ISSN 1075-7007, Studies on Russian Economic Development, 2024, Vol. 35, No. 4, pp. 518–529. © Pleiades Publishing, Ltd., 2024.
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FINANCIAL PROBLEMS

Investor Sentiment and Stock Market Dynamics: Ways to Forecast Stock Prices

V. D. Milovidov*

Moscow State Institute of International Relations, Ministry of Foreign Affairs of Russia, Moscow, Russia

**e-mail: vmilovidov@hotmail.com*

Received January 22, 2024; revised February 7, 2024; accepted February 21, 2024

Abstract—The article analyzes search queries in the Russian and American segments of Google. The author proposes a methodology for selecting and classifying search queries that reflect investor sentiment, which potentially influence the activity of the population in the financial market. The article calculates sentiment indices for the United States and Russia, demonstrating a high correlation with the national stock indices S&P500 and IMOEX. The author summarizes that financial market quotes can be determined as indicators of investor sentiment, which in turn are formed on the basis of a complex of economic and noneconomic factors.

Keywords: Google, S&P500, IMOEX, investor sentiment, stock market, market quotes, sentiment index, investor behavior, social networks

DOI: 10.1134/S1075700724700072

Introduction. The financial market is that area of human economic activity where uncertainty reigns. It is beyond human capabilities to predict all the fluctuations in market conditions, to anticipate its ups and downs, and most importantly, to clearly identify absolutely all the factors and reasons that underlie these fluctuations. However, the path to the stock market is far from hidden in impenetrable thickets, it is well trodden by countless numbers of investors who simply ignore their ignorance of all sorts of market variables. Only in 2020–2022, around the world, tens of millions of retail investors, who have traditionally been distinguished by conservatism and aversion to risk as such, entered stock markets. An analysis of their behavior undertaken by the author in previous works [1–3] shows that the mass entry of these players into the stock market was accompanied by the formation of emotional communities in social networks, gamification of investments, that is, an increase in the game element in the decision-making process, and manifestations of signs of a financial subculture (special jargon, symbolism of successful and unsuccessful investments, demonstrative behavior), as well as the growth of search activity on the Internet. The investment decisions of mass investors were supported by a collective type of behavior, the exchange of opinions, knowledge and information on social networks. This significantly expanded the sensory and emotional component of financial transactions, increasing the separation of market quotes from the dynamics of objective economic indicators.

This transformation of mass investor behavior in the financial market had twofold consequences. On the one hand, it increased the unpredictability of the financial situation and provoked investors' "raids" on the shares of certain issuers. However, on the other hand, it opened up the opportunity to track the behavior of investors by their activity on social networks, measure sentiment and accumulate an array of data that could allow assessing future changes in market conditions. Thus, the behavioral factors of the financial market became available for quantitative analysis. It is the absence of the latter that is often the reason for criticism and denial of behavioral finance as a science by adherents of formalized neoclassical financial theory, such as the author of the hypothesis[1] efficient financial markets Eugene Fama.[2]

Search queries on the Internet and, in particular, on Google, as the dominant modern search engine, correlate with the growing interest of the general public in the financial market, helping it find a guide in the complex world of finance. Today, researchers of the causes of market volatility, adhering to the concepts of behavioral economics and finance, are almost unanimous in the fact that, other things being equal,

[1] The efficient market hypothesis implies that all significant information is immediately and completely reflected in the price of securities.

[2] Fama E. Inflation is totally out of the control of Central banks. Interview to "The Market." 2020. August 10. https://themarket.ch/english/inflation-is-totally-out-of-the-control-of-central-banks-ld.2476.

search queries on the Internet reflect investor sentiment and their attention to financial indicators, and thereby reveal intentions to make transactions with financial instruments. The much more difficult questions are which search terms are most consistent with this finding, and whether they actually precede the decision to invest rather than being a reaction to changing market conditions?

The motivations for decisions in the financial market are complex, and their cause-and-effect relationships with processes occurring in the market are very confusing. However, the most important "commodity" in the financial market is expectations of future income, and in this sense, moods, expectations, fears, that is, the emotional mood, by definition, plays the role of a conditional predictor of decisions made by investors. The author understands the existence of a constantly revolving feedback loop between variables such as investor sentiment and market prices of financial assets. However, today there is no indisputable evidence as to which of these variables is primary in the endless cyclical nature of their mutual conditionality.

In the article, the author offers readers a deliberately provocative hypothesis: the primary source of fluctuations in market prices are the special moods of people, even those not having a direct connection with the financial sector, which, however, strengthen the economic determination of market participants—individuals ("physicists")—their focus to increase well-being, income, and quality of life. These sentiments help overcome ignorance, conservatism and risk aversion, focus attention on financial instruments and create a growing demand for them. In other words, people's positive moods increase their attention to market transactions and turn them into investors, perhaps without significantly increasing the total body of knowledge they have. That is, interest in the financial market is an element of general optimism and determination of the broad masses of people.

