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NEW TRENDS IN THE DEVELOPMENT OF FINANCIAL ANALYTICS OF AN EXCHANGE TRADER

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Abstract. The financial sector has undergone profound changes over the past twenty years, affecting the ways in which both individuals and organizations interact. The active introduction of artificial intelligence (AI) and big data analytics has significantly changed the approaches to activities of financial institutions and their interaction with customers and other organizations. It is expected that these changes will continue to gain momentum due to development of technologies that allow us to focus on innovation and solving complex problems. Every day, the financial industry records billions of events in markets, which generates significant amounts of diverse data related to the Big Data category.

AI algorithms and models that work with big data to analyze patterns and generate recommendations in areas such as portfolio strategies and fraud detection are becoming increasingly important in the financial sector. However, level of their application and development differs significantly depending on capabilities and competencies of different organizations. These differences, as well as the impact of new technologies on financial sector, are becoming central topics of discussion among industry professionals.

This article is devoted to the study of the use of AI and big data analytics in stock trading, as well as the analysis of consequences of their use. The research

examines current trends and practices that allow us to draw conclusions about the impact of these technologies on the strategies and decision-making processes of market participants.

Keywords: big data analytics, AI in finance, stock trading, the implications of big data, Fintech, the application of big data and artificial intelligence in finance.

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БИРЖАЛЫҚ ТРЕЙДЕРДІҢ ҚАРЖЫЛЫҚ АНАЛИТИКАСЫН ДАМЫТУДЫҢ ЖАҢА ТЕНДЕНЦИЯЛАРЫ

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Аннотация. Қаржы секторы соңғы жиырма жыл ішінде жеке тұлғалардың да, ұйымдардың да өзара әрекеттесу тәсілдеріне әсер еткен терең өзгерістерге ұшырады. Жасанды интеллект (AI) пен үлкен деректерді талдауды белсенді енгізу – қаржы институттарының қызметіне және олардың клиенттермен және басқа ұйымдармен өзара әрекеттесуіне көзқарасты айтарлықтай өзгертті. Бұл өзгерістер инновацияларға назар аударуға және күрделі мәселелерді шешуге мүмкіндік беретін технологияларды дамыту арқылы қарқын алуды жалғастырады деп күтілуде. Күн сайын қаржы саласы нарықтардағы миллиардтаған оқиғаларды тіркейді, бұл Big Data санатына жататын әртүрлі деректердің айтарлықтай көлемін тудырады.

Портфолио стратегиялары және алаяқтықты анықтау сияқты салаларда заңдылықтарды талдау және ұсыныстар қалыптастыру үшін үлкен деректермен жұмыс істейтін ЖИ алгоритмдері мен модельдері қаржы секторында маңызды бола түсуде. Дегенмен, оларды қолдану және игеру деңгейі әртүрлі ұйымдардың мүмкіндіктері мен құзыреттеріне байланысты айтарлықтай ерекшеленеді. Бұл айырмашылықтар, сондай-ақ жаңа технологиялардың қаржы саласына әсері сала мамандары арасында талқылаудың басты тақырыбына айналады.

Бұл мақала биржалық трейдингте ЖИ және үлкен деректерді талдауды

қолдануды зерттеуге, сондай-ақ оларды қолданудың салдарын талдауға арналған. Зерттеу осы технологиялардың нарыққа қатысушылардың шешім қабылдау стратегиялары мен процестеріне әсері туралы қорытынды жасауға мүмкіндік беретін заманауи тенденциялар мен тәжірибелерді қарастырады.

Түйін сөздер: үлкен деректерді талдау, ЖИ қаржыда, биржалық сауда-саттық, үлкен деректердің салдары, Финтех, үлкен деректер мен жасанды интеллектті қаржыға қолдану.

