Scientific Research Publishing

Modern Economy, 2025, 16(1), 81-113
https://www.scirp.org/journal/me
ISSN Online: 2152-7261
ISSN Print: 2152-7245

Gas Pedal or Stabilizer: The Mystery of Financial Development Affecting Financial Fraud Revisited

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How to cite this paper: Duan, L. L., Qu, Y., & Li, Y. B. (2025). Gas Pedal or Stabilizer: The Mystery of Financial Development Affecting Financial Fraud Revisited. *Modern Economy, 16,* 81-113.
https://doi.org/10.4236/me.2025.161004

Received: September 15, 2024
Accepted: January 17, 2025
Published: January 20, 2025

Abstract

The rapid development of finance is accompanied by the trend of new type and digitization, and at the same time, the phenomenon of financial fraud has also emerged. Based on CHFS micro data and official macro data respectively, this paper uses entropy weight method Topsis to construct a three-level and more universal financial development index, which proves the positive relationship between financial development and financial fraud through both macro and micro dimensions. At the micro level, this relationship is transmitted through risk appetite and exogenous financing ability, and is more significant in the micro groups of eastern region, low education level, and non-financial practice. At the macro level, this relationship is further attributed to the increase in financial development potential and the development of Internet finance, while the increase in the size of the traditional financial market and financial regulatory inputs contribute to the regulation of financial fraud. The paper accordingly provides policy recommendations to help build more transparent, regulated and healthy financial markets.

Keywords

Financial Development, Financial Fraud, Macro and Micro, Policies and Recommendations

1. Introduction

As computers began to enter China in the 1990s and gradually became more popular, the enrichment of financing means under the auspices of science and technology seemed to provide a more fertile ground for financial fraud. 2013 has seen a new wave of finance sweeping through China, represented by WeChat Pay, Ant

Group, Tencent Financial, Jingdong Financial and other financial technology subsidiaries. "Tencent Finance" "Jingdong Finance" and other financial technology subsidiaries are the representative of a new wave of financial sweeping. Official and private financing methods are endless. According to data from China's referee network, in the past twelve years, the frequency of financial fraud in China has shown a trend of first rise and then fall, and the starting point of its sharp rise is precisely synchronized with the starting point of the explosive development of finance, from more than 2000 cases in 2013 to more than thirteen thousand cases in 2014, and after 2016, the trend is decreasing year by year. 2023 Premier Li Keqiang, at the first meeting of the fourteenth session of the National People's Congress, pointed out that in this year, one of the priorities of the government's work is to "effectively prevent and resolve major economic and financial risks, deepen the reform of the financial system, improve financial supervision, pressurize the responsibilities of all parties, and prevent the formation of regional and systemic financial risks"; in October of the same year, the Central Financial Work Conference put forward the idea of "unswervingly taking the road of financial development with Chinese characteristics, and promoting the high-quality development of China's financial sector". It also mentioned "doing a good job in five aspects: science and technology finance, green finance, inclusive finance, pension finance, and digital finance"; January 16, 2024 to promote the high-quality development of financial seminar opening ceremony further emphasized the need to "conscientiously implement the decisions and deployments of the financial work conference, and promote the high-quality development of the economy and finance in an integrated manner, so as to make new and greater contributions to the comprehensive advancement of the construction of a strong nation and the national rejuvenation of the great cause with Chinese-style modernization".

On the one hand, financial development has generated a richer range of financial products and services, objectively providing a wider range of opportunities and space for financial fraud; on the other hand, financial development is accompanied by the continuous improvement of the regulatory system and technical means, which will contribute to preventing and combating financial fraud. Which influence is more dominant needs to be explored through empirical evidence.

Exploring this connection, we comprehend the financial development and financial fraud under different time and space conditions. It is conducive to the government and regulatory agencies effectively formulating relevant policies and regulatory measures to ensure the stability and healthy development of the financial market, thus providing a strong guarantee for realizing the long-term sustainable growth of the national economy. Meanwhile, it also provides the theoretical basis for financial institutions and investors to identify and manage the risk of financial fraud more accurately, and promotes public awareness of financial security. At the same time, it provides a theoretical basis for financial institutions and investors to more accurately identify and manage the risk of financial fraud,

promotes the public's ability to prevent financial fraud, enhances the overall financial literacy of citizens, strengthens the awareness of social financial security, lays a solid foundation for the promotion of high-quality development of China's economy, is conducive to boosting the confidence of the development of the financial market, coordinates the development of financial security, deepens the implementation of the "financial power" development strategy, promotes the economic transformation, upgrading and sustainable development, and contributes to the construction of a more transparent and sustainable development. It is conducive to boosting confidence in the development of the financial market, integrating financial development and security, deepening the implementation of the development strategy of a "strong financial country", promoting economic transformation, upgrading and sustainable development, and contributing to the construction of a more transparent, standardized and healthy financial market, so as to accelerate the realization of building a socialist modernized power.

2. Literature Review

2.1. Progress in Financial Development Research

Unlike the static attributes of most economic concepts, financial development, as a macro-dynamic concept, is a product of the continuous development of the economy and society. Thus, the theory of financial development is not fixed, it contains rich theoretical content, which in turn reflects the different characteristics of financial development in different times (Li, 2020). From the earliest research, financial development was simply defined as the increase in the number of financial institutions and the expansion of the scale of financial assets (Gurley & Shaw, 1955). Later, some scholars further expanded the connotation and extension of financial development from the perspective of financial marketization and introduced financial inhibition in the study of financial development, thus summarizing financial development into three major parts, namely, the increase in the increase and enrichment of financial assets and categories, the increase in the number of financial institutions, and the market-oriented pricing of interest rates and exchange rates (McKinnon & Pill, 1997). Some scholars, based on the idea of Gurley & Shaw, summarize financial development as the expansion of financial scale and the improvement of efficiency (Wang et al., 2022). Due to the different backgrounds of the times, various scholars have interpreted financial development from different focuses, and it has later been defined as the increase of marketization level (Wang, 2018), the improvement of financial functions (Wang et al., 2023), and so on.

In short, the definition of financial development by relevant scholars is relatively focused on two levels: macro level—financial development is the process of continuous improvement and expansion of a country's or region's financial system, aiming to promote economic growth, improve productivity, increase employment opportunities, and enhance the well-being of the people's lives; micro level—financial development covers five major aspects: the number and size of

financial institutions, the depth and breadth of financial markets, the degree of innovation in financial products and services, the effectiveness of financial regulation and governance, and the cultivation and expansion of financial talents (Tian, 2020; Wang, 2018).

Financial development is jointly driven and influenced by a variety of factors, including economic growth, financial market demand, fintech innovation, financial market liberalization, financial regulatory reform, and policy support and the legal environment. Firstly, economic growth is regarded as the foundation and driving force of financial development, and the booming economy makes financial demand expanding, thus promoting the development and growth of financial institutions and the innovation and diversification of financial products; secondly, the iteration of financial technology can bring great changes to the financial industry, improve financial efficiency, reduce financing costs, and promote the popularization and convenience of financial services; at the same time, a sound financial regulatory system and a At the same time, a sound financial regulatory system and standardized market order is the guarantee of financial development, and effective regulatory reform can enhance the stability and transparency of the financial system; finally, government policies and legal environment have an important impact on the development of the financial industry, and good policy support and the rule of law environment can attract more investment, promote financial innovation, and provide sustained vitality for the development of finance (Zhang, 2023).

The influencing factors of financial development involve all aspects of the socio-political economy, which is an intricate and complex systematic project, and the exploration of its influencing and driving factors is conducive to the further improvement of the realization path of high-quality financial development.

2.2. Progress in Financial Fraud Research

In order to ensure the systematic nature of the research content, this paper analyzes the characteristics of financial fraud research, found that the current financial fraud mainly shows three characteristics.