At the end of the 19th century, the Russian scientist and lawyer L.I. Petrazycki, speaking about the psychological motives of speculation in the financial market, formulated the category of "optimistic premium," thanks to which people overcome the ignorance and fear that holds them back and rush to the financial market [4]. Nearly four decades later, J.M. Keynes proposed the category of "animal spirit," which has become popular among behavioral economists, meaning a certain state of mind, an internal strength that motivates a person to invest activity, while forgetting about possible losses and damage. At the same time, Keynes called for taking into account what such a cheerful attitude of an investor may depend on: "nerves, a tendency to hysteria, even digestion and reactions to changes in weather" [5].

The author of the article aims to use an analysis of search queries on Google to try to measure the components of the "optimistic premium" or "spirit of cheerfulness" and propose an index of search query sentiment, which could be considered not only as an indicator, but possibly as a predictor of changes in market conditions.

Rhetoric of search queries. The efficient financial markets hypothesis implies that all information is reflected in the prices of financial assets. The mechanism of information saturation of market prices, according to E. Fama, is based on the constant competition of numerous, rational market participants. Fama divided them into "analysts" (adherents of fundamental analysis) and "chartists"[3] (specialists in technical analysis). Both seek to maximize their income by predicting the future price level [6].

The idea that market prices ultimately reflect all the knowledge available to economic agents was, before Fama, expressed in a more generalized form by Hayek [7]. However, it is the emphasis on information, as a narrower concept, which has become dominant in neoclassical approaches to financial market analysis.

The most important condition of the hypothesis put forward by Fama is absolutely free and free access to information for market participants [8]. Grossman and Stiglitz doubted the realism of the theoretical abstraction, noting that taking into account the cost of information factor, prices cannot fully (perfectly) reflect all the information that is available [9]. However, these two contradictory conclusions do not deny a more important circumstance, namely the inevitable need for market participants to collect and analyze the maximum possible information from any sources available to them. Moreover, it is quite obvious that attempts by market participants to obtain information quickly and without additional costs will precede attempts to obtain it, first by making more efforts, and then by paying. And in the process of obtaining paid information there will be a scale of priorities: from the cheapest methods to the more expensive, until the cost of information exceeds the potential income from transactions with financial instruments.

Another important condition for the implementation of the hypothesis of efficient financial markets is the agreement of all players that the available information actually influences the current and future prices of financial instruments. In reality, this condition is also controversial: any information can affect prices, so investor consensus will most likely be possible regarding a very limited list of it. In addition, information may not only have different costs, but also different quality. Moreover, in this case we are not talking about deliberate manipulation of information. It can be ambiguous, equivocal, incomplete, and of a general nature, due to which the investor is simply unable to

[3] From chart (English)—diagram; technical analysis is based on the interpretation of the configuration of stock price charts.

make any meaningful decision based on it. Ellsberg proved that in ordinary life situations, when faced with information ambiguity, a person makes a decision, choosing not so much the lesser of two evils as the one that he can evaluate and measure [10]. Based on this "Ellsberg paradox," Epstein and Schneider showed that in the financial market the risk of ambiguous information is expressed in price discounting, in investors' attempts to compensate for the low quality of information with an "ambiguity premium" [11]. However, the understanding of the ambiguity of information, as well as the perception of it by all market participants, can be completely different. This will make it more difficult to take into account such information in the pricing process, pushing investors to look for simpler and more unambiguous clues for making a decision.

The impression that information is ambiguous can also arise due to the psychological and physiological characteristics of a person. In the literature on information systems, the concept of throughput capacity of information channels has become widespread. It is also applicable to the behavior of financial market participants, each of whom, due to a combination of reasons, has different abilities to perceive information. The greater the flow of information that needs to be processed, the more, other things being equal, investors will experience greater difficulty in perceiving and analyzing it.

As Sims proves, in conditions of limited ability to perceive information, investors will be prone to the so-called selective or rational inattention, that is, meaningful avoidance of information that they currently consider noise [12, 13]. In this logic, "accentuated" information receives the greatest power, that is, that which is highlighted in the source and attracts attention. In fact, in development of this idea, Barber and Odean formulated a special strategy for the acquisition of attention grabbing stocks by retail investors [14].

Taken together, the above means that for the formation of prices in the financial market, not just all information will be of particular importance, but that which attracts the attention of investors, is perceived by them, is emphasized for them by sources, which, in particular, are the media or social networks, and related with it, risks can be determined with greater or less accuracy. In fact, following precisely this logic, Tatlock focused his attention on negative information in the media and showed how it affects stock prices [15]. His research largely anticipated subsequent scientific work that analyzed the impact of Internet search queries on the financial market. The technique of selecting words with negative connotations used in the media and comparing the frequency of this use with the dynamics of the Dow Jones Industrial Average (DJIA) has been adopted by a number of authors.