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НОВЫЕ ТЕНДЕНЦИИ РАЗВИТИЯ ФИНАНСОВОЙ АНАЛИТИКИ БИРЖЕВОГО ТРЭЙДЕРА

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Аннотация. Финансовый сектор за последние двадцать лет претерпел глубокие изменения, затронувшие способы взаимодействия как частных лиц, так и организаций. Активное внедрение искусственного интеллекта (ИИ) и аналитики больших данных существенно изменило подходы к деятельности финансовых учреждений и их взаимодействию с клиентами и другими организациями. Ожидается, что эти изменения продолжат набирать обороты благодаря развитию технологий, позволяющих сосредоточиться на инновациях и решении сложных задач. Каждый день финансовая отрасль фиксирует миллиарды событий на рынках, что порождает значительные объемы разнообразных данных, относящихся к категории Big Data.

Алгоритмы и модели ИИ, работающие с большими данными для анализа закономерностей и формирования рекомендаций в таких областях, как портфельные стратегии и обнаружение мошенничества, приобретают все большее значение в финансовом секторе. Тем не менее, уровень их применения и освоения существенно отличается в зависимости от возможностей и компетенций различных организаций. Эти различия, а также влияние новых технологий на финансовую сферу, становятся центральными темами обсуждения среди специалистов отрасли.

Данная статья посвящена изучению применения ИИ и аналитики больших

данных в биржевом трейдинге, а также анализа последствий их использования. В рамках исследования рассматриваются современные тенденции и практики, позволяющие сделать выводы о влиянии этих технологий на стратегии и процессы принятия решений участников рынка.

Ключевые слова: аналитика больших данных, ИИ в финансах, биржевый трейдинг, последствия больших данных, Финтех, применение больших данных и искусственного интеллекта в финансах.

Introduction. Quantitative analysis involves applying numerical and mathematical methods to financial analysis. While these techniques have been integral to various industries for a long time, their adoption in the financial sector has gained momentum only in recent decades. Initially, quantitative analysts, also known as quants, focused on areas such as investment management, risk management, and the pricing of derivative instruments. Over time, however, the application of quantitative methods has broadened significantly to encompass virtually every aspect of finance where mathematics can be applied. Some notable examples of quantitative analysis in practice include statistical arbitrage, algorithmic trading, and electronic market operations. These approaches utilize advanced mathematical models and computational tools to analyze financial data and identify opportunities.

In trading, quantitative analysis is crucial for determining pricing strategies, managing risk, and uncovering profitable opportunities. Historically, distinct roles existed for quantitative analysts and quantitative traders. However, as the industry evolves, the boundaries between these roles are becoming increasingly blurred. Today, a strong background in quantitative analysis is almost a prerequisite for anyone aiming to succeed in professional trading. Quantitative methods are also widely employed in asset management. Many prominent companies, such as AQR and Barclays, rely heavily on quantitative strategies for their operations. Others, including Pimco, Blackrock, and Citadel, integrate both quantitative and fundamental approaches to manage their assets effectively. In fact, nearly all large-scale asset management firms and hedge funds incorporate quantitative techniques to some degree.

To enhance their operations, these firms are making significant investments in the development of standardized libraries for cost and risk assessment methodologies. These tools not only improve efficiency but also provide a competitive edge in an increasingly data-driven financial landscape.

Materials and methods

In this study, data obtained from official sources such as the KASE exchange and specialized financial databases were used to analyze the dynamics of financial markets. The original dataset covers the period from 2019 to 2023 and includes information on trading volumes, quotations, indices, and companies' financial indicators. The data were pre-processed to remove outliers and errors, ensuring the accuracy of further analysis.

For processing and interpreting the collected information, methods of systems,

logical, and comparative analysis were applied. In particular, statistical tests such as the Kolmogorov-Smirnov test and the run test were used to evaluate the distribution of returns and to identify patterns in market behavior before and during the financial crisis. This approach enabled a comprehensive investigation into the impact of technological innovations on the decision-making efficiency of stock traders.

