Hindawi
Security and Communication Networks
Volume 2023, Article ID 9834879, 1 page
https://doi.org/10.1155/2023/9834879

Retraction

Retracted: Analysis of Management Innovation of State-Owned Enterprises in the Context of Artificial Intelligence and Market-Oriented Economic Fluctuations

Security and Communication Networks

Received 1 August 2023; Accepted 1 August 2023; Published 2 August 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] Y. Wang and L. Sun, "Analysis of Management Innovation of State-Owned Enterprises in the Context of Artificial Intelligence and Market-Oriented Economic Fluctuations," *Security and Communication Networks*, vol. 2022, Article ID 1518447, 10 pages, 2022.

Hindawi
Security and Communication Networks
Volume 2022, Article ID 1518447, 10 pages
https://doi.org/10.1155/2022/1518447

Research Article

Analysis of Management Innovation of State-Owned Enterprises in the Context of Artificial Intelligence and Market-Oriented Economic Fluctuations

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Received 20 May 2022; Accepted 8 July 2022; Published 8 September 2022

Academic Editor: Hangjun Che

At this stage, with the development of society, China's modernization level has also been greatly improved. Under the background of artificial intelligence and the impact of economic globalization, China's external economic environment is changing with each passing day. Chinese enterprises are looking for new development ways to maintain their own development vitality under the condition of artificial intelligence. State-owned enterprises are controlled by the central or local governments. On this basis, this paper mainly discusses the innovative methods of state-owned enterprise management under the background of artificial intelligence, so as to provide reference for the innovation of state-owned enterprise management.

1. Introduction

China has a large population, unbalanced regional development, and different levels of economic development in different regions, and the strength of SOEs is different [1]. Under the socialist market conditions, SOEs on the same line should maintain a high degree of market sensitivity, actively make use of advanced market information, actively seize opportunities, appropriately adjust internal business strategies, better improve operation and management efficiency, and stabilize their development advantages under the condition of market competition [2]. The times are advancing, science and technology are developing, and industry norms and requirements are constantly improving. In terms of SOEs, there are certain problems in their own management to varying degrees [3]. It is necessary to further strengthen the advantages and overcome the disadvantages, so as to improve the best combination of resources and improve the efficiency of resource utilization [4]. As the management of SOEs is more complex, it involves the management of people, money, and materials. To strengthen supervision, how to stimulate the working motivation of all employees and produce $1+1>2$ synergy is an important development issue worthy of consideration in the development of SOEs.

Under the condition of artificial intelligence, the innovative management of SOEs can make the internal financial management of enterprises consistent with the optimal scheme of enterprises, maximize the profits of enterprises, and realize the low cost and high profitability of production process. The innovation of enterprise management is also reflected in the innovation of enterprise financial management [5]. The innovation of enterprise financial management is becoming more and more important in enterprise management. At this stage, the economic development of SOEs is facing the problems of high cost and low capital turnover, which has an adverse impact on the economic benefits of enterprises. The implementation of management innovation can give full play to the function and role of enterprise financial management and play a key role in the economic development of enterprises.

However, most SOEs adopt a centralized form of management, resulting in a lack of scientific decision-making. At this stage, many managers of large enterprises in China are directly appointed by the government and adopt centralized management, resulting in many people in charge of several jobs, resulting in a lack of efficiency in decision-making, which affects the normal development of the enterprise. In addition, many enterprises have a strong political management color, and there is a personal decision-making monopoly, which seriously affects the management efficiency of enterprises, resulting in the lack of scientific and effective decision-making, and even affects the economic benefits of the company.

The design of internal institutions of SOEs lacks rationality. Because China is influenced by the planned economic system, although it has been improved after the reform and opening up, it still has the influence of the planned economic system. At the present stage, the division of labor on the management institutions of Chinese enterprises is too fine, there is crossover between functions, and the main leaders of many companies assume other positions in the company, which is not conducive to improving the effectiveness of the company, and even more so to the improvement of the company's management level, resulting in some people doing nothing in the office, while others have things to do, which to a certain extent increases the expenses of managers [6].

There is a lack of secondary innovation ability of technological innovation in SOEs. Technological innovation is one of the important core contents of an enterprise's development, and only continuous innovation can keep the development with constant vitality and vigor [7]. With the development of technology, many enterprises in China began to introduce a large number of foreign advanced technologies, but due to the backward management of Chinese enterprises, there is no way to adapt to the development of technology, resulting in the use of technology does not play its true role in the effect [8–10].

2. Related Work

The regulating capacity refers to the ability of the state-owned economy to participate in industries with a dominant position and to control and support pillar industries in order to promote stable growth of the national economy [11]. Safeguarding capacity, on the other hand, refers to the ability to maintain national security and social stability through control of the public security sector. This interpretation of the control capacity of the state-owned economy has also been widely adopted by domestic scholars [12].

