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The Dominant Force of Science and Technology Financial Genes in the Great Power Technology Game

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Abstract: Technology is the primary productive force and drives the development of the world economy. Traditional science and technology(ST) finance research methods are usually based on experience and qualitative analysis, lack the support of quantitative data, and are unable to provide accurate and reliable prediction and decision support, and the subjectivity of experts and the slowness in processing complex data lead to certain errors in people's judgment and analysis of gene dominance. To this end, this article needs to use advanced technologies such as big data analysis technology and artificial intelligence to model and analyze large-scale complex data. This article aims to analyze the relationship between ST finance and competition among major powers, reveal the genetically dominant role of ST finance in shaping the landscape of ST competition among major powers, and explore its importance in global ST competition. This article conducts an in-depth analysis of the genetic dominance of ST finance and builds a relevant model. This article uses big data technology and analysis methods to calculate and draw the variables of technology finance and innovation, and conducts data analysis and comparison based on the graphics. Investigating the experimental data shows that in the F test, its statistic is 18.76 and the p-value is 0.

1. Introduction

The big-power ST game refers to the competition and cooperation between major ST countries around the world. This game involves technological innovation, industrial development, trade strategy, financial investment and other aspects. In today's context of globalization and technological competition, the technological game between major countries has become increasingly fierce. As an element that promotes scientific and technological innovation, technology finance plays a vital role in this game. The dominant force of ST financial genes has emerged in the ST competition between major countries, and its influence in leading scientific and technological innovation and promoting the development of ST industries has become increasingly prominent. At present, in-depth research on the dominant power of ST finance genes is not enough, and related issues need to be solved urgently.

Research on ST finance can win opportunities in the technology game, which means that the application of technology promotes the optimization of the financial industry, thus adding fuel to the technology game. This article makes full use of technologies such as big data analysis and

machine learning to conduct an in-depth analysis of technological and financial issues in the technological game between major powers from multiple dimensions and angles. This helps to provide more comprehensive and accurate data support, and reveals the patterns and trends hidden behind the data, emphasizing data-driven and model building, and reducing the impact of personal subjective judgments. By applying professional knowledge in the field of ST and finance, research results will be more objective, accurate, and have higher reliability and interpretability.

2. Related Work

Fintech refers to financial innovation driven by technology, which aims to use modern scientific and technological achievements to transform or innovate financial products, business models, business processes, etc., and promote financial development to improve quality and efficiency. Scholars in the past have proposed a series of theories and methods in an attempt to solve the problem of the dominant role of ST finance genes in the ST games of major countries. These efforts have been successful to some extent, but there are still some flaws. The advantages of new green technologies are uncertain, companies are interconnected, and company decisions demonstrate strategic substitutability and complementarity. To analyze the strategic interaction between business decisions with relevant and uncertain returns, Wang X, Cho S H, Scheller-Wolf A used the recently developed global game framework in economics [1]. Rashikala Weerawarna, Shah Jahan Miah, Xuefeng Shao said that as an effective platform without intermediaries, blockchain had developed into a widely used information system technology in recent years. Although the increasing use of blockchain in various fields such as finance, supply chain, healthcare, education and energy consumption has promoted the development of distributed Internet databases, there has not been much exploratory research to understand the development of this field [2]. In order to improve risk prediction capabilities and effectively ensure the effectiveness of credit risk prediction through technology financing, Guiping Li proposed a cloud-based credit risk prediction algorithm [3]. With the emergence of various online payments, the development of traditional commercial banks has been severely hindered, resulting in serious losses of resources and customer loyalty. Therefore, Pei Pei and Yingji Li discussed how to improve customer loyalty in the context of Internet finance and multimedia technology [4]. Supply chain finance faces complex challenges around trust and transaction data verification when implementing automated inventory, order and receivables financing. Arief Rijanto aims to explore how the introduction of blockchain technology solves problems using a multi-case approach based on the Technology Acceptance Model. The benefits of blockchain provide an automated solution for global supply chain management practices with transparent and secure smart contracts and distributed registration data [5].

In the fierce competition among major countries in ST, ST finance has become increasingly prominent as an element in promoting scientific and technological innovation. The problem with traditional research is that it fails to deeply explore the substantive role of the dominant force of technological and financial genes in the technological gaming of major countries. This article comprehensively explores the key role of technological financial genetic dominance in the technological gaming of major countries.

