

## Research Article

# Optimization Analysis of Advertising Information Resource Allocation in View of the Dynamic Game Model

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Advertising has become the most important part of emerging advertising media with rich content, vivid form, huge browsing volume, and exponential growth in market share. It brings huge profits to operators and advertisers participating in bidding every year. Formulate reasonable allocation rules and payment rules for advertising resources in advertising space sales. The advertising configuration platform mainly has three functions: the entry function of home page advertising, serving the company's operation department and storing the advertising information entered by operation, with a large amount of data, involving more than a dozen tables. The advertisement output function outputs the advertisement of the storage layer through the interface in JSON data format. This part of the function serves the downstream systems, such as mobile phone clients and PC. Starting from the requirements' analysis, this study introduces the platform design and the analysis method logic, shows the implementation of the platform, and then analyzes and describes the test process from the aspects of function and performance. Based on the review and summary of the formation and characteristics of the competitive structure of China's advertising market and the research results of foreign advertising classification, this study makes a qualitative and quantitative study on the competitive strategy of China's advertising game by using the principles of service marketing and advertising, the classical model of oligarch competitive structure, game theory, differential game, and dynamic optimization. In terms of qualitative research, this study discusses the impact of advertising on China's market competition pattern and the advertising game strategy through the comparative study of advertising and the analysis of market characteristics. The study found that due to the high barriers to entry of the advertising market and the intangibility of products, the strategy of putting category advertising and information advertising should be adopted. In quantitative research, based on the Sethi model, this study discusses the advertising game strategy model of the Oligarchic competition structure. The important conclusions include the profitability of enterprises from the market share is the most important factor to determine the market share and advertising expenditure. The impact of advertising on market share is obvious. The role of advertising expenditure has a time lag. Drastic changes in the scale of advertising expenditure will cause long-term fluctuations in the market structure. The research method has a certain universality, so the research results can also be used for reference for the advertising strategy of other industries with oligopoly competition structures.

## 1. Introduction

Advertising information resources play an important economic, political, and cultural role in society, making it one of the important pillars of social development. The continuous development and progress of society objectively require the optimal allocation of information resources. In turn, the optimal allocation of information resources has a positive correlation with the development and progress of society.

However, the inherent asymmetry of advertising information resources intensifies the asymmetric state of the information market, resulting in the infinite cycle of "asymmetry symmetry asymmetry" of the information market. The asymmetric allocation of advertising information resources has brought a series of negative effects to all parties of advertising activities, such as advertisers, advertising companies, advertising media, advertising audiences, and whole economic market, resulting in the loss of

