

NK Model and the Construction of Enterprise Management Strategy

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Abstract: *The complexity of enterprise operations is increasing, especially in supply chain management and strategic planning. This study explores the NK model and its application in the construction of enterprise management strategies. By comparing the performance of the NK model with the traditional Keynesian model in three key indicators of enterprise management efficiency, market share, and profit margin, this article aims to reveal the advantages of the NK model in simulating complex market environments and enterprise decision-making. This article first constructs an NK model, selects appropriate parameters, and sets the model structure. Subsequently, through simulation experiments, this article compared the operational performance of the NK model and the traditional Keynesian model in different market environments. The experiment designed simulated markets with various economic conditions, including economic prosperity, recession, intensified competition, or changes in market demand, and designed 18 enterprises with different characteristics for these simulated markets. By simulating the management of these enterprises, this article records and observes the enterprise response and its impact on key indicators guided by two models. The research results indicate that companies managed under the NK model outperform those managed under the traditional Keynesian model in terms of management efficiency, market share, and profit margin. Under the NK model, the maximum management efficiency of enterprises can reach 97.5%, while under the traditional Keynesian model; the maximum management efficiency of enterprises is only 77.2%. In addition, under the NK model, the maximum market share of enterprises reached 9.5%, while under the traditional model, the maximum market share of enterprises was much lower. In terms of profit margin, the highest profit margin for enterprises managed by the NK model reached 28%, while the highest profit margin for enterprises under the traditional model was only 12.7%. The application of the NK model in the construction of enterprise management strategies has shown significant advantages, especially in improving the adaptability and competitiveness of enterprises to market changes.*

Keywords: *NK Model, Enterprise Management Strategy, Management Efficiency, Market Share*

1. Introduction

In terms of supply chain management, product innovation, market positioning, and other aspects, enterprises need more scientific and systematic management strategies to cope with the complex and ever-changing external environment. The NK model, as a macroeconomic model, provides a new perspective for understanding economic cycles and formulating economic policies by introducing financial market frictions and central bank monetary policy tools, especially quantitative easing. However, there are not many studies that can apply the NK model to the construction of enterprise management strategies, especially in empirical analysis compared to traditional Keynesian models.

The contribution of this article is to apply the NK model for the first time in the construction of enterprise management strategies, and to compare and analyze it with traditional Keynesian models. Through simulation experiments, this article reveals the potential advantages of the NK model in improving enterprise management efficiency, market share, and profit margins, providing new theoretical support and practical guidance for strategic decision-making in complex market environments.

The first part of the article is the introduction, which introduces the research background, contributions, and structure of the article; the second part is related work, summarizing theoretical and empirical research on enterprise management strategy, supply chain management, NK model, and other related fields. The third part is the methodology, which elaborates in detail on the construction method

of the NK model and the application framework of the NK model for enterprise management strategy; The fourth part is the results and discussion, which presents the comparative experimental results between the NK model and the traditional Keynesian model in terms of enterprise management efficiency, market share, and profit margin, and conducts in-depth analysis; The fifth part is the conclusion, summarizing the research findings and providing suggestions for future research directions.

2. Related Work

With the continuous changes in economic globalization and market environment, the complexity of enterprise operations is increasing, especially in supply chain management and strategic planning. In the new era of development, Lian Bo took scientific measures from the perspective of the supply chain to build a comprehensive and systematic management system. Based on the management characteristics of the current supply chain strategy, it analyzes the shortcomings of current enterprise management, clarifies the source of problems, and provides targeted solutions for reference [1]. With the development of China's economy and the continuous promotion of a series of reform measures, various fields have shown a vigorous development momentum, and competition among enterprises has become increasingly fierce. Chi Guozheng is conducting research on enterprise management strategies from the perspective of differentiated management, providing a certain reference for workers in related industries [2]. Taking Southern Power Grid Company A as an example, Yao Dongfang systematically analyzed the problems in strategic management. Based on the principle of "two in one", he studied and proposed a framework for the strategic management model of state-owned enterprises, providing new ideas and practical references for the reform of strategic management in state-owned enterprises, which has certain theoretical value and practical significance [3]. Nie Guihong first briefly introduced the basic meaning and characteristics of the network economy, and then pointed out the main problems under traditional strategic management of enterprises. Finally, a series of explorations were conducted on the innovative strategies of enterprise strategic management in the era of network economy, which played a certain role in promoting the sustainable development of enterprises and the increasingly perfect market economy system [4]. Sun Hao analyzed and studied the concept and current situation of strategic cost management, and explored the implementation paths of flexible cost, activity-based cost, and standard cost applications. He aims to innovate strategic cost management, optimize enterprise management and operation models, improve operational quality, and accumulate experience and provide reference for future cost management [5].

