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Comparative Analysis of the Stability of the Russian and US Stock Markets in the Context of Geopolitical Transformations

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ABSTRACT

Subject. The global economic crisis of 2008, geopolitical crises between 2014 and 2023 and the socio-economic consequences of the COVID-19 pandemic have a significant negative impact on the stock markets. The result of this influence is a significant increase in stock market volatility and instability. **The purpose** of the article is to develop a methodology for assessing the sustainability of the stock market and, on its basis, carrying out a comparative analysis of the sustainability of the stock markets of the Russian Federation and the USA. **Methodology.** Systematic and comparative analysis is used, as well as statistical methods and methods of the theory of cenoses. **Scientific novelty:** a dimensionless indicator of the stability of the economic system of stock market companies has been developed. **Results.** A methodology is proposed for assessing the sustainability of stock market issuing companies based on its model — economic cenosis. Within the framework of this methodology, a cenological analysis of structural changes and stability of the economic system under consideration is carried out. The developed methodology was tested based on the capitalization data of 100 companies listed on the Moscow Exchange and the S&P 500 index. A comparative analysis of the stability of the stock markets of the Russian Federation and the United States showed a sufficient degree of stability of the Russian stock market in relation to one of the most developed stock markets in the world — the US stock market. **Conclusions.** The proposed methodology makes it possible to assess the sustainability of the stock market as a unified economic system of issuing companies based on their key parameter — capitalization. Maximizing the sustainability indicator makes it possible to determine the potential investment valuation of the selected company shares, provided that the economic system of the stock market, in the process of its evolution, strives for its most stable state. **Practical significance.** The results and conclusions of the article may be in demand not only by regulatory organizations and stock market participants, but also by potential ordinary investors.
Keywords: stock market; issuing company; capitalization of companies; economic sustainability; economic cenosis; indicator of sustainability

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INTRODUCTION

In recent times, in the context of crisis phenomena in the world economy and global geopolitical transformations, one of the main features of stock markets/ stock exchanges (SE) development is a significant increase in their volatility and instability. Such significant changes in stock assets and indices may further adversely affect the economies of countries. In this regard, governmental organisations regulating stock market processes need to react quickly in order to mitigate and, if possible, eliminate these phenomena. Therefore, the task of assessing the sustainability of the Russian stock market and comparing it with one of the most developed ones — the US stock market — is relevant. The results of this assessment allow regulators to take appropriate corrective or prohibitive actions to stabilise the stock market, and provide participants with knowledge about its dynamics and development, on the basis of which they form tactics and strategies for exchange trading.

The topical issue presented in this article is actively researched by the scientific community, whose interests lie in the field of analysing the state, development, and sustainability of stock markets under the influence of external factors.

Various features of the influence of external factors on the stock market of Russia are considered in the works of Russian scientists. The article by E. A. Kudryavtseva shows that the volume of GDP and the cost of oil have a significant impact on the Russian stock market [1]. The study by A. V. Berdyshev and F. N. Ilmukov is devoted to the features of the Russian stock market development in 2021, before the introduction of financial and economic restrictions on the Russian Federation by Western countries [2]. The need for state regulation in the stock market under unfavourable geopolitical conditions is formulated in the work of L. I. Tenkovskaya [3]. The study conducted by M. R. Narzulloev and A. S. Duisembayeva proves that the stock market reacts to the cost of oil to a greater extent [4]. And I. I. Belyaev, S. N. Silvestrov and T. S. Gaibov in their article demonstrate that, despite the impact of the COVID-19 pandemic on the global and Russian economy, the domestic banking sector has uneven growth rates of total assets and stable growth of equity capital. At the same time, the stability of the Russian banking sector at the end of 2020 is observed [5].

Many scientific works pay attention to various aspects of stock market sustainability. Thus, V. A. Gorelik and T. V. Zolotova assess the collective risk and sustainability of the stock market based on the concept of entropy and correlation coefficients of random values of companies' returns [6]. Time effects on the stock market of the Russian Federation are studied by S. V. Vatrushkin [7]. The articles of foreign scientists state that some industry clusters of Warsaw stock market indices during the COVID-19 pandemic had different stability indices [8]; the stock market stability based on diffusion entropy and the Dow Jones Industrial Index is analysed [9]; the stock market stability index is formulated within the framework of the asymptotic steady-state autoregressive model (ASAR). [10]. At the same time, in one paper the authors prove that most of the world stock markets in the process of adapting to various aspects of globalisation have faced new problems related to their stability and efficiency, and in order to mitigate these negative effects of globalisation they propose to adopt a number of regulations, measures and practices [11].