The specific quantification and measurement of SOE control can be reflected in two aspects: "quantity" and "quality." From the perspective of "quantity," the control power of SOEs should be reflected in the scale of SOEs [13]. In other words, the employment, main business income, total output value, and total asset value of SOEs should occupy a certain proportion of the corresponding overall index. From the perspective of "quality," the control of SOEs should be reflected in a reasonable industrial layout. In [14], the number of employees and operating income of state-owned and state-controlled enterprises were used to analyze the control power of SOEs. [15] selected the share of the gross product of SOEs in the total output value of the society and used this indicator as a measure of the control power of SOEs. In subsequent studies, domestic scholars began to measure the control power of SOEs by combining the indicators of industrial value added, total assets, total profit, main business income, and owner's equity. In order to refute the theory of "the state advancing and the people retreating," [16] used industrial enterprise data and selected the changes in the number, profit, and output value of SOEs as a measure of SOE control. However, these measures of SOEs' control are all based on the scale and do not take into account the changes in the layout of SOEs in the industry. Therefore, the most cited measure of SOE control is that of the National Bureau of Statistics (2001). This measure defines the regulation and guarantee coefficient and the vitality coefficient, and measures the control power of SOEs in three steps: in the first step, data on the proportion of state-owned owners' equity in the whole industry M_1, the proportion of state-owned assets in the whole industry M_2, and the proportion of state-owned sales revenue in the whole industry M_3 are selected and given different weights according to the degree of importance, i.e., according to the formula.

$$A_j = 0.3 * M_1 + 0.3 * M_2 + 0.4 * M_3. \tag{1}$$

Measure the j th industry state-owned enterprise regulation and guarantee coefficient; select state-owned and industry-wide owner's equity growth rate d_1, D_1, state-owned and industry-wide asset growth rate d_2, D_2, state-owned and industry-wide sales revenue growth rate data d_3, D_3, and state-owned and industry-wide labor growth rate d_4, D_4 data, according to the formula.

$$\begin{aligned} D_j = 0.25^* \frac{\left(1 + d_{1j}\right)}{\left(1 + D_{1j}\right)} + 0.2^* \frac{\left(1 + d_{2j}\right)}{\left(1 + D_{2j}\right)} \\ + 0.3^* \frac{\left(1 + d_{3j}\right)}{\left(1 + D_{3j}\right)} + 0.25^* \frac{\left(1 + d_{4j}\right)}{\left(1 + D_{4j}\right)}. \end{aligned} \tag{2}$$

Measure the vitality coefficient of SOEs in the j th industry. In the second step, the control power of SOEs in the j th industry is obtained by multiplying the regulating guarantee coefficient of SOEs in the j th industry with the vitality R_j. In the third step, different weights are assigned to different industries and summed up to obtain the overall SOE control power R.

Based on the measurement method of the National Bureau of Statistics subject group, [17] re-estimated the weights that should be assigned to the share of state-owned owner's equity, the share of state-owned assets, and the share of state-owned sales revenue in measuring the control power of SOEs in different industries. The article selected data on total market value, total assets, and main business revenue of 1287 representative industrial SOEs according to $M = \beta_0 + \beta_1 K + \beta_2 R$, where M represents the total market value of the enterprise, K represents the total assets of the

enterprise, and R represents the main business revenue. The weight indicators were estimated by β_1, β_2 regression results.

At present, fewer domestic scholars have studied the relationship between SOEs and economic volatility in depth into the mechanism. [18] used time series data to analyze the relationship between the share of the state-owned economy and the volatility of China's economic growth over the period 1980–2012. The study used a vector autoregressive model and an error correction model, taking consumption, investment, export, and institutional factors into account in the model, and examined the impact of the declining share of the state-owned economy on the magnitude of economic growth volatility through impulse response function and variance decomposition. The results of the study indicated that the declining share of the state-owned economy was one of the important reasons for the magnitude of economic growth volatility being amplified. [19] proposed that the business objectives of SOEs are dual in nature, i.e., profit objectives and scale objectives. On the one hand, SOEs pursue the maximization of their own interests, and on the other hand, they need to coordinate the relationship between national interests, collective interests and employees' interests, and the relative weights between SOEs' profit goals and scale goals are constantly changing [20]. How to develop a scientific, reasonable, and effective management mechanism to enhance the competitiveness of state-owned enterprises has become an urgent and important problem-facing state-owned enterprises at present [21–23].

The results of the study show that the model well represents the "high volatility" characteristic of China's economic fluctuation before 2000 and the "narrowing volatility" phenomenon after 2000. Therefore, the paper concludes that the duality of SOEs' business objectives and the change of relative weights between them are one of the important reasons for the phase change of China's economic volatility around 2000.

All in all, the results show that compared with previous studies, this model can better reflect the phenomenon of "high volatility" and "narrow volatility" of China's economic fluctuations before 2000. Therefore, this paper considers that the duality of state-owned enterprises' business objectives and the change of their relative weight are one of the important reasons for the fluctuation cycle of China's economy around 2000.

3. Methodology

The main goal of innovative change is to adjust the economic structure in the current market and reasonably allocate all resources so as to promote the healthy development of the national economy, among which the supply-side factors include land, innovation, labor, and capital. By carrying out innovative changes, we can reasonably adjust the industrial structure of China in the form of reform, adjust and optimize the unreasonable allocation of factors, enhance the utilization rate of factors, and gradually achieve the optimal allocation. In addition, in the process of carrying out supply-side structural reform, incremental reform is often adopted when adjusting the stock of factors, which means that promoting this reform can not only lead to a reasonable investment structure, but also expand the market effect as well as rationalize the industrial structure. In addition, innovative changes focus on the market and government being able to play a decisive role in allocating relevant resources, alleviating problems such as supply inhibition and supply constraints, meeting the growing new demands of the market economy, and tapping the potential of all types of consumption in the market.

Based on the principles of scientificity, feasibility, effectiveness and systematization, the enterprise management innovation process under the background of artificial intelligence is regarded as a continuous chain process. The structure of this paper is shown in Figure 1, which includes three stages of creativity generation, creativity transformation and creativity dissemination. Specifically, it mainly includes six key modules of creativity collection, screening, absorption, transformation, and innovation.