However, Tetlock's findings are primarily important for another reason. It turns out that information that is emphasized in the source, that is, attracts attention and is obviously positively or negatively colored, serves as a basis for investors to make decisions. In this regard, the question arises: what information is reflected in prices? The piece that was independently obtained and processed by competing market participants maximizing their income, or the other that was presented to them by the media, and how does one differ from the other? With this formulation of the question, the hypothesis of efficient financial markets will require many reservations and further deepening into the very concept of information.

In conditions of uncertainty, the considered factors of distortion or limitation of information due to its cost, low quality and ambiguity, and difficulties in its perception by investors can lead either to the latter's refusal to carry out certain financial transactions with securities, or to the desire to somehow compensate for the lack of information. Let us assume that it is impossible to compensate for this shortcoming by applying even greater efforts to search for information, since in the end this will be a cyclical process that closes on itself, with a dubious result. These attempts aside, compensation could probably be material in the form of price discounting.

However, another approach to solving the problem of lack of information is quite possible. For example, a person can make a decision not on the basis of his "solid" knowledge, but "by mood," which is determined by emotions, internal vitality, "animal spirit," "optimistic premium." Thus, in a state of euphoria, even with a lack of information, an investor, anticipating a high return, will be willing to pay more for a financial asset, not less, as if he were discounting the price of this asset taking into account the uncertainty and ambiguity of information.

As justified by Schwartz, feelings can be considered as information that is taken into account when making a decision [16]. Immersing people's feelings and moods in the common pot of information they need to make final decisions seems to be a logical compromise between the efficient markets hypothesis and behaviorism, since in this case it will be possible to accurately say that ALL information is reflected in prices. However, this conclusion gives rise to other questions: firstly, how to measure the process of accumulation by potential investors of all information, including knowledge, experience, sentiments, emotions, and secondly, how to assess the impact of this information on the dynamics of prices for financial assets?

Attempts to answer these questions lie in the plane of measuring investor sentiment, their quantitative processing and comparison with market indicators, for example, with stock indices.

So, Sakariyahu and a group of fellow researchers classified the scientific literature on economic sentiment into five areas: 1) study of sentiment based on market indicators (market-based studies), the results

of which, for example, are the fear and greed index, the Baker–Wurgler Sentiment Index and a number of others; 2) sentiments of social network users (media-based studies); 3) sentiments of search queries on the Internet (internet-based studies); 4) so-called "non-fundamentally based studies," that is, sentiments of the widest spectrum not related to the financial market; 5) sentiments revealed during public opinion polls (survey-based studies) [17]. If we are guided by this classification, then in this article the author primarily focuses on two to four areas.

Considering the array of sentiment studies based on processing data from social networks and Internet queries, it should be noted that the vast majority of them were conducted on materials from the United States [18]. However, increasingly, works are appearing based on the analysis of data from other countries, for example, France [19], Turkey [20], Norway [21], India [22], Portugal [23], China [24, 25], Russia [26], as well as by region.

For example, Dimpfl and Yank analyzed the influence of search queries on Google on the dynamics of four key regional indices: DJIA (United States), FTSE (UK), CAC (France), DAX (Germany) [27]. Noteworthy are comparative studies from the United States, Canada, Great Britain, Australia [28–30], as well as the Philippines, Indonesia, Malaysia and Thailand [31]. The most extensive studies in terms of regional coverage were carried out on 31 countries of the world by Akarsu and Suer [32], as well as an international group of scientists led by Szzygielski, who compared the influence of search queries and the dynamics of MSCI country indices, which in total cover the financial markets of 77 countries [33].

Along with the regional focus, scientific publications on the problem under consideration differ in the setting of tasks, goals and research methodology. Researchers focus on both the sentiment itself and the attention of investors. In the first case, the emphasis is on the wording of the requests, their connotation; in the second case, the intensity of the requests. Liu, Yang and others, using the example of the Chinese commodity futures market, combine the analysis of investor sentiment and attention, showing that in some cases the dynamics of investor sentiment and attention may not coincide [25]. Search sentiment researchers tend to adopt Tetlock's methodology, focusing on terms with negative connotations that reflect investor uncertainty and uncertainty. This methodology consists of using dictionaries of special (financial) or general terminology, as well as tools of formal contextual analysis, which allows one to evaluate the positive or negative meaning of the selected term. Next, the intensity of queries for selected terms in Google is checked and, based on the statistics obtained, sentiment indices are calculated, for example, indices of negative sentiments and fears [19, 34] or uncertainty [20, 30].

According to the author, the most interesting in this group of studies is Brochado's idea to construct an aggregated index that reflects the ratio of positive and negative investor sentiment at a specific point in time [23]. Comparing such an index with the dynamics of market indicators makes it possible to capture the impact of changes in investor sentiment on market conditions, and not positive or negative sentiment taken separately. The author uses a similar idea when developing his own search query sentiment index.