3. Analysis of the Dominant Force of Technology and Financial Genes

3.1 Technological and Financial Genes

Technology-driven financial innovation aims to use modern scientific and technological achievements to transform or innovate financial products, business models, business processes, etc., and promote financial development to improve quality and efficiency [6-7]. Artificial intelligence

extends human intelligence to computer systems, allowing computers to perform biometric recognition, speech recognition, natural language processing, machine learning, etc. [8-9]. It can be used for: based on biometrics, online account opening and online payment; based on voice recognition, intelligent customer service, intelligent counters, business outlet robot services; based on machine learning, intelligent investment advisory, big data intelligent risk control platform. Big data is large in scale, fast in speed, and diverse in type, and requires specific technologies and analysis methods to transform it into information assets of actual value [10-11]. Its application scenarios include: customer profiling, mining potential customer needs, and precision marketing; big data credit investigation, focusing on borrower behavioral information, using machine learning model fitting; and digitizing credit processes. Cloud computing takes a distributed processing architecture as the core and transfers data originally stored and calculated on local servers to the cloud [12-13]. Its application scenario is to expand system storage and processing capabilities, complement big data, and meet disaster prevention and backup needs. The blockchain distributed shared accounting mechanism is characterized by decentralization, non-tamperability, and anonymity. This technology is commonly used in the Internet of Things, supply chain finance, payment settlement, digital currency, etc. [14-15].

3.2 Main Force Analysis

Technological innovation is an important driving force in promoting the development of ST finance [16-17]. Technological finance involves financial services and financial business, so financial professional capabilities are a key factor in determining the direction and quality of technological finance development. Its development requires a good legal environment to ensure compliance operations and risk prevention and control. Capital support is one of the necessary conditions for the development of ST finance. Only by meeting market demand and solving practical problems can it be widely used and promoted. The dominant force of technology and financial genes is shown in Figure 1:

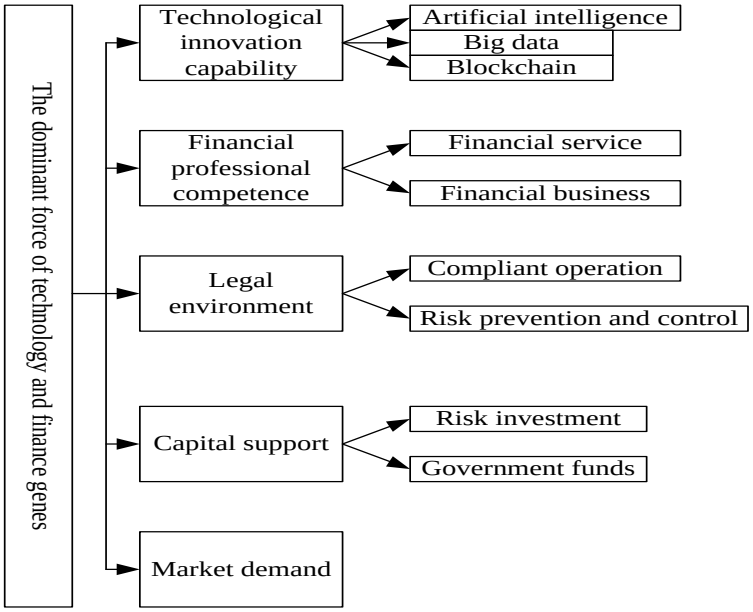

Figure 1: The dominant force of technology and financial genes

In the ST games of major countries, the leading force of ST finance is reflected in many aspects [18-19]. First, it can provide sufficient financial support for technology companies and promote the

research, development and application of technological innovation. Technology companies often require large investments to carry out scientific research projects, and these projects may take a long time to achieve commercial success. By providing long-term and stable financial support, it enables technology companies to focus on technological innovation without being restricted by financial pressure. There are certain uncertainties and risks in the process of technological innovation. Financial institutions use risk management tools to reduce risks and protect investors' interests. At the same time, it can also provide professional investment evaluation and consulting services to help technology companies optimize resource allocation and business development, and improve R&D efficiency and market competitiveness. In addition, it can also promote the transformation and commercialization of scientific and technological achievements. If scientific and technological innovation cannot receive effective financial investment and market support, it will be difficult to truly achieve industrialization and commercialization. Its application provides corresponding financial services and market channels for ST enterprises, helps scientific and technological achievements move from the laboratory to the market, and promotes the results of scientific and technological innovation to better benefit society [20].