As shown in Figure 2(a), the traditional closed innovation model emphasizes the concept that "successful innovation requires strict internal control"; i.e., an enterprise can only obtain a strong competitive advantage through continuous and intense internal technological research and development, and ensure strict control of intellectual property rights through internal channel marketization. This kind of closed innovation was successfully verified by many large enterprises in the 20th century and before, but since the 21st century, this innovation mode of enterprises can no longer adapt to the competitive environment of informationization and globalization, so the open innovation mode combining external innovation resources and internal R&D to enhance the competitiveness of enterprises has become an inevitable trend of enterprise innovation. As shown in Figure 2(b), the open innovation model emphasizes the permeability of enterprise boundaries and the importance of external resources to enterprise innovation, interacts effectively with the external environment, promotes cooperative knowledge development and two-way flow, and realizes value co-creation by integrating all new ideas from within and outside the enterprise. In order to better understand the new innovation concept of open innovation, some domestic and foreign scholars have conducted a comparative study of two innovation models, open innovation and closed innovation, mainly in terms of staff concept, innovation ideas, R&D process, competitive advantages, intellectual property rights, organizational boundaries and innovation scope, etc. The results are shown in Table 1.

The econometric model was further set up as an individual effects model.

$$Y_{it} = \alpha S_{it} + \beta X_i + \lambda_t + \mu_i + \varepsilon_{it}, \tag{3}$$

where the explanatory variable Y_{it} denotes market economy fluctuations; S_{it} denotes the size of SOEs and all other explanatory variables; X_i denotes individual characteristics that do not change over time; μ_i denotes the intercept specific to the i th individual; λ_t denotes the time-dependent characteristics that do not change with time only and can be

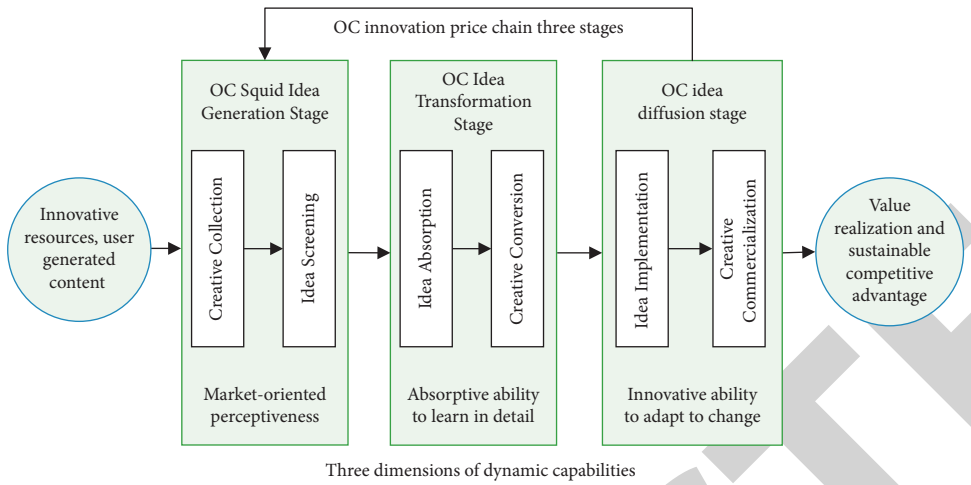

Figure 1: Innovation value chain model in the context of enterprise artificial intelligence.

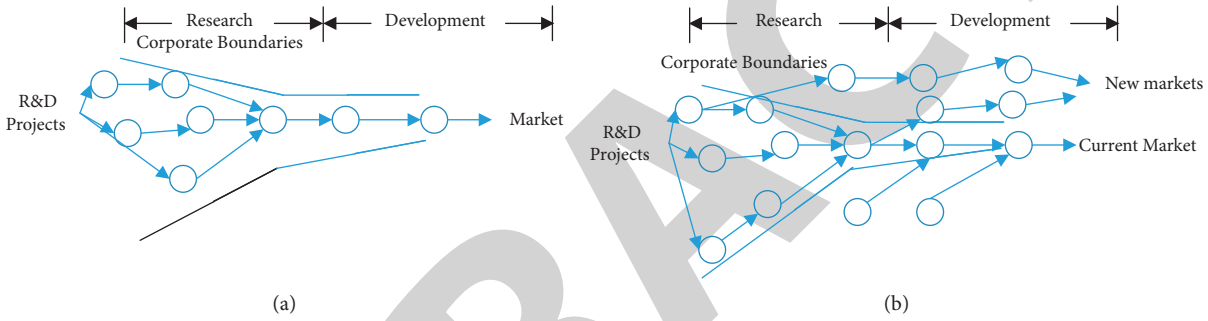

Figure 2: Comparison of two innovation models: (a) closed innovation and (b) open innovation.

Table 1: Comparison of closed innovation and open innovation.

Comparative content	Closed innovation	Open innovation
Staff philosophy	The smartest people in our industry are the internal employees who work for us	The smartest people do not all work for us, and we need to use the brightest external brains
Innovation ideology	The company wins if it has the most and best creative ideas in-house	Companies will win if they leverage internal and external creative knowledge
R&D process	The entire development process, from idea conception to implementation, is closed within the company	External R&D can create great value and should be combined with internal R&D
Competitive advantage	Be the first to turn a new idea into a new product and the first to bring it to the customer market	Having a successful business model is more important than being first to market
Intellectual property	Strictly control your intellectual property so that other companies cannot profit from your innovation	Competitiveness should be enhanced through paid use of patents or equity partnerships
Organizational boundaries	Clearly defined and impermeable	Ambiguous and permeable
Innovation scope	In-house R&D organization	All stakeholders inside and outside the company

considered as the intercept specific to period t; and $\mu_i + \varepsilon_{it}$ these two parts of the perturbation terms, together, constitute the compound perturbation term of the model. In the model, we assume that the regression equation for each individual has a consistent slope, and the use of a differential intercept term captures the difference between individuals.