In addition, Sims E proposed a new Keynesian model that combines financial market friction with central bank monetary policy tools, particularly quantitative easing. The core of this model is to analyze the impact of credit shocks on the economy and how unconventional monetary policies affect the economy. It introduces financial intermediaries and distinguishes between short-term and long-term bonds to capture some key features in the real economy [6]. Auclert A suggested that the new Keynesian model with frictionless labor supply faces a challenge: given standard parameters, they cannot simultaneously match reasonable estimates of marginal propensity to consume (MPC), marginal propensity to Earn (MPE), and fiscal multiplier [7]. Seidl H found that in the new Keynesian model with household heterogeneity, fiscal policy can perfectly replace monetary policy. The three simple conditions of consumption tax, labor tax, and government debt level are sufficient to induce equal consumption and labor supply for each household, resulting in the same distribution as interest rate policies [8]. Gal í J analyzed the extension of the New Keynesian model, which is characterized by overlapping generations of finite life entities and a (random) transition to inactivity. Compared with the standard model, it allows rational expectation equilibrium with the asset price foam [9]. Elias C J used Bayesian methods to estimate small-scale New Keynesian models with heterogeneous expectations (HE). The results indicate that the data exhibits significant expected heterogeneity, and the HE model fits the data better than the model with homogenizer adaptive learning [10]. Although the above research provides profound insights into enterprise management and the New Keynesian model, there has not been a detailed explanation of the NK model in the construction of enterprise management strategies. In view of this, this article explores the New Keynesian Model (NK Model) and its application in the construction of enterprise management strategies, helping enterprises better understand and respond to economic fluctuations, optimize their management and operation models, and improve operational quality.

3. Method

3.1 NK Model Construction Method

The NK model is a macroeconomic model that analyzes economic behavior by introducing financial market friction and central bank monetary policy tools, particularly quantitative easing:

$$M_{t+1} = M_t + \alpha \cdot (Y_{t+1} - Y_t) \quad (1)$$

M_t and M_{t+1} represent the money supply of time t and $t+1$, Y_{t+1} and Y_t represent the economic output of time $t+1$ and t , respectively, and α is the adjustment parameter of quantitative easing policy.

The core of this model is to examine the impact of credit shocks on the economy and the role of unconventional monetary policies. It captures key characteristics of the real economy through financial intermediaries and distinguishing between short-term and long-term bonds, providing a theoretical basis for understanding economic cycles and formulating economic policies. The simulation of credit shock is represented as:

$$C_{t+1} = C_t + \beta \cdot (I_t - I_{t-1}) \quad (2)$$

C_t and C_{t+1} are the credit levels of time t and $t+1$, respectively, I_t and I_{t-1} are the investment levels of time t and $t+1$, and β is the coefficient of the impact of credit shocks on credit levels.

In the parameters of the NK model, N represents the total number of variables in the system, which is the number of decision factors that need to be considered in the enterprise, while K represents the number of influences each variable is affected by, which is how much other factors affect each decision factor:

$$I_i = \sum_{j=1}^K w_{ij} \cdot (x_j - x_i) \quad (3)$$

I_i is the total impact on the i th variable, j is the index of other variables that interact with the i th variable, K is the number of impacts on the i th variable, w_{ij} is the weight of the impact of variable j on variable i , x_j and x_i are the values of variables j and i , respectively.