In the course of the work, the following research methods were applied: system analysis as a methodology for setting and approaching the problem as a whole, methods of logical and comparative analysis and synthesis, methods of economic and statistical comparisons, abstract logical judgments.

Results and discussion

Many modern scientists are actively working in the field of studying trends in the development of financial analytics for stock traders. Andrew W. Lo from the Massachusetts Institute of Technology (MIT) is exploring the application of algorithmic trading and machine learning to improve the effectiveness of analytics (Lo, 2021). In his work, he emphasizes the role of AI in predicting market trends and minimizing risks. John H. Cochrane of Stanford University notes that automation and the use of big data significantly accelerate the decision-making process for traders (Cochrane Methods Report, 2021). Markus K. Brunnermeier from Princeton University explores the influence of psychological factors on market decisions and the development of new analytical tools to account for them (Brunnermeier, et al., 2019). Nicholas C. Barberis from Yale University studies the cognitive and emotional aspects that affect traders with high levels of uncertainty (Barberis, et al., 2020). Terrance Odean from the University of California at Berkeley analyzes the impact of cryptocurrencies and digital assets on traditional financial analytics (Odean, et al., 2021). He highlights the need to take into account the volatility and specifics of these instruments. Matthew Richardson from New York University emphasizes that the digitalization of assets requires new models for assessing their value and risk (Richardson, et al., 2022).

The modern financial markets are evolving rapidly. Technology has a significant impact on the development of trading software. New custom solutions and mobile platforms are becoming increasingly popular. They are transforming the industry. This article highlights key trends, focusing on custom solutions and the role of mobile app developers (Lindsay, 2024).

Artificial Intelligence (AI) and Machine Learning (ML) have greatly changed trading software. They enable advanced analytics, predictive modeling, and automation. AI processes large volumes of data, identifies patterns, and provides valuable insights. Machine learning, such as neural networks, helps software adapt to market changes in real time.

Custom trading software leverages AI and ML to create advanced algorithms. It also develops risk management tools and analytical modules. These programs help automate routine tasks, simplify traders' work, and offer more opportunities for market analysis.

Blockchain is becoming a critical component of trading systems. It provides

security, transparency, and decentralization. Blockchain allows transactions without intermediaries, ensuring all data remains immutable. Smart contracts automate deal execution and settlements. This reduces errors and operational costs.

Custom trading platforms integrate blockchain technology into their operations. This allows for the development of decentralized exchanges and digital asset management platforms. They also enable tokenized securities. These innovations enhance market transparency and security, creating new opportunities for traders and investors.

Big data and analytics play a vital role in trading software. These technologies provide real-time market insights and analyze large datasets. The data may come from social media, news outlets, or market feeds.

Custom trading solutions use advanced analytical tools. These include sentiment analysis and pattern recognition. These tools help identify market trends, predict price movements, and improve trading strategies.

Cloud computing is transforming the approach to trading software development. It offers flexible and scalable solutions. Cloud platforms like AWS and Azure provide on-demand access to resources.

Cloud-based trading systems process large data volumes and run complex algorithms. These systems are highly adaptable, making them ideal for traders in dynamic markets.

Mobile applications are becoming more popular among traders. They offer convenient access to markets from any device. These apps are functional and user-friendly.

Software developers collaborate with mobile platform creators to design trading applications. These apps work across multiple devices. They provide access to market data, trading tools, and account management features.

Quantum computing introduces new possibilities for trading. It solves complex problems like financial modeling and algorithm optimization.

Companies are exploring quantum technologies to develop advanced algorithms and risk assessment tools. These systems allow faster and more accurate operations, giving traders an edge in competitive markets.

As of January 1, 2024, the Exchange had 52 professional participants, comprising all licensed banks and brokerage organizations in the Republic of Kazakhstan. Additionally, the membership included four foreign participants and two international financial organizations.