The article sets the fluctuation of real GDP growth rate (HP) as a proxy variable for the economic fluctuation of the explanatory variable. The HP filter was used to separate the long-term trend term and the cyclical term from the real GDP growth rate, and then the absolute value of the fluctuation part was taken to represent the magnitude of economic fluctuation.

Hodrick and Prescott argue that the trend of economic growth is flat and that in the actual economic operation, economic variables fluctuate up and down around the growth trend. Method is that the trend term of the variable g_t and the short-term fluctuation term c_t together form the time series data y_t. Thus, there are

$$y_t = g_t + c_t, \quad t = 1, \ldots, T. \tag{4}$$

The moving average method principle was used to process the data, and the HP filter was constructed, which separates the trend term and the periodic fluctuation term from the time series y_t, while the fluctuation part g_t is the solution of the following problem.

$$\text{Min}\left\{\sum (y_t - g_t)^2 + \lambda \sum [(g_t - g_{t-1})(g_t - g_{t-2})]\right\}. \tag{5}$$

That is, the fluctuation term g_t is the solution of the problem when the loss function is minimized. In the above problem, $\sum (y_t - g_t)^2$ is the measure of the fluctuation component, while $\sum [(g_t - g_{t-1})(g_t - g_{t-2})]$ represents the "smoothness" of the data, and λ is called the "smoothing parameter," which can be used to adjust the ratio between the fluctuation component and the smoothness. Because different values of the "smoothing parameter" λ lead to a different smoothness of the data for different filters, the issue of the value of λ has been the subject of controversy in the academic community. At present, when economists study quarterly data, they basically follow the findings of Hodrick and Prescott (1980, 1997) [12], where the smoothing parameter is taken as 1600. However, when studying annual data, the value of λ is more controversial. In this paper, we set the smoothing parameter $\lambda = 100$ to do the HP filtering of annual GDP growth rate, and the econometric software EViews also sets the smoothing parameter to 100 by default.

The article selects state-owned enterprise control (soe) as the core explanatory variable. The control power of SOEs is calculated using equation $soe = \alpha_1 K + \alpha_2 R + \alpha_3 Q + \alpha_4 L$, where K, Q, R, J denote the shares of total assets, total main business income, total output value, and total employed population of industrial enterprises in the region, respectively, for state-owned and state-controlled enterprises. For the weights, they can be estimated by the linear regression equation $M = \beta_0 + \beta_1 K + \beta_2 R$ using the data of total annual market value, total assets, and main business income of enterprises. The regression results can be obtained according to the following constraints $\alpha_1, \alpha_2, \alpha_3, \alpha_4$.

$$\begin{gathered} \frac{\alpha_1}{(\alpha_1 + \alpha_2)} = \frac{\beta_1}{\beta_2}, \\ \alpha_4 = \alpha_1, \alpha_3 = \alpha_2, \\ \alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 = 1. \end{gathered} \tag{6}$$

The reason for $\alpha_4 = \alpha_1$ is that a large number of industrial enterprises in China currently use labor-intensive production techniques, and the weight of labor in control should be comparable to that of capital. $\alpha_3 = \alpha_2$ is because the total output value is not directly reflected in the enterprise data.

In recent years, shocks to technology (tfp) have increasingly become one of the main sources of macroeconomic volatility, and the article selects the change in total factor productivity as a proxy variable for technology shocks. According to the real economic cycle theory, when total factor productivity increases, labor demand increases, leading to a rise in real wages in the market, making employment increase and output rise. The estimation of total factor productivity is done in two steps: the first step is the estimation of the capital stock. The year 1999 is chosen as the base period, the perpetual inventory method is used, fixed capital formation is selected as the investment data for that year, and the capital stock data for 1999–2017 are calculated under the assumption of geometric decline in the relative efficiency of capital goods (the estimated depreciation rate is around 10.96%). In the second step, total factor productivity is calculated. The growth accounting method is used. Assume that the aggregate production function is neutral technological progress; $Y = A_t f(K, L)$, further assume that the production function is flush at once, whereby the tfp growth rate or tfp level is estimated. The article takes the absolute value of the growth rate of total factor productivity to measure the magnitude of technological change.

The article also introduces investment shocks (I), consumption shocks (c), trade shocks (tr), and wage factors ($wage$). According to Keynesian investment theory, investment has a multiplier effect. When investment behavior occurs, it is transmitted in a chain through all sectors of the economy, and effective demand keeps expanding, which eventually leads to an increase in output several times this investment; conversely, when investment decreases, GDP also decreases several times. Therefore, the article sets up the change of investment to describe the investment shock, selects the social fixed asset investment data, uses the fixed asset price index to exclude the price factor, and calculates the growth rate. Finally, the absolute value of the growth rate data of social fixed asset investment is taken to measure the size of investment shock. According to the above analysis, a rise in investment will lead to an exponential rise in GDP, while a fall in investment will lead to an exponential fall in GDP, so the change in investment is expected to be positively correlated with GDP fluctuations. The change in consumption reflects the change in demand from domestic sources. In the theory of national income determination, consumption, as one of the four economic sectors on the demand side, plays a crucial role in macroeconomic operation. The article selects total retail sales of consumer goods, uses the retail price index to remove the price factor from the data, and then calculates the growth rate and takes the absolute value for the growth rate. It is expected that consumption changes are positively correlated with economic fluctuations. The article selects the change in total exports as a proxy variable for trade shocks, uses the annual average exchange rate, and the consumer price index to remove the price factor from the export value data, then calculates the growth rate, and takes the absolute value of the growth rate to obtain the change in exports. Wages constitute an important part of production costs of enterprises, and changes in wages will bring about changes in production costs of enterprises, which will in turn affect output and lead to economic fluctuations. The article selects the average wage of the urban unit of employment, uses the consumer price index to put forward the price factor, calculates the growth rate, and then takes the absolute value of the growth rate; it is expected that the greater the change in wages, the greater the

Table 2: Regression results of the dispersion method.