If we talk in general about the shortcomings of the methodology for studying investor sentiment based on search queries, then, first of all, we should note the "dictionary" approach to the selection of terms tested for popularity on the Internet. Ordinary Internet users do not speak "dictionary language." Each of us, turning to an Internet search, formulates a query simply and briefly in order to obtain the most complete set of links on the issue of interest. We hardly think about the dictionary accuracy of the word or expression used, or even the correctness of its spelling, so some queries may include a variety of abbreviations and spelling errors (the Google search engine algorithm always suggests correcting the spelling of a query). Dictionaries can provide guidance in the process of selecting analyzed queries, but in no way serve as their main source.

The pioneers of the analysis of investor attention reflected in search queries are Mondria, Wu and Zhang, who were the first to try to compare user interest in different countries in one of the first search engines Netscape Navigator with the interest of national investors in foreign financial instruments [35]. According to their findings, the growth of investment in foreign assets, as a rule, is a consequence of investors' attention to other countries, and most importantly, their awareness of such countries. Almost simultaneously with this group of researchers, Da, Engelberg and Gao conducted an analysis of the popularity of queries for more than 3600 companies (their "tickers"[4] in trading systems) whose shares are (or were included) in the Russell 3000 index [36]. They confirmed Barber and Odean's findings about the tendency of individual investors to buy attractive securities and argued that increasing popularity of inquiries about a security generally increases its price. More than ten years later, Da, in the team of his new coauthors, somewhat corrected the results he had previously obtained. After studying Google searches as an indicator of retail investor attention and daily readership statistics on Bloomberg articles as an indicator of institutional investor attention, he and his colleagues concluded that an increase in retail investor interest was more likely to predict a decline in security prices than an increase in the interest of Institutions predicts an increase in prices [37]. The method chosen by these

[4] Ticker (ticker symbol, English) is a short name in the exchange information of quoted financial instruments.

researchers for assessing investor attention by company names or tickers has become widespread today [21, 22, 31, 32, 38, 39].

Another direction of research into investor attention involves choosing not the names of individual companies, but numerous financial and stock exchange terms. In the scientific literature, variations in the choice of the wording of thematic queries, both in meaning and in quantity, are quite wide. For example, these could be single root concepts "stock," "dow," names of indices, financial media, etc. [25, 28, 40, 41], or dozens and even hundreds of terms selected from the dictionary and reflecting the broad topics of the financial market [42, 43]. Taking into account the methodology used by the authors working in this logic, this direction can be considered transitional from the study of attention to the study of moods. The fact is that a search for specific names of shares or their stock tickers should hypothetically reflect a higher level of interest and attention of investors to operations on the market; this interest is substantive. Requests on general financial topics, on stock indices, most likely can reflect a wide range of investor feelings: from simple curiosity to fear of the unknown and randomness, provoked, for example, by current news.

In the gradation of knowledge states, the general financial terminology of queries can signal attempts by Internet users to clarify the boundaries of their own ignorance. The broader the wording of the request, the more likely it is that the person asking it on the Internet does not have any conscious and specific goals. In addition, this may indicate his initial level of attention to the market, extremely little experience and knowledge in this area. In this case, the path of a market participant to actual purchases may be quite long, which means that the correlation of his attention with the dynamics of financial indicators may turn out to be random and have no predictive power.

A look searching for similarities. Much less popular, but more intriguing in terms of possible results, are studies of a wide range of sentiments that do not have a clearly expressed financial component. Currently, one can find examples of studying the influence of religious sentiment on market dynamics; moods caused by weather changes; natural disasters or, for example, sporting events. Of course, one can treat such studies with a grain of salt, just like the examples of "financial astrology" that have appeared in the scientific literature, trying to identify the influence of stars and planets on the dynamics of stock quotes. Due to the limited scope of the article, the author avoids their detailed analysis. Nevertheless, there is a rational grain in the study of "not fundamentally justified" sentiments.

Firstly, interest in financial transactions cannot be divorced from a person's general perception of the surrounding reality. The author believes that substantive, investment-focused sentiments (desire for income, optimism about the growth of stock prices, willingness to accept or not accept risk) are part of a much broader set of sentiments of people in specific current conditions. Most likely, optimism regarding financial transactions should, to a greater or lesser extent, correspond to a person's general optimistic mood regarding other aspects of his life and activities.

Secondly, the choice of specific "focused" sentiments, which are expressed in a substantive interest in specific stocks, indicators, financial transactions, each time refers us to the dilemma of primacy: either market dynamics encourage these sentiments, or sentiments lead to certain changes in market prices. When we move to a wide range of relationships, we thereby distance ourselves from this interdependence. After all, it is hardly possible to say with confidence, for example, that the positive dynamics of the stock market contributes to a person's desire to buy a car or a house, go on vacation, go to a restaurant, or find a new higher-paying job. Theoretically, here too one can trace the power of influence of stock exchange speculation, but only very indirectly and conditionally. But a feeling of well-being and satisfaction with life may well push a person to riskier ways of investing part of their savings. Guided by these considerations, the author proposes to consider a set of queries on Google, which, in his opinion, reflect various life situations and may indicate certain sentiments of network users who are not directly related to the financial market.