This article uses advanced big data technology, distributed storage and processing systems to obtain relevant scientific and financial data from multiple sources. Through web crawlers and application programming interfaces, various types of scientific and technological financial data are obtained on a regular basis in real time to ensure the comprehensiveness of the data. Then this article strictly cleans the data, establishes a cleaning process, removes duplicate data, handles missing values, corrects outliers, formulates standardized rules to ensure the consistency of the data format, and then uses data cleaning tools such as Python's Pandas library to perform automated cleaning and reduce human errors [21].

3.3 Variable Selection

This article selects government, financial institutions, venture capital and technology finance environment as the first-level variable indicators of technology finance. Government fiscal expenditure (F1), financial institution ST loans (F2), the ratio of fixed asset investment to gross product (F3), and the ratio of full-time equivalent of R&D personnel to the total population (F4) are used as secondary indicators of ST finance. Invention patent output rate, scientific and technological achievement revenue generation rate, and technology market transaction rate are first-level indicators of scientific and technological innovation, measuring scientific and technological innovation. The ratio of market turnover to R&D investment (I1), the ratio of the number of patent authorizations to R&D manpower investment (I2), and the ratio of new product sales revenue to main business revenue (I3) are secondary indicators.

3.4 Indicator Measurement

This article uses the entropy method to measure technological finance and technological innovation indicators. The calculation process is as follows:

The standardized formula for positive indicators is:

$$a'_{ik} = \frac{a_{ik} - a_k^{\min}}{a_k^{\max} - a_k^{\min}} \tag{1}$$

The standardized formula for negative indicators is:

$$a'_{ik} = \frac{a_k^{max} - a_{ik}}{a_k^{max} - a_k^{min}} \tag{2}$$

Then performing translation processing:

$$a''_{ik} = I + a'_{ik} \tag{3}$$

Among them, I is the translation amplitude. Using the specific gravity method to carry out infinite tempering:

$$b_{ik} = \frac{a''_{ik}}{\sum_{i=1}^{m} a'_{ik}} \tag{4}$$

Calculating the entropy value of the kth indicator:

$$f_k = -\frac{1}{\ln m} \sum_{i=1}^{m} b_{ik} \ln b_{ik} \tag{5}$$

Its difference coefficient is:

$$h_k = 1 - f_k \tag{6}$$

Among them, $k = 1,2,...,q$.

$$v_k = \frac{h_k}{\sum_{k=1}^{q} h_k} \tag{7}$$

Multiplying weights using standard data:

$$G_i = \sum_{k=1}^{q} v_k a'_{ik} \tag{8}$$

4. Measurement of Technological Finance and Technological Innovation Capabilities

4.1 Assessment of Leading Forces

In the construction of scientific and technological innovation indicators, the system structure of scientific and technological innovation indicators is formulated and multi-dimensional factors are considered, including but not limited to R&D investment, innovation output, number of patents, etc. This article conducted a survey (the scope of the survey is from 2018 to the present) and used computers to conduct statistics.

According to the generated line chart (as shown in Figure 2), we can conclude that from 2018 to 2023, R&D investment will increase year by year. During this time period, R&D investment increased from 150 units to 250 units. Innovation output also shows an increasing trend year by year. Innovation output increased from 100 units to 180 units. This shows that the innovation capabilities in the field of technology and finance are constantly improving. The number of patents is also increasing year by year, from 50 to 120. In the field of ST and finance, innovative achievements have received more protection and recognition. To sum up, the development of ST finance has achieved positive results and played an important role in promoting economic growth and innovation.