There is a study where Discrete Ricci curvature procedures are considered within a hybrid model of time series analysis to describe the nonlinear architecture of financial networks, which is used to estimate future risks, volatility, and stability of the Shanghai Stock Exchange of China. It is shown that this estimation procedure can be used for the whole stock market of China [12].

Several articles present stock market models as a nonlinear non-stationary system with strong

volatility, close coupling, and asymmetry [13–18]. Within these models, various tools, and interdisciplinary approaches such as trigger points, stock price and cash flow feedback and complexity theory are proposed to estimate the stock market with a high degree of correlation and to monitor and adjust it.

"One study shows that sentimental" traders who buy stocks in rising markets and sell stocks in falling markets jeopardise the stability of stock markets [19]. And others consider a number of models of stock market dynamics based on the behaviour of heterogeneous interacting agents (chartists and fundamentalists). It is established that the stock price will tend to its fundamental value as long as the influence of chartists (traders using technical analysis) and fundamentalists (traders focusing on company fundamentals) on the stock market does not exceed certain limits [20, 21]. Based on the evolutionary model of the stock market, scientists demonstrate that the stock market is evolutionarily stable if and only if stocks are valued by expected relative dividends [22].

The given review of the current state of the problem under study shows that the mentioned scientific works cover various aspects related to the analysis of the state, development, and local stability of stock markets under the influence of external factors. At the same time, the assessment of stock market sustainability as a unified economic system of issuing companies is not fully studied, so this problem is of particular scientific interest.

METHODOLOGY FOR ASSESSING THE SUSTAINABILITY OF THE STOCK MARKET

Many companies — stock market issuers are considered as an economic system that develops in a competitive environment for access to financial resources under the influence of internal and external factors. In the process of evolution of this system there is a natural selection and development of the most effective organisations. The sustainability of companies — issuers of the stock market is studied on the basis of economic cenosis [23], which is a model of the economic system.

The structural changes and stability of the economic system under consideration are analysed using rank parametric distributions of economic cenoses. The key economic indicator of a given economic system is usually chosen as a parameter, so for companies — stock market issuers such parameter can be their capitalisation. The rank parametric distribution is formed by ranking the issuing companies according to the decrease in their capitalisation. The belonging of the economic system to the cenological type is determined by the value of Kendall's coefficient of concordance (W) [23], which gives an estimate of the correlation of rank parametric distributions of issuing companies in time dynamics:

$$W = \left(12\sum_{i=1}^{N}\left(\sum_{j=1}^{T} r_{ij} - \mathrm{S}\right)^2\right) / \left(T^2\left(N^3 - N\right)\right), \quad (1)$$

$$S = \left(\sum_{i=1}^{N}\sum_{j=1}^{T} r_{ij}\right) / N, \quad (2)$$

where N — is the number of issuing companies of the stock market; T — is the number of time periods under consideration, for which rank distributions are constructed; r_{ij} — is the i-th rank of the j-th time period; S — is the average sum of ranks of issuing companies for each time period.

If $W > 0.5$, the given economic system belongs to the cenological type. To calculate the Kendall's coefficient of concordance, the rank parametric distributions of the capitalisation parameter of the issuing companies for each time period (quarter, half-year and year) are generated.

As practice shows, in the process of evolution in the environment competing for access to financial resources under the influence of internal and external factors, the rank parametric distributions of economic cenoses tend to their most stable state. This state is described by the hyperbolic H-distribution with a rank

coefficient in the interval β ∈ [0.5; 1.5] [24]:

$$P(r) = P_1 / r^{\beta}, \quad (3)$$

where $P(r)$ — is the economic indicator of the company with rank r; P_1 — is the economic indicator of the company with rank 1; β — is the rank coefficient.