When selecting parameters, it is necessary to have a deep understanding of the actual operation and management structure of the enterprise, set parameters, and build a network. Each node represents a decision variable, and the connections between nodes represent the interactions between variables. These connections define the topology of the model, and each edge has a weight representing the strength of the influence. The model topology is represented as:

$$G = (V, E) \quad (4)$$

G is the network, V is the set of nodes in the network, representing decision variables, E is the set of edges in the network, representing the interactions between variables.

Next, it is necessary to design a network that reasonably reflects the relationships between different departments or decision-making points within the enterprise and how they interact with the external environment. Various network structures can be constructed using the principles of graph theory and network science, such as fully connected networks, random networks, small world networks, or scale-free networks. Each structure has its specific characteristics and applicable scenarios, and optimizing the model structure may involve adjusting network connectivity, clustering coefficients, or modularity to better simulate the management structure and processes of enterprises under the NK model [11-12].

3.2 Framework of NK Model for Enterprise Management Strategy

The framework of applying the NK model first involves in-depth analysis of the internal and external environment of the enterprise, identifying key influencing factors such as market trends, competitor behavior, consumer demand, etc., and incorporating these factors as variables into the network of the NK model. Each variable corresponds to a node, and the interaction relationships between these variables are determined through expert interviews, historical data analysis, and other methods. These relationships are represented in the form of network edges, and the weights of the edges reflect the actual degree of influence. The state change of each variable x_i can be expressed as:

$$x_i' = f(x_i, A) \tag{5}$$

x_i' is the new state of variable x_i after one iteration, and $f(x_i, A)$ is the state change function of variable x_i under the influence of a given adjacency matrix A .

The NK model simulates different strategic choices by adjusting the state of each node in the network, evaluates the impact of these choices on the internal and external environment of the enterprise, and predicts key indicators such as market share, cost-effectiveness, and competitive advantage [13-14]. The model output can be combined with the actual business goals of the enterprise for multiple rounds of iterative analysis to explore and optimize strategic decisions. It may be necessary to adjust the model parameters or structure to more accurately reflect the actual operation of the enterprise. Based on the simulation results of the NK model, enterprises can develop a strategic plan that comprehensively considers internal and external environmental factors. This set of plans can help enterprises make flexible and effective responses in the constantly changing market conditions, improve the scientific and forward-looking nature of enterprise strategic planning, and thus gain advantages in fierce market competition.

3.3 NK Model Application Methods

Table 1: Application method data of NK model

Company Name	Market Share (%)	Profit Margin (%)	Risk Index	ROI (Return on Investment) (%)	Management Efficiency Gain (%)	Policy Simulation Impact	Sensitivity Analysis Outcome	Optimization Analysis Result
Company A	5.2	21.5	3.8	15.3	12	Interest rate cut by 1%, resulting in a 5% profit increase	Raw material costs up by 5%, leading to a 3% profit decrease	Cost reduction by 10%, efficiency improvement by 15%
Company B	6.1	18.9	4.2	14.1	10	Tax incentive of 4%, increasing ROI by 3%	Exchange rate fluctuation of 10%, affecting profit by 7%	Production efficiency improved by 20%, cost savings of 8%
Company C	4.8	24.6	2.9	16.5	15	Government subsidies of 10%, R&D costs down by 4%	Wage level up by 10%, resulting in a 2% profit decrease	Marketing efficiency up by 30%, market share increased by 5%

The application of NK model in the construction of enterprise management strategy involves a series of systematic methods, which help enterprises optimize their strategic decisions through simulation and analysis [15-16]. Scenario analysis is one of the methods that explores different market and policy scenarios by changing the values of key variables in the NK model. Policy simulation focuses on simulating different policy choices. Sensitivity analysis evaluates the degree to which a system responds to changes in specific input variables. Optimization analysis utilizes models to find the optimal decision-making solution that can maximize enterprise benefits under specific constraints. Risk assessment helps businesses identify potential risk points and develop risk mitigation measures, while decision support provides tools for decision-makers. Dynamic simulation enables enterprises to analyze how strategic decisions evolve over time and predict long-term trends. Multi-objective optimization helps businesses find a balance between multiple objectives, such as maximizing profits while also considering minimizing risks. Table 1 shows the application method data of NK model in enterprise management strategy construction [17-18].