First, the phenomenon of modern financial fraud is frequent. In the modern era of the rapid development of the Internet and digitalization, financial fraud is mainly modern type, and at present, other scholars in the same field also mainly combine financial fraud and financial risk with modern technology to conduct research, for example, research on financial fraud centered on the Internet, and analyze the characteristics of the characteristics and preventive measures to explore (Yan, 2017). In addition, there are scholars who study the operation mechanism of financial fraud gangs in the context of digitization (Ai et al., 2023), in short, modern-type financial fraud occupies a major position in the current frequent financial fraud. Secondly, financial frauds targeting middle-aged and elderly families predominate. It is not difficult to analyze the modern financial fraud to find that the current financial fraud gangs take the middle-aged and old-aged

families as the main object of their fraud, and relevant scholars have also studied it, such as the financial risk factors of middle-aged and old-aged families from the perspective of the victim of financial fraud (Li et al., 2022). And on the basis of relevant research, scholars have mainly put forward proposals to prevent financial fraud in middle-aged and elderly families (Xia, 2019). Thirdly, rural financial fraud is frequent. The frequent occurrence of financial fraud in rural areas inhibits the economic development of rural areas and reduces economic benefits. In this context, scholars are generally more concerned about financial fraud in rural areas, the lower level of financial knowledge of rural households has become the main factor of rural financial fraud, and financial knowledge has a heterogeneous and moderating effect on rural financial fraud (Li et al., 2020), therefore, improving the level of financial literacy of farmers is the key to preventing financial fraud in rural areas, and in addition to this key factor, financial management mode, legal awareness, illegal fund-raising, etc. are also important factors affecting rural financial fraud (Li & Jiang, 2019).

2.3. Study on the Relationship between Financial Development and Financial Fraud

On the one hand, the innovative, technological and diversified nature of the financial sector provides a breeding ground for financial fraud, enriching the means of financial fraud and making it difficult to be recognized and curbed. The rapid development of Internet finance has substantially contributed to the trend of online financial consumption, and data leakage has induced fraud (Cui, 2023). The most important element in Internet finance is big data, and lawless elements control massive amounts of data for profit, inducing financial fraud crimes (Wan, 2016). Currently, the financial black and grey zone industry is highly organized, specialized, and technological (Cui, 2023), resulting in financial fraud currently has a variety of means. In addition, the network and the Internet have become one of the main mediums for financial fraud, and cybercrime is prevalent because of the increase in Internet penetration, the network prosperity created during the outbreak closure and control, the development of digital financial payment technologies such as Alipay, and the existence of a large amount of violable property in cyberspace due to the high degree of non-cash payment, all of which are triggers that lead to the occurrence of cyber-electrofraudulent behaviors (Du & Chen, 2023), and the use of the Internet has the characteristics of a "black belt", which is highly organized and technologically advanced. The use of the Internet has an "exposure effect", which can increase the incidence of fraudulent behavior among the elderly (Lei, 2022). There are also difficulties in identifying and regulating financial development and criminal offenses, as the two are easily converged, and the corresponding laws, regulations and technical support are lagging behind, making it difficult for the relevant departments to investigate and verify the identity of the real users of funds and the use of funds, as well as to identify and regulate the use of funds (Wei, 2018).

On the other hand, the financial industry's deep development, systemic completeness, and technological efficiency also provide effective ways to combat financial fraud. The rapid development of science and technology enables the risk control of financial crimes, and the means of information technology helps residents, financial regulators and fraudsters to carry out "information battles" (Liu, 2023). Internet companies can also participate in the front-end prevention and management of wire fraud, which has given rise to a new mode of cooperation between police and enterprises (Zhu, 2023). Internet technology also has a "learning effect", the positive influence makes the probability of the elderly actually being defrauded reduced, the actual amount of loss is reduced. The positive learning effect has the greatest impact on rural and elderly women in the information cocoon state, outweighing the negative effect. Similarly, the degree of digital financial inclusion has a greater impact on female seniors, but the positive effect it plays in rural areas needs to be further enhanced. For example, using the Peking University Digital Financial Inclusion Index in place of digital financial development, it was found that older people in areas with a high degree of financial inclusion had a higher likelihood of being exposed to fraud, but a lower probability of being exposed to fraud and then being subjected to actual fraud (Lei, 2022). At the same time, by actively participating in financial and business activities, people have a deeper understanding of the relationship between financial market characteristics and return-risk, which is conducive to enhancing their ability to screen for fraud. In addition, past studies have mostly linked investors' objective financial literacy and financial fraud (Meng & Cao, 2023), and the likelihood of being subjected to financial fraud decreases significantly with the improvement of objective financial literacy (Zhang et al., 2020).

At present, the existing academic literature lacks a direct discussion of the relationship between financial development and financial fraud, mostly Internet finance as a proxy variable for the degree of financial development to discuss the relationship with financial fraud, such a proxy lacks comprehensiveness. In the existing relevant empirical research, financial development as the independent variable is more "Internet finance", "data finance" and other indicators to replace, cannot fully reflect the attributes of financial development connotation, so the conclusions and recommendations based on this there is still room for further improvement. Therefore, there is still room for further improvement of the conclusions and recommendations based on them. And because most of the literature adopts a single domain indicator as the ultimate sole independent variable, its research fails to reflect the multiple structural indicators covered under the broad connotation of "financial development" for the inhibition or promotion of financial fraud, and thus fails to draw strong explanatory power for the phenomenon of financial fraud in different time zones and groups, and then in the future, it is not possible to draw effective conclusions on the occurrence of financial fraud in different time zones and groups. The occurrence of effective conclusions, and thus the lack of the underlying theoretical support for the potential operation of the

current financial market in the provision of advice.

In summary, the main marginal contributions of this paper are: first, combining the micro and macro levels, directly studying the relationship between financial development and financial fraud, and scientifically establishing the path of the transmission mechanism between financial development and financial fraud, which bridges the gap in the study of the relationship between the two. Second, it scientifically constructs a more universal financial development index covering three levels, taking into account traditional and innovative financial development as well as human capital and quality in the financial field, and optimizes the single-focused financial development indicators in existing research. Third, based on the coverage of the financial development index, we explore the structural impact of the independent variable "financial development" and adopt structural deepening measures for it, so as to provide multifaceted suggestions for the policy governance of regulating financial fraud, and also create more sufficient feasibility for the implementation of relevant policies.

3. Theoretical Framework and Research Hypotheses

3.1. Financial Development and Financial Fraud

As mentioned above, there is currently a widespread view in the academic community that there is a promotional relationship between financial development and financial fraud. Cui Jiatong believes that Internet finance will give rise to financial fraud under the incentive of data leakage; similarly, the scholar Weining believes that the mismatch between the rapid development of finance and the time lag of relevant regulation is the main cause of financial fraud.

At the same time, according to the information asymmetry theory and moral hazard theory, it is not difficult to derive the following conduction process: along with the development of financial markets and the increase in the enrichment of financial products and services, financial institutions and their practitioners usually have more systematic and comprehensive information and professional knowledge than the general investment enterprises and individuals, so that they have the objective basis and subjective tendency to take advantage of the difference in resources and information in order to defraud or induce investors to carry out unfavorable transactions. The objective basis and subjective tendency of financial institutions and their practitioners to take advantage of resource information differences to defraud or induce investors to engage in unfavorable transactions.

Based on the current stage of research on the relationship between the level of financial development and financial fraud and its shortcomings, this paper combines the research content of its own subject and puts forward the following hypotheses:

H1: Individuals with higher levels of financial development are more vulnerable to fraud losses.

3.2. Heterogeneous Elements of Financial Fraud

For the study of the heterogeneity factors of financial fraud, the current academic community focuses on two parts, one part is the basic information characteristics of the sample and the other part is the family characteristics of the sample.

In terms of basic information characteristics, relevant scholars are generally concerned about the impact of gender, age, household registration, region of affiliation, education level, marital status, occupational status and so on financial fraud (Chen, 2020; Chu et al., 2017; Grohmann et al., 2018; Utkarsh et al., 2020); in terms of family characteristics, scholars are more concerned about the impact of home ownership, household assets and income on financial fraud (Anderson et al., 2017; Feng et al., 2019).