Consequently, the closer the capitalisation values of the rank parametric distribution are to its approximating function (3) with the rank coefficient β ∈ [0.5; 1.5], the higher is the stability of this economic cenosis of stock market issuers. The parameter of the approximating function β is determined by the following formulae:

$$\min \sum_{r=1}^{N} \left| C(r) - \frac{C_1}{r^{\beta}} \right|, \quad (4)$$

$$\min \sum_{r=1}^{N} [C(r) - C_1 / r^{\beta}]^2, \quad (5)$$

where C(r) — is the observed capitalisation of the issuing company of the stock market with rank r; C 1 — is the capitalisation of the company with rank 1.

Formula (4) is based on the method of least moduli, formula (5) — is based on the method of least squares.

Figure 1 shows the rank parametric distribution of the first 100 companies of S&P 500 by capitalisation parameter, as of 04.10.2023,[1] and the approximating function constructed to it with the ranking coefficient β = 0.7534, calculated by formula (4). Additionally, *Fig. 1* shows hyperbolic *H*- distributions (3) with rank coefficients β = 0.5 and β = 1.5, limiting the stability region.

Visual analysis of the graphs in *Fig/ 1* shows that the observed capitalisation of S&P 500 companies, as of 04.10.2023, is mostly in the stability region (except for companies with ranks 2 and 3). Moreover, the entire constructed approximating curve to the empirical capitalisation data of these companies is also located in the stability region. The capitalisation data of the top five ranked companies of the S&P 500, as of 04.10.2023, and their corresponding *H*-distribution values with rank coefficients β = 0.5 and β = 1.5, presented in *Table 1*, confirm that the capitalisation of companies with ranks 2 and 3 is outside the sustainability area.

To assess the proximity of capitalisation values of the rank parametric distribution of issuing companies to its approximating function of the hyperbolic *H*-distribution, we introduce a dimensionless indicator of the stability of the economic cenosis of the stock market:

$$\Pi_{mnm} = \left| \sum_{r=1}^{N} C(r) \right| / \sum_{r=1}^{N} \left| C(r) - C_1 / r^{\beta_{\min}} \right|, \quad (6)$$

$$\Pi_{mnk} = \left(\sum_{r=1}^{N} C(r) \right)^2 / \sum_{r=1}^{N} \left[C(r) - C_1 / r^{\beta_{\min}} \right]^2, \quad (7)$$

where $C_1 / r^{\beta_{\min}}$ — is the approximating hyperbola to the empirical rank parametric distribution $C(r)$; β_{min} — solution to the extreme problems (4) or (5).

Calculation of the stability index according to formula (6) is carried out using the method of least moduli, and the calculation according to formula (7) corresponds to the method of least squares. It follows from formulas (6) and (7) that a greater stability index characterises greater stability of the stock market.

Finding the maximum values of stability indicators (6), (7) when changing the values of capitalisation of some selected companies makes it possible to obtain those values of their capitalisation at which the economic structure under consideration has maximum stability with the capitalisation of other issuing companies remaining unchanged. For this purpose, we select companies whose capitalisation differs sufficiently from the corresponding values of the approximating curve, for example, with rank 2 and 3 (*Fig. 1*).

The developed methodology for assessing the sustainability of the stock market includes:

[1] URL: https://ru.tradingview.com/symbols/SPX/components/ (accessed on 04.12.2023).

