Analysis on the Cooperative Mode and Advantages of Financial Auditing and Economic Supervision Based on Bigdata

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Abstract: Cooperative game model refers to the game conducted by some participants in the form of alliance and cooperation. The game activity is the confrontation between different groups. In cooperative game, participants may not make cooperative behavior, but an external organization will punish non cooperators. Cooperative game, also known as positive sum game, means that the interests of both sides of the game have increased, or at least the interests of one party have increased, while the interests of the other party are not damaged, so the interests of the whole society have increased. The model is mostly used for industrial chain connection and industrial This study analyzed the job functions of financial auditing and economic regulation in details from the perspective of data model, and calculated the core data of economy factor productivity and the constringent economic and financial auditing development, and analyzed the feasibility of the combination and summarized the advantages, so as to provide research opinions to China's financial security and sustainable and sound economic development.

Key words: Financial Auditing; Economic Function; Regulatory Collaboration

1 Introduction

With the continuous development of economies at home and abroad, the relationship among each country in terms of economic construction has become increasingly close, which has also caused international economic competition to a certain extent [1]. The study of its working mode is the main component of China's future economic construction research. In this background, our country's financial auditing and economic supervision department have made numerous achievements. But there still are some issues related to the utilization of resource information (such as abusing of resources and unclear regulatory responsibilities), because of the problems such as their respective duty and authority and jurisdiction, etc. This not only caused a hidden danger for the national economy, but also seriously affect the financial markets at home and abroad [2]. In this regard, it is necessary to build a new cooperative mode of financial auditing and economic supervision, by combining the characteristics of the current domestic and foreign economic situation, for the purpose of national economic security and development. Starting from data, this study introduces concepts such as mathematical model, and builds a new model of regulatory cooperation development and analyzes its advantages, on the basis of analyzing the functions of financial auditing and economic supervision, providing a new idea for the work related to economic development [3].

ICEMME 2022, November 18-20, Nanjing, People's Republic of China
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DOI 10.4108/eai.18-11-2022.2326873

1.1 Construction of Cooperative Mode between Financial Auditing and Economic Supervision

1.1.1 Analysis on Function of Financial Auditing and Economic Supervision Department

According to the current economic development situation at home and abroad, China's financial auditing and economic supervision cooperative mode has gradually become a new rule of world economic development. Based on the past experience, the orderly economic supervision cannot be carried out without the assistance of financial auditing, and the implementation of financial auditing cannot be done without the huge energy provided by economic supervision [4]. Therefore, the effective cooperation and integration of financial auditing and economic supervision can give full play to their advantages in economic development, so as to achieve corresponding economic results in economic development. In addition, according to the actual needs of China's economic development, incorporating financial auditing into economic supervision can effectively improve the utilization rate of external resources and reduce resource waste to a certain extent. Figure 1 shows the functional framework of cooperative mode of this design study.

At the top of the functional framework, it is the highest economic authority in China, strengthening the supremacy of the government in national economic development and supervision. Its subsidiary institutions include the financial auditing department, the economic inspection agency and the central bank of China. With the national financial auditing as the core, the departments work together to transfer information to economic supervision and the central bank and reduce resource backflow. The three parallel institutions, with a clear division of responsibilities and of united function, are allowed to conduct centralized management on the domestic financial risk factors and take responsibilities for the monetary policy issued by our nation's central bank and other daily businesses (including auditing analysis and daily management on domestic monetary economic problem), providing monetary stability conditions for other domestic business, under the leadership of government agencies. Under this functional framework, the new financial auditing department not only needs to do traditional auditing work, but also needs to supervise and punish different economic crimes in an orderly manner [5]. At the lowest level, it is the financial institutions, including various financial development centers such as centers at the provincial level, etc.