Table 1 presents the numerical results of the application of enterprise management strategy construction under an NK model, demonstrating the adaptability of enterprises in changing market environments and the effectiveness of strategic decision-making [19-20]. The common goal of these methods is to enhance the adaptability and competitiveness of enterprises in the face of market changes, enabling them to make wiser and more effective strategic decisions in complex and ever-changing business environments.

4. Results and Discussion

In the previous text, this article implemented the construction of the NK model and its application in the construction of enterprise management strategies. In order to understand its practical application data in enterprise operations, this article conducted comparative experiments with traditional Keynesian models. The experiment focuses on examining their performance in the three key indicators of enterprise management efficiency, market share, and profit margin, in order to reveal the advantages and limitations of the NK model application process, and provide more accurate strategic planning tools for enterprises, helping them make more effective decisions in a dynamic and changing economic environment.

During the experiment, a simulated market environment containing different economic conditions was first constructed, such as economic prosperity, recession, intensified competition, or changes in market demand, and 18 companies were designed for these simulated markets. They are different in terms of scale, product line, capital structure, and market positioning, which can better simulate the diversity of enterprises in the real world. Then, the NK model and traditional Keynesian model can be used to simulate and manage these enterprises separately, ensuring that the input parameters of the two models are consistent during the management process. Through simulation, the paper can record and observe how companies respond under the guidance of two models in different market and economic scenarios, as well as how these reactions affect management efficiency, market share, and profit margins.

4.1 Enterprise Management Efficiency

In the constantly evolving global market environment, the efficiency of enterprise management is directly related to the vitality and market competitiveness of enterprises. The comparison results are shown in Figure 1:

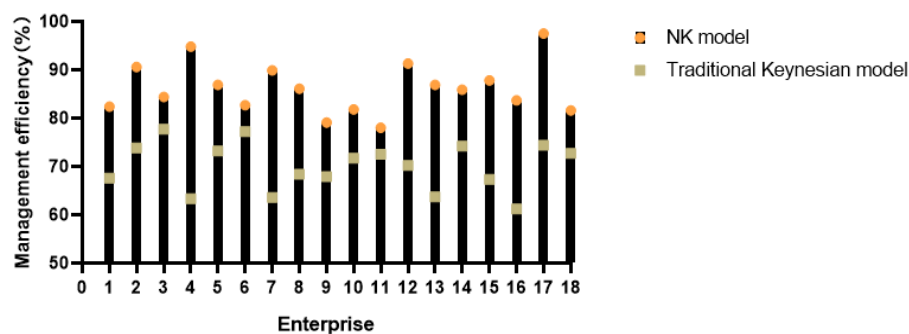


Figure 1: Comparison of management efficiency

As shown in Figure 1, it is evident that the management efficiency of enterprises in the market environment under the NK model is higher than that under the traditional Keynesian model. Under the NK model, the maximum management efficiency of enterprises reached 97.5%, while under the traditional Keynesian model, the maximum management efficiency of enterprises was only 77.2%. This significant difference indicates that the NK model can more effectively capture the interaction between internal management and external market dynamics in simulating complex market environments and corporate decision-making, thereby improving the management efficiency of the enterprise.