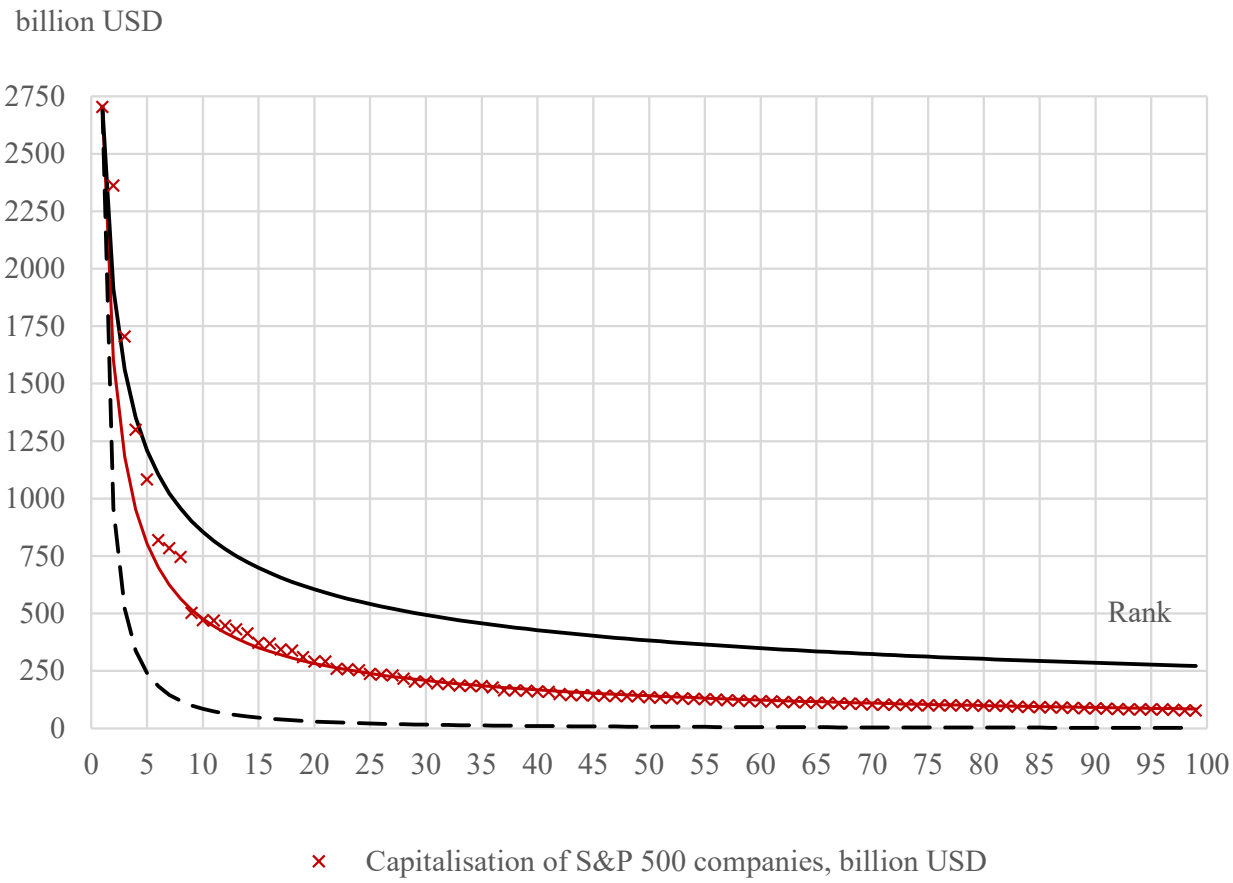

Fig. 1. **The area of stability for rank parametric distributions of S&P 500 companies**

Source: compiled by the author.

Table 1

Capitalization of the top 5 S&P 500 companies and *H*-distribution values with β = 0.5 и β = 1.5

Rank	1	2	3	4	5
S&P 500 companies' capitalisation data (as of 04.10.2023), USD bln.	2705.00	2362.00	1706.00	1300.00	1084.00
H-distribution with β = 0.5	2705.00	1912.72	1561.73	1352.50	1209.71
H-distribution with β = 1.5	2705.00	956.36	520.58	338.13	241.94

Source: compiled by the author.

• selection of a time interval for cenological analysis and selection of a set of companies — issuers of the stock market;

• construction of rank parametric distribution of issuing companies by the selected parameter (capitalisation) for each reporting time period (quarter, half-year, year) of the selected time interval;

• determining whether the selected economic system of stock market issuers belongs to the cenological type according to the value of the Kendall coefficient ($W > 0.5$), formulas (1), (2);

• construction of approximating function of hyperbolic H-distribution according to formulas (4), (5) and determination of stability assessment of the given stock market by the selected parameter for each reporting time period (quarter, half-year, year) according to formulas (4)-(7).