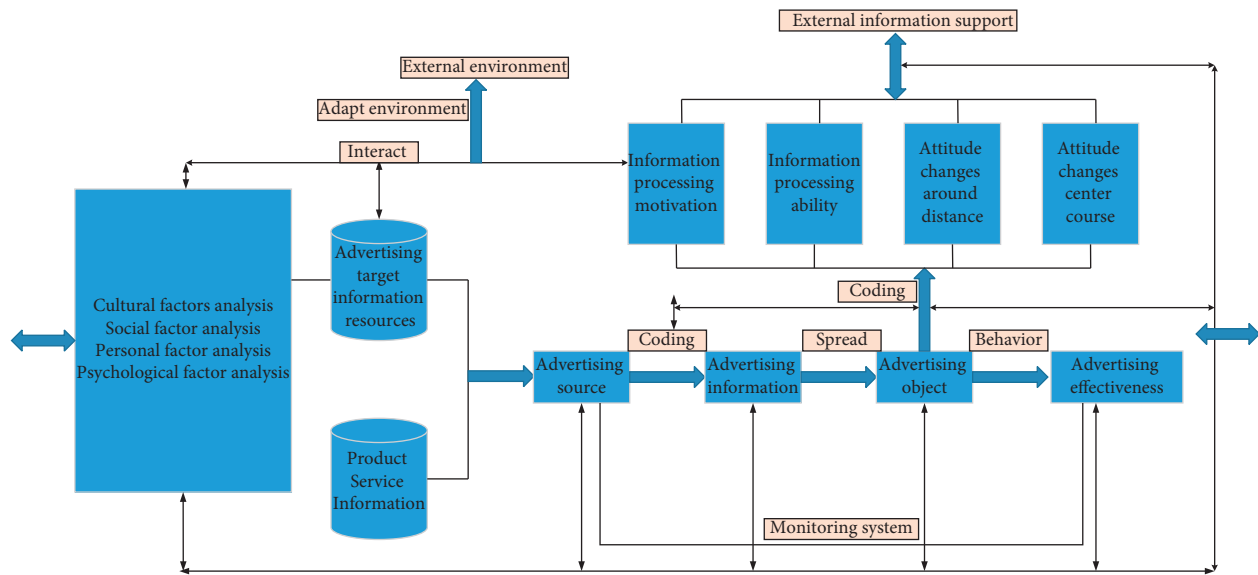


FIGURE 1: Dynamic adaptation of advertising information resources.

consumers as advertising audiences (inferior subjects of information). Increase the media investment cost of advertisers, resulting in advertising waste and low efficiency. Therefore, the research on the optimal allocation of advertising information resources has positive theoretical significance and application value [1–8].

Since the reform and opening up, with the continuous development of the market economy, advertising has become a part of social life, a feature of the socialist economy and a cultural landscape. The development of advertising not only plays an undeniable role in the field of enterprise management and commodity sales but also becomes an important embodiment and condition for the establishment and development of the market. However, while advertising information resources play a positive role in the allocation process, they also have some negative effects, which not only affect the normal economic order and bring immeasurable economic losses and spiritual harm to the majority of consumers but also are not conducive to the development and progress of society. The purpose of our optimal allocation of advertising information resources is to form a state of the relative balance between advertising communicators and advertising objects, eliminate the asymmetry of advertising information in the allocation process, not only maximize the interests of advertising sources but also reduce the cost of searching information for advertising objects and improve the income. Finally, maximize the interests between the advertising source and the advertising object, that is, the goal of “win-win,” as shown in Figure 1.

With the rapid development of modern information technology, especially computer network technology, it is possible to spread and share technology, knowledge, and information all over the world. It also speeds up the operation of global economic integration, resulting in the gradual expansion of business activities of enterprises into borderless operations. The rapid development of modern technology not only shortens the renewal cycle of products

or services and improves their product productivity but also makes the market competition more intense. At first, most of the methods for enterprises to reduce production costs were mass production, or when seeking profits, they regarded increasing sales as their core competitiveness, but such an era has passed. Now, enterprises must find new competitiveness to obtain profits. Therefore, supply chain management also appears and receives attention. British supply chain management expert Martin Christopher once said: “the competition in the 21st century is not only the competition of enterprises but also the competition between supply chains.” The simple strength competition among enterprises has lost the key position of market competition, and the competition between supply chains has been highlighted [9–13].

In modern society, advertising is a means of communication, that is to say, for a specific requirement, it is a means of publicity to openly and widely transmit information to the public through some form of media. In terms of the use of advertising by enterprises, because the phenomenon of product homogenization is becoming more and more obvious and the market capacity is becoming more and more saturated, consumers have more choices when choosing products. Therefore, advertising, as one of the communication methods between manufacturers, dealers, and consumers, has increasingly attracted the attention of enterprise managers, and enterprises are increasingly dependent on advertising. Data show that, in 1980, the cost of global advertising was about \$111.4 billion. By 2000, its cost increased to \$410 billion, an increase of nearly four times. Among them, the United States ranks first in the world in advertising expenses, which can be called the center of the advertising industry. Its advertising investment reached the US \$226.8 billion in 2000, accounting for 55.1% of the global advertising expenses. When analyzing Chinese advertising, it is found that its position in the global advertising industry is also slowly increasing. Since the reform and opening up in