1.2 Functional Integration and Legal Supervision under the Cooperative Mode

In the functional development of the cooperative mode of financial auditing and economic supervision, the government's financial auditing institution should pay more attention to the high-level re-supervision, while the economic supervision department should be responsible for the direct subordinate supervision and management. In addition, the relevant regulatory authorities should also be responsible for the risk supervision and behavior avoidance that may occur in the daily operation of domestic financial enterprises. If necessary, the corresponding responsibility for risk inspection and policy formulation should be placed on one person, which can not only clarify the core authority of the supervision department, but also improve work efficiency.

From the past experience, the work of China's economic regulatory departments are of oneness and independence. There are no clear conclusions for the legal constraints and

inspection system. It can be said that the current domestic economic regulatory departments are less subject to the laws, and the relevant regulatory power is concentrated and less be regulated, which will cause slackness at work, thus generating corruption and mistakes in terms of financial supervision. In order to effectively improve the work quality of economic supervision and give play to the macro-control role of economic supervision, the new economic regulatory agencies need to take the initiative to play its role of macro-control, scientificity and perfectness, striving to achieve the integration and development of functions.

The collaborative functional integration built in the study is not only the integration of supervision authority, but the integration and management of comprehensive legal also need to be considered. The integrated economic supervision department's authority should be set in a clear legal framework, in accordance with the current *Audit Law of the People's Republic of China*, the *Law of the People's Republic of China of Regulation and Supervision over the Banking Industry*, *Company Law of the People's Republic of China* and other relevant legal provisions.

1.3 Comprehensive Analysis of the Collaboration Mode

From the perspective of comprehensive analysis, China's central government should play the main role in the new regulatory framework, and the subordinate economic departments should play their due functions under the leadership in an orderly manner. From the micro perspective, the government's financial auditing needs to highlight its own inspection and publicity functions. The relevant departments should not participate in the operation and management of financial enterprises anymore and maintain their neutral status. As a financial auditing department, it should focus on the verification and inspection of the formulation and implementation of financial laws and regulations. If necessary, the verification can be strengthened through the methods of staff accountability and financial data analysis, so as to timely discovery and analyze the current financial risks and find solutions.

In general, under the new cooperation mode, economic supervision should be strengthened, and punishment should be strengthened, and internal cooperation and control of the two departments should be enhanced, so as to further improve the work efficiency. Compared with the financial auditing institutions, economic regulatory departments need to constantly improve the law enforcement, actively guide the operation of major financial enterprises, and improve the legal awareness of financial institutions, through necessary means of legal publicity.

According to the data, it is obvious that the financial auditing data of our country has been increasing year by year. By the end of the first half of 2021, China's total financial auditing involved doubled compared with that in 2017, and based on the situation, it can be seen that financial auditing will have the effect that cannot be ignored in the future economic development of our country. The collaboration of financial auditing and economic regulation can provide the forward force for China's continuous development to the greatest extent.

2 Analysis on Advantages of Financial Auditing and Economic Supervision Cooperative Mode with Data Thinking

2.1 Productivity of Economic Factor under External Economic Risk

The total factor productivity of national economy is one of the important indexes to measure the stability of the overall operation of the domestic economy. It is also the discriminant data to analyze the risk characteristics at home and abroad and the anti-risk degree of the domestic economy. And it is the core index for the analysis of the effect of economic audit supervision. In order to comprehensively consider the impact of regulatory cooperative mode on national economic development, this study introduces mathematical model thinking, and constructs an effect evaluation framework model, by analyzing a series of indicators such as economic factor productivity.

Based on the functions of financial auditing and supervision, this study conducts analysis and calculation by combining the SBM directional distance function and Tobago productivity index which are used to calculate the productivity of economic factors on the base of the current domestic economic production data. In addition, in order to improve the stability of the overall data, the introduced international risk variable data is analyzed according to the data economic variables calculated by productivity. And the development of national economy and productivity of economic factors is analyzed from different perspectives.