COMPARISON OF SUSTAINABILITY OF ISSUING COMPANIES ON THE EXAMPLE OF MOSCOW STOCK EXCHANGE AND S&P 500 INDEX COMPANIES

To study the sustainability of the economic system of Moscow Exchange issuing companies in the period from 2022 to 2023, rank parametric distributions of the first 100 companies by the size of their capitalisation are formed. Based on the obtained data on the dynamics of capitalisation ranks of the issuing companies for 2022 and 2023[2] the Kendall's coefficient of concordance is determined using formulas (1) and (2), which takes the value: $W = 0{,}9872 > 0{,}5$. Similarly, the coefficient of concordance is determined for the economic system of the first 100 companies from the S&P 500 index, which for the data on the value of their capitalisation for 2022 and 2023[3] takes

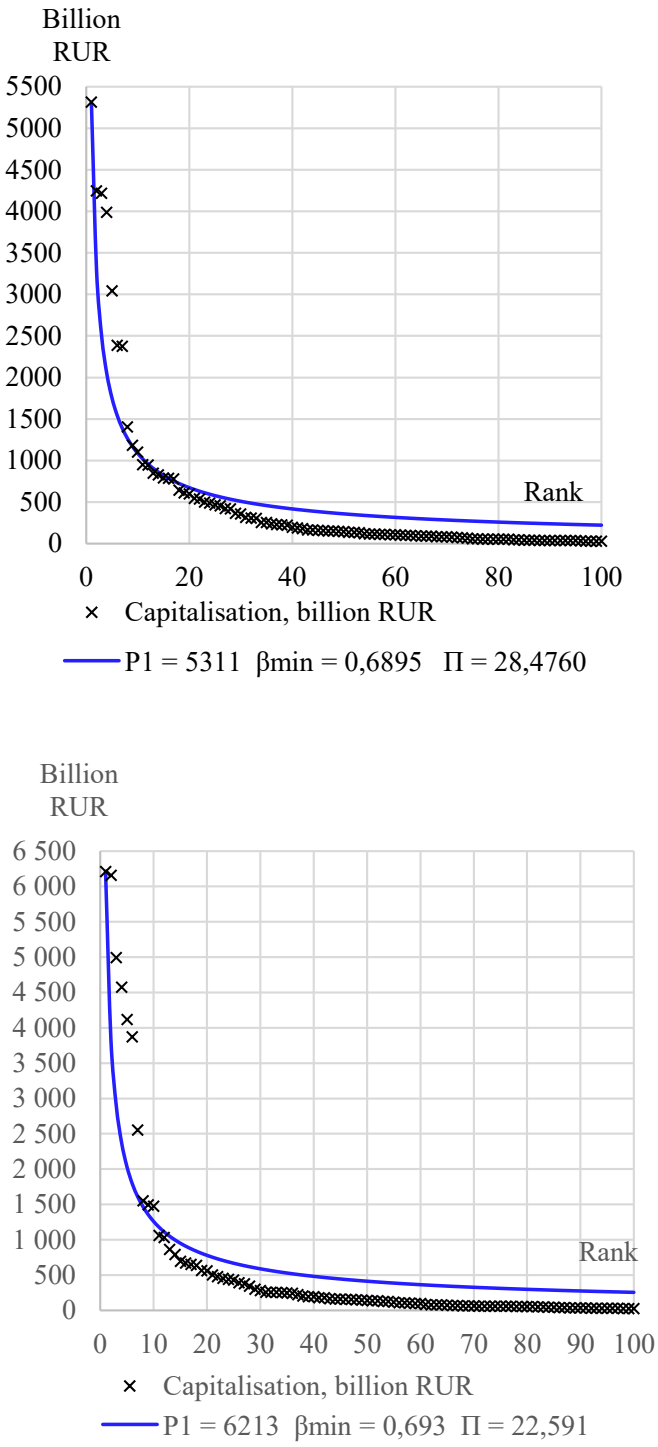

Fig. 2. **Rank parametric distribution of the first 100 companies by capitalization of the Moscow Stock Exchange and the hyperbolic H-distribution curves approximating them**

Source: compiled by the author.

[2] URL: https://smart-lab.ru/q/shares_fundamental4/order_by_title/asc/?field=market_cap (accessed on 04.12.2023).