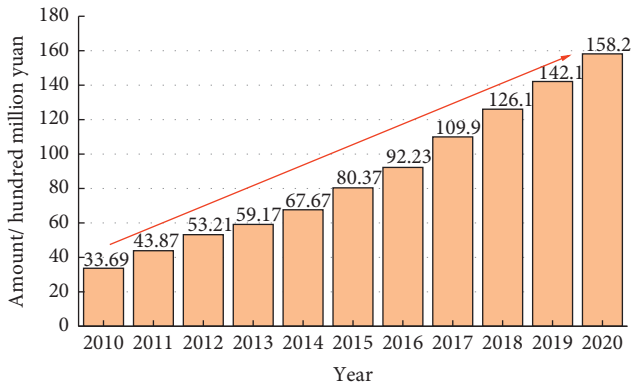


FIGURE 2: Total advertising.

the 1980s, China's advertising industry has entered a stage of rapid development. Its average annual growth rate far exceeds the average annual growth rate of China's GDP and has become one of the countries with the fastest advertising growth rate in the world. From Figure 2, over the years, the total amount of advertising bidding increased almost in a straight line, playing an increasingly important role in market competition and enriching people's cultural life [14–20].

In the past traditional business model, manufacturers and retailers invested in advertising alone, and the actual effect was not obvious when promoting and selling products. If manufacturers and retailers can choose to cooperate with each other and make rational use of their respective advantages in the advertising field, the improvement of product sales can be realized, and revenue sharing and risk sharing can be further promoted, so as to finally maintain the competitiveness of the whole supply chain in the market competition.

With the development of network technology, the traditional Internet with strong interference to users will be blocked or intercepted by users using software, and the development of traditional Internet advertising has encountered obstacles. The original advertising concept was put forward in 2012, and Phoenix introduced it into China for the first time. The essential idea of native advertising is to integrate the brand content into the user experience. Native advertising forms and types are not limited. Native advertising spreads from the perspective of users, integrates experience to attract users to actively browse, and pays more attention to content creativity, precision marketing, and data mining. The original advertising is led by the media and assisted by advertisers. The media will create the original advertising content based on the needs of users, so as to ensure the objectivity of advertising information.

As an important branch of modern mathematics, game theory was born in the 1920s. So far, game theory has been widely used in physics, sociology, economics, and other aspects. Using game theory to study the advertising competition between enterprises began in 1983. Under the assumption of noncooperation among enterprises, Friedman discusses the optimal output and advertising investment level of  $N$  enterprises. Then, Krishnamurthy establishes a

static game model and discusses how to choose the amount of advertising investment in the case of advertising spillover. Then, based on the assumption of the spillover effect, Han and Nakata use game theory to analyze the impact of advertising on the market environment. Toshimitsu studies the optimal advertising time of enterprises in the presence of advertising spillover effect. Schmeiser analyzed the advertising problems in different industry environments and found that when there is an advertising spillover effect, the profits of enterprises mainly depend on the industry environment.

However, the above models are static. It is undeniable that the research of static models has certain limitations. In the actual economic environment, factors such as market demand are constantly changing, resulting in the dynamic change of the whole market environment. Therefore, using the dynamic model to simulate advertising competition among enterprises has attracted more and more scholars' attention. Brady establishes an advertising-driven competition model based on Cournot's duopoly analysis model and discusses the advertising effect. Cellini and Lambertini established a differentiated game model with an advertising spillover effect based on differentiated products. Prasad established a stochastic difference game model of advertising competition among uncertain enterprises. Lambertini establishes and analyzes the dynamic advertising model with a spillover effect. Norman and Colombo analyzed the enterprise's dynamic advertising strategy and its corresponding impact on the industry environment.

