhstan". *TURAN-SAM*, vol. 14, iss. 56 (2022): 118-124. https://www.ceeol.com/search/article-detail?id=1084314

Mukherjee, T. K., and Naka, A. "Dynamic Relations between Macroeconomic Variables and the Japanese Stock Market: An Application of a Vector Error Correction Model". *Journal of Financial Research*, vol. 18, no. 2 (1995): 223-237.
DOI: https://doi.org/10.1111/j.1475-6803.1995.tb00563.x

Sekula, P. "Causality Analysis Between Stock Market Indices". *Financial Sciences*, vol. 24, no. 1 (2019): 74-93.
DOI: https://doi.org/10.15611/fins.2019.1.05

Sidhik, R. R. K. "Analisis Hubungan Jangka Panjang Variabel Makroekonomi Terhadap Indeks Harga Saham Gabungan (IHSG) Di BEI periode 2006-2016". Depok: Universitas Indonesia, 2017. https://lib.ui.ac.id/detail?id=20472536&lokasi=lokal

The World Bank. https://www.worldbank.com