Variables	National sample	Northeast region	Eastern region	Western region	Central region
c	0.015**	0.002	0.024***	0.006	0.011*
	(0.0055)	(0.0211)	(0.0059)	(0.0097)	(0.0049)
tr	0.009**	0.002	0.018***	0.005	0.015*
	(0.0034)	(0.0050)	(0.0048)	(0.0047)	(0.0072)
I	0.033**	0.051*	0.002	0.004	0.004
	(0.0093)	(0.0167)	(0.0152)	(0.0097)	(0.0202)
soe	−0.125*	−0.041	−0.044	−0.345***	0.087
	(0.063)	(0.0332)	(0.0129)	(0.0432)	(0.0245)
tfp	0.022	0.022	−0.015	0.062	0.149**
	(0.0305)	(0.1233)	(0.0359)	−0.597	(0.0447)
wage	0.029	0.006	0.002**	0.027*	0.012
	(0.0038)	(0.0093)	(0.0049)	(0.0085)	(0.0182)
$cons$	0.015	0.005	0.005***	0.025***	−0.005
	(0.0052)	(0.0083)	(0.0120)	(0.0042)	(0.0159)
$ad - R^2$	0.198	0.171	0.231	0.189	0.191

change in production costs of enterprises, which leads to more serious economic fluctuations; that is, wage growth is positively correlated with economic fluctuations.

Since the fluctuation characteristics vary from region to region and there may be omitted variables that do not change over time, the fixed-effects model regression is first performed on the national sample using the outlier method. Because the sample values can be divided into different clusters by province, observations in the same cluster may be correlated, so cluster robust standard errors are used. The regression results using the fixed-effects model are shown in Table 2.

From the results of the econometric analysis, the coefficient of the core explanatory variable *soe* on economic fluctuations is −0.124, $t = -2.04$, $p = 0.051$, which is significantly negative at the 10% level. Changes in consumption growth, export growth, and investment growth move in the same direction as economic volatility and are significantly positive at the 5% level. tfp land changes and *wage* changes have insignificant effects on economic volatility.

To examine whether there are regional differences in the impact of SOEs on economic volatility, the article also performs regression analysis on subsamples from each of the four major economic regions in China. Under the northeast sample, the regression coefficient of the core explanatory variable *soe* on economic volatility is −0.039, $t = -1.19$, $p = 0.319$, and the effect of SOE control on economic volatility is not significant. Changes in consumption growth, changes in export growth, changes in total factor productivity, and changes in wages fluctuate in the same direction as economic fluctuations, but the estimated coefficients are not significant. Only the estimated coefficient of the change in investment is significantly positive at the 10% level of significance. This indicates that in the case of the northeast region, economic fluctuations mainly originate from investment shocks.

The estimated coefficient of *soe* remains negative but insignificant under the eastern region sample. Changes in consumption growth and exports show a significant positive correlation with economic fluctuations, and the estimated coefficients are significant at the 1% level of significance. The estimated coefficient of technological change changes from positive to negative, but is not significant. The estimated coefficient of wage changes is positive but insignificant. The results indicate that the main sources of economic fluctuations in the eastern region are changes in consumption and exports.

The estimated coefficient of state control changes from negative to positive, $p = 0.743$. Changes in consumption growth and changes in export growth move in the same direction as economic fluctuations and pass the 10% level of significance test. The estimated coefficient of technological change is significantly positive at the 5% level of significance. The effect of changes in wages and investment changes on economic fluctuations is not significant. This indicates that, for the central region, economic fluctuations mainly originate from consumption, exports, and technological changes.

Overall, in the national perspective, SOEs do have a stabilizing effect on the fluctuations of the market economy, while changes in consumption, exports, and investment are positively associated with economic fluctuations. The regression results for the sample of four major economic regions show that SOEs play an important role in stabilizing regional fluctuations in the western region; however, the stabilizing role of SOEs is not significant in the northeastern, eastern, and central regions.

To ensure that the model was used correctly, the article conducted an F-test on whether to use individual fixed-effects regression or mixed regression. The original hypothesis of the F-test was "intercept term $\mu_i = 0$ for all individuals," which means that mixed regression should be used. The test results showed that under the national sample, the F statistic = 2.79, $p = 0.0001$; i.e., the original hypothesis of "all $\mu_i = 0$" was strongly rejected, and the individual fixed-effects model and mixed regression were considered to be chosen between the individual fixed-effects model and the mixed regression.

Second, for whether to use individual random effects model regression or mixed regression, the article refers to the study of Breusch and Pagan (1980). Breusch and Pagan

propose an LM test that can test individual random effects, and the original hypothesis of this LM test is H_0: $''\sigma_u^2 = 0''$. If the original hypothesis is rejected, it indicates that individual random effects should be taken into account in the model; i.e., mixed regression cannot be performed; conversely, the model is considered acceptable for mixed regression. The test results show that x^2 statistic = 18.38, $p = 0.0001$, which means that $\sigma_u^2 = 0''$ is strongly rejected, and that the former should be used for regression between the individual random effects model and the mixed regression.