The directional distance characteristic function adopted in this study needs to construct a qualitative data set of output expected data value, namely economic supervision technology, and it also needs to set the production proportion of data units under different supervision technologies. It is assumed that under the development of China's new economy, each technological decision- making unit uses *N* kinds of input proportion: $\mathrm{x}=(x_{1}\cdots\cdots\mathrm{x}_{\mathrm{n}})\in\mathrm{R}^{\mathrm{N}}$. There are *M* kinds of expected output $\mathrm{y}=(y_{1}\cdots\cdots\mathrm{y}_{\mathrm{n}})\in\mathrm{R}^{\mathrm{M}}$ and *I* kinds of unconventional output that is produced $U=(u_{1}\cdots\cdots\mathrm{u}_{\mathrm{I}})\in R^{I}$. Then the domestic economic environment shall be $P(x)=\left\{(y,u):xy,u\right\}x\in R^{N}$. The economic regulatory technology needs to meet the following characteristics:

1: The ratio of current domestic economic regulatory input to the expected proportion data can be guaranteed as free disposal, i.e., if $(\mathrm{y},\mathrm{u})\in\mathrm{P}(\mathrm{x})$ and $x'\le x$ or $y'\le y$, then $\left(y',u\right)\in P(x),P(x)\subseteq P(x')$.

2: The expected statement of economic regulation and the unexpected output are of jointly weak disposability. That is, if $(\mathrm{y},\mathrm{u})\in\mathrm{P}(\mathrm{x})$ and $0\le\theta\ge1$, then $\left(\theta y,\theta b\right)\in P(x)$.

The analytical data above must also include non-expected data units as it shows the output of economic regulation. Therefore, the data analysis model of this study adopts DEA economic digital processing method on the whole. It is assumed that $t=1,\ \cdots\cdots T$, and K=1. The data unit output value of No. K economic component shall be: $(\mathrm{x}^{k,t},y^{k,t},u^{k,t})$, and the

ratio of China's current economic unit production factors can be expressed by the following formula:

$$P^t(x^t) = \begin{cases} (yt, ut): \sum_{k=1}^{K} Z_k^t x_{kn}^t \le x_n^t, n = 1,2\ldots N \\ \sum_{k=1}^{K} Z_k^t x_{kn}^t = u_i^t, \ i = 1,2\ldots I; Z_k^t \ge 0, k = 1,,2\ldots K \end{cases} \quad (1)$$

In formula (1), Z_k^t represents that the weight of economic supervision production unit K is within the range of $\mathrm{k} = 1\cdots\mathrm{K}$, the weight of economic factors in structure environmental construction.

The analysis formula above only expresses the influence of the specific trend of total factor productivity in China's economy under the background of external economic risk factors. The distance function should be also introduced, to further improve the data analysis:

$$\mathrm{ETE}\left(\mathrm{x_t},\ \mathrm{y_{t,}}\ \mathrm{u_t}:\ \mathrm{g_t} - \mathrm{g_u}\right) = \frac{1}{1+\mathrm{D_0}\left(\mathrm{x_t},\ \mathrm{y_{t,}}\ \mathrm{u_t}:\ \mathrm{g_t} - \mathrm{g_u}\right)} \quad (2)$$

In formula (2), g is the distance index; u is the influence coefficient of the unexpected output (natural external economic risk factors); D is the Tobago productivity index [8].

Two formula components can be obtained from formulas (1) and (2) above, which are static calculation comparison and dynamic calculation comparison in consideration of external economic risk factors respectively. According to the comparison, the total factor productivity of national economy under the influence of external economic risk factors can be obtained.

2.2 Convergence Analysis of National Economic Factors under Cooperative Mode

The above analysis mainly takes and analyzes the data such as productivity of economic factors in China. A single productivity is not fixed, but it constantly changes with the evolution of domestic and external economic risks. With the change of international situation, the change of domestic financial auditing and data supervision policy will break the external risk coefficient. Therefore, the convergence analysis is designed to be done on the above data results, in order to ensure the effectiveness of this analysis.