Any study of the impact of search queries on the dynamics of the financial market begins with solving one difficult task: to formulate search queries that are accurate and relevant to the objectives of the study. Its difficulty is that the researcher actually has to think for those whose behavior and attention he would like to study. Due to the natural fear of making a mistake or being subjective, the authors of the above scientific works turned to dictionaries as independent sources of query formulations. Nevertheless, trying to imagine what kind of queries certain users might formulate on the Internet is a creative and extremely exciting task. As the English rhetorician and literary critic Ivor Richards noted, all people have an "eye for resemblance" [44]. According to the author, it is the rule of reasonable similarity that should be followed when selecting the wording of search queries to check the sentiments of Internet users. Following this rule, we must put ourselves in the place of a reasonable Internet user and imagine how, ceteris paribus, we ourselves would formulate our query in a search engine.

Previously, the author analyzed the relationship between the popularity of search queries with predominantly financial content on Google and stock market indicators using data from the American segment of the search engine [1–3]. In this article, the author complicates the task: to analyze the dynamics of the popularity of search queries across a wider range of sentiments in the United States and Russia, to calcu-

late on this basis the sentiment indices of Russian and American investors, comparing them with the dynamics of the most representative national stock indices: S&P500 in the United States and the Moscow Exchange Index in Russia (IMOEX).

The author's attempt to compare consumer demands in Russia and the United States can be considered a certain preparation for this analysis [45]. Based on previous research and experience gained in the process of analyzing synonymous search queries of Americans and Russians, the author offers a list of 84 words and expressions (keywords), 42 each for the Russian and American segments of Google. This list is based on formulations previously studied in the mentioned works. Each of the country groupings, in turn, is divided into two parts of 21 keywords, which are defined by the author as goal-oriented queries (purpose-driven) and problem-driven queries. This division is largely subjective in nature, however, the author iteratively tried to ensure that goal-oriented requests were more likely to be proactive in nature, aimed at achieving a specific goal, improving the quality of life, and success. Problem-oriented requests, in a certain sense, are "defensive" in nature, that is, they focus on solving a certain problem, everyday issues, overcoming fatigue, negative psychological symptoms, seeking social support, "making ends meet."

When distributing keywords into groups, the author adhered to the following hypothesis: proactive, goal-oriented queries should generally correspond to more risky behavior, reflect a positive emotional mood, optimism, therefore, most likely, they will have a positive correlation with financial indicators, that is, grow along with market growth. As for problem-oriented requests, some of them reflect an increase in fatigue and emotional tension, which may well also positively correlate with general economic euphoria and investment excitement, which may result in these problems (for example, in Russia such requests are depression, psychologist, coffee, burnout, what to do, how to fall asleep, in the United States – depression, psychiatrist, caffeine, get tired, anxiety, can't sleep). The list of problem-oriented queries includes the name of the drug "Adderall," used in the United States, among other things, to overcome attention deficit hyperactivity disorder (ADHD), which, judging by some publications, affects more and more American adults.[5] It is believed that this phenomenon is the result of increased mental stress and intense workload, so this syndrome is detected in many employees of technology firms in Silicon Valley. The name of the drug "Phenibut" was chosen as a synonymous query in the Russian segment of Google.

[5] What performance-enhancing incentives mean for economic growth // The Economist. 2023, May 25. https://www.economist.com/finance-and-economics/2023/05/25/what-performance-enhancing-stimulants-mean-for-economic-growth.

Some problem-oriented requests reflect sentiments that can distract from active investment activities and are a consequence of people being immersed in everyday problems (in Russia—looking for a job, making money, in the United States—find a job). This part of the queries indicates nervousness and psychological discomfort (about happiness, horoscope for today), lack of money and the need to save (amortization, sales, buy cheap, used car, welfare, prices). This group of requests accompanies a negative turn of events in the market (stock market quotes, short sales). Thus, goal-oriented and problem-oriented requests seem to balance each other. This is an important condition for the further construction of a sentiment index, which represents precisely the balance of positive and negative emotions.

Most of the compared search queries are identical and can be considered linguistic analogs, some are semantically similar, only a few are rather associatively close. The complete list of requests is given in Table 1.

In accordance with the given classification, the author obtained data on the popularity of goal-oriented and problem-oriented queries from 2006 to 2023 inclusive in all search categories on Google, in English in the United States and in Russian in Russia. The specified time interval is determined by the appearance of the tool for analyzing the popularity of search queries Google trends (2004), as well as by the fact that in Russia more or less stable statistics of search queries on Google begin no earlier than 2006. The resulting series of popularity of search queries were compared with stock market ones indicators. Table 2 presents the values of the correlation coefficients of goal-oriented and problem-oriented queries with the corresponding stock indices.