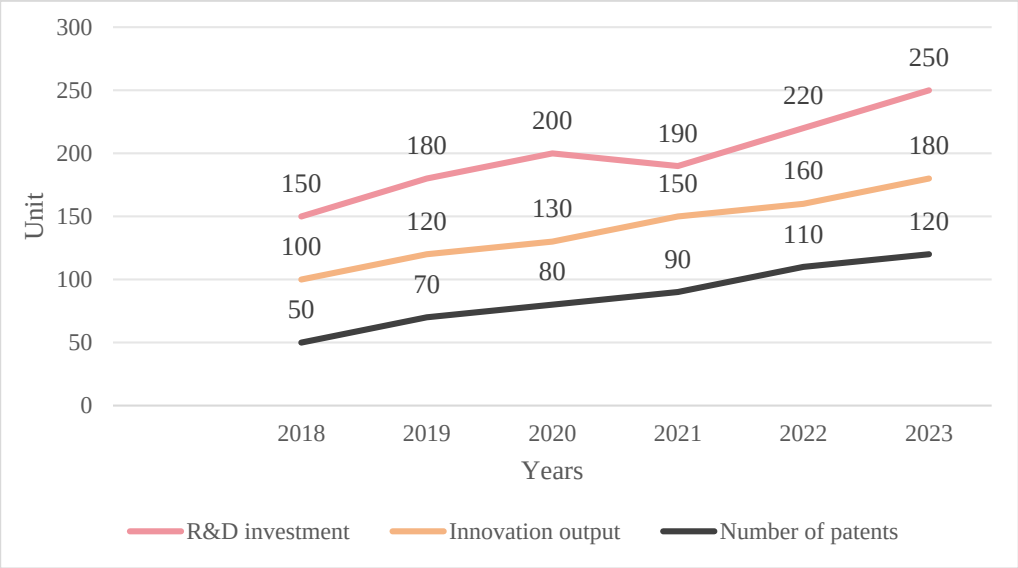

Figure 2: Development of ST finance

This article relies on professional knowledge in related fields to ensure the comprehensiveness and sensitivity of the indicators, and uses advanced indicator systems to construct scientific and technological innovation evaluation indicators. This article then establishes a financial support model to quantify financial support for technological innovation, and combines economics and finance to build a comprehensive evaluation model. This article uses cross-analysis methods to deeply explore the correlation between technological innovation and financial support, and uses correlation mining technology to discover the hidden rules of the dominant force of technological and financial genes. After designing the basic structure of the ST financial support model, this article determines the input variables of the model (such as loans, venture capital, etc.). This article uses a weight distribution or scoring system to quantify support, considers the differences in various forms of financial support, and deeply explores the potential connections between them by comparing the relationships between different technological innovation factors and financial support factors. This article uses charts to display the results of cross-analysis in order to more intuitively understand the correlation between factors. When using the association mining algorithm, this article chooses the Apriori algorithm to mine large-scale data and discover potential patterns and laws between technological innovation and financial support.

As shown in Figure 3, this article finds that in technology finance, the entropy values of F1 to F4 are all 0.997, the weight value of government fiscal expenditure is 0.265, and the difference coefficient is consistent with that of technology loans from financial institutions (its weight value is 0.273). The weight value and difference coefficient of the ratio of fixed asset investment to gross production value are the smallest, and the weight value and difference coefficient of the ratio of full-time equivalent of R&D personnel to the total population are the largest.

In technological innovation (I1~I3), the entropy value of the ratio of market turnover to R&D investment is the largest, and the weight value and difference coefficient are the smallest. The entropy value, weight and difference coefficient of the number of patent authorizations and the proportion of R&D manpower investment all rank second. The entropy value of the ratio of new product sales revenue and main business income is the smallest, and the weight and difference coefficient are the largest.