If the original hypothesis holds, the random effects estimates (*RE*) are also consistent; moreover, the within-group estimates are more efficient than the random effects estimates. If the random effect is not the correct model, the *RE* is inconsistent. Therefore, if the original hypothesis holds, the in-group and random effects estimates will converge to the true parameters and the gap between them will disappear under the condition of a large sample, if the gap between the in-group and random effects estimates is too large.

Considering that there are many factors that affect the market economy volatility, the factors that have an impact on the market economy volatility cannot be exhaustively considered into the model, and all may have endogeneity problems due to omitted variables. That is, the explanatory variables are correlated with the random disturbance terms. First, the economic variables should be coherent in time, and the strength of SOEs' control in the previous period will affect SOEs' control over economic resources in the current period; second, SOEs' control in the previous period should be considered as a predetermined variable, which is related to the market economic fluctuations in the previous period but not to the market economic fluctuations in the current period. Therefore, the one-period lagged term of SOE control satisfies the assumption that it is both correlated with the explanatory variables and uncorrelated with the disturbance term.

If the estimation results of GMM are consistent, it is necessary to satisfy that there is no autocorrelation in the perturbation terms. Even when the assumption of no autocorrelation of the perturbation term holds, the first-order difference of the perturbation term still has autocorrelation. The results of the test for first-order differential autocorrelation of the nuisance term in the national sample showed that the z-statistic = −2.32, $p = 0.021$, and the test for second-order differential autocorrelation showed that the z-statistic = 1.18, $p = 0.237$. Therefore, the original hypothesis is accepted and the nuisance term is not autocorrelated. Finally, the article also tests for overidentification of the instrumental variables.

The results of the GMM estimation show that the regression coefficient of *soe* is −0.0889 with a $p = 0.035$. The effect of SOE control on economic volatility is negative at the 5% level of significance. That is, the estimation results suggest that SOEs do play a role in stabilizing economic volatility, which is consistent with the findings of the regression using fixed-effects model.

From Table 3 about literature analysis, we know that the control of SOEs is the ability of SOEs to control economic

Table 3: Regression results after replacing variables.

Variables	Estimated coefficient	Standard error	t-statistic	p-value
c	0.013525	0.0054221	2.52	0.019
tr	0.0085133	0.0032329	2.63	0.015
I	0.0211727	0.0090736	2.44	0.029
scale	−0.1610045	0.0687723	−2.35	0.026
t f p	197659	0.0302065	0.66	0.527
wage	0.0025832	0.0036605	0.75	0.487
cons	0.0129823	0.0049624	2.62	0.015

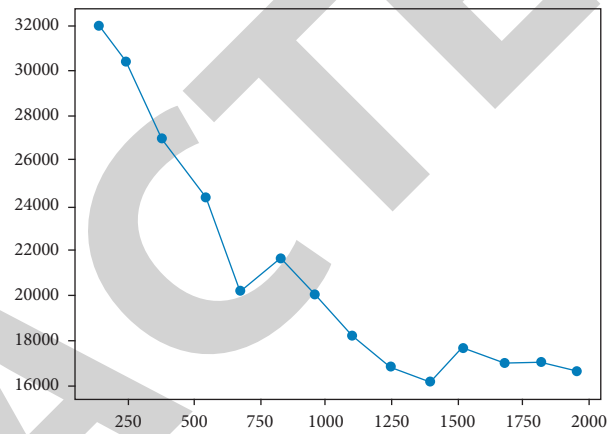

Figure 3: Number of state-owned and state-controlled enterprise units.

resources. The "total assets" portray the size of the enterprise from the perspective of production factors and resource possession. Referring to the study of [24], the article uses the data of industrial enterprises. This indicator is also used as a proxy variable for SOE control, and a regression analysis is conducted on the national sample as shown in the following table. It can be seen from the data that in northeast China, the economic fluctuation mainly comes from investment shock.

From the regression results after replacing the core explanatory variables, the change in consumption, change in exports, and change in investment are positively associated with economic fluctuations in the national sample and significant at the 5% level of significance, while the size of SOEs is negatively associated with economic fluctuations and significant at the 5% level of significance. Changes in technology and changes in wages do not have a significant effect on economic fluctuations. Therefore, it can be concluded that SOEs do smooth out economic fluctuations in the market; the larger the size of SOEs, the less volatile the regional economy and the smoother the economic growth.

4. Case Study

Taking industrial enterprises as an example, the number of state-owned and state-controlled enterprises in China from 2003 to 2016 is shown in the following figure.

As shown in Figure 3, since 2003, the number of state-owned and state holding enterprises in China has decreased

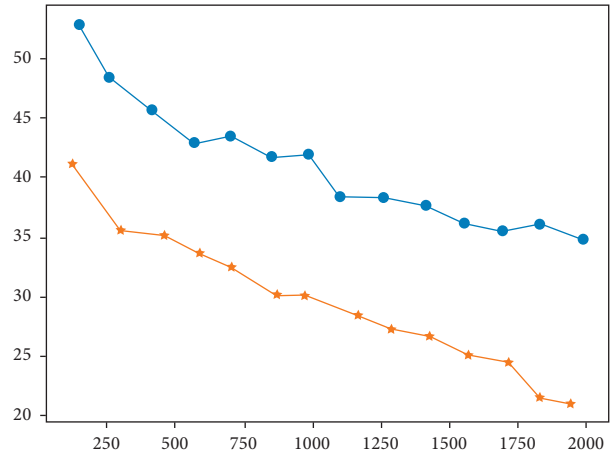

Figure 4: The proportion of main business income and total assets of SOEs.