4.2 Market Share

Market share not only symbolizes a company's market position, but is also a key indicator of its

financial health and future growth potential. The experimental data is shown in Figure 2:

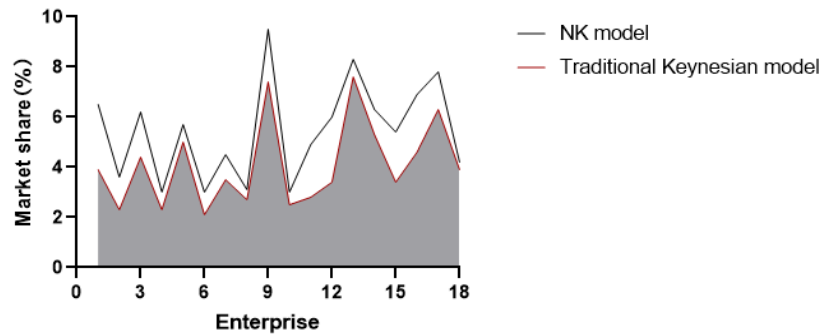


Figure 2: Market share comparison

According to the data analysis in Figure 2, it can be seen that the market share of enterprises under the NK model has slightly increased compared to the traditional Keynesian model. All enterprises achieved a maximum market share of 9.5% and a minimum of 3% under the management of the NK model. This data shows that under the management of the NK model, enterprises perform more strongly in the market and their competitiveness is improved. The growth of market share reflects that the NK model can more accurately capture market dynamics and consumer behavior when simulating enterprise operations, thereby helping enterprises formulate more effective market strategies.

4.3 Profit Margin

The profit margin directly reflects the economic benefits and market competitiveness of the enterprise, and its specific experimental results are shown in Figure 3:

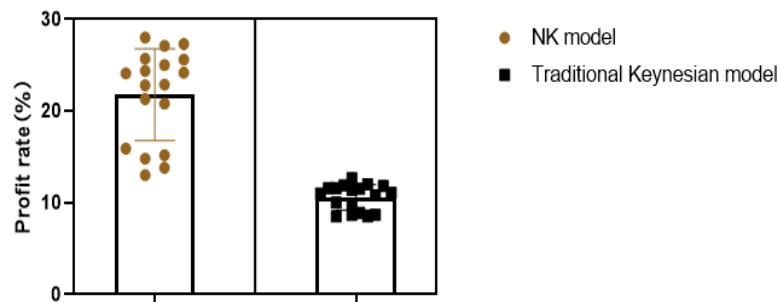


Figure 3: Profit margin comparison

Analyzing the data in the above figure, this article found that the profit margin of enterprises under the management of the NK model reached the highest of 28% and the lowest of 13%. However, the highest profit rate of enterprises under the traditional Keynesian model is only 12.7%, which is far from the profit rate of enterprises under the management of NK model. This discovery reveals the remarkable advantages of NK model in improving the economic benefits of enterprises.

5. Conclusions

The conclusion of this paper is drawn through the comparison of the aforementioned insights of the NK model construction and traditional Keynesian model on the enterprise management strategy. In the simulation experiment under complex market environment and enterprise decision-making, it is found that the NK model can significantly increase the management efficiency, market share, profit margin and other internal factors of the enterprise. The research result is that the NK model is superior to the traditional Keynesian model in corporate strategic decision-making, especially in coping with market changes and optimizing resource allocation, and in improving the economic efficiency of the enterprise. The reason is that the NK model has more flexibilities and higher degrees of freedom in different set-up parameters, and thus better utilizes limited resources. The interaction between its network structure and

the operation of internal and external nodes of the enterprise is more fully utilized, making enterprises have stronger adaptability in the fierce competitive market. Using the NK model, it is conducive to internal and external dynamic research of enterprises in a complex market environment and can help enterprises improve their economic benefits by optimizing the strategy to achieve the goal at a low cost. This provides a new method for enterprise managers to understand the economic fluctuations, to optimize the operation mode and management model, and to improve operational efficiency. It is shown in this study that enterprises should also consider the characteristics of the internal and external environments while developing management strategies, including the complexity and dynamics, and at the same time emphasize the importance of maintaining flexibility and adaptability to the market environment which is experiencing continuous changes. The application of the NK model enables enterprises to have a clear understanding of the relationship between each decision node, which can help optimize strategic planning and structure, and further improve themselves so as to increase the competitive advantage.