Based on the heterogeneity factor of financial fraud, this paper proposes the following hypotheses:

H2.1: There is regional heterogeneity in the positive relationship between level of financial development and financial fraud.

H2.2: There is education level heterogeneity in the positive relationship between level of financial development and financial fraud.

H2.3: The positive relationship between the level of financial development and financial fraud is influenced by the financial practitioner's household.

3.3. Financial Development and Financial Fraud Transmission Mechanisms

It is particularly important to clarify the transmission mechanism in which financial development affects financial fraud, and this paper explores possible transmission mechanisms starting from the internal factors of financial development.

Internet finance, as a central factor in the level of financial development, has improved the risk tolerance of households when investing to a certain extent, and it is also easier for households to access financial information (Ning, 2023), while there is a significant positive correlation between risk attitudes and both whether or not they experience fraud and the amount of money lost due to fraud, i.e., people with a risk preference are more likely to experience fraud, and the amount of money lost due to fraud is also greater (Chen, 2020).

Digital inclusive financial development is one of the specific embodiments of financial development, while digital inclusive financial development will effectively promote residents' consumption, which is mainly realized through two mechanisms: alleviating liquidity constraints and facilitating residents' payments (Li & Jiang, 2019). At the same time, having rich financial knowledge can enhance financial self-confidence and alleviate the credit constraints faced by residents (Yin & Zhang, 2020), and thus the available funds faced by residents increase and the level of indebtedness rises. And in the context of the predominance of online mobile payments, fraudsters have the opportunity to capitalize on the information leakage in loan financing to commit loan fraud by posing as a fraudulent person from online borrowing platforms through digital payment accounts (Zheng, 2021).

Based on the results of existing related literature and in conjunction with the content of our own research, the following hypotheses are proposed:

H3.1: Risk appetite positively mediates the relationship between level of financial development and financial fraud.

H3.2: Exogenous financing capacity positively mediates the relationship between level of financial development and financial fraud.

3.4. Structural Impact of Financial Development

The potential for financial development, Internet finance and traditional financial markets have a dual impact on the occurrence of financial fraud.

On the one hand, the expansion and innovation of financial markets have provided criminals with a wider scope of action, which has had a catalytic effect. The increased potential for financial development, as new financial products and services are often accompanied by new regulatory and risk management challenges, means that the vulnerability of the financial system may increase. This trend is further amplified by Internet finance, which is characterized by the rapid dissemination of information and ease of transactions, providing an ideal platform for criminal acts such as cyberfraud.

On the other hand, traditional financial markets have a dampening effect on financial crime through the transmission process of strict regulation and standardization, supervision and enforcement by regulators, increased information disclosure and transparency, and heightened compliance awareness among market participants. The regulatory framework of the traditional financial market can ensure that market participants comply with the code of conduct and prevent the occurrence of illegal acts such as insider trading and market manipulation; the law enforcement capability of the regulatory bodies and the information disclosure requirements have increased the transparency of the market and reduced the risk of fraudulent acts; at the same time, such a strict regulatory environment has also prompted the market participants to enhance their awareness of compliance and consciously comply with the market rules and laws and regulations, which has effectively reduced the occurrence of financial crimes.

Therefore, based on the above analysis, the following assumptions are made:

H4: The potential for financial development and the development of Internet finance act as a catalyst for the occurrence of financial fraud, while the development of traditional financial markets acts as a disincentive.

4. Research Design

4.1. Data and Variables

4.1.1. Independent Variables

The explanatory variable of this paper is the level of financial development. There is a wide range of methods to measure financial development, which can be broadly categorized as technical indicator method, customer satisfaction survey, economic impact assessment, literature review and case study assessment and so

on. This paper has conducted extensive research on the technical indicator method, and some scholars have used the three dimensions of financial scale, financial structure and financial efficiency to measure the level of financial development (Wang, 2018; Dong & Zhou, 2019). These methods focus on traditional financing channels, ignoring the measurement of non-traditional financing channels such as the bond market and equity financing, and lack definitions at the micro level, making it difficult to combine financial development with the behavior and awareness of households or individuals. In this paper, we first construct the financial development index system at the micro level, and after screening the relevance of indicators and the completeness of observations, we define the following questions in the CHFS micro survey, and give the corresponding scoring rules to construct the financial development index.

The development and enrichment of the financial system is firstly reflected in the financial assets owned by households, and the number of investable financial assets of households has increased and become more diversified, so financial assets are selected as an aspect of measuring the level of financial development; secondly, with the progress of information technology, the development of finance is also reflected in its vertical deepening and Internet innovation, and Internet finance is a new form of business in the development of China's financial industry, therefore we also chose the degree of financial innovation linked to the Internet to measure the level of development, and accordingly measured the degree of penetration of the Internet into the household, and learned about the innovative financial tools that have been used by the household; finally, financial literacy refers to the ability of an individual to obtain economic and financial information and accordingly to plan their finances, return debts on time, plan ahead to save for retirement, and accumulate wealth (Lusardi & Mitchell, 2014), and the increased level of development of the financial society is also reflected in the increased level of investors and the increased completeness of their knowledge, so we measure the overall financial literacy of households.

Table 1. Definition of independent variables.

Interpretive dimension	Interpretative indicators	Questionnaire number	point system
financial asset	Availability of stock accounts	D3101	Yes = 1 point No = 0 points
	Whether or not the fund is held	D5102	Yes = 1 point No = 0 points
	Ownership of bank financial products	D7102	Yes = 1 point No = 0 points
Internet finance	Availability of Internet financial products	D7106d	Yes = 1 point No = 0 points
	Ever used innovative banking services	D2107	Only used bank/credit union branch counters = 0 points Also used other mobile types = 1 point

Continued

	Smartphone ownership	G1009a	No cell phone = 1 point, non-smart phone = 2 points Smartphone = 3 points
	Any online shopping experience	E2019	Yes = 1 point No = 0 points
financial literacy	Participation in finance courses	A4002b	Yes = 1 point No = 0 points
	Financial Information Attention	A4002a	Never Concerned = 1, Rarely Concerned = 2, Generally = 3. Concerned = 4, Very concerned = 5

A total of 5026 observations and the corresponding 9 indicators describing financial development screened above (Table 1) were tested for reliability and validity respectively to verify whether the samples and classifications we chose are credible and reasonable.

The results of the reliability test showed that the Cronbachα coefficient value was 0.621 and the quality of reliability of the study data was acceptable.

Table 2. Cronbach's reliability analysis.

Name (of a thing)	Correction Item Total Correlation (CITC)	α coefficients that have been deleted from the entry	Cronbach α coefficient
Participation in finance courses	0.342	0.588	0.621
Financial Information Attention	0.416	0.623	
Availability of stock accounts	0.443	0.561	
Whether or not the fund is held	0.254	0.607	
Ownership of bank financial products	0.229	0.610	
Availability of Internet financial products	0.326	0.591	
Ever used innovative banking services	0.328	0.589	
Smartphone ownership	0.281	0.601	
Any online shopping experience	0.396	0.569	

Standardized Cronbachα coefficient: 0.660.

The results of the validity test (Table 2) showed that the KOM value was 0.771, which indicated that the research data was suitable for extracting information, side by side reflecting a good validity. Also, the dataset passed the Bartlett's test, corresponding to a p-value of less than 0.05.

Second, the factor categorization of the questions matched expectations very well, with Factor 1 representing the "Internet finance" category as we defined it, Factor 2 representing the "financial literacy" category, and Factor 3 reflecting the "financial assets" category. Factor 2 represents the category of "financial literacy" and Factor 3 reflects the category of "financial assets". In the factor rotation,

"owning a stock account" is categorized in the "financial literacy" category, with a loading factor of 0.504; however, its expected category "financial assets" also has a loading factor of 0.3, and its expected category "financial assets" also has a loading factor of 0.3. However, its expected category "financial assets" has a loading coefficient of 0.364, which is within a reasonable range, so it can be used to measure the level of ownership of financial assets with a high degree of accuracy as well.

