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Exploring the Impact of AI on the Stock Market

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Abstract: The rapid development of artificial intelligence is reshaping the global financial competition pattern. Studying the impact of AI on China's stock market is of great theoretical and practical significance for improving market efficiency and optimizing regulatory mechanisms. However, China's stock market is facing the limitations and efficiency bottlenecks of traditional analytical methods, so there is an urgent need to explore new ways with the help of AI. Studying the impact of AI on China's stock market is of great theoretical and practical significance for improving market efficiency and optimizing regulatory mechanisms. Through empirical analysis, case comparison and international empirical studies, this paper systematically explores the application of AI in the fields of high-frequency trading, quantitative modeling and regulatory technology, and analyzes its comprehensive impact on China's stock market efficiency, structural anomalies and regulatory model. The paper concludes that AI significantly improves market information processing speed and trading efficiency, but exacerbates the deterioration of small-order liquidity and the risk of algorithmic convergence and that China's regulatory framework centered on "technologically controllable" is more adaptable than that of the U.S. and Europe, but needs to guard against algorithmic failures in extreme markets. This paper lays a theoretical foundation for the construction of a "technologically controllable regulation" system with Chinese characteristics, and provides policy guidance for balancing AI technology innovation with risk prevention and control.

Keywords: Artificial intelligence, stock market, high-frequency trading, quantitative analysis, regulatory technology.

1. Introduction

The rapid development of Artificial Intelligence (AI) is reshaping the global competition pattern of science and technology and economy and has become the core area of strategic layout of various countries. As the world's second largest economy, China regards AI technology as an important engine to promote high-quality economic development and continues to increase investment in policy, funding, and technology research and development. For example, Deepseek, China's self-developed deep learning model, empowers multi-industry innovation through the open source model, demonstrating the wide potential of AI technology applications. Against this backdrop, the financial market, as a core hub for resource allocation, is crucial to the country's economic development in terms of its operational efficiency and stability. The stock market has become a key platform for promoting innovation in the real economy by guiding the flow of social capital to high-efficiency areas. However, traditional stock market analysis methods generally have limitations such as low

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prediction accuracy and weak strategy adaptability in the face of massive heterogeneous data, nonlinear relationships, and market noise styles. For example, linear regression models based on historical data are difficult to capture market mutation signals, while investment decisions driven by human experience are susceptible to subjective biases. In this context, AI technology, with its powerful data processing capabilities, pattern recognition efficiency and automated decision-making advantages, provides a new path to break through the bottleneck of traditional analytical methods, and at the same time poses a new challenge to the market structure, trading behavior and regulatory framework.

In recent years, academia and the industry have carried out extensive exploration around the application of AI in the stock market. Kercheval et al. introduced vector machine (SVM) models into the field of high-frequency trading for the first time, and significantly improved the prediction ability of market depth and price volatility by modeling limit order thin data, laying the foundation for algorithmic trading[1]. Wang et al. further proposed a high-frequency time series prediction method based on quasi-stacked noise-reducing self-encoder (SDA), and verified the applicability of deep neural networks (DNN) in complex market environments by dynamically updating the training dataset[2]. In the field of regulatory technology, the Chongqing Operation and Management Department of the People's Bank of China (PBOC) constructed a real-time risk detection system based on big data and machine learning, realizing a minute response to abnormal trading behaviors, which provides a practical example of AI-driven regulatory model[3]. These studies show that AI technology can effectively improve market information processing efficiency and risk management capabilities, but its potential impact on market liquidity, volatility, and algorithmic convergence risk still needs to be further explored.

This paper aims to systematically analyze the multi-dimensional impact of artificial intelligence (AI) technology on China's stock market, focusing on the mechanisms and challenges of AI technology in the improvement of trading efficiency, market structural changes, and the transformation of regulatory models. Specifically, firstly, through case study and empirical research, it reveals the current status and effectiveness of AI application in high-frequency trading, quantitative modeling, etc.; secondly, by combining market data and policy practice, it analyzes the double-edged sword effect of AI technology on market effectiveness and liquidity; lastly, by comparing the international regulatory frameworks and technological paths, it puts forward policy recommendations to build a “technology-penetrating regulatory” system with Chinese characteristics. Finally, by comparing the international regulatory framework and technology path, it puts forward the policy suggestions to build a “technology-penetrating supervision” system with Chinese characteristics.

2. Current status of AI applications in the stock market

2.1. High frequency trading and algorithmic strategies

Artificial intelligence technology has significantly improved the trading efficiency and prediction accuracy of the stock market through the continuous innovation of high-frequency trading algorithms and strategies. In academic research, in 2014, Kercheval et al proposed two support vector machine models, one based on price-level information and the other based on time-series information, for modeling and predicting high-frequency limit order book data, which improved the prediction ability of market depth and price volatility[1]; in 2016, Wang L et al applied the Stacked Denoising Autoencoders (SDA) to the prediction of high-frequency time series, proposing a method to automatically update the training dataset of the SDA model, confirming the predictability of Deep Neural Network (DNN) neural network in high-frequency time series[4]; in 2018, Zhou X et al applied Generative Adversarial Networks for stock prediction and showed through a large number of

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experiments that Adversarial Neural Networks for stock volatility prediction can achieve significant results[5].

In practice, according to the Financial Times, Jump Trading used reinforcement learning to optimize its order strategy to achieve 76% excess returns in 2021. The team primarily applied microsecond delay network techniques and deep neural networks to predict short-term price fluctuations. China also continues to make progress and breakthroughs. Huatai Securities' "Rising Wealth" realizes microsecond order flow processing and will contribute 12% of A-share turnover in 2022. Mirage quantitative "nine chapters" system through deep reinforcement learning, in the GEM index constituents to achieve annualized 35% excess return. AI has produced a huge market impact, Shanghai and Shenzhen exchanges programmed trading accounted for 12% in 2015 to 58% in 2022, AI to achieve a quantum leap in predictive capacity, the implementation of nanoscale optimization, the data dimension, the data dimension of the nanoscale optimization. of nanoscale optimization, and the data dimension of downscaling.

2.2. Quantitative analysis and predictive modeling

Traditional quantization is a strategy model based on data and models, and its ultimate goal is to achieve stable long-term returns through automated trading. AI quantization, on the other hand, extracts a large number of high-dimensional features through machine-learning models and transforms them into factor variables affecting investment decisions, so as to dig deeper laws in the complex market.

AI realizes the closed loop of decision-making path, constructs an industry rotation prediction model, and directly drives the execution of an algorithmic trading system, realizing the automation of the whole process of "prediction-decision-execution". Boshi Fund pioneered the "Smart Investment System", which integrates 1300+ macroeconomic indicators, and the accuracy of industry rotation prediction reaches 79%. Flush ifnd accesses more than 4,000 news sources and utilizes NLP to build a market sentiment index. China has achieved great results, and the coverage rate of AI investment research of public equity funds has increased from 15% in 2019 to 83% in 2023.

2.3. Regulatory technology

In terms of arithmetic, technologies such as big data, open APIs, blockchain, etc. aggregate and integrate long-accumulated, multi-institutional financial regulatory data for AI applications, and the comprehensive use of statistical analysis, data mining and other technologies can realize real-time monitoring and data analysis, identify potential risks, and enhance risk perception and reaction sensitivity. In terms of arithmetic power, advances in technologies such as cloud computing and specialized hardware (e.g., GPUs, etc.) have made it possible to promote AI applications. Cloud computing has the advantages of ultra-large scale, high scalability, and high reliability, which is conducive to low-cost and rapid completion of application deployment by regulators and regulated organizations, timely response to changing risk trends, and meeting regulatory and compliance needs.GPUs support massively parallel computing architectures and have excellent capabilities in tensor computing. AI chips such as ASICs and FPGAs customized for specific scenarios can achieve deep learning algorithm acceleration and significantly increase the speed of customized algorithms. In terms of algorithms, in-depth analysis of regulatory data through machine learning, natural language processing, knowledge mapping and other technologies can better achieve risk analysis, prediction and presentation, and improve regulatory effectiveness. Anti-fraud, risk monitoring and other application practices drive the continuous progress of AI applications, and AI-based regulatory technology applications have ushered in a period of development opportunities.

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3. The impact of artificial intelligence on the efficiency of China's stock market

3.1. Increased market effectiveness

Under the influence of AI, the speed, accuracy and coverage of stock market price response to information are significantly enhanced, enabling asset prices to incorporate public and non-public information faster and more comprehensively, and reducing information asymmetry to book price bias. Based on an event study of Shenzhen Stock Exchange listed company announcements and AI opinion system, Zhang Xiaohui et al. use a double difference model (DID) to compare the difference in alpha returns between traditional quantitative funds and AI-enhanced funds, which shows that AI shortens the digestion time of earnings information from T+3 to T+0.5 through natural language processing (NLP), and delays the quotes of high-frequency trading accounts to the subtle level[6]. Yiming Wang et al. constructed a three-dimensional evaluation system of "market depth-liquidity-volatility" for high-frequency trading strategies and analyzed that from 2015 to 2022, the discount and premium of ETFs decreased from 0.9% to 0.15%, and the volume of AI-driven cross-market arbitrage accounted for more than 60% of the total volume of trades, which proved that AI significantly reduces the non-effectiveness of the market. However, Zhang does not consider the risk of algorithmic failure under extreme market conditions, such as the 2020.3 U.S. stock meltdown[7].

3.2. AI-induced changes in market structure

The widespread application of AI technology has led to a significant deviation from the traditional market structure in the distribution of stock market liquidity, price formation mechanism and trading behavior patterns. According to Chen Wei et al, the thinness of orders in the AI trading session decreased by 38%, but the liquidity of small orders (<10,000 shares) deteriorated significantly, and the bid-ask spread widened to 0.03%-0.05%. Similar incidents have also occurred in Chinese enterprises, for example, the microsecond order flow of Huatai Securities "Rising Le Wealth" triggered the phenomenon of liquidity black hole, and a new energy stock fell in three minutes due to the AI programmed sell order in 2022. Therefore, this paper argues that China should introduce a mandatory "order dwell time" requirement to prevent algorithmically induced instantaneous liquidity depletion. In "AI Trading and Market Volatility: Evidence from China's Growth Enterprise Market", Li et al. put forward the hypothesis of the "algorithmic convergence effect" to explain the two-way amplification of volatility due to high-frequency trading. The study finds that stocks with high AI participation (>40% of daily programmed trades) have a 27% increase in volatility index (VIX) volatility, but a 42% decrease in the frequency of extreme declines (one-day declines >5%)[8]. The stronger dampening effect of AI trading on volatility in A-shares compared to U.S. stocks may be related to the stronger administrative intervention.

4. International experience and China's path

This paper analyzes the differences and effectiveness of the regulatory frameworks, technology application paths, and cutting-edge research directions of artificial intelligence in China, the United States, and the European Union by comparing and contrasting them to analyze how China can build a development path that takes into account both regulatory effectiveness and technological innovation based on international experience and how it can deal with the multiple challenges of algorithmic convergence, privacy protection, and globalized competition with a localized strategy.

First, through a comparative study of regulatory frameworks, China's "technologically controllable" and the US "algorithmically transparent" are compared, with China adopting a "data localization + algorithmic filing" system, while the US emphasizes "algorithmic disclosure +

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sandbox testing" . China adopts a system of "data localization + algorithm filing", while the US emphasizes "algorithm disclosure + sandbox testing"[9]. The U.S. focuses on algorithm transparency, while China focuses on technology control. China can build a dynamic sandbox model that combines China's regulatory transparency with the flexibility of the U.S. market. Comparison with the European Union's "human rights-first model" reveals that AI model training in the European Union requires "explicit consent" from users, resulting in a 23% higher churn rate of AI advisors at European management firms than in China [10]. For example, Deutsche Bank used federated learning technology to achieve cross-border data privacy protection, but model accuracy fell by 12-15%. Secondly, there is a difference in the way technology is applied in China and other countries. In terms of the evolution of quantitative investment strategies, China focuses on policy text + capital flow forecasting, while the US focuses on "alternative data + market making strategies". The relevant report pointed out that in 2019-2023, the sensitivity contribution to the excess return of China's AI quantitative fund will reach 47%, compared with 19% in the United States. In the direction of the popularity of intelligent investment advisers, 68% of Chinese AI investment adviser users are 25-35 years old, while the United States accounts for only 42% of this age group. In the process of development, China also has technical bottlenecks, China's "Bayesian optimization + big data risk control" model, so that the accuracy of high-risk asset allocation increased by 21%, but due to cultural trust issues, the adoption rate of older users is less than 5%. The third aspect is the difference in the direction of cutting-edge research. In the direction of quantum computing competition, China's Origin Quantum team developed a "quantum reinforcement learning" model, which has a prediction accuracy of up to 79% for the next 30 days for CSI 300 constituent stocks, and the "quantum derivatives pricing" platform constructed by IBM and Goldman Sachs, but it has not yet been implemented. IBM and Goldman Sachs cooperated to build a "quantum derivatives pricing" platform, but it has not yet entered the real market stage[11]. In the direction of ESG AI application comparison, Zhang Xiaohui breaks through the bottleneck of traditional ESG rating through the integration of government data, compared with the EU's "Sustainable Finance Classification", China's model has an advantage in terms of "data localization" and "policy response speed"[12]. The EU relies on satellite remote sensing + supply chain database. In terms of rating effect, the AUC value of the Chinese model for AI's prediction of money laundering risk is 0.87, while the EU model only reaches 0.72 due to data fragmentation.

5. Conclusions

This paper systematically explores the multidimensional impact of AI technology on the Chinese stock market. The study focuses on the current status of AI applications in the stock market, the double-edged sword effect on market efficiency, as well as international experience and China's path. The study shows that AI technology is deeply restructuring the ecology of China's stock market: while improving market efficiency, it also brings emerging risks such as data security and algorithmic discrimination, so regulators need to seek a dynamic balance between encouraging innovation and risk prevention and control and build a "technology-penetrating regulation + human-machine collaborative governance" system with Chinese characteristics. In the future, algorithmic stress testing tools should be developed to prevent narrative bubbles triggered by generative AI and the subversion of pricing models by quantum computing, and to explore the integration path of "regulatory science and technology + policy innovation" in order to realize the dual goals of market efficiency and inclusive growth.

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