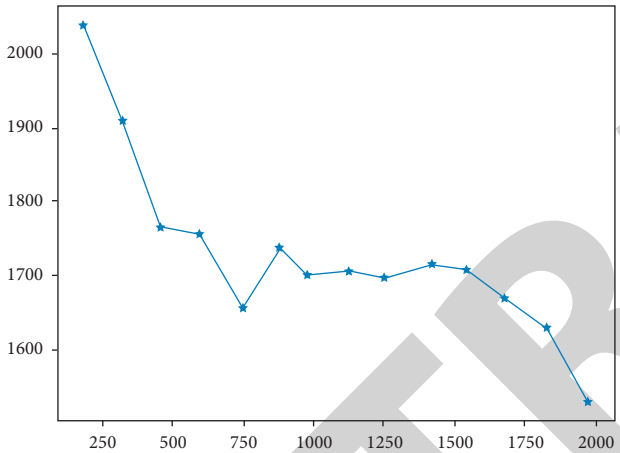

Figure 5: Average number of workers employed by state-owned and state-controlled enterprises.

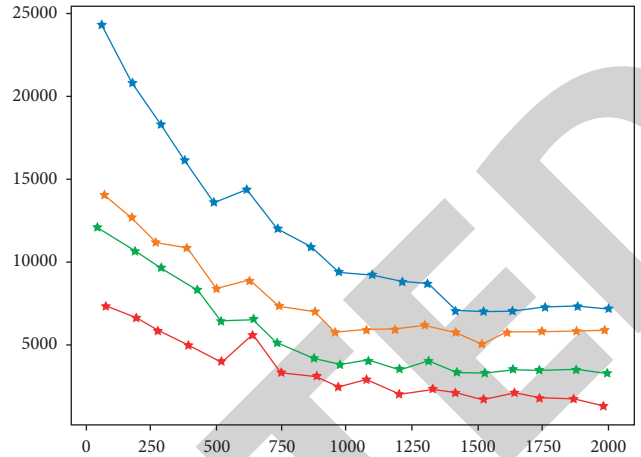

Figure 6: Number of units of state-owned and state-controlled enterprises.

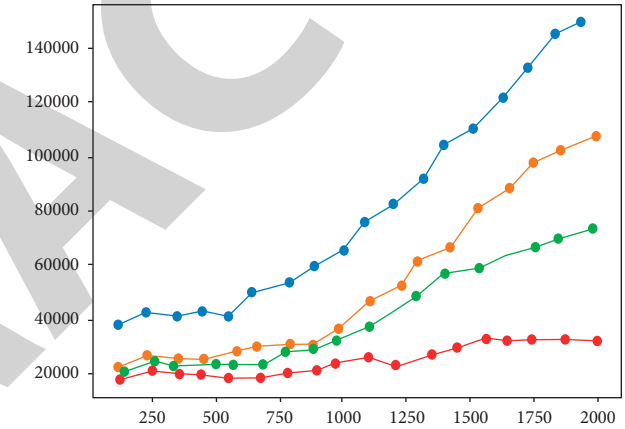

Figure 7: Total assets of state-owned and state-controlled enterprises.

from 34280 in 1998 to 19022 in 2016. Although the number of state-owned and state holding companies increased slightly in 2007–2008 and 2012–2015, the total number of enterprises decreased significantly. The relationship between the operating activities and total assets interest income and expenditure of the state-owned holding company is shown in Figure 4.

As can be seen from Figure 4, the proportion of core business income in total assets of state-owned and state-controlled enterprises is declining every year. From 2003 to 2016, the proportion of total assets of state-owned and state holding companies decreased from 55.99% to 38.47%; The share of core revenue decreased from 40.53% to 20.62%. It is worth noting that although the proportion of total assets and operating income of state-owned enterprises shows a downward trend, the total assets and operating income continue to grow.

On the other hand, Figure 5 shows the average employment dynamics of state-owned enterprises and state holding companies from 2003 to 2006. As shown in Figure 5, the average number of employees in state-owned and state-controlled enterprises has changed little. From 2003 to 2007, the average number of employees in state-owned and state-controlled enterprises decreased slowly and remained basically unchanged after 2007. Through the study of the number of state-owned and state holding units, the proportion of total assets, the proportion of main operating income, and the average number of employees, we can draw a conclusion that the scale of China's SOEs is slowly shrinking, "the state is moving and the people are retreating".

In order to scientifically reflect the social and economic development trends of different regions of the country and provide a basis for the party and the state to formulate regional development policies.

The number of state-owned and state-controlled enterprise units in China from 1999 to 2016 is shown in Figure 6.

In the northeast, east, central, and west regions have all declined significantly overall, and the trend and speed of decline are similar. Specifically, enterprise units in the four major economic regions declined rapidly from 1999 to 2003, rebounded slightly from 2003 to 2004, declined slowly from

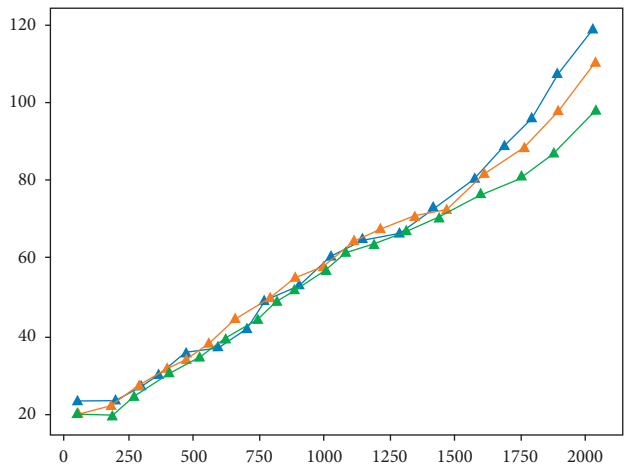

Figure 8: Comparison of simulation results of innovation revenue of SOEs with different time steps.