One problem that must be solved in a dynamic model is complexity. In fact, the models of economics and sociology always show great complexity because they are related to the decision-making of bounded rational people. As an economic model, the complexity of the advertising competition model has also attracted the attention of many scholars. Qi et al. extended Krishnamurthy's static model to a dynamic model and discussed the dynamic complexity of the established model. Accordingly, Gori established a nonlinear Cournot duopoly model using advertising and discussed the local and global dynamic behavior in the model. Yao established a duopoly advertising model with nonlinear cost and pointed out that the manufacturer of chaos cannot obtain more advantages than its competitors when entering chaos. Guo and Ma established a cooperative advertising model and proved that when the Nash equilibrium becomes unstable, two bifurcations may occur.

In the above model, only the impact of advertising investment on profit is considered, so the model is only a one-stage game model. In recent years, more and more scholars begin to pay attention to the two-stage game of enterprises. However, few scholars use the two-stage dynamic game method to analyze the complexity of advertising competition among enterprises, so this field is still worthy of further research.

In addition, another valuable topic in nonlinear dynamics is global dynamics, synchronization, and multistability. In recent years, many scholars have studied these problems. Peng established a duopoly model with interfirm externalities and analyzed the multistability of the system.

Fanti found that when multistability occurs, the global dynamic behavior becomes more complex. Then, scholars study the synchronization and intermittency of two-dimensional discrete dynamical systems. Esashi studied the intermittent phenomenon between synchronization and nonsynchronization when enterprises operate cross-regional business.

In China, some scholars also use the static game to study the advertising competition among enterprises. Zhong Shuai analyzes the performance of two enterprises in the three cases of advertising competition, semicooperation, and whole alliance cooperation through the duopoly game model. On the basis of game theory, Ma Lu analyzed and discussed the linear relationship between product differentiation and advertising investment. Using the theoretical knowledge of game theory, Dan bin and Tian Lina studied the advertising strategy among complementary products enterprises. Peng Shuhong established a duopoly competition model under vertical differentiation and analyzed the game behavior among oligopoly enterprises through different types of advertising. However, due to the limitations of the static games, some scholars began to use the dynamic game to study advertising competition. Qi Jie puts forward a game model of dynamic advertising investment on the basis of Peng Shuhong. Yao Hongxing et al. established a dynamic oligopoly game model of nonlinear cost and analyzed it through numerical simulation. The same situation exists with the research of foreign scholars. Most domestic scholars study the one-stage advertising competition game. Some scholars use the two-stage game to study other aspects, but the two-stage game research on advertising competition is still lacking. Therefore, using the two-stage game to study the advertising investment of enterprises is an issue we need to pay attention to. For the study of nonlinear dynamics, Xu Feng established a duopoly advertising competition model to study the chaotic state of the system through nonlinear dynamics. Cao Yinxia analyzed that enterprises should not only maximize their own profits but also bear certain social responsibilities and studied the phenomena of synchronization, intermittence, and multistability in the system. Then, scholars study the synchronization and intermittency of two-dimensional discrete dynamical systems. Esashi studied the intermittent phenomenon between synchronization and nonsynchronization when enterprises operate cross-regional businesses.

## 2. Basic Concepts and Classification of Game Theory

Game theory can be divided into cooperative game theory and non-cooperative game theory, depending on whether players can reach a binding agreement between them. For example, the cooperative game is the cooperation between two oligarchic enterprises in order to monopolize the market and obtain the maximum benefits. However, most of the enterprises in reality only consider their own profits, and some practical constraints make it difficult to achieve cooperation, so most of the games at present refer to non-cooperative games. In the oligopoly game model, firms do