The Exchange operates with distinct platforms designed to cater to a diverse range of companies. The Main site is targeted at large, established companies with significant operational histories. In contrast, the Alternative site is tailored to small and medium-sized enterprises (SMEs), featuring simplified listing requirements. This structure enables both large corporations and SMEs to access funding through the stock market.

The Exchange also offers a Mixed platform, where a variety of financial instruments are traded. These include Islamic securities, derivatives, government

securities, and securities issued by international financial organizations. These instruments can be denominated in either the national currency or foreign currencies, adding flexibility for investors. Meanwhile, the **Private Placement platform** focuses on non-government securities intended for private placement. This involves a non-public offering of bonds to a select group of qualified investors, with the terms of issuance defined in a private memorandum.

In 2023, the total trading volume on the Exchange reached an impressive 411 trillion tenge, marking a significant 57% increase (149 trillion tenge) compared to the previous year. The number of transactions also rose considerably, with 1.4 million trades conducted, representing a 53% growth over 2022.

Most indices in developed markets concluded 2023 with positive performance. However, the Chinese stock market showed a decline during the year. The Shanghai Composite index fell by 4% in 2023, driven by persistent challenges in China's real estate sector and mounting municipal debts. These long-term structural issues acted as a significant drag on market performance (Figure 1).

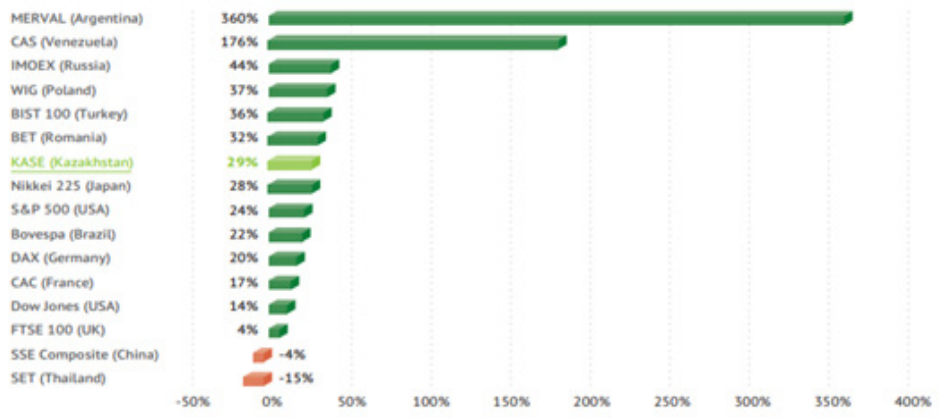

Figure 1 - Growth indicators of the main global stock indexes and the KASE Index by the end of 2023, %
Note: compiled on the basis of KASE

The year 2023 proved to be a positive period for the Kazakh stock market, supported by several favorable developments. A reduction in the annual inflation rate, stabilization of markets following the mitigation of external economic shocks, and improved macroeconomic indicators collectively created a conducive environment for market growth.

By the end of the year, nearly all stocks included in the KASE Index Representative List exhibited positive performance, with KEGOC shares being the sole exception. Key drivers behind the growth of KASE Index shares included the release of financial reports, dividend payouts, and the rising prices of raw materials in global markets.

For the third consecutive year, KASE trading volumes reached historic highs. In 2023, the total trading volume across all markets grew by an impressive 57%

compared to 2022. This increase brought the annual total to a record-breaking 410.7 trillion tenge, representing a 3.5-fold increase compared to the 2020 figure (Figure 2).

This strong performance highlights the resilience and dynamism of the Kazakh stock market, driven by both domestic economic stability and global market trends.