Table 3. Validity analysis.

Name (of a thing)	Factor number charge factor			Commonality (common factor variance)
	Factor 1	Factor 2	Factor 3	
Participation in finance courses	0.072	**0.771**	−0.033	0.600
Financial Information Attention	0.135	**0.769**	0.160	0.635
Availability of stock accounts	0.238	**0.504**	**0.364**	0.443
Whether or not the fund is held	0.068	0.142	**0.658**	0.457
Whether or not you own Money Bank financial products	0.019	0.038	**0.758**	0.576
Availability of Internet financial products	**0.538**	0.026	0.326	0.396
Ever used innovative banking services	**0.699**	0.091	0.013	0.496
Smartphone ownership	**0.606**	0.158	−0.106	0.404
Any online shopping experience	**0.716**	0.118	0.147	0.549
Eigenroot value (before rotation)	2.461	1.119	0.977	
Variance explained % (before rotation)	27.347%	12.428%	10.850%	
Cumulative variance explained % (before rotation)	27.347%	39.776%	50.626%	
Eigenroot values (after rotation)	1.743	1.508	1.305	
Variance explained % (after rotation)	19.369%	16.754%	14.503%	
Cumulative variance explained % (after rotation)	19.369%	36.123%	50.626%	
KMO value		**0.771**		
Barthels' spherical value		4389.050		
df		36		
p-value		0.000		

Using SPSSAU for 5026 evaluation (Table 3) objects from 9 index dimensions, entropy weight TOPSIS evaluation, through the entropy weight method to determine a good weight of each dimension, through the TOPSIS method weighted calculation of the final degree of proximity to the value of C, and will be defined as the financial development index, as the independent variable represents the level of financial development (Table 4).

Table 4. Summary of the results of the entropy method of calculating weights.

Term (in a mathematical formula)	The information entropy value e	Information utility value d	Weighting factor w
Participation in finance courses	0.8228	0.1772	17.49%
Financial Information Attention	0.9899	0.0101	1.00%
Availability of stock accounts	0.8663	0.1337	13.20%
Whether or not the fund is held	0.7815	0.2185	21.58%
Ownership of bank financial products	0.7895	0.2105	20.78%
Availability of Internet financial products	0.8279	0.1721	16.99%
Ever used innovative banking services	0.9721	0.0279	2.75%
Smartphone ownership	0.9991	0.0009	0.08%
Any online shopping experience	0.9380	0.0620	0.12%

4.1.2. Dependent Variables

In the related literature, most of the literature measures financial fraud from three aspects: whether one has suffered from financial fraud, financial fraud loss, and the number of types of financial fraud (Huang et al., 2021; Gong, 2020). Due to the large amount of missing data on the amount of privacy in the CHFS questionnaire, this paper selects the dichotomous variable of whether or not one has been subjected to financial fraud to measure financial fraud, and assigns a value to the variable through the respondent's answer to the question in the questionnaire; if the respondent answers "yes", it means that he/she has been subjected to financial fraud losses, and the variable is assigned a value of 1 at this time; If the answer is "no", the respondent is not considered to have suffered losses from financial fraud, i.e., the variable is assigned a value of 0 (Table 5).

Table 5. Definition of independent variables.

Variable type	variable name	Questionnaire number	Variable Meaning
explanatory variable	Whether or not you have been subjected to financial fraud	E3018	Binary variable, 1 for yes, 0 for no

4.1.3. Control Variables

Relevant studies have shown that the low level of financial knowledge of rural

households has become the main factor of rural financial fraud, and financial knowledge has a heterogeneous and moderating effect on rural financial fraud (Li et al., 2020), and scholars have also put forward suggestions for preventing financial fraud in middle-aged and elderly households (Xia, 2019). According to the key features of academic attention, this paper selects control variables from three dimensions of basic family characteristics, ability level characteristics, and macroeconomic characteristics, mainly age, literacy, real after-tax income, the region to which they belong, urban and rural areas, and so on. Since most of the control variables vary within the household, in order to match at the household level, and considering the similarity of the financial situation within the household, we choose the variable characteristics of the head of the household to represent the household characteristics (Table 6).

Table 6. Control variable definitions.

Interpretive dimension	Interpretative indicators	Questionnaire number	Point system
Basic characteristics of the family	Age of head of household	a2005	Specific values
	Account type	rural	Urban = 0 points Rural = 1 point
Characterization of the level of competence	Educational level of the head of household	A2012	Never attended school = 1 point, Elementary school = 2 points, Middle school = 3 points, High school = 4 points, Junior high school = 5 points, Junior college and high school = 6 points. High school = 4 points, middle school vocational high school = 5 points, college high school = 6 points, and Undergraduate = 7, Master's degree = 8, Doctoral degree = 9
	Whether the family is in the financial sector	A3006a	No one in the household is in the financial industry = 0 points One person in the household working in the financial sector = 1 point
	After-tax take-home pay within the household	A3020	Gross intra-household income, as a specific value
Macroeconomic characteristics	Area to which the family belongs	region	East = 1 point Central = 2 points West = 3 points

4.1.4. Mediating Variables

This paper discusses the transmission mechanism from the risk appetite and financing ability of micro individuals. Risk preference is expressed by respondents' answers to the question "For the first lottery ticket, you have a 100% chance to get $4000; if you choose the second ticket, you have a 50% chance to get $10,000, and

a 50% chance to get nothing, which one would you prefer?" The response to the questionnaire is expressed as if the respondent is willing to choose a higher return and take a higher risk, i.e., choosing the second lottery ticket, i.e., assigning a value of 1. If the respondent chooses the first lottery ticket, the risk appetite is low, and assigning a value of 0. As for the measurement of exogenous financing capacity, this paper draws on the ideas of Zhang (2022), and expresses it in terms of the borrowing capacity of each type, which is constituted as the household head's education, housing, vehicles, medical care, business and industry, and the sum of total indebtedness pens (Table 7).

Table 7. Intermediate variable definitions.

Interpretive dimension	Interpretative indicators	Questionnaire number	Points Rules
risk appetite	Return-Risk Options	A4006a	First ticket = 0 points Second ticket = 1 point
exogenous financing	Number of education loans	E1005	Specific values
	Number of housing loans	C2027	Specific values
	Number of vehicle loans	C7021	Specific values
	Number of medical loans	E4002	Specific values
	Number of commercial and industrial loans	B3004	Specific values

4.2. Descriptive Analysis (Table 8)

Table 8. Descriptive statistics.

Variable Properties	Variable name	Sample size	Average value	Description of variables and descriptive statistics
implicit variable	Whether or not you have suffered a fraudulent loss	5026	0.0464	1 = loss by fraud, 0 = no loss by fraud
independent variable	Financial Development Index	5026	0.2378	Maximum value = 1, minimum value = 0, standard deviation is 0.1760
control variable	Age of head of household	5026	3.7288	The ln value of the actual age of the respondents, the maximum value = 4.4886, the Minimum value = 2.8332 and standard deviation = 0.2672
	Literacy level of the head of household	5026	1.5131	Maximum value = 2.1972, minimum value = 0, standard deviation 0.4076
	Annual after-tax household income	5026	10.7506	The maximum value = 13.0170 and the minimum value = 5.5215. The standard deviation is 0.9662
	Presence of financial professionals within the household	5026	0.0770	No one in the household is in the financial industry = 0 points One person in the household working in the financial sector = 1 point

Continued

	city and countryside	5026	0.0551	Urban = 0 points, Rural = 1 point
	as suffix city name, means prefecture or county (area administered by a prefecture level city or county level city)	5026	1.6345	East = 1 point, Center = 2 points
intermediary variable	risk appetite	5026	0.6946	Maximum value = 1, minimum value = 0, standard deviation is 0.4606
	exogenous financing	5026	0.2673	Maximum value = 7, minimum value = 0, standard deviation is 0.5617