References

- [1] Lian Bo, Wang Kun. *Research on Enterprise Management Strategy based on supply Chain*. *China Management Informatization*, 2023, 26(23):119-122
- [2] Chi Guozheng. *Research on enterprise Management Strategy from the perspective of differentiated management*. *Chief Financial Officer*, 2023, 19(6):162-164
- [3] Yao Dongfang, Zhang Guanlu, Wu Ying, Yang Guangyuan. *Research on the construction of the strategic management model of state-owned enterprises based on the concept of closed-loop management--Taking Southern Power Grid Company A as an example*. *Value Engineering*, 2024, 43(2):51-53
- [4] Nie Guihong. *Exploration on the strategic management of enterprises in the network economy environment*. *China Management Informatization*, 2023, 26(22):109-111
- [5] Sun Hao. *Exploration and application of enterprise strategic cost management*. *Contemporary petroleum and petrochemical*, 2023, 31(9):51-54
- [6] Sims E, Wu J C, Zhang J. *The four-equation new keynesian model*. *Review of Economics and Statistics*, 2023, 105(4): 931-947.
- [7] Auclert A, Bardóczy B, Rognlie M. *MPCs, MPEs, and multipliers: A trilemma for New Keynesian models*. *Review of Economics and Statistics*, 2023, 105(3): 700-712.
- [8] Seidl H, Seyrich F. *Unconventional Fiscal Policy in a Heterogeneous-Agent New Keynesian Model*. *Journal of Political Economy Macroeconomics*, 2023, 1(4): 633-664.
- [9] Galí J. *Monetary policy and bubbles in a new keynesian model with overlapping generations*. *American Economic Journal: Macroeconomics*, 2021, 13(2): 121-167.
- [10] Elias C J. *Bayesian estimation of a small-scale new Keynesian model with heterogeneous expectations*. *Macroeconomic Dynamics*, 2022, 26(4): 920-944.
- [11] Shaulska L, Kovalenko S, Allayarov S, et al. *Strategic enterprise competitiveness management under global challenges*. *Academy of Strategic Management Journal*, 2021, 20(4): 1-7.
- [12] Ali S Z, Qureshi I A. *A Note on the Neo-Fisher Effect in the New Keynesian Model*. *Macroeconomic Dynamics*, 2023, 27(7): 2012-2028.
- [13] Okada T. *Endogenous technological change and the new Keynesian model*. *Review of Economics and Statistics*, 2022, 104(6): 1224-1240.
- [14] Sobieraj J, Metelski D. *Application of the Bayesian New Keynesian DSGE Model to Polish Macroeconomic Data*. *Engineering Economics*, 2021, 32(2): 140-153.
- [15] Almajali A A Q, Almubidin R F. *Estimating the indirect effects of monetary policy on inflation, the output gap and foreign reserves in Jordan using the new Keynesian model*. *Jordan Journal of Economic Sciences*, 2022, 9(2): 172-188.
- [16] Iiboshi H, Shintani M, Ueda K. *Estimating a nonlinear new Keynesian model with the zero lower bound for Japan*. *Journal of Money, Credit and Banking*, 2022, 54(6): 1637-1671.
- [17] Hommes C, Mavromatis K, Özden T, et al. *Behavioral learning equilibria in New Keynesian models*. *Quantitative Economics*, 2023, 14(4): 1401-1445.
- [18] Minford P, Ou Z, Zhu Z. *Can a small New Keynesian model of the world economy with risk-pooling match the facts?* *International Journal of Finance & Economics*, 2021, 26(2): 1993-2021.
- [19] Cole S J, Martínez-García E. *The effect of central bank credibility on forward guidance in an estimated New Keynesian model*. *Macroeconomic Dynamics*, 2023, 27(2): 532-570.
- [20] Tagne, J. S., Ningaye, P., & Kobou, G. *The Effects of Openness on Managerial Innovation in Cameroonian Companies*. *Journal of Organizational and End User Computing*, 2021, 33(4), 28-43.