At the next step of the analysis, the median value of the popularity of goal-oriented and problem-oriented queries was calculated for each month for the period 2006–2023. The obtained values were used to calculate the sentiment index. The final search query sentiment index for each month of the period under review was calculated as the quotient of the monthly median value of the popularity of goal-oriented queries divided by the monthly median value of the popularity of problem-oriented queries. Thus, in the case of rapid growth in the popularity of goal-oriented queries, the sentiment index should become higher than 1, and in the case of predominant popularity of problem-oriented queries, the sentiment index should become less than 1.

Results: financial market barometer? As a result of the analysis, final sentiment indexes of search queries in Google for Russia and the United States were obtained for the period 2006–2023. Over the entire period under review, the minimum value of the sentiment index in the United States was 0.41, and in Russia 0.39, the maximum value was 1.58 and 1.79, respectively, and the average was 0.91 and 1.03. In the

Table 1. Classification of Google queries used to calculate the sentiment index

Goal-oriented queries		Problem-oriented queries	
United States	Russia	United States	Russia
Identical in meaning and significance			
Money transfer	Transfer (money)	Today horoscope	Horoscope for today
Bank deposit	(Bank deposit)	ADHD	ADHD (attention deficit hyperactivity disorder)
Cash	Cash	Depression	Depression
Working hours	Opening hours	Prices	Prices
Buying better	Buy better	Used car	(Car) with mileage
Buy car	Buy a car	Sales	Sale
Salary	Salary	Work at home	Work from home
Purpose	Target	Buy cheap	Cheap buy
Bitcoin	Bitcoin	Welfare	(Social) benefit
Jobs hiring	Vacancies	Problem	Problem
Buy stocks	Buy shares	Stock market quotes	Quotes (stock market)
Close in meaning and meaning/synonymous			
Buy home (buy a house)	To buy an apartment	Adderall	Phenibut
Rent home (rent a house)	To rent an apartment	Caffeine	Coffee
Flights to	Airplane	Psychiatrist	Psychologist
Train to	Russian Railways	Get tired	Burnout
Where to eat	Cafe	Anxiety	What to do
Make money	Money	Can't sleep	How to fall asleep
Invest	Investments	Happiness	Oh happiness
Interest rate	Income	Find a job	Looking for a job
		Amortization (loan amortization)	Credit calculator
Other/associative			
Get a job	TIN	Short sale	Earn money
Get paid	IP		

process of comparing sentiment indices with stock indices, a fairly high correlation was revealed (Table 3).

Moreover, a graphical representation of the monthly dynamics of sentiment indices and stock indices also does not help much in determining the direction of the dependence vector. Nevertheless, the data obtained give some reason to assume that at certain points in time (at least) sentiment outpaces the dynamics of stock indicators. To try to see this, the author calculated six-month moving averages for sentiment indices and stock price indices (Figs. 1, 2).

As can be seen in the graphs presented, in the United States there are clearly four periods when the average smoothed values of the sentiment index are ahead of the dynamics of the average smoothed values of the S&P500 index: the crisis of 2007–2008, the election campaign of 2016, the pandemic of 2020–2021 and the "inflationary-energy crisis" of 2022. At the same time, noteworthy is the decrease in the sentiment index in the United States (that is, the increase in its problem-oriented component) during the second wave of the COVID-19 virus (second half of 2020) until mid-2021 The market failure in 2022 was certainly related to global economic problems and geopolitical tensions, but the deterioration in sentiment about six months earlier should not be discounted.

In Russia, there are also four periods of different durations when there was a rapid growth in sentiment: the crisis of 2007–2008, from mid-2011 to mid-2014, from the spring of 2017 to the beginning of 2018, from the beginning of 2022. During the last period, the sentiment index remained on the rise, despite the sharp decline in share prices at the beginning of the year. The subsequent market growth was also based on the

Table 2. Correlation of the popularity of queries on Google, in the United States and in Russia, 2006–2023