4.3. Modeling and Benchmarking

Whether an individual suffers from financial fraud is a dichotomous variable that is suitable for discrete models, and in this paper we use the tobit model, The model is set up in the form of Equation (1):

$$\text{fraud}\_{i} = \alpha + \beta_1 \text{fin}\_{\text{develop}_i} + \beta_2 X + u_i \quad (1)$$

Among them, fraud_{i} is the explanatory variable, which is a dummy variable for whether or not one encounters financial fraud; $\text{fin}\_{\text{develop}_i}$ is the core explanatory variable, which indicates the level of financial development, analyzed by entropy weight TOPSIS method, including three dimensions of "financial literacy", "financial assets" and "Internet finance"; is the coefficient of the core explanatory variable, and is the intercept coefficient, all of which are estimated by constructing a Tobit model regression; the control variable contains: household head's household, and is the intercept coefficient. "The coefficients of β_1 are the coefficients of the core explanatory variables, and α is the intercept coefficient, which are estimated by constructing a Tobit model regression; the control variables$X$ include: basic household characteristics such as household head's account and age of the head of the household, and the level of competence such as the head of the household's literacy level, the household's annual after-tax income, and the presence or absence of a financial professional in the household, as well as macroeconomic characteristics such as the region to which the household belongs. and macroeconomic characteristics such as the region to which the household belongs.

5. Empirical Results and Analysis

5.1. Baseline Regression

The results of the benchmark regressions, as in Column (1), show the effect of individual financial development level on the probability of being subjected to fraud (**Table 9**).

Column (1) shows that the marginal effect of the variable of interest, Individual Financial Development Index (IFDI), on exposure to fraud is 5.3%, which is

Table 9. Benchmark regression results.

Explanatory variable	(1) Whether or not you have been subjected to financial fraud
Individual financial development index	0.053*** (0.020)
Age of head of household	−0.034*** (0.012)
Literacy level of the head of household	−0.018** (0.009)
Annual after-tax household income	−0.008** (0.003)
Presence of financial professionals within the household	0.020* (0.011)
As suffix city name, means prefecture or county (area administered by a prefecture level city or county level city)	0.005 (0.004)
City and countryside	0.003 (0.013)

Note: *, **, ***denote significant at the 10%, 5%, and 1% levels, respectively, standard errors are in parentheses, and marginal effects of the estimates are reported in the table.

significant at the 1% confidence level, indicating that an individual's IFDI significantly increases the likelihood that the individual will be exposed to fraud.

In terms of the effects of the other variables in Column (1), the age of the head of household, the literacy of the head of household, and the annual after-tax income of the household significantly dampen the probability of being exposed to fraud, financial experience within the household somewhat exacerbates the exposure to fraud, while regional and urban-rural differences have no significant effect on whether or not one is exposed to fraud.

Since the variable uses the age of the head of the household, and the head of the household recorded in the questionnaire is almost an adult who already has a certain ability to recognize fraud, due to the late development of China's financial market, the older group is exposed to financial assets later, has a lower level of trust in the financial products, and does not easily pay for them, so the lower the risk of exposure to fraud, and is not easy to be scammed. Higher levels of literacy are accompanied by stronger anti-fraud capabilities and a lower likelihood of exposure to fraud. Households with higher annual incomes tend to be more loss averse, less likely to be gamblers, and less likely to be exposed to fraud. However, financial experience within the family may lead to more frequent exposure to financial products and more open-mindedness about investment and finance, making it easier to be exposed to fraud.

5.2. Intermediary Testing

To explore how individual financial development level is transmitted to the

probability of being defrauded, this paper uses group regression to investigate the transmission mechanism of financial defrauding triggered by individual financial level. Individuals with a high level of financial development tend to have a higher tolerance for risk and are willing to pursue higher investment returns, and this risk preference may make them less vigilant in the face of the temptation of high returns, thus increasing the risk of being defrauded. And according to Yin and Zhang (2020) and Zhang (2022), higher levels of financial literacy are associated with fewer credit constraints, and increased financial literacy broadens financing channels, thus this paper hypothesizes that the increased level of financial development with financial literacy as the first-level indicator is also accompanied by the relaxation of financing constraints, which in turn increases the probability of being defrauded when receiving exogenous financing. In this paper, risk preferences are characterized by respondents answering risky choice questions, and borrowing for education, housing, vehicles, healthcare, and business and industry are used as proxies to measure exogenous financing (Table 10).

Table 10. Intermediate test results.

Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)
	Individual risk appetite	Whether or not you have been subjected to fraud		Individual exogenous financing	Whether or not you have been subjected to fraud	
		High risk appetite	Low risk appetite		High exogenous financing	low exogenous financing
Individual financial development index	0.2561***	0.0793***	−0.0007	0.1926***	0.0583***	0.0456
	(0.0435)	(0.0234)	(0.0385)	(0.0526)	(0.0225)	(0.0438)
City and countryside	−0.0067	−0.0010	−0.0033	0.0210	−0.0034	0.0047
	(0.0297)	(0.0153)	(0.0288)	(0.0360)	(0.0148)	(0.0343)
As suffix city name, means prefecture or county (area administered by a prefecture level city or county level city)	0.0117	0.0040	0.0046	0.0333***	0.0035	0.0054
	(0.0081)	(0.0043)	(0.0072)	(0.0098)	(0.0042)	(0.0078)
Literacy level of the head of household	−0.0303	−0.0279***	0.0030	0.1181***	−0.0290***	0.0171
	(0.0193)	(0.0101)	(0.0178)	(0.0233)	(0.0098)	(0.0212)
Age of head of household	−0.1441***	−0.0386***	−0.0346	−0.1476***	−0.0434***	−0.0143
	(0.0260)	(0.0142)	(0.0223)	(0.0315)	(0.0130)	(0.0301)
Annual after-tax household income	0.0202***	−0.0085**	−0.0013	0.0532***	−0.0066*	−0.0070
	(0.0072)	(0.0038)	(0.0065)	(0.0087)	(0.0037)	(0.0079)

Continued

Presence of financial professionals within the household	0.0413	0.0236	−0.0067	0.0088	0.0218	−0.0074
	(0.0262)	(0.0149)	(0.0208)	(0.0317)	(0.0144)	(0.0222)

Note: *, **, ***denote significant at 10%, 5%, and 1% levels, respectively, with standard errors in parentheses.

The results of the risk preference mechanism test are shown in columns (1) (2) (3). The marginal effect of an increase in the level of financial development of an individual on risk preference is 25.6% and is significant at the 1% confidence level, which suggests that the better the financial development of an individual, the higher the risk tolerance that follows. In the group with higher risk preference, the effect of financial level exacerbating the probability of fraud is significant at 1% level and the marginal effect is 7.93%. In contrast, this effect is not significant and the regression coefficient is significantly smaller in the group with lower risk preferences. Thus, this paper proves that along with higher degree of risk appetite, higher level of financial development exacerbates the probability of financial fraud, which is consistent with the hypothesis of this paper.

The results of the exogenous financing mechanism test are shown in columns (4) (5) (6). The marginal effect of the level of individual financial development on exogenous financing is 19.26%, which is significant at the 1% confidence level. An increase in the level of finance means that it is easier for individuals to obtain loans from banks and financial institutions, thus increasing the likelihood of indebtedness, and this exogenous financing ability helps individuals to mobilize the required funds more quickly when they face an urgent need for funds. The mechanism test shows that in the group with high exogenous financing capability, the probability of suffering fraud increases by 5.83% for every 1 unit increase in financial level, which is significant at 1% confidence level. Financing activities are accompanied by higher exposure, along with higher fund-raising activities, which are more financially attractive to fraudsters, and tend to make financing individuals potential targets of fraudsters, increasing the probability of being defrauded, a result consistent with the hypothesis of this paper.

5.3. Heterogeneity Analysis

The results are analyzed for heterogeneity. Due to the vast terrain of China, the development differences between the eastern and western regions show obvious asymmetric situation, financial fraud breeding and reproduction of different environments, the individual financial level of the differences in the probability of suffering from fraud has a different impact; at the same time, there are also large differences in the characteristics of the individual households, which will affect the financial level of the conduction strength of the fraud. Therefore, this paper analyzes the heterogeneity of the valid households of the questionnaire by region, by education level of the head of the household, and by financial practice of the

family.

As the eastern region leads the country uniquely in development, while the central and western regions have more similar development characteristics, they are distinguished as the eastern region and the central and western regions; the education level of the household head is divided into 9 levels in the questionnaire, and in order to make the differentiation more significant, it is divided into two dimensions of high education and low education level, with the high level of education including post-secondary high school and above, and the low level of education including post-secondary vocational high school and below; and the regression results are shown in Table 9, based on the questionnaire's statistics on the statistics on the industry of family members, distinguishing between families with financial practitioners and families without financial practitioners, the regression results are shown in Table 11.

Table 11. Results of heterogeneity analysis.

Explanatory variable	(6)	(7)	(8)	(9)	(10)	(11)
	Eastern part	Central and Western region	High level of education	Low level of education	Financial industry	Non-financial services
	Whether or not you have been subjected to financial fraud					
Individual financial development index (factor)	0.060** (0.025)	0.047 (0.033)	0.044 (0.028)	0.053** (0.027)	0.091 (0.086)	0.052*** (0.020)
Control variable	YES	YES	YES	YES	YES	YES
N	2917	2109	2209	2817	359	4667

Note: *, **, ***denote significant at 10%, 5%, and 1% levels, respectively, with standard errors in parentheses.

As far as regions are concerned, the positive effect of the level of individual financial development on the probability of suffering fraud losses is more significant in the eastern region, while there is no significant effect on the residents of less developed regions in the central and western parts of the country, which may be due to the fact that fraudsters can obtain more economic rewards for their crimes in places with stronger economic power, and thus financial fraud is more prevalent in developed regions, and fraud in developed regions is more susceptible to the influence of the level of financial development. In terms of different levels of education, secondary vocational high school and below are more likely to be affected by the level of financial development and suffer from fraud, this effect is not significant for college high school and above, this may be due to the low level of education is often the main target of fraud, in which the high level of financial development of the population is more likely to be targeted, and the high level of education of the group of higher anti-fraud literacy, the level of financial

development does not play a decisive role. The level of financial development does not play a decisive role. As far as the type of occupation is concerned, financial practitioners have richer channels of financial information and higher financial literacy, and can effectively avoid financial fraud, a role that holds only in the group of non-financial practitioners.

6. Robustness Tests

In order to examine the reliability of the model estimation results above, this section provides a robustness check of the previous estimation results from various aspects.

6.1. Indented Upper and Lower 1% Samples

Shrinking the sample 1% up and down for all continuous variables to exclude the effect of extreme values on the results and repeating the previous regression steps, the results are shown in Table 12 Column (12), which yields regression results that are consistent with the previous section. The probability of being subjected to fraud increases by 5.2% when the level of individual financial development increases by 1 unit. The age of the head of the household, the literacy level of the head of the household, the annual after-tax income of the household, and the financial sector employment within the household all significantly affect the probability of being subjected to fraud.

6.2. Replacement of Models

In order to test the generalizability of the data, a replacement model is used. Considering the regression model with dichotomous results, a logit model can be used to measure the probability of fraud due to individual financial level. The regression results are similar to the previous section, with all estimated F-values greater than 10 and robust results. The results are presented in Table 12 Column (13).

Table 12. Robustness test results.

Explanatory variable	(12) Exposure to financial fraud	(13) Exposure to financial fraud
	Abbreviated tobit	logit
Individual financial development index	0.052*** (0.020)	1.12*** (0.428)
Age of head of household	−0.032*** (0.012)	−0.721*** (0.257)
Literacy level of the head of household	−0.018** (0.009)	−0.416** (0.194)
Annual after-tax household income	−0.008** (0.003)	−0.151** (0.068)
Presence of financial professionals within the household	0.019* (0.011)	0.334* (0.205)

Continued

As suffix city name, means prefecture or county (area administered by a prefecture level city or county level city)	0.005 (0.004)	0.110 (0.081)
City and countryside	0.003 (0.013)	0.051 (0.303)

Note: *, **, ***denote significant at the 10%, 5%, and 1% levels, respectively, standard errors are in parentheses, and marginal effects of the estimates are reported in the table.

6.3. Endogeneity Testing-Instrumental Variables Approach

There may be endogeneity in the level of financial development in the above analysis. For example, there is reverse causality in the case of an individual who has experienced fraud, whose financial assets are lost due to fraud, and a defensive decline in Internet exposure, which will lead to biased estimation results. In order to solve this problem, this paper constructs the community average "stock market transparency perception" as an instrumental variable, the respondents' perception of stock market transparency is divided into five levels: very transparent, relatively transparent, basically transparent, relatively opaque, and very opaque (questionnaire D3102b), and assigns a score of 1 - 5, to obtain the stock market transparency perception grouped by community pseudo-code. Perceived stock market transparency. Respondent's perception that the more transparent the stock market is indicates that his trust and participation in the stock market and financial market is higher, and according to the definition of this paper, his financial development level is also higher, and the two are endogenous; while respondent's perception of stock market transparency is not directly related to whether he suffers from fraud, which is exogenous and a good instrumental variable.

The regression results are shown in the table. The p-value of Wald test is less than 0.01, which rejects the hypothesis of exogeneity of the explanatory variables and indicates that the variable of financial development index is endogenous, which is in line with the expected hypothesis. Since the Ivprobit test has already verified the endogeneity, the Durbin-Wu Hausman test will not be conducted. Since the Ivprobit test has verified endogeneity, the Durbin-Wu Hausman test is no longer performed. Further analysis shows that the F-value of the one-stage estimation is 424.30 (p-value = 0.000), which exceeds the empirical value of F-value equal to 10 (Stock & Yogo, 2005); and the p-value of the weak instrumental variable test, AR-Test, is 0.0031, and the p-value of the Wald Test is 0.0248, which is less than 0.01, which indicates that there is no weak instrumental variable problem and more accurate estimates can be obtained using instrumental variables. After correcting for endogeneity bias, the FDI still has a significant positive effect on whether or not one suffers from fraud, and the value of the regression coefficient is larger than before, which supports the hypothesis proposed in this paper. As shown in Column (15), a 1% increase in the average stock market transparency

perception in the community is associated with a 12.8% decrease in the probability of suffering from fraud (Table 13).

Table 13. Instrumental variable regression results.

Explanatory variable	(14) Mean_Financial Development Index (FDI)	(15) Exposure to financial fraud	(16) Exposure to financial fraud
	IV-Probit stage (I)	Probit	IV-Probit
Mean_Financial Development Index			22.032** (10.055)
Mean_Stock Market Transparency Perception	−0.006*** (0.002)	−0.128*** (0.043)	
Mean_ln Age of head of household	0.026*** (0.008)	−0.465*** (0.166)	−1.054*** (0.352)
Mean_ln Educational level of household head	0.171*** (0.007)	−0.099 (0.144)	−3.851** (1.752)
Mean_ln annual after-tax household income	0.038*** (0.002)	0.125** (0.055)	−0.711* (0.388)
Mean_Whether or not there is a financial professional within the household	0.178*** (0.010)	−1.407*** (0.228)	−5.331*** (1.793)
As suffix city name, means prefecture or county (area administered by a prefecture level city or county level city)	−0.019*** (0.001)	0.066*** (0.027)	0.486*** (0.196)
City and countryside	0.103*** (0.017)	−4.757 (123.367)	−2.271** (1.082)
N		3633	
Phase I R^2		0.4503	
Phase I F-value		424.30	
Weakiv-AR Test		8.75	
Weakiv-Wald Test		4.80	

Note: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$, standard errors of coefficient estimates in parentheses.

6.4. Endogeneity Test—PSM Propensity Score Matching Method

Considering that the FDI is a synthetic indicator, it may be affected by some unobservable factors, which may be related to whether or not it suffers from fraud losses, thus making the FDI correlated with μ_i. Propensity Score Matching (PSM) can effectively overcome the "selection bias" caused by biased estimation and sample selection, and has obvious advantages in solving the endogeneity problem of variables. Therefore, this paper adopts PSM method to measure the processing effect brought by the synthesis of financial development index. The steps are as follows:

First, the factors influencing financial development are selected on the basis of existing literature. The degree of financial development is mainly affected by factors such as urban and rural areas, regions, individual income and the cultivation

and expansion of financial talents, while in the process of measuring a household as a unit, the presence of financial professionals in the household and the literacy level of the family members also affect the financial development to a certain extent. Secondly, since the financial development index is a continuous variable, it needs to be converted into a binary discrete variable for PSM test, so we take the third quartile as the critical value, and assign the largest 1/3 as the group with better financial development, and assign the value of 1, and the remaining 2/3 is assigned to 0. Next, this paper mainly adopts the method of nearest-neighbor matching to carry out a 1-to-1 matching; when there are two samples of the control group that are at the same distance as the experimental group, the juxtaposition is allowed in order to improve the matching efficiency of the samples; according to the idea of PSM, this paper firstly applies logit model to regress the multi-dimensional characteristics of the enterprises, calculates the propensity scores of the experimental group and the control group, and further carries out a balanced test on the matched samples, and the test results are shown in Table 14.

Table 14. PSM test results.

Variant	Match state	Average value		Standard deviation	Bias curtailment	T-value	
		Process group	Control group	%	%	t-value	*p*-value
City and countryside	prematch	0.00906	0.07774	−34.2	99.1	−10.03	0.000
	after matching	0.00908	0.00847	0.3		0.19	0.852
As suffix city name, means prefecture or county (area administered by a prefecture level city or county level city)	prematch	1.5205	1.6905	−21.2	86.5	−7	0.000
	after matching	1.5212	1.4982	2.9		0.85	0.393
Literacy level of the head of household	prematch	1.7177	1.4125	83.2	99.9	26.66	0.000
	after matching	1.717	1.7168	0.1		0.02	0.982
Age of head of household	prematch	3.6749	3.7552	−30.2	88.2	−10.12	0.000
	after matching	3.6755	3.685	−3.6		−1.03	0.303
Annual after-tax household income	prematch	11.019	10.619	42	95.5	14.06	0.000
	after matching	11.016	11.033	−1.9		−0.57	0.569
Are you a financial professional?	prematch	0.16606	0.3323	41.9	94.5	15.81	0.000
	after matching	0.16162	0.15436	2.3		0.52	0.601

It is generally accepted that matching is valid as long as the absolute value of the standardized deviation is less than 20%. The results showed that most of the standardized deviations (%bias) decreased significantly before and after matching, which implies that the matching process improved the similarity between the treatment and control groups on these variables. most of the *p*-values of the t-tests

were no longer significant after matching, which implies that there were no significant differences between the treatment and control groups on the matched variables, indicating that the matching was successful. After performing propensity score matching, the results showed that the matching process effectively reduced the differences between the treatment and control groups on each covariate and improved the balance of the sample. And according to the results of the balance test after matching, the quality of matching is good and the explanatory power of the model decreases substantially after matching, which is a positive sign implying that the matching procedure is effective in reducing selection bias.

7. Expansive Analysis

This paper further explores this by constructing a financial development index at the macro level and examining the relationship with financial fraud.

7.1. Description of Variables

The core explanatory variable of this paper is the level of financial development, which is used to measure the status of financial development in each province and city. The financial development index is used to measure the level of financial development, which is measured by three aspects: financial development potential, traditional financial market development and Internet finance. With the rapid development of electronic information technology and the popularization of terminal equipment, traditional financial institutions such as banks and insurance institutions gradually expand their business to mobile banking, Internet banking and other mobile applications, digital inclusive finance plays an increasingly important role in daily life, financial innovation products continue to emerge, and the financial literacy of residents is continuously improved in the process, and the financial market is also developing.

Zhang et al. (2019) used the "digital financial inclusion index" to measure the level of digital financial development. The index covers the three dimensions of the breadth of coverage, depth of use and digital support services of digital financial services, and this paper draws on the methodology, with the data on the Internet finance level coming from the Digital Finance Research Center of Peking University, and selects the three dimensions of the breadth of coverage, depth of use and digitization of digital financial services to portray China's digital financial development. Qiu et al. (2018) proposed to use the ratio of total loans to GDP to measure the level of financial development, and Liu et al. (2014) used the amount of loans from financial institutions to measure the level of financial development, and this paper refers to this method, while the measurement of the development of the traditional financial market was selected from the market value of stocks in circulation in the provinces and cities across the country, the premium income, the total amount of RMB loans, the number of financial institutions, and the local The data on the five dimensions of financial supervision and fiscal expenditures are used to measure the development of traditional financial markets in terms of financial assets, local supervision, and other aspects. The data for the financial

development potential dimension comes from the Global Statistical Data Analytics Platform and the National Bureau of Statistics, including the number of employees in the financial industry as well as the education level of each province and city across the country.

Using SPSSAU for 240 evaluation objects to carry out entropy weight TOPSIS evaluation, through the entropy weight method to determine the weight of each dimension, through the TOPSIS method to weight the calculation of the final degree of proximity to the C value, first of all, to get the potential for financial development, the traditional financial market and the Internet financial three levels of the index; at the same time, for the three has been constructed to complete the second-level index of the index and then carry out entropy weight At the same time, the entropy weight of the indexes of the three completed secondary indicators is then evaluated by TOPSIS, and the final result, i.e., the C value, is defined as the financial development index, which represents the level of financial development as the independent variable (Table 15).

Table 15. Summary of the results of the entropy method of calculating weights.

Indicator dimension	Indicator name	Term (in a mathematical formula)	The information entropy value e	Information utility value d	Weighting factor w
Level 1 indicators	Financial Development Index	Financial development potential	0.9676	0.0324	19.89%
		financial market	0.8916	0.1084	66.52%
		Internet finance	0.9778	0.0222	13.59%
Secondary indicators	Financial development potential	educational level	0.9549	0.0451	58.10%
		Number of employees	0.9675	0.0325	41.90%
		Market value of shares outstanding	0.8262	0.1738	36.70%
	Traditional financial markets	RMB loan	0.9373	0.0627	13.24%
		premium income	0.8769	0.1231	26.00%
		Regulatory expenditure	0.9271	0.0729	15.39%
		Number of institutions	0.959	0.041	8.67%
	Internet finance	breadth of coverage	0.9753	0.0247	33.02%
		Depth of use	0.9792	0.0208	27.72%
		Degree of digitization	0.9706	0.0294	39.26%

The explanatory variable of this paper is the quantitative performance of financial fraud. Scholars are often concerned about the severity of financial fraud, so only two indicators, whether they have experienced financial fraud and financial fraud loss, are set in the variable definition, without the number of financial fraud types (Chen, 2020). We consider the types of cases and download and organize data from the National Bureau of Statistics on the number of credit card fraud cases filed in 31 provinces and cities across China from 2011 to 2020 to define the

occurrence of financial fraud. It should be noted that due to the "reporting effect" of crime statistics, the published crime data may be much lower than the actual number of occurrences, but Chuang (2022) point out that the impact of underreporting of crime is small if only criminal offenses are considered.

The control variables in this paper draw on Ding et al. (2024) and Li and Jiang (2020) to introduce control variables such as the level of regional economic development, unemployment rate, and labor force level (**Table 16**).

Table 16. Description of macro variables.

Variable type	Variable name	Proxy variable	Description of variables
Explanatory variable	Occurrence of financial fraud	Number of credit card fraud cases filed	Number of credit card fraud cases filed
Explanatory variable	Level of financial development	Financial development potential	Number of urban financial sector employees
			Number of students enrolled in higher education
		Financial market	Market value of shares outstanding
			Total RMB loans
			Premium income
			Number of institutions
			Expenditures on local financial supervision
		Internet finance	Breadth of coverage
			Depth of use
			Degree of digitization
Control variable	Economic factor	Level of economic development	Gross GDP/total population
		Unemployment rate	Urban registered unemployment rate
		Labor force per capita	Number of urban labor force/total population

7.2. Modeling

Since the proxy variable defining the occurrence of financial fraud is a continuous variable, and considering the lag effect of financial development, in order to test the impact of the level of financial development on the occurrence of financial fraud, this paper firstly lags the independent variable after shrinking the tail by 5 percent to the first order, and adopts the least squares (OLS) model to analyze the impact of the level of financial development on the probability of the occurrence of financial fraud. The model is as follows:

$$\text{fraud}_i = \alpha_i + \beta \text{fin}_i + \gamma x_{it} + \varepsilon_i \quad (2)$$

Among them, fraud_i is the explanatory variable, which is the occurrence of financial fraud; fin_i is the core explanatory variable, which indicates the level of financial development, analyzed by the entropy weight TOPSIS method, including

the three dimensions of "financial development potential", "traditional financial market" and "Internet finance"; contains a series of other control variables; is the heteroskedastic robust standard error, is the coefficient of the core explanatory variable, and is the intercept coefficient, all through the construct OLS. " x_{it} contains a series of other control variables"; ε_i is the heteroskedasticity robust standard error, β_1 is the coefficient of the core explanatory variables, and α is the intercept coefficient, all of which are estimated by constructing the OLS model regression.

7.3. Empirical Results and Analysis

The results of the benchmark regression are shown in Table 17, indicating the impact of the level of financial development on the probability of the occurrence of financial fraud. Column (1) shows that there is a significant positive relationship between the level of financial development and the occurrence of financial fraud, verifying the micro results of this paper that financial development stimulates the occurrence of financial fraud to some extent. Column (2) shows that the secondary indicators of the level of financial development, i.e., financial development potential, traditional financial market, and Internet finance, all have a significant effect on the occurrence of financial fraud. Specifically, the increase in the overall financial development potential of society and the deep development of Internet finance exacerbate the possibility of financial fraud, while the development of traditional financial market business has a significant inhibitory effect on the occurrence of financial fraud. The rapid development of Internet finance makes financial transactions more convenient and efficient. People can carry out financial transactions anytime and anywhere through cell phones, computers and other devices, such as online payment, online banking, P2P lending and so on. However, this convenience has also given financial fraudsters an opportunity to take advantage of the fact that they can use false investment and financial management platforms, fake financial institutions and other means to lure victims to carry out transactions, thereby committing fraud; moreover, the anonymity and cross-regional characteristics of Internet finance have increased the difficulty of fraudsters in evading the crackdown, and exacerbated the degree of frequency of financial fraud. Financial development potential is reflected in the human capital of the field and its quality, the financial industry scale expansion, the number of practitioners increased dramatically, the future of the industry space is vast, the continuous opening of the institutions, the continuous enrichment of the product will provide a huge value-added profit, attracting fraudsters into the game. At the same time, with the development of the financial market, regulators usually strengthen the supervision of financial institutions and businesses, and establish a more comprehensive regulatory framework and norms, including the supervision of financial products, financial services and financial transactions. Such enhanced regulation helps to standardize the order of the financial market, improve the transparency and integrity of financial business, and reduce the space and

opportunities for financial fraud; and traditional financial institutions usually focus on their own market credibility and reputation, and tend to win the trust and reputation of their customers by providing high-quality financial products and services. And good market reputation and word-of-mouth helps reduce the incidence of financial fraud, as investors are more inclined to choose financial institutions with good reputation and word-of-mouth for investment and transactions.

Table 17. Benchmark regression and robustness test results.

Explanatory variable	(1) ln_number of financial frauds	(2) ln_number of financial frauds	(3) Baidu Index_Financial Fraud
Financial Development Index	13.251**		
	(2.416)		
Financial development potential		2.884**	21.410*
		(0.607)	(10.744)
Traditional financial markets		−5.467**	−93.438**
		(1.007)	(19.130)
Internet finance		3.864**	73.157**
		(0.722)	11.540
Level of economic development	0.098	−0.461*	3.350*
	(0.098)	(0.052)	(1.021)
Unemployment rate	−0.351	0.236**	−8.558
	(0.273)	(0.196)	(3.428)
Labor force per capita	0.009**	0.011**	−0.016
	(0.002)	(0.002)	(0.056)

Note: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$, standard errors of coefficient estimates in parentheses.

7.4. Robustness Tests

In order to test the robustness of the relationship between various dimensions of financial development on financial fraud, this paper will Baidu index in the "financial fraud" search index of the annual average value of the provinces as a proxy variable for the dependent variable financial fraud OLS regression. Baidu is one of the most authoritative search engines, when a high incidence of financial fraud cases in a region, often accompanied by a large number of headline news reports, the residents' attention to the rapid increase in the network of related topics accordingly spread, brewing, reflected in the Baidu search index, so the Baidu index is more reliable for the measurement of financial fraud. Regression after replacing the dependent variable yields regression results for each dimension that are consistent with the previous paper, proving the robustness of the macro conclusions. The test results are shown in Column (3) of Table 17.

8. Conclusions and Recommendations

This paper explores the relationship between the rapid and innovative development of the financial industry and financial fraud based on both macro and micro dimensions. On the one hand, at the micro level, this paper adopts the CHFS2015 data and finds that the individual financial development level enhances the risk appetite and exogenous financing ability to a certain extent, which makes the probability of individuals suffering from financial fraud climb, and there are significant regional and group differences in this effect: the positive effect of the level of financial development on financial fraud is more significant in the eastern region, the micro group with secondary vocational high school education and below, and the micro group lacking family practitioners. The lack of family practitioners in the micro groups is more significant. On the other hand, on the macro level, this paper uses EPS and other official data to confirm the level of financial development exacerbates the probability of fraud set theory. In-depth analysis found that the greater the potential for social and financial development, the more obvious the characteristics of the Internet, then the higher the incidence of fraud; the more massive the development of the traditional financial market, the more powerful the financial supervision, the lower the incidence of fraud.

The results of this study have some policy implications for the innovative development of China's financial market and the regulation of financial fraud: first, safeguard the standardized operation of digital financial products and be aware of online fraud. Formulate strict regulatory policies and regulations for digital financial products to ensure that product design and operation comply with laws and regulations; strengthen the review and supervision mechanism for digital financial products to detect and correct violations in a timely manner; and provide user education and training to enhance the public's knowledge and security awareness of digital financial products, and teach them how to recognize and avoid cyber fraud. Second, strengthen financial supervision. Increase human and technological investment in regulatory authorities to improve regulatory efficiency and coverage; improve financial regulatory laws and regulations to strengthen the supervision of various financial institutions and products; and strengthen cross-border financial regulatory cooperation to prevent regulatory loopholes and risks in cross-border financial activities. Third, enhance the quality of financial practitioners. Strengthen the quality of professional training for financial practitioners, including financial knowledge, risk management, and compliance awareness; set up industry entry thresholds and a professional qualification certification system to ensure that financial practitioners have the necessary professionalism and ethical standards; strengthen the supervision and assessment of financial practitioners, set up a strict disciplinary mechanism, and seriously deal with violations, so as to improve the self-discipline and sense of responsibility of practitioners.

Of course, there are also a large number of psychological and sociological factors behind financial fraud, for example, fraudsters are good at exploiting people's psychology of pursuing profits, promising high returns or privileges to lure

victims into the trap. At the same time, they are accustomed to taking advantage of people's psychological expectations, memory biases and other cognitive deficiencies to design a tempting scam. In addition, at the sociological level, the new characteristics of the digital age, such as social connectivity, computation and virtuality, have shaped a new way of social interaction, giving rise to the network cascade mechanism, the platform management mechanism and the transaction offshore mechanism, which has brought about the organization's scale diffusion effect, the centralized effect of control, and the operation of the hidden effect, and provided a stable structural condition for the organized financial frauds. All of these areas can serve as important expansion directions for future financial fraud.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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