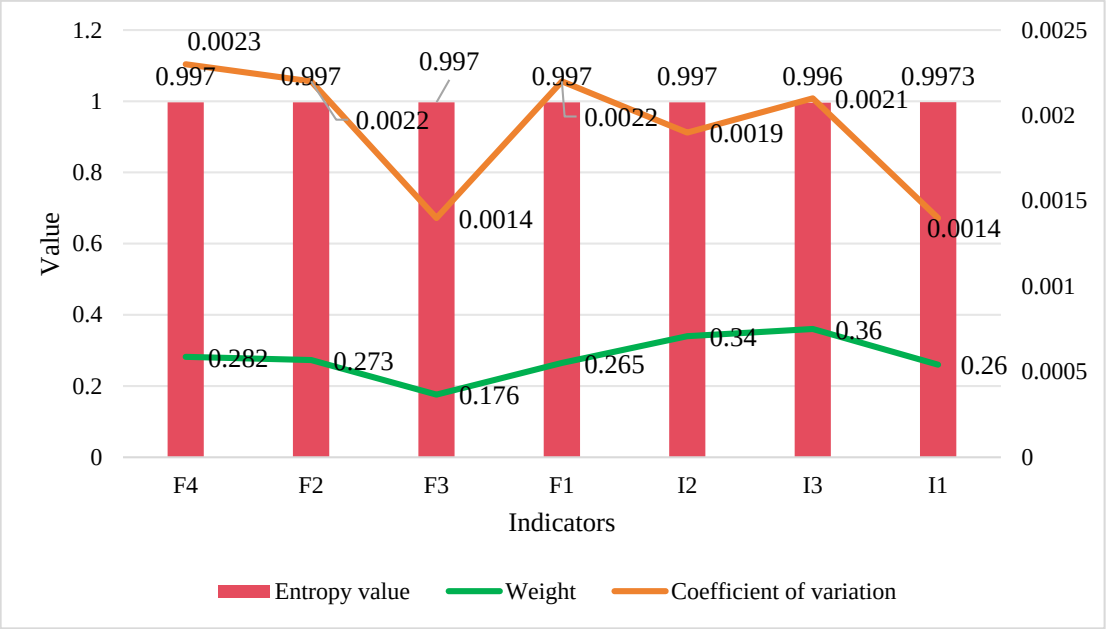

Figure 3: Composition and weight of technology finance and innovation indicators

There are differences in technology finance, technological innovation, and economic development in different regions. This article makes statistics on five variables: economic development, ST finance, scientific and technological innovation, external development level and higher education.

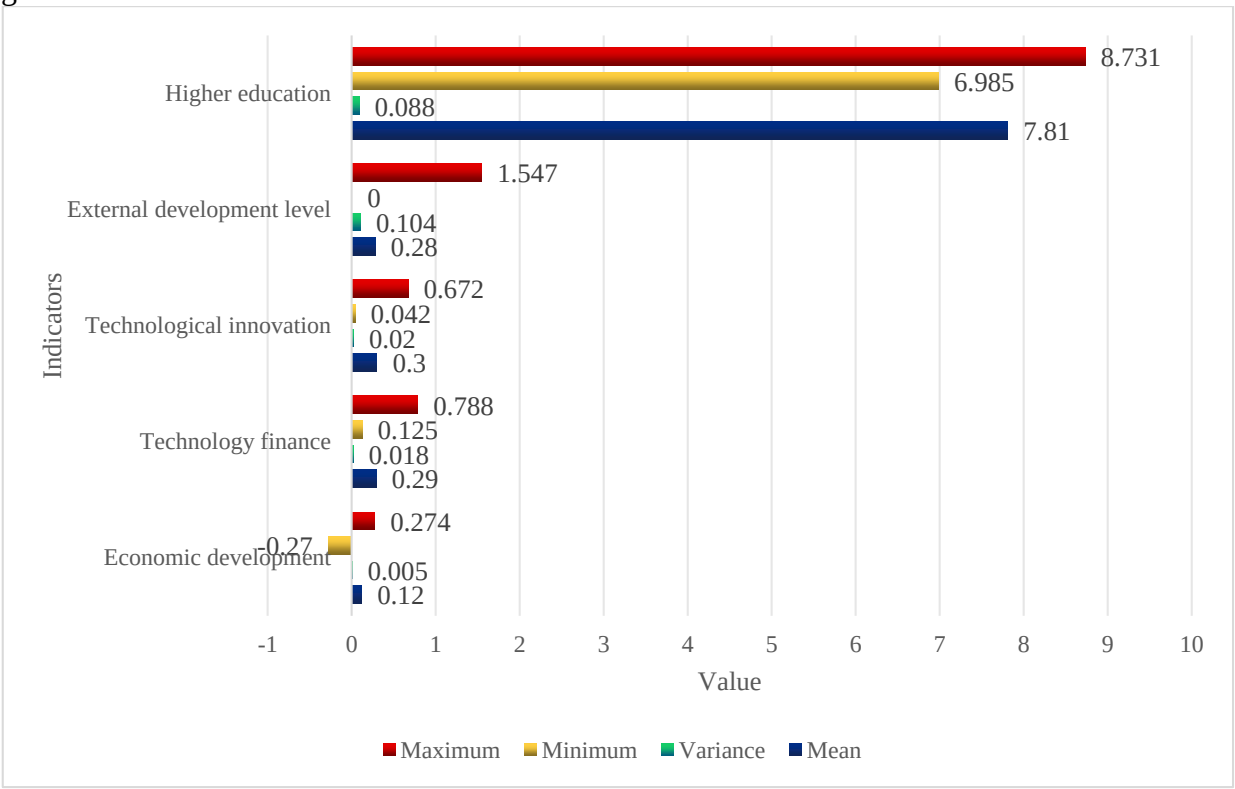

Figure 4: Descriptive statistics of variables

As shown in Figure 4, this article finds that in economic development, the average value is only 0.12, the variance is 0.005, the minimum value is a negative number, and the maximum value is