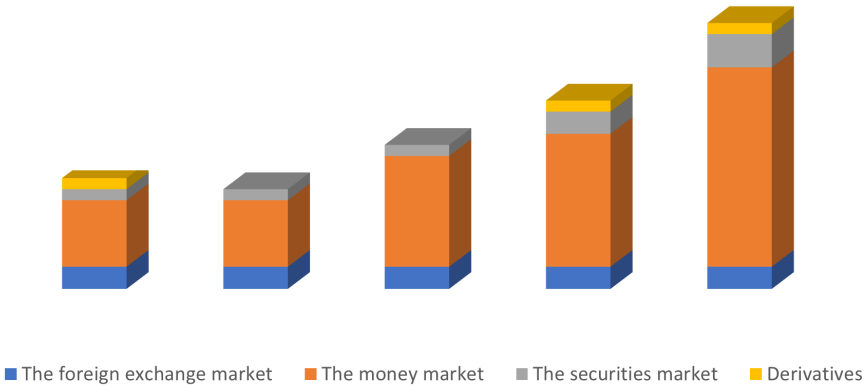

Figure 2 - Dynamics of trading volume by sector 2019-2023, trillion tenge
Note: compiled on the basis of KASE

The main increase in trading volume on KASE was achieved due to an increase in trading on the money market – by 60% to KZT 370 trillion – against the background of an increase in the demand of market participants for short-term tenge liquidity, while the increased supply was supported by high rates.

Positive financial results, dividend payments and rising uranium prices were the driving force behind the growth of the KASE Index during 2023 (Figure 3).

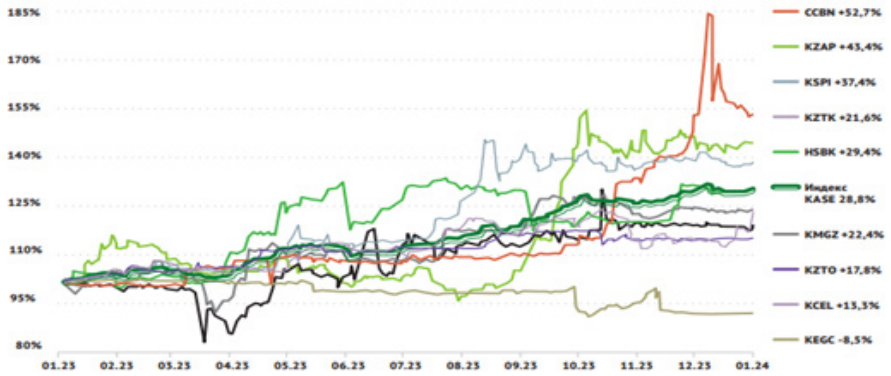

Figure 3 - Components of the KASE Index
Note: compiled on the basis of KASE

By the close of 2023, nearly all stocks listed in the Representative List of the KASE Index showed positive growth, with KEGOC shares being the only exception. The most significant gains were observed in the fintech and energy sectors. Notable contributors to this growth included JSC Bank Center Credit, JSC NAC Kazatomprom, and JSC Kaspi.kz. This robust performance highlights the resilience of key sectors in the Kazakh market and underscores the influence of both local and global economic factors on stock market dynamics.

The Kolmogorov-Smirnov (KS) one-sample test is a statistical method used to evaluate whether a given sample of data follows a specific distribution. It does this by comparing the cumulative distribution function (CDF) of the observed data to the CDF of a reference distribution, which can be either uniform or normal. The test determines the degree of alignment between the observed data and the hypothesized distribution, thereby indicating whether the data likely originated from that particular distribution.

In this study, the KS test was applied to data from two distinct periods, referred to as Period-I and Period-II. The results of these analyses are summarized in Table 1. The table provides a detailed comparison of the observed data's CDF against the expected CDF for the specified distribution during each period. This approach helps assess the consistency of the data distribution over time and determine whether any significant deviations occurred between the two periods.

Table 1- One-Sample Kolmogorov-Smirnov Test

		Period - I		Period - II	
		BSE	NSE	BSE	NSE
N		1246	1246	1228	1228
Most Extreme Differens	Absolute	0.052	0.058	0.088	0.082
	Positive	0.052	0.058	0.088	0.082
	Negative	-0.048	-0.047	-0.067	-0.066
Kolmogorov-Smirnov Z		1.832	2.050	3.087	2.858
Asymp. Sig. (2-tailed)		0.002	0.000	0.000	0.000
Test distribution is Normal					

During Period-I, the statistical analysis indicates that the returns from both the NSE and BSE markets do not align with a normal distribution. This conclusion is based on the probability values being less than 0.05, evaluated at a 5% level of significance. As a result, the null hypothesis, which assumes normal distribution for the returns of these markets, is rejected.

Similarly, in Period-II, the data reveals that there is no significant change in the distribution pattern of market returns during the financial crisis. The results demonstrate that the returns for both markets continued to deviate from a normal distribution. Furthermore, the frequency distributions for the NSE and BSE returns during this period were also found to not conform to a normal distribution. Therefore, it can be concluded that the returns in both periods are not normally distributed.

The outcomes of the run test, a non-parametric test used to analyze the randomness of data, are summarized in the subsequent tables. Table 3 presents the run test results

for Period-I, which corresponds to the time before the financial crisis. Additionally, the table includes the values obtained for Period-II, representing the period affected by the recent financial crisis. These findings provide further insight into the behavior and patterns of market returns during the analyzed timeframes.

Table 2- Run Test

	Period-I		Period-II	
	BSE	NSE	BSE	NSE
Test Value[a]	0.00	0.00	0.00	0.00
Cases < Test Value	623	623	614	614
Cases < = Test Value	623	623	614	614
Total Cases	1246	1246	1228	1228
Number of Runs	559	567	601	601
Z	-3.684	-3.231	-0.799	-0.799
Asymp. Sig. (2-tailed)	0.000	0.001	0.424	0.424
a. Median				

The analysis of Period-I reveals that the Z values derived from the run test exceed +1.96. This indicates that the null hypothesis, which assumes randomness in the data, is rejected at a 5% level of significance for the time before the financial crisis. As a result, it is evident that the time series data for both NSE and BSE does not follow a random walk. This lack of randomness suggests that the two markets can be classified as weak-form inefficient during this period.

In contrast, the run test results for Period-II show a different trend. Here, the Z statistic values are below +1.96 at the same 5% significance level. This change suggests that the markets began to exhibit characteristics of efficiency, meaning the data now appears to follow a random walk. From these findings, it can be inferred that the financial crisis had a transformative effect on the Indian stock markets, pushing them towards greater efficiency during this period.

Another noteworthy observation is the similarity in the run test values for both markets in Period-II. This consistency implies that NSE and BSE displayed a comparable shift in their behavior during the financial crisis, regardless of their differing levels of efficiency in Period-I. This alignment highlights a uniform response to the market disruptions caused by the crisis, indicating a shared drift towards improved efficiency.

Conclusion

The performance of stock markets indicates how efficiently stock prices reflect all available market information. This efficiency is critical because it enables investors to make informed decisions about buying or selling shares. When market efficiency is high, investment strategies can be formulated with greater confidence, as stock prices accurately reflect the underlying value of securities.

However, when stock markets are inefficient, significant practical consequences can arise. One such issue is the potential alteration of expected returns on securities, as price fluctuations may exceed expectations when new information enters the market.

In an inefficient market, share prices may not accurately represent the fair value of stocks. This mispricing can lead to challenges for companies with undervalued shares, as they may face difficulties in raising capital. Over time, this can disrupt the investment framework of a country, hindering its economic growth and long-term stability.

Simultaneously, technological advancements are reshaping the development of trading software. These innovations provide traders with cutting-edge tools to leverage advanced analytics, automation, and mobility in financial markets. Custom trading software solutions and mobile trading applications are empowering traders to make well-informed decisions, streamline repetitive tasks, and maximize market opportunities.

As technology continues to evolve, the development of trading software will play a pivotal role in enhancing the efficiency, transparency, and flexibility of global financial markets. This progress not only supports individual traders but also strengthens the overall functionality and competitiveness of financial systems worldwide.

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