[3] S&P 500 Index. List of SP: SPX stocks. TradingView Inc., 2023. URL: https://ru.tradingview.com/symbols/SPX/components/

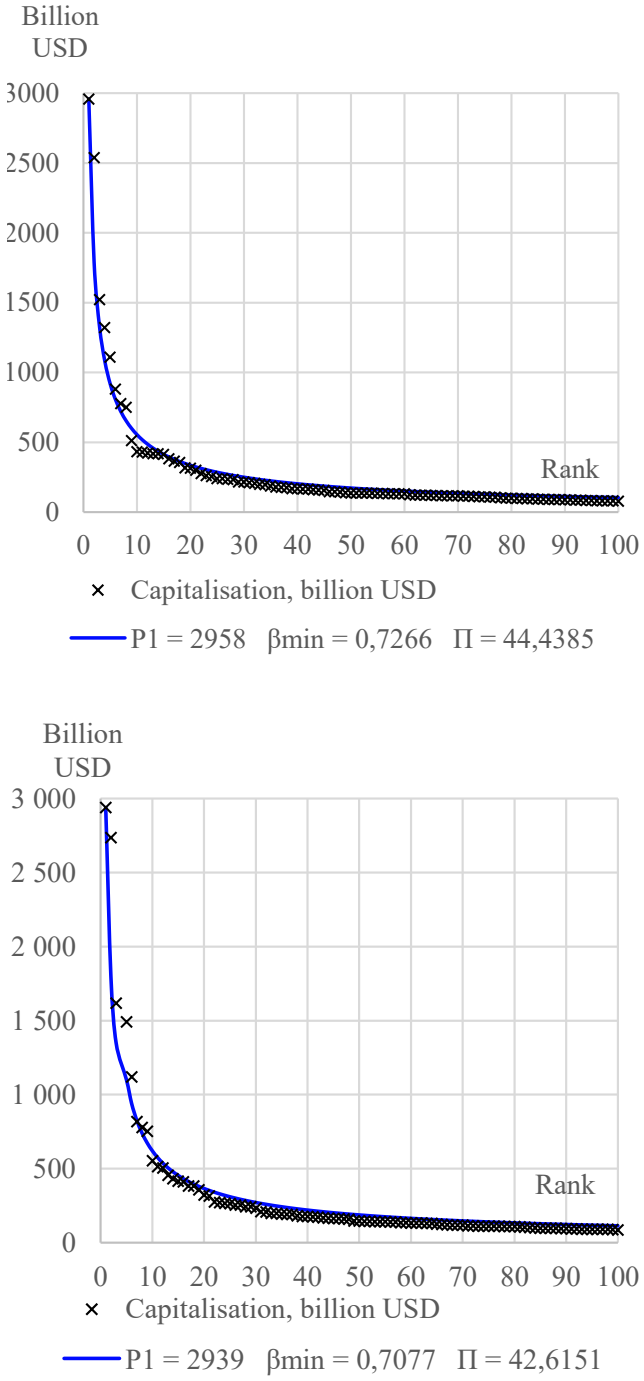

Fig 3. **Rank parametric distributions of the first 100 companies by capitalization of the S&P 500 and the hyperbolic H-distribution curves approximating them**

Note: P1 — capitalisation of the company with rank 1; βmin — rank coefficient, which gives the minimum value to the problem (5); П — stability indicator calculated by formula (7).
Source: compiled by the author.

the value $W = 0,9998 > 0,5$. Consequently, the economic systems of the Moscow Exchange and S&P 500 Index issuers under consideration can be classified as economic cenosis.

To compare the sustainability of the Moscow Exchange issuing companies and the S&P 500 Index from 2022 to 2023, data on the value of their capitalisation as of 01.07.2023 and 04.12.2023 are considered. *Figure 2* shows the rank parametric distributions of the first 100 Moscow Exchange companies by capitalisation and the approximating curves of the hyperbolic *H*-distribution. The first graph is based on capitalisation data as of 01.07.2023, and the second — as of 04.12.2023.

Figure 3 shows the rank parametric distributions of the first 100 S&P 500 companies by capitalisation and the approximating curves of the hyperbolic *H*-distribution. The first graph is based on capitalisation data as of 01.07.2023, and the second — as of 04.12.2023.

Determination of β_{min} in problem (5) is carried out using a nonlinear optimisation method based on Nelder-Mead simplex search in the Matlab software environment.[4] Based on empirical data on rank parametric distributions and their corresponding generated approximating hyperbolic functions (3), the stock market stability indicators (П) are calculated by formula (7).