only 0.274. In ST finance, the average value is slightly higher than the level of economic development and opening to the outside world, the variance is 0.018, the maximum is close to 0.8 (actual 0.788), and the minimum is 0.125. The average value of technological innovation is 1 percentage point higher than that of technological finance, with a variance of 0.02, a maximum value close to 0.7 (actual 0.672), and a minimum value of 0.042. It can be seen from the financial and innovation data that the maximum value difference between the two is about 0.1, and the minimum value difference is about 0.8. Among these two types of values, the financial value is higher than the innovation value. The minimum value of the level of openness to the outside world is 0, the maximum value exceeds 1 (1.547), and the average value is 0.28. In higher education, the values are much larger (except for the variance). Among them, the maximum value reaches 8.731, the minimum value reaches 6.985, and the average value is 7.81.

In addition, this article needs to test the model established by the above variables, using F test and Hausman test as methods respectively. The F test constructs statistics to determine the constraints and thereby determine the fixed effects in the model. The Hausman test is used to determine the effect of regression. The alternative hypothesis at this time is to construct an individual fixed effects model. The test results are specifically shown in Table 1:

Table 1: Test results of two methods

	Statistic	P value
F-test	18.76	0
Hausman test	4.72	0.03

In the Hausman test, the statistic is 4.72 and the p-value is 0.03. The p-values of both methods are less than 0.05, so to choose the alternative hypothesis, a regression model with individual fixed effects should be constructed. On the basis of this model, the regression equation is calculated and the parameter estimates are estimated.

4.2 Analysis of Technological Financial Innovation

Financial innovation can improve the operating efficiency of the financial system, develop inclusive finance, improve the inclusiveness of the financial system, and digitize the credit process. Under the traditional financial model, many small and micro enterprises have irregular management and operation, imperfect financial accounting systems, and many individuals are also unable to form credit reports, the degree of information asymmetry is high, and banks need to invest higher costs in obtaining the information required for risk pricing. Under the fintech model, banks can use artificial intelligence, big data, and cloud computing technologies to verify digital trajectories of customers by cooperating with external Internet platforms, reducing information asymmetry, lowering the cost of screening and supervision, and reducing reliance on collateral, allowing long-tail entities to obtain financing at a lower cost, while also improving customer experience and convenience. The application of financial technology has significantly increased the bank's inclusive financial loan scale, reduced non-performing ratios, and increased income. In addition, the popularity of mobile payment has increased the convenience of payment and benefited more groups. Supply chain finance based on blockchain can increase loans to small and medium-sized enterprises. It has also played an important role in China's rural revitalization, poverty alleviation, and epidemic prevention and control. In the process of rural revitalization, digital finance can digitize underlying assets and make the production chain transparent, reduce bank risk control costs, help rural areas obtain loans at lower costs, promote agricultural production and increase farmers' income.

However, financial technology also has some problems: increasing the fragility of the financial system and brewing systemic risks. The timeline is that algorithmic trading in AI investment may

lead to a machine version of the herd effect. The spatial axis is that after Internet companies enter the financial industry, they generally appear in the form of financial holding companies, with large platform scale, wide business scope, and stronger spillover effects. The existence of economies of scale and network effects brought about by zero marginal costs in market monopoly usually results in a “winner takes all” situation. Fintech companies' thirst for data may lead them to excessively collect customer data and use the collected data to infer consumer preferences, thereby implementing price discrimination and obtaining more consumer surplus.

We insist that all financial activities be subject to supervision, and financial businesses must be operated with a license, and we emphasize functional supervision and compliance to carry out Internet deposits and loans, insurance, funds and other businesses. We should return to our roots, carry out antitrust on the premise of protecting innovation and protecting risk premiums, and strengthen data and information protection through legislation.

5. Conclusion

The intensity of global technological competition is increasing day by day, and a fierce technological game has begun among major countries. In this game, technological and financial genes have become the dominant force. As the leading force in the ST game of major countries, the gene of ST finance carries the competitiveness and strategic development goals of various countries in the field of ST. It not only leads the innovative model of the technology and finance industry, but also has a profound impact on the operation and evolution of the entire technology ecosystem. Technological innovation helps accelerate China's economic transformation and achieve high-quality development of the Chinese economy. Technology financing partly determines the trend of technological innovation. Therefore, we should ensure the coordinated development of the three, play the role of technological financing and technological innovation more effectively, realize the construction of an innovative country, and improve the economic level.

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