σ convergence is mainly used to analyze and express the impact of different financial and economic regulatory policies on the variation of domestic economic productivity differences. The standard deviation and the results variable coefficient are designed to be adopted, to express the data convergence and test the σ convergence. The formula is as follows:

$$\mathrm{S} = \sqrt{\frac{\sum\left(\mathrm{y_i} - \mathrm{y_i}\right)^2}{\mathrm{N}}}, \ \mathrm{CV} = \frac{S}{y} \quad (2)$$

In the formula, y represents the total factor economic productivity level of a certain region; and i is the mean value of national economic production factors; N is the total number of areas under study; S is the standard deviation; CV is the variable coefficient.

If the productivity variable coefficient and standard deviation included in the current analysis data show a decreasing trend, it is proved that σ is convergent. In addition, in order to improve the verification accuracy, the σ convergence can be measured by the following

research model:

$$\mathrm{Var}_{y,\ it}=c+\delta.t+u_{it} \tag{4}$$

Of which, Var is the variable coefficient of agricultural productivity in the study area; and c is a constant term; and t is the study time variable; u_{it} is the interfering variable factor (natural external economic risk factor).

If $\sigma < 0$, it is proved that σ convergence exists in the area under study; otherwise, it does not exist.

β convergence is the complement of σ convergence and it belongs to necessary but not sufficient conditions. Due to different economic regulation and development conditions in some areas, external economic risk factors are quite different. So even if there is no σ convergence, there may still be β convergence. Considering that β convergence has different sensitivity to regional span and time span, the traditional β convergence equation is appropriately corrected and span fusion is carried out for the time part. The result is shown as follows:

$$\mathrm{Ln}(\frac{Yit}{Yi0})/T=\alpha+\beta \mathrm{Ln}(Y_{i0})+\varepsilon_{it} \tag{5}$$

The formula T is the time span; Y_{it} and Y_{i0} respectively describe the production growth rate in the beginning and at the end of the time span. According to the σ and β convergence calculation model, the total factor productivity of the national economy can be calculated, to determine its convergence relationship for the study of the overall impact.

2.3 Analysis of the Impact Rate of Economic Regulatory Collaboration

In order to ensure the comprehensiveness of the impact rate study, it is necessary to use the spatial econometric model and adopt the spatial panel for regression test. And in order to ensure the standard of the test results, the global subspace distribution cluster is used, to measure the overall impact rate. The formula is as follows:

$$MORANSI=\frac{1}{\sum_{i=1}^{n}\sum_{j=1}^{n}W_{ij}}*\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}W_{ij}(y_j-y)}{\sum_{i=1}^{n}\sum_{j=1}^{n}W_{ij}(y_j-y)}^2 \tag{6}$$

In the formula, y_j is the national economic productivity within the region; n is the number of sample areas; W_{ij} is the analysis space weight.

After the data convergence has been completed for the above-extracted factors productivity, it can be used to extract the valid division value as the input parameter of Formula (6) above. By comparing the quantitative value, the influence advantage can also be pointed.

3 Conclusion

Under the current economic situation in China, the integration of financial auditing and economic supervision is an inevitable trend of economic development. The cooperation between financial auditing and economic supervision can not only improve the publicity of financial risks and avoid financial risks, but also improve the application of financial resources and improve the risk resistance of domestic market economy. Starting from their functions, this study builds an advantage analysis model based on mathematical thinking, and determines the advantages of collaboration. Firstly, under the framework of cooperation, financial auditing of the government can be regarded as a core system to carry out effective supervision. Secondly, the cooperation between the two conforms to the new situation of economic development at home and abroad. The combination of the two can effectively resist economic risks. Especially in today's information technology era, the cooperation between the two can ensure the efficiency of the management department and promote the comprehensive optimization of its financial information. Finally, the cooperation between the two can also facilitate the communication between relevant departments, in favor of the sharing of resources and information on the unified platform and strengthening work efficiency.

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