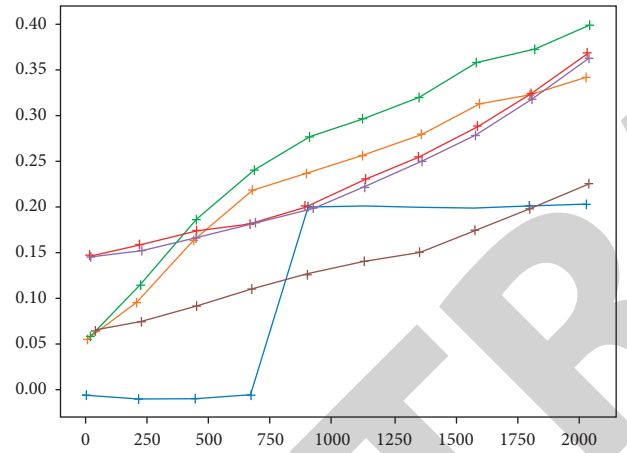

Figure 9: Simulation results of "the number of management ideas of SOEs" and its influencing factors.

2004 onward, and remained stable after 2012. The number of enterprises in the northeast region fell from 6,448 in 1999 to 1,406 in 2006, a decrease of 78.2%; the number of enterprises in the eastern region fell by 71.8%. Figure 7 gives the total assets of state-owned and state-controlled enterprises in the four major economic regions of China.

Therefore, we can conclude that the number of SOEs has been declining, the differences in the number of SOEs in the four major economic regions of China have been significantly reduced, and the geographical distribution of the number of enterprises tends to be even. However, SOEs in the eastern region show better profitability, and the profit income of SOEs in the eastern region still occupies the most important share of profit income of SOEs in China.

As shown in Figure 8, the simulation of the parameter "innovation revenue in the context of artificial intelligence," for example, shows that for the models with three simulation steps, there is no pathological result in the process of its operation. The system behavior is basically stable, so the model can be considered as valid.

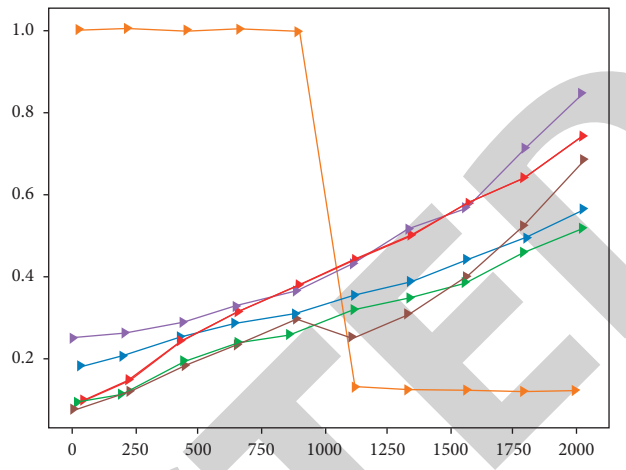

Figure 10: Simulation results of the number of ideas adopted and their influencing factors.

As shown in Figure 9, the number of ideas collected in the context of AI in the enterprise shows an approximately linear increase, which is positively correlated with the "number of users in the context of AI" and "users' motivation to innovate."

As shown in Figure 10, the number of creative ideas adopted by enterprises in the context of AI first shows an approximately linear increasing trend, and after a short decline after 2013, it again shows a gradually increasing development trend, which is mainly influenced by "the number of creative ideas in the context of AI," "the number of creative ideas online in the context of AI," "the quality of creative ideas in the context of AI," "the number of comments in the context of AI," "the perception of enterprises," and "the number of creative ideas online in the context of AI." The trend is mainly influenced by "the number of creative ideas in the context of AI," "the online cycle of creative ideas in the context of AI," "the quality of creative ideas in the context of AI," "the number of comments in the context of AI," and "the perceived ability of enterprises."

5. Conclusion

For SOEs, management innovation is an important part of enterprise innovation, and it is an inevitable trend for the development of SOEs, which can help them maintain vitality and vigor and remain invincible in the market competition. In today's economic globalization, the development of SOEs faces many opportunities and also ushers in many challenges. If SOEs want to overcome the problems encountered in their development, they need to establish perfect management mechanisms and continuously upgrade the management mode. Only by comprehensively strengthening the management and innovation of SOEs can they better dispatch and utilize resources from all sides, form a strong synergy, and create greater operational benefits. This requires continuous exploration, in-depth research, and effective response according to the changes in the market situation and SOEs' own reality, and ultimately forms a driving force. This requires continuous exploration, in-

depth research, and effective response to changes in the market situation and SOEs' own realities, and ultimately the formation of a sustainable impetus for the long-term development of SOEs to improve the competitive power of SOEs in the social market.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding this work.

Acknowledgments

The study was supported by "Open Foundation of Guangdong Provincial Key Laboratory of Public Finance and Taxation with Big Data Application" (2019B121203012).

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