not cooperate. Game theory can be divided into static and dynamic games, depending on the order in which players act. In a static game, players take actions at the same time, regardless of order, and both players make decisions at one time. A dynamic game is one in which the players act in order. In this study, a dynamic adjustment mechanism is introduced to establish a dynamic game model and the strategy at one moment will affect the decision at the next moment, simulating the future running state of the enterprise, so as to provide a reference for the future strategy of oligarch enterprises and choose the decision that is beneficial to themselves. Game theory can be divided into complete information games and incomplete information games, depending on whether players know their characteristics, strategy space, and payment function accurately. Complete information game refers to that participants fully understand each other's information in terms of ability and willingness, while the latter does not possess such characteristics. Based on the hypothesis of a bounded rational person, both sides of enterprises participating in the competition cannot completely know each other's situation, so it belongs to an incomplete information game. To sum up, the game model established in this study belongs to the dynamic game of incomplete information in the case of noncooperation among oligarch enterprises participating in competition [21–25].

Assume that the relationship between the manufacturer and the retailer is symmetric, and there is no binding agreement signed by both parties; the game between the two is noncooperative. Both manufacturers and retailers aim to maximize their profits, and they make decisions simultaneously on this basis. The solution to this noncooperative game structure is called Nash equilibrium.

Advertising effect measurement is a systematic evaluation of the effect of advertising activities. Product attributes, media types, consumer shopping psychology, and other factors affect the measurement of advertising effect. Fixed advertising input, although simple and easy to operate, from the overall view of its formulation, does not have targeted. In order to improve the scientificity and effectiveness of advertising strategies, enterprises should make corresponding advertising strategies according to the measurement of advertising effectiveness and the combination of product attributes. Nash equilibrium is a kind of non-cooperative game equilibrium. In reality, non-cooperative situation is more common than cooperative situation. So, Nash equilibrium is a major development of dynamic game theory, even a revolution. Nash equilibrium is the result of rational choices by players. In modern economic life, the idea of Nash equilibrium is often used, which involves the concept of Nash equilibrium. Assume that the relationship between the manufacturer and the retailer is symmetric, and there is no binding agreement signed by both parties, the game between the two is non-cooperative. Both manufacturers and retailers aim to maximize their profits, and they make decisions simultaneously on this basis. The solution to this noncooperative game structure is called a Nash equilibrium.

Usually, enterprises will increase profits, sales growth, market share increase, and brand reputation for their pursuit