United States				Russia			
Goal-oriented queries	Correlation with the S&P 500 Index	Problem-oriented queries	Correlation with the S&P 500 Index	Goal-oriented queries	Correlation with the IMOEX index	Problem-oriented queries	Correlation with the IMOEX index
Money transfer	0.91	Caffeine	0.93	To buy an apartment	0.89	Phenibut	0.83
Bank deposit	0.91	Anxiety	0.90	TIN	0.89	Coffee	0.80
Get paid	0.90	Get tired	0.86	IP	0.79	Psychologist	0.79
Flights to	0.87	ADHD	0.85	To rent an apartment	0.76	What to do	0.67
Cash	0.86	Today horoscope	0.84	Salary	0.76	Burnout	0.66
Invest	0.83	Psychiatrist	0.83	Opening hours	0.72	ADHD	0.61
Working hours	0.83	Can’t sleep	0.63	Airplane	0.70	How to fall asleep	0.51
Jobs hiring	0.82	Adderall	0.44	Cash	0.69	Horoscope for today	0.46
Where to eat	0.82	Depression	0.05	Bitcoin	0.69	Benefit	0.43
Buying better	0.81	Prices	–0.27	Buy shares	0.66	Depression	0.40
Buy car	0.81	Used car	–0.26	Buy a car	0.64	Cheap buy	0.38
Salary	0.79	Sales	–0.40	Translate	0.60	Credit calculator	0.37
Make money	0.78	Work at home	–0.47	Buy better	0.49	Used	0.01
Purpose	0.73	Buy cheap	–0.61	Money	0.49	Quotes	–0.22
Interest rate	0.69	Welfare	–0.62	Cafe	0.48	Sale	–0.28
Get job	0.66	Short sale	–0.63	Russian Railways	0.46	Oh happiness	–0.44
Bitcoin	0.65	Stock market quotes	–0.66	Income	0.45	Problem	–0.61
Buy home	0.64	Happiness	–0.66	Contribution	0.43	Earn money	–0.68
Rent home	0.51	Find a job	–0.70	Vacancies	0.38	Work from home	–0.75
Buy stocks	0.44	Problem	–0.75	Target	0.36	Prices	–0.76
Train to	0.41	Amortization	–0.79	Investments	0.21	Looking for a job	–0.80

Source: Google trends, SPX Historical data. NASDAQ, Moscow Exchange.

Table 3. Summary data illustrating the relationship between search query sentiment and stock indices in Russia and the United States, 2006–2023

Index	Correlation	Index
Goal-oriented queries in Russia	0.96	Goal-oriented quieries in the USA
US Search Sentiment Index	0.91	S&P 500 Index
Goal-oriented queries in the US	0.90	S&P 500 Index
Moscow Exchange Index (IMOEX)	0.88	S&P 500 Index
Search Query Sentiment Index in Russia	0.87	US Search Sentiment Index
Goal-oriented queries in Russia	0.79	Moscow Exchange Index
Search Query Sentiment Index in Russia	0.76	Moscow Exchange Index
Problem-oriented search queries in Russia	0.45	Moscow Exchange Index
Problem-oriented search queries in Russia	0.43	Problem-oriented search queries in the US
Problem-oriented search queries in the US	0.31	S&P 500 Index

Source: Google trends, SPX Historical data. NASDAQ, Moscow Exchange.

continuing upward trend in the sentiment index. During the pandemic, the mood of Russian investors coincided with market pessimism for a short period of time, but, as can be seen in the chart, this pessimism quickly passed. During the pandemic period, the dynamics of the monthly values of the Moscow Exchange index and the sentiment index nearly coincided.

The following is also noteworthy in the results obtained. As the author has already noted in previous works [45], the Google queries of Russians and Americans are very similar in dynamics. Thus, the correlation of goal-oriented queries in each country is 0.96, which, at such a time interval and taking into account the characteristics of cultures, the integration of the Google search engine into Russian practice cannot but attract attention. But this relationship certainly cannot be considered as cause-and-effect. As for the dynamics of the popularity of problem-oriented queries in the United States and Russia, the correlation of the obtained values is small—less than 0.5. That is, when striving for any goal, the moods of Russians and Americans coincide to a much greater extent than when it comes to problems. No less significant is the high correlation of search query sentiment indices in Russia and the United States (0.87). Against this back-

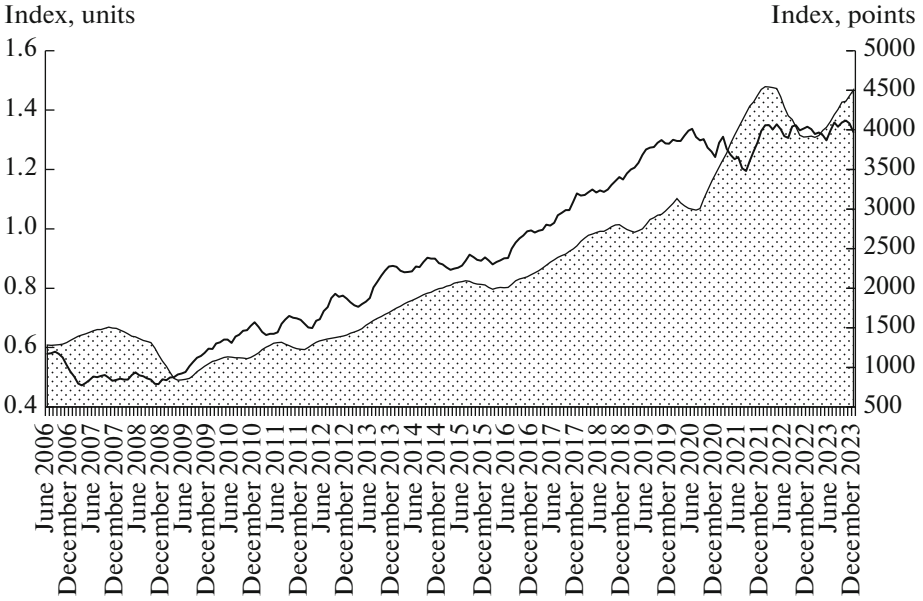

Fig. 1. US Search Sentiment Index and S&P 500 Index, 2006–2023, six-month moving averages ⊡ S&P 500 Index, six-month moving average (right scale) — US Search Sentiment Index, six-month moving average. Source: Google trends, SPX Historical data. NASDAQ.

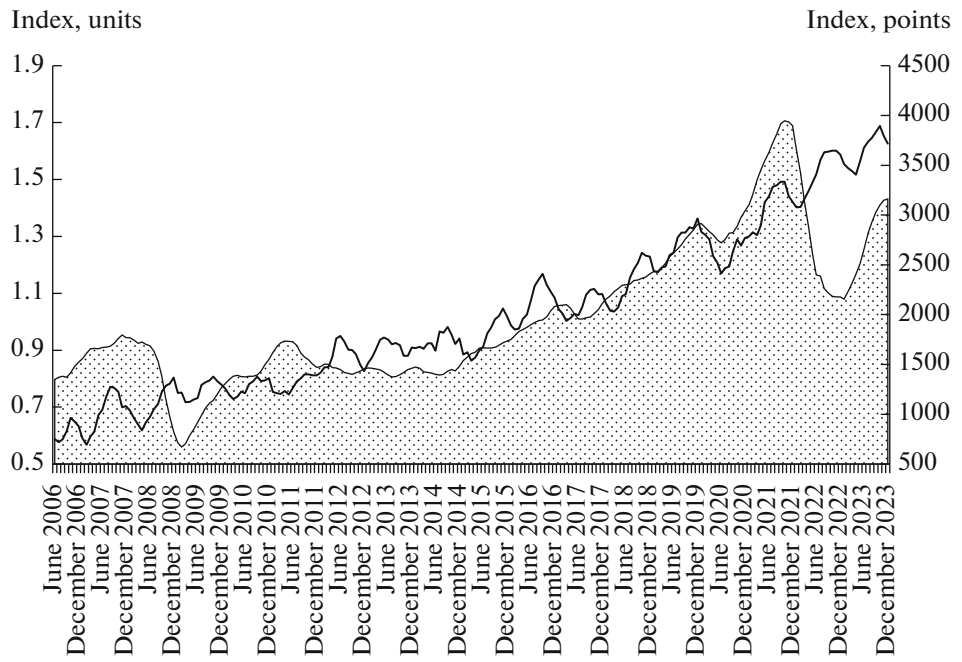

Fig. 2. Search Sentiment Index and Moscow Exchange Index, Russia, 2006–2023, six-month moving averages ⊡ Moscow Exchange index, six-month moving average (right scale) — search sentiment index in Russia, six-month moving average. Source: Google trends, Moscow Exchange.

ground, the correlation of the S&P500 and IMOEX indices (0.88) seems quite natural, and not only due to the influence of purely economic factors, such as the interconnectedness of world financial markets, exchange rate dynamics, and capital flows. Perhaps the high correlation of indicators of the American and Russian financial markets is somehow connected with the commonality of positive, goal-oriented sentiments.

Conclusions. The results obtained by the author show the connection between investor sentiment and stock market dynamics. At the same time, the author acknowledges that the presented methodology and calculations of the search query sentiment index are debatable. These results do not allow us to put an end to it; on the contrary, they encourage deeper research, and this is where the author sees the main task, raising the topic of measuring sentiment and assessing their impact on stock market indicators.

Unlike the English-language scientific literature, in the Russian literature, research within the framework of this issue is rather episodic in nature, which can hardly be considered justified. The importance of this area of research is determined not only by the search for a methodology for forecasting the financial market and potential stock bubbles. The ability to identify the connection between emotional, psychological and economic indicators, not only stock exchange indicators, but also a wider range, can become a serious help in the process of implementing state economic policy aimed at ensuring long-term sustainable growth based on the formation of positive public sentiment.

The author considers the most important directions for further research: 1) studies of the semantics of Internet queries, allowing assessment of their compliance with public sentiment, semantic content, positive or negative connotation; 2) study of various economic indicators for their sensitivity to changes in public sentiment towards consumer or investment orientation; 3) development of models and methods for forecasting economic indicators based on the collection and analysis of large amounts of data reflecting the sentiments of economic entities.

FUNDING

This work was supported by ongoing institutional funding. No additional grants to carry out or direct this particular research were obtained.

CONFLICT OF INTEREST

The author of this work declares that he has no conflicts of interest.

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