Table 2 presents calculated data of rank coefficients of approximating curves of hyperbolic *H*-distribution, as well as indicators of stock market stability of Moscow Exchange companies and S&P 500 index companies as of 01.07.2023 and 04.12.2023.

The analysis of *Fig. 2, 3* and the calculated data presented in *Table 2* shows that the capitalisation values of the first 100 companies of the Moscow

(accessed on 04.12.2023). Largest 1000 US Companies in 2023. Top Companies from the United States as of Jul. 01, 2023. URL: https://disfold.com/united-states/companies/ (accessed on 04.12.2023).

[4] Find minimum of unconstrained multivariable function using derivative-free method. The MathWorks, Inc. URL: https://www.mathworks.com/help/matlab/ref/fminsearch.html (accessed on 04.12.2023).

Table 2

Rank coefficients of approximating curves of the hyperbolic H-distribution and indicators of stability of stock markets

Parameters	01.07.2023	04.12.2023
Moscow Stock Exchange		
βmin	0.6895	0.6930
Π	28.4760	22.5911
S&P 500		
βmin	0.7266	0.7077
Π	44.4385	42.6151

Source: compiled by the author.

Exchange and the S&P 500 index are close enough to their most stable state (rank coefficients of approximating curves in the interval $\beta \in [0.5; 1.5]$). Therefore, the above economic systems of the issuing companies are sufficiently stable in the cenological sense.

However, a visual comparison of the graphs in *Fig.2 and 3* shows that the approximating curves in *Figure 3* are closer to the rank parametric distributions of capitalisation of S&P 500 index companies than the approximating curves in *Fig. 2* are to the rank parametric distributions of capitalisation of Moscow Exchange companies. The results of calculations of stability indicators of these stock markets, presented in *Table 2*, confirm this fact. Judging by *Table 2*, the stability index of the Moscow Exchange companies is much lower than the stability index of the S&P 500 index companies. Moreover, over the period from 01.07.2023 to 04.12.2023, the sustainability index of the Moscow Exchange decreased by 20.67%, while that of the S&P 500 index — only by 4.10%.

Thus, we can conclude that the economic system of the S&P 500 index companies representing the US stock market is more sustainable than that of the Moscow Exchange companies representing the Russian stock market. The different rate of decline of the sustainability indicator may depend on both its initial value and negative factors affecting the economic system of the stock market.

Taking into account the results of the study of sustainability of stock markets in Russia and the United States, it is advisable to identify the following areas of possible activities of domestic stock market regulators to improve the sustainability of the economic system of issuing companies:

• creating conditions for attracting long-term financial resources to the Russian stock market, especially from Russian residents and non-residents from friendly countries;

• limiting the inflow and outflow from the Russian stock market of financial resources of non-residents from unfriendly countries;

• creation of attractive conditions for domestic backbone financial institutions to operate on the Russian stock market in the first place;

• creation of favourable conditions for attracting financial resources of private Russian investors.

The closer the economic system of the Russian stock market is to its most stable state, the better its structure reflects the real state of the Russian economy. The optimal structure of the Russian stock market is characterised by the fact that the share of capitalisation of its various sectors roughly corresponds to the shares of these sectors in the country's economy.

CONCLUSIONS

The developed methodology provides an opportunity to carry out a pricing analysis of structural changes in companies — issuers of the stock market as a single economic system and calculate the assessment of its stability by the key parameter — capitalisation. The given dimensionless stability index determines the proximity of rank parametric distributions of companies to the most stable (optimal) cenological structure of the stock market economic system described by the hyperbolic *H*-distribution with a rank coefficient in the interval $\beta \in [0.5; 1.5]$. Finding the maximum of the stability index of variational problems (7) and (8) allows to determine the potential movement of the exchange rate value (investment valuation) of the selected shares of the issuing companies under the condition of aspiration of the considered economic system of the stock market in the process of its evolution to the most stable position.

Numerous Russian and foreign specialised Internet resources engaged in the analysis of stock market processes provide on their websites current information on the main parameters of companies — issuers of various stock markets, including the capitalisation indicator. On the basis of this information it is possible to calculate the current value of the stability indicator for the stock market under consideration. This information may be useful not only for stock market participants, owners and acquirers of companies, but also for potential ordinary investors.

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