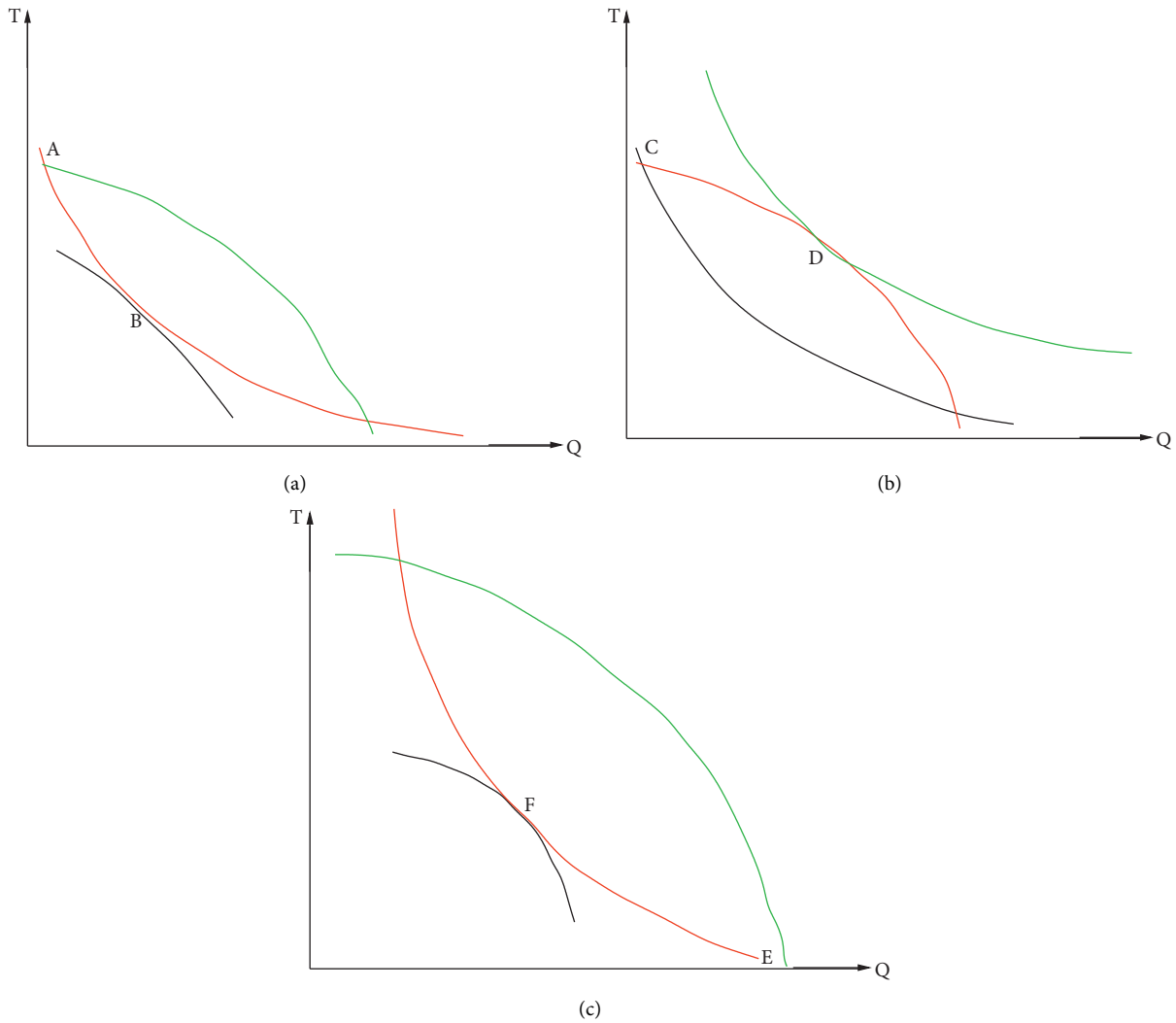


FIGURE 3: Profit indifference curve.

of advertising goals. A clear advertising target is a prerequisite for the success of enterprise advertising. In order to achieve the established advertising objectives, we need to use advertising effect measurement to manage scientifically and effectively. First, through prior analysis, estimate the lag time of advertising effect, understand the feasibility and effectiveness of advertising target, and make reasonable positioning, before the activity of the enterprise should try to specify the advertising target. Second, in the process of advertising implementation, the advertising target should be decomposed according to the estimated lag time of the advertising effect, and the decomposition target of each stage should be clarified. By comparing with the decomposition target, the effect of each link and stage of advertising is tracked and measured, so as to master the actual situation of advertising effect, timely find problems, and control and adjust the advertising strategy to ensure that activities are carried out as planned. Although these detection and analysis results cannot accurately determine the lag time of advertising effect, they can know whether the advertising campaign is running according to the target, which is helpful

to strengthen the rational positioning and scientific management of the advertising target. In order to make better use of the advertising effect, it is necessary to measure the advertising effect quantitatively. Quantitative analysis of brand reputation, purchase rate, brand loyalty, market share, and profit rate can make the original fuzzy advertising effect clear and measurable. Quantification of advertising effect is helpful for enterprises to determine the market positioning of products and the market conditions of competitors, so as to formulate scientific market strategy, marketing strategy, and advertising strategy in Figure 3.

Thus, the expected profit function of manufacturers and retailers can be obtained as follows:

$$\pi_m = \rho_m(\beta a^{-\gamma} q^{-\delta}) - ta - q, \tag{1}$$

$$\pi_r = \rho_r(\beta a^{-\gamma} q^{-\delta}) