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## METHODS FOR ANALYZING FINANCIAL MARKETS IN THE DIGITAL ECONOMY

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**Annotation.** The purpose of this article is to study and summarize the principles, methods and value characteristics of generally accepted types of analysis of financial instruments and an alternative type of analysis of behavioral finance, which have become relevant due to the development of the digital economy. The development of the economy constantly requires the mobilization, distribution and redistribution of financial resources between its spheres and sectors. Financial markets play an important role in this process. Financial markets act as a means of ensuring the normal functioning of all sectors of the economy, as well as a means of combining state, institutional and individual interests, protecting the population's money from inflation and improving its financial situation. As a result of the study, the main aspects of behavioral finance are highlighted, and examples of the most common mistakes of investors are given. The use of the investor sentiment index is proposed for assessing the state of the market and for more efficient forecasting of financial instruments. With this index, government agencies can track financial risks that arise from speculation by the media and financial analysts. The results of the study can be of significant importance in both the investment and political spheres. In the political arena, instability can have a negative impact on the functioning of markets and the pricing of assets within the state and in the international market. If a change in investor sentiment is added to financial risks, this leads to capital outflow and financial instability in the country, but using only the method based on building an investor sentiment index is not recommended.

**Key words:** *financial markets, securities portfolio, financial instruments, behavioral finance, technical analysis, mathematical analysis, digital economy, speculation, risks.*

### INTRODUCTION

The financial market plays an important role in economic development as a tool of financing the activities of companies, as well as mediating the movement of equity capital and its spillover to the most profitable areas of economic activity.

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Developed financial markets are an important condition for stable economic development of any state. Availability of developed financial markets gives companies an opportunity to attract equity capital and creates conditions for their further growth and development. The possibility to forecast with a certain degree of probability the market movements and specific financial instruments is one of the factors that make financial markets attractive for investors, who start using financial instruments not only as a means of getting control over the company, but also for risk management, keeping savings. or getting investment income.

Regardless of what portfolio management strategy (active or passive) investors pursue in financial markets, market value forecasting is an integral component of the securities portfolio management process, which allows the investor to make informed decisions regarding the qualitative and quantitative composition. of the investment portfolio, as well as the choice of the best time to invest.

In general, financial markets, classical methods of analysis and forecasting of the rate of financial instruments are devoted to many works of such scholars as: M. Alpert, A. Anderson, E. B. Barber, R. Thaler, N. Berg, E. Brewer, A. Boulir, S. Camerer, A. Ziglin, D. Ziglin and others. However, with the development of the digital economy, new factors that can influence the price are not reflected in the conventional types of analysis, so we need to use an alternative method of forecasting to account for these factors - behavioral finance. Many works of scientists are devoted to behavioral finance: T. Paris, M. Becker, P. Tetlock, M. Stetman. Despite this, many scientific communities do not recognize behavioral finance, although it is widely used by traders and professional investors.

**Purpose of article** - a study and synthesis of the principles, methods, and value characteristics of generally accepted types of analysis of financial instruments and behavioral finance.

The main methods of forecasting are considered to be fundamental and technical analysis, but because of the significant jump in the development of information technology in the XXI century, which increased the speed of processing and dissemination of information that technologically allowed to influence the opinions of investors around the world at any time, formed and established in economic practice, a new type and forecasting of behavioral finance.

Fundamental analysis is the analysis of securities aimed at predicting future prices, based on the study of economic and political factors influencing the price. As with any analysis, the goal of fundamental analysis is to predict future trends and

capitalize on them. Fundamental analysts assume that there is a fair value in a stock, which contrasts market value with fair value. The intrinsic value of a security is tied to a specific set of factors of varying strength and duration. A change in these factors results in a change in price.

In terms of fundamental analysis, supply and demand in the market appear when the market price compares to its intrinsic value. If the intrinsic value of a stock is greater than its market price, the stock is considered undervalued, then there is demand from investors; investors expect the price to rise to a fair level. If the intrinsic value of a stock is less than its market price, the stock is considered overvalued, then investors try to sell that stock. Both cases will lead to a change in price in the market. The emergence of new factors will be a signal for a change in price direction.

Technical analysis examines changes in prices on charts and based on that makes predictions about their further possible development in the future. The current price movements are compared to past price movements and a more or less realistic forecast is made. The important distinction between technical analysis and fundamental analysis is that technical analysis does not look at why the price is changing, but rather takes into account the fact that the price has changed and then makes a suggestion as to how to proceed in the new situation. Technical analysis allows you to make a clear plan of action on the market. It is achieved by identifying trends (direction of price movements), levels (entry/exit points). Competent technical analysis is an ability to understand the mood of market participants by price and volume charts. Its main purpose is to determine the current direction of price movement, as well as to calculate with a high enough probability when this direction begins to change.

In the world practice it is accepted to divide two main types: graphic (classical) technical analysis and mathematical (or computer analysis). The first type of analysis appeared since the birth of technical analysis and is based on the analysis of stock price charts and trading volume, based on which a conclusion is made about the possible further direction of the price movement. Mathematical analysis is the calculation and analysis of statistical indicators, by analyzing which we get signals about the strength of buyers or sellers, as well as the time of market entry. Mathematical analysis is composed of rather time-consuming mathematical calculations, so it has been actively developed in the 80s-90s with the development of computer technology. Market participants themselves choose the type of analysis that they think will be most effective in their work.

The price chart is a graphical representation of the price configuration of any monetary instrument over time. The vertical line usually shows the price value, the

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horizontal line - time. There are three main types of charts: line chart, bar chart, Japanese candlestick chart.

Technical analysis is built on logical assumptions that make its existence possible. The main ones are:

1) price takes into account everything - the meaning of this statement is that any factor that can affect the price (economic, political) is already taken into account by the market and included in the price. A technical analyst considers only the price movement, not the reasons for that movement;

2. There are trends (directed price movements) - for example, in an uptrend, each successive maximum is getting higher, as well as each successive minimum, which indicates the growing activity of buyers and a high probability that the trend will continue.

In a downtrend, each successive low becomes lower than the previous low, as does each successive high. This indicates the strength of the sellers and increases the probability that the direction of price movement will not change. There is also a sideways trend (corridor) - in this case there is a variable dynamics of price movement, when the price goes up to a certain level, then down, then goes up again to about the same level it reached last time;

3) History repeats itself. The rules that were in effect in the past are still in effect now, and will continue to be in effect in the future. In spite of the fact that markets are constantly changing, there are objective rules which do not stop working in different markets (for example, trend movement). In the world practice there are three main ways of displaying the price on the chart. The simplest one is linear, where the price is displayed as a line. More complex and popular ways of displaying prices are bars and candlesticks. Their great popularity is explained by the great capacity of information which we receive right after viewing a chart.

Computer methods of technical analysis are based on the application of methods of statistical processing of price fluctuations and obtaining these or those statistical evaluations, which are called indicators and help to identify trends in price movements and their reversals, to assess the ratio of forces between "buyers" and "sellers". At present, a considerable number of technical indicators have already been developed. Some of them show trends in price movements, others allow us to work more effectively in trends, they can indicate a change in the direction of the trend. We can argue about the direction of the trend, but if the technical indicator shows that the trend

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is there, then it really is, if it is not - it really is not, but with the laid down parameters which may not reflect the true picture of the market.

It should also be understood that computer analysis contains no less subjectivity than graphical analysis. To reduce this subjectivity as much as possible, computer analysis should be used as a supplement to classical types of analysis - it will allow you to analyze price charts more accurately.

Behavioral finance is a new paradigm in finance that continues to evolve. Created in opposition to modern finance theory, behavioral finance refutes the assumption that investors always act rationally when making investment decisions because they are subject to various behavioral biases. This affects asset pricing, so Markowitz's average variance portfolio theory is replaced by Schiffrin and Stetman's behavioral portfolio theory, as a consequence traditional asset pricing models, such as LinTher and William Sharpe's capital asset pricing model, are replaced by behavioral models. Average variance portfolio theory and traditional pricing models are based on the assertion that expected returns are determined by risk and that risk is determined only by movements in fundamentals. In addition to basic risk, behavioral portfolio theory and behavioral asset pricing models determine the impact of behavioral biases on investors' decisions [1].

Irrational traders are investors whose desires, cognitive errors and emotions influence their attitude toward certain financial instruments. Consequently, they react irrationally to news and misleading analytics when making investment decisions, which is the fundamental information that will allow them to consistently profit in the financial markets [2].

Irrational money market participants can trade for long periods of time. In addition, rational investors demand a risk premium to trade the stocks traded by irrational investors. This is because the unpredictability of trends creates a risk that discourages rational arbitrageurs from betting aggressively against them [3].

Irrational investors are associated with prevailing market trends. Trends are defined as investors' general attitudes toward specific financial assets or financial markets, independent of the flow of fundamental information [4].

Irrational pricing that occurs during periods of positive trends leads to increased market volatility. According to Devo Sias and Starks, traders move from safer to riskier stocks when the trend is positive. As trends spread between irrational traders, unacceptable values rise in the markets.

Rational traders would benefit from entering the market to take advantage of this unreliable price. However, their actions are constrained by the risk of volatility and various arbitrage constraints, such as restrictions on selling. As a result, overpricing occurs due to underestimation of risk by irrational traders and lack of arbitrage activity by rational traders, resulting in price bubbles. When sentiment and expectations are reversed, these price bubbles burst due to mass liquidation of portfolios by trend traders. This process causes volatility in money markets [5].

The relationship between trend trading and financial asset price volatility has implications for market participants. Traditional asset pricing models assume that risk is related only to fundamentals. However, increased volatility in markets due to trends can entail increased risk unrelated to changes in fundamental variables. Therefore, risk has traditional asset pricing models that involve rationality in investments. This is because risk management, portfolio management, and price policy development are all aspects of financial markets that depend on the ability of market participants to assess risk. Failure to do so will lead to ineffective risk management, ineffective portfolio strategies, and hence, irrational pricing [6].

Lotharingia Rupanda, Hillary Tinotenda Muguto, and Paul-François investigated the relationship between investor sentiment and market volatility on the Johannesburg Stock Exchange (JSE) using an all-stock index and a sentiment index. They analyzed the dynamics of investor sentiment and volatility on the JSE using daily data from 2002-2018. It has also been confirmed that the media can influence investor sentiment. One of the most common examples is "Pamp and Damp", the so-called "bubbles" in the stock market. Before a financial instrument rises, false news appears with great exaggeration about fundamental changes or changes in the expected returns of the instrument. Usually these financial instruments have limited and small issues, after such news the stock starts to grow quickly due to small supply. This attracts even more attention, even more investors start to invest in it, although there are no real fundamental changes. As a consequence, after the rapid growth there is a fall in the value of financial instruments, investors lose most of their investments, the most famous example of this is bitcoin [7].

Consequently, there is a need to assess investor sentiment for successful forecasting in money markets. To assess investor sentiment, Juan José García, Esther Vaquero and Antonio Rua have proposed a new indicator that combines the use of principal component analysis with web searches. Not only does their indicator confirm the relevance of sentiment to future asset performance and provide more predictive potential than standard formulations, but it also generates new insights into the globalization of investor sentiment and the role that information flow and technology play in this process. Moreover, it challenges some of the common views in the

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sentiment literature, such as the prevalence of local biases, the greater influence of sentiment in developed markets, or the fact that institutional investors are not sentiment sensitive. The implemented investment strategy shows how a sentiment-based investment rule generates returns in the market.

However, establishing a definition of investor sentiment is not an easy task through two elements:

- 1) sentiment is not an objective and directly measurable variable;
- 2) sentiment contains a heterogeneity of expectation.

Their work treats investor sentiment as a set of undisclosed information explaining the difference between expected future asset returns and their fundamental values, constructed from publicly available information. According to this definition, the disclosure of undisclosed investor information becomes a key element for establishing any viable measure of investor sentiment.

Given that the goal of a sentiment indicator should be to reveal as much information about an investor's future intentions as possible, this is done by actively using information technology to obtain new data from agents. The Internet has become the greatest source of information, and it has the advantage of ease and global accessibility. These properties make it easy to generate massive datasets from the Web that can be considered representative of collective behavior [8].

The sentiment index is constructed using a sentiment model based on S. Heston, N. Singh. These models focus on agents as direct providers of information and assume that only information technology data can fully reflect all the information needed to form future intentions [9].

We can identify at least three essential classification features of models based on information retrieval:

1. News and media analysis. This large category mainly looks for evidence of investor sentiment through a news signal or the presence of a predetermined vocabulary in the media. Most studies conducted on this topic attempt to demonstrate a correlation between the presence of this vocabulary in the news and further financial asset returns. In fact, several studies show a positive relationship between these stocks whose news is covered or simply mentioned in the media and their returns.

2. Social Media. This category analyzes the interaction between information disseminated on social media and investor sentiment. Most studies based on social media look for a correlation between the amount or content of messages and their impact on future returns. Accordingly, most results from this line of research show a negative relationship between asset returns and peak message volume or between social media activity and trading volume. Twitter serves as the primary tool for social media analysis.

These two categories represent one common element: they analyze the text for sentiment analysis. Creating a good vocabulary is therefore crucial to correct interpretations of that sentiment. In fact, most studies in these directions tend to look at a set of items coming from popular economic dictionaries, specifically the Harvard IV dictionaries. However, popular dictionaries of financial terms are not the best tools. Three-quarters of the word counts in 10-K reports that were based on the content of Harvard Dictionary terms are generally not negative in a financial context and show an incorrect bias. Therefore, the choice of term and the need to pre-define the sentiment signal for each can be considered a disadvantage of using these methods.

In addition, there is another drawback associated with social media models that needs to be noted: consistency. Users tend to switch networks quite frequently, and there are also a significant number of inactive or erroneous profiles that can skew the results.

Finally, there is the question of how these categories can properly represent the intent of the entire population. For example, Tetlock focuses his sentiment studies on analyzing Wall Street Journal news. It analyzes the impact of Twitter comments on financial markets and looks at the content of 1.5 million tweets. This scale and scope of information sources seems limited for making a global measurement of sentiment, but the results are close to the truth [10].

3. Search engines. This category has been highlighted because of the limitation of previous search methodologies, this approach of link analysis through search engines shows a correlation between the number of queries of specific terms and the response (now or future) of economic or financial variables.

Google is the most popular tool used for search, so its statistics are used.

However, most research on queries has shown inconclusive results when trying to establish a robust relationship between sentiment and future asset performance. In fact, using Google searches to gather information on specific company names has succeeded in identifying predicted trading volume opportunities and establishing

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correlations with periods of uncertainty, but they do not reflect a significant relationship between stock returns and searches.

However, the wrong study period can distort the results of the analysis. Actually, most of the original studies in this approach have data prior to 2008, and there has been a recent surge in Internet penetration. In this regard, the rate of Internet penetration among the global population has shown exponential growth, as opposed to population growth itself, reinforcing the idea of the growth of global networks, especially in the last decade. This data confirms the link between investor intentions and the use of technology.

Following this idea, there is a correlation between changes in the number of views on financial topics and further major movements in the stock market. Similarly, J. Engelberg finds a link between Google searches and stock returns. They go even further and construct a sentiment index based solely on search volumes, finding a negative relationship between sentiment and further profits. Recent research on the subject confirms a negative relationship between online searches and future market returns [11].

Given the above, these studies make a significant methodological contribution to the study of sentiment search models by combining factor analysis with web searches. The use of factor analysis is widely used in the financial literature to derive a variety of indicators. For example, M. Baker, J. Uglar use the first principal component of a set of variables related to market and financial liquidity to create a measure of liquidity risk. Similarly, focusing on sentiment scores, the use of this methodology has been widely applied to find the economic degree of sentiment.

The problem with these economic approaches, however, is that they make assumptions about the information conveyed by the variables. Therefore, there may be a significant amount of noise in the final indicator. For example, M. Baker and J. Wurgler (2006) explained that only 49% of the total variance is explained by the main factors of the variables that are considered in creating the sentiment indicator. The significance of the Baker and Wurgler indicator may be related to market conditions or broad or narrow economic content of the variables. In the end, Baker and Wurgler refine their indicator by removing the major components to reduce the noise [12].

It should be noted that search-oriented sentiment indicators usually do not use factor analysis in constructing a sentiment index. Most studies focus directly on looking at search values, the different terms chosen earlier according to a predetermined

sentiment bias. Unfortunately, this methodology depends on the correct choice of terms to construct the sentiment index.

Thus, combining core components with search engines would solve search-only problems by outlining the structure of sentiment indicator factors, avoiding the traditional fit problems attached to economic models.

In addition, identifying those components truly relevant to highlighting net investor sentiment will also help provide economic sense to sentiment-creating participants.

A different order of term selection is required than is typically used in searches. Given the disadvantages associated with the use of standard dictionaries, one should rely on the list created by Price based on financial criteria with some modifications if necessary.

Choosing a term with a clear financial bias should help achieve a more accurate assessment of the degree of sentiment. Moreover, the fact that the searches are carried out only in the financial space ensures not only that the interest in a particular term is not biased by its interest in another category (which may be larger), but also that the overall relationship between all the terms should reflect the intentions (or sentiments) of the agents behind the searches [13].

In fact, if an index based on Preiss' financial criteria fully reflects global investor sentiment, it should ensure that there is a correlation between information dissemination and investor intentions. Moreover, given the globalization of information flows (and the impact on investor sentiment), a global index should be more accurate than an index that is based only on local information.

## CONCLUSIONS

Investor Sentiment Index research conducted over the past decade allows for more accurate forecasting models based on the underlying methods. The results of the study can be significant in both the investment and political spheres. But using only a method based on the construction of an index of investor sentiment is not recommended. Increased trading on investor-driven trends increases financial market volatility, which in turn increases risk.

Given the significant increase in risk, investors need to have well-diversified portfolios in order to be rewarded for systematic risk under CAPM. In the political arena, instability can have a negative impact on the functioning of markets and the

pricing of assets within a state and in the international marketplace. If investor sentiment changes are added to risk, it leads to capital outflows and financial instability in the country.

Therefore, it is important to track investor trends on media and social media to avoid capital outflows, because media owners can influence and manipulate investor sentiment for their own purposes.

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### ЦИФРЛЫҚ ЭКОНОМИКА ЖАҒДАЙЫНДАҒЫ ҚАРЖЫ НАРЫҚТАРЫН ТАЛДАУ ӘДІСТЕРІ

**Андатпа.** Осы мақаланың мақсаты – цифрлық экономиканың дамуына байланысты өзекті бола бастаған қаржылық құралдарды талдаудың жалпы қабылданған түрлерінің және мінез-құлық қаржысын талдаудың баламалы түрінің принциптерін, әдістерін және құндылық сипаттамаларын зерттеу және жинақтау. Экономиканың дамуы қаржы ресурстарын оның сфералары мен секторлары арасында жұмылдыруды, бөлуді және қайта бөлуді үнемі талап етеді. Бұл процесте қаржы нарықтары маңызды рөл атқарады. Қаржы нарықтары экономиканың барлық салаларының қалыпты жұмыс істеуін қамтамасыз ету құралы, сонымен қатар мемлекеттік, институционалдық және жеке мүдделерді біріктіру, халықтың ақшасын инфляциядан қорғау және оның қаржылық жағдайын жақсарту құралы ретінде әрекет етеді. Зерттеу нәтижесінде мінез-құлық қаржысының негізгі аспектілері атап өтіліп, инвесторлардың жиі кездесетін қателіктерінің мысалдары келтірілген. Нарық жағдайын бағалау және қаржы құралдарын тиімдірек болжау үшін инвесторлардың көңіл-күй индексі пайдалану ұсынылады. Бұл индекс арқылы мемлекеттік органдар бұқаралық ақпарат құралдары мен қаржылық талдаушылардың алыпсатарлығынан туындайтын қаржылық тәуекелдерді бақылай алады. Зерттеу нәтижелері инвестициялық салада да, саяси салада да маңызды мәнге ие болуы мүмкін. Саяси аренада тұрақсыздық нарықтардың жұмыс істеуіне және мемлекет ішіндегі және халықаралық нарықтағы активтердің бағалануына кері әсерін тигізуі мүмкін. Егер инвестордың көңіл-күйінің өзгеруі қаржылық тәуекелдерге қосылса, бұл капиталдың кетуіне және елдегі қаржылық тұрақсыздыққа әкеледі, бірақ инвестордың көңіл-күй индексі құруға негізделген әдісті ғана пайдалану ұсынылмайды.

**Кілтті сөздер:** қаржы нарықтары, бағалы қағаздар портфелі, қаржы құралдары, мінез-құлық қаржысы, техникалық талдау, Математикалық талдау, цифрлық экономика, алыпсатарлық, тәуекелдер.

## МЕТОДЫ АНАЛИЗА ФИНАНСОВЫХ РЫНКОВ В УСЛОВИЯХ ЦИФРОВОЙ ЭКОНОМИКИ

**Аннотация.** Целью этой статьи является исследование и обобщение принципов, методов и ценностных характеристик общепринятых видов анализа финансовых инструментов и альтернативного вида анализа поведенческих финансов, которые стали актуальны из-за развития цифровой экономики. Развитие экономики постоянно требует мобилизации, распределения и перераспределения финансовых ресурсов между ее сферами и секторами. Важную роль в осуществлении этого процесса играют финансовые рынки. Финансовые рынки выступают средством обеспечения нормального функционирования всех отраслей экономики, а также средством сочетания государственных, институциональных и индивидуальных интересов, защиты денежных средств населения от инфляции и улучшения его материального положения. В результате исследования выделены основные аспекты поведенческих финансов, и приведены примеры наиболее частых ошибок инвесторов. Предложено использование индекса настроений инвесторов для оценки состояния рынка и более эффективного прогнозирования финансовых инструментов. С помощью этого индекса государственные органы могут отслеживать финансовые риски, которые возникают из-за спекуляций СМИ и финансовых аналитиков. Результаты исследования могут иметь существенное значение как в инвестиционной, так и в политической сферах. В политической сфере нестабильность может оказать негативное влияние на функционирование рынков и ценообразование активов в пределах государства и на международном рынке. Если к финансовым рискам добавляется изменение настроений инвесторов, это приводит к оттоку капитала и финансовой нестабильности в стране, но использование только метода, основанного на построении индекса настроений инвесторов, не рекомендуется.

**Ключевые слова:** *финансовые рынки, портфель ценных бумаг, финансовые инструменты, поведенческие финансы, технический анализ, математический анализ, цифровая экономика, спекуляция, риски.*