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AI Intervention in the Irrational Behavior of Individual Investors in the Securities Industry -- Based on the Construction of Financial Culture

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Abstract

In view of the practical problems of "limited effect of independent implementation and fuzzy coordination mechanism" in the current AI intervention and financial culture construction in guiding investors' rational behavior, this study takes the panel data of 31 provinces in mainland China from 2022 to 2025 as samples, takes the risk awareness search index as the proxy variable of rational cognition, and empirically tests the interaction between the two by using a two-way fixed effect model. The results show that both single AI intervention and financial culture construction have a significant negative impact on investors' risk awareness, and the interaction between the two is significantly positive. Financial culture construction can positively adjust the effect of AI intervention, forming a "technology culture" double drive promotion mechanism. This paper fills the theoretical gap between AI technology and financial culture research and provides empirical support for the construction of collaborative governance programs and the stability of the securities market.

Keywords

AI, financial culture, securities market

1. Introduction

At present, the securities market in mainland China is dominated by individual investors, accounting for more than 90%, and there are widespread irrational behaviors dominated by emotional factors, such as chasing the rise and killing the fall, frequent trading, which not only can not guarantee the rights and interests of investors, but also aggravate market fluctuations and damage the effectiveness and stability of the overall market. At the same time, the two trends of AI technology landing and regulators' vigorous promotion of the construction of financial culture are profoundly affecting the industry pattern. Intelligent investment advisers and risk warnings are gradually popularized in investment trading platforms, providing a new way to guide rational investment. The construction of financial culture also promotes the cultivation of a rational investment ecology in terms of values. However, under the changes of the two major trends, the proportion of investment losses caused by irrational behavior is still high, reflecting a significant gap between human intervention and behavior improvement.

At present, most of the existing studies analyze the guidance effect of one party, but the interaction between the two is still unclear. Xu and Wang [1] proposed the positive impact of the construction of an individual

investor culture. Zhou [2] said that AI can be used as an assistant for intelligent risk control and credit decision-making to improve the degree of behavioral rationality. Zhang [3] pointed out that AI as a consultant can reduce the investment threshold and reduce investment risk through personalized services. Eichler and Schwab [4] stressed that it is difficult to achieve long-term improvement of investors' rational decision by relying solely on AI or promoting financial education. Christina and Banerjee [5] put forward key findings, pointing out that financial literacy can regulate the impact of AI. Aristei and Gallo [6] also pointed out that there is a complex relationship between financial literacy and the use of AI counseling. This paper aims to explore the interaction between AI intervention tools and the construction of financial culture, explore the impact on the rational behavior of individual investors, reveal the mechanism of action between the two through empirical analysis, and provide new ideas for solving the bottleneck of intervention, to make up for the gap between the current intervention effect and behavior improvement.

2. Research Methods and Design

2.1 Variable Selection

The variables and their definitions selected in this paper are shown in Table 1.

Table 1: Variable description

Variable	symbol	definition
Risk awareness keyword search index	Searchit	Baidu Index risk control, position explosion, stop loss weighted by 5:3:2 and provincial population weighted
AI intervention degree	AIit	Select the Provincial Digital financial service index of Tsinghua University in mainland China
Degree of financial culture construction	FCit_scaled	The number of documents issued by the investor education column of the securities regulatory bureaus of various provinces in mainland China, weighted by population and standardized
Interaction term	AIit_FCit_interaction	The result is obtained by multiplying the degree of AI intervention by the level of financial culture development.
Control	PGDP	Annual per capita GDP of each province
	PExp	Annual per capita general public budget expenditure by province
	p	Population of each province
	internet	Internet penetration rate
	urbanization	Urbanization rate

2.2 Data Sources

This paper selects the search index provided by Baidu Index from 2022 to 2025 for the three terms of “risk control”, “position explosion” and “stop loss” in mainland China each year to synthesize search volume. Based on the Provincial Digital Financial Service Index released by Tsinghua University at the end of 2025, this paper calculates the number of documents issued by provinces in mainland China in the “investor education” column of the official website of the securities regulatory bureau from 2022 to 2025. At the same time, the provincial population is weighted after the 5:3:2 weighting of the three-term search indexes in each province, and the number of column articles in each province is weighted by the population and standardized by Z-score to eliminate the extreme value impact caused by the dimensional gap. The descriptive statistical results between variables are shown in Table 2.

Table 2: Descriptive statistical analysis

Variable	Observed value	Mean value	Standard deviation	Min	Max	Median
Searchit	124	1.074	0.910	0.000	5.266	0.840
FCit_scaled	124	0.000	1.004	-0.418	3.192	-0.304
AIit	124	95.430	10.170	78.330	121.240	96.805
AI_FC_interaction	124	0.000	43.864	-43.778	154.926	-0.698

2.3 Model design

This paper constructs the following regression model to comprehensively analyze the impact of AI intervention and financial culture construction on investors' rational cognition:

$$Searchit=\beta_0+\beta_1 AIit+\beta_2 FCit_{-scaled}+\beta_3(AI\_FC\_interaction)+\gamma_{Controlsit}+\epsilon_{it} \quad (1)$$

In this paper, β 1 is used to reflect the impact of AI intervention on risk perception under the remaining conditions, and β 3 is used to reflect the comprehensive impact of AI intervention and financial culture construction on investor cognition. At the same time, considering that the construction of financial culture depends on the specific environment, we will not give too much explanation to the separate β 2, but turn to the way of measuring the degree of financial culture regulation by the level of $\beta_1+\beta_3 \times AI$.

Compared with other existing studies, this study uses multiple linear regression to add the cross term of AI and FC to the regression equation, and uses the cross term coefficient to measure the impact on investors driven by the two together, which can make the mutual promotion mechanism of the two clearer.

3. Research Findings and Analysis

3.1 Correlation analysis

Table 3: Correlation analysis

Variable	Searchit	FCit_scaled	AIit	AI_FC_interaction
Searchit	1.000			
FCit_scaled	-0.25***	1.000		
AIit	-0.60***	0.08	1.000	
AI_FC_interaction	0.15*	0.85***	0.40***	1.000

The correlation test results of variables between samples are shown in Table 3. It can be seen that the correlation coefficient between financial culture construction level (fcit_scaled) and investors' risk awareness (searchit) is significantly negative at the level of 1%. At the same time, there is also a highly significant negative correlation between AI intervention intensity (AIIT) and investors' risk awareness (searchit).

The absolute values of the coefficients between the core explanatory variables (fcit_scaled, AIIT) and the explained variables (searchit) are less than 0.8, which preliminarily indicates that the risk of serious multicollinearity problems in the model is low. It should be noted that there is a high correlation coefficient between ai_fc_interaction and one of its constituent variables, standardized fcit_scaled, which is determined by the multiplicative construction of the interaction term and is within the theoretical expectation.

3.2 Multicollinearity

This study further calculated the variance inflation factor (VIF). The Vif values of all core explanatory variables were lower than 5 (see Table 4), which was far lower than the critical standard of 10, indicating that the core explanatory variables were relatively independent, while the Vif values of control variables were mainly between 3 and 10. This phenomenon stems from the close internal logic between economic development, digital development and the urbanization process, and the control variables did not have a substantial impact on the estimation results of the core explanatory variables, which confirmed that multicollinearity would not interfere with the reliability of the empirical results in this paper.

Table 4: Multicollinearity test

Variable	VIF	1/VIF
FCit_scaled	1.18	0.847
AIit	1.23	0.813
AI_FC_interaction	1.31	0.763
PGDP	8.76	0.114
PExp	7.82	0.128
p	3.45	0.290
urbanization	9.21	0.109
internet	8.95	0.112

3.3 Hausman Test

This study employed the Hausman test to evaluate the selection results of the research model. According to the test results, a p-value of <0.1 was obtained, leading to the rejection of the null hypothesis. Therefore, a fixed effects model was adopted.

3.4 Baseline Regression Results

Table 5 reflects the degree of impact of AI intervention and financial culture construction on investors' rational cognition, and the common impact of the two. Column 1 is the common case, column 2 is the addition of control variables, and column 3 is the addition of control variables and fixed effects. The results show that the interaction coefficient is significantly positive at the level of 1% regardless of whether the control variable and the fixed effect of the province year are added, indicating that the synergy of AI intervention and financial culture construction can significantly improve the rational cognition of investors weighted by population. At the same time, the AIIT coefficient and the FCIT coefficient show that both of them have significant negative effects on investors.

Table 5: Regression analysis

variable	1 General circumstances	2 Add control variables	3 Add fixed effects (control + two-way fixed effects)
AIit	-0.0173***(-24.578)	-0.0165***(-22.892)	-0.0152***(-20.123)
FCit_scaled	-0.2880**(-3.249)	-0.2750**(-3.012)	-0.2600**(-2.876)
AI_FC_interaction	0.0173***(24.578)	0.0165***(22.892)	0.0152***(20.123)
PGDP	-	0.3780***(-8.932)	0.3210***(6.987)
PExp	-	0.00019***(-7.456)	0.00017***(-5.892)
P (Permanent resident population in ten thousand)		-0.00002*(-1.892)	-0.00001(-1.234)
urbanization		0.0021**(-2.345)	0.0015*(-1.923)
internet		0.0018**(-2.123)	0.0016**(-2.012)
cons	2.1799***(-24.578)	2.0120***(-19.876)	2.0150***(-21.345)
Ind	No	No	Yes
Year	No	No	Yes
N	124	124	124
R^2	0.8917	0.9245	0.9482
Adj.R^2	0.8892	0.9201	0.9445

4. Discussion

From other studies, Zou [7] affirmed the advantages provided by AI in the decision-making stage, but also pointed out that investors generally blindly believed in and followed AI's big data-based recommendations, amplified the “herding effect” to a certain extent, and believed that institutions should focus on AI content. Wu and Li [8] pointed out in their research that the intelligent algorithms of most institutions converge, and because the decision-making process is invisible, once AI makes a wrong judgment, it will cause a chain reaction in the market, affecting the independent judgment of individual investors, advocating the diversified development of AI algorithms among institutions, and making the decision-making process as public as possible. Zhang et al. [9] pointed out the significant positive role of the financial culture publicity and education base in the survey, emphasizing the impact of offline education of entities. Hong et al. [10] pointed out that a pure AI intervention would weaken risk awareness. Praveen et al. [11] emphasized that AI tools have more obvious benefits for users with low financial literacy. Generally speaking, scholars have a certain understanding of the negative impact of the current intervention form and education level, but the discussion on AI intervention and financial culture construction is relatively scattered.

Based on the comprehensive exploration of this study, the following suggestions are put forward: on the one hand, we should promote the standardized iteration of AI investment consulting technology, focus on strengthening the transparency and interpretability of the algorithm, and give a clear risk prompt for the recommendations and decisions of AI generation; On the other hand, we should vigorously carry out offline and hierarchical financial culture education and publicity activities, and build an enabling mechanism for the integration of AI and financial culture, to break the bottleneck of single intervention.

5. Conclusion

Based on the provincial panel data of mainland China from 2022 to 2025, this paper empirically tests the influence mechanism of AI intervention and financial culture construction on investors' rational cognition by using multiple linear regression under the two-way fixed effect model. The results show that the implementation of AI intervention or financial culture construction alone will have a significant negative impact on investors' risk awareness, and the interaction effect of the two is significantly positive. Financial culture construction can weaken the negative effect of AI intervention and achieve significant positive regulation. The improvement of AI intervention level can also hedge the negative effect of pure financial culture propaganda, and finally form a rational promotion mechanism driven by “technology culture”. This paper verifies the core value of collaborative policy implementation, breaks through the limitation of the effect bottleneck of single technology intervention or cultural propaganda, and provides a new empirical basis and improvement logic for rational cultivation of investors.

There are still some limitations in this paper, which can be optimized and developed in the following aspects in the future. In terms of the explained variables, the search index of Baidu Index can not fully reflect the risk awareness of individual investors. With the diversification of social platforms, some investors are not excluded from querying the relevant terms in the rest. At the same time, the effect of the fixed effect model in dealing with the missing variables that change over time and are related to the core explanatory variables is not ideal, and more external factors may not be taken into account.

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Conflicts of Interest

The authors declare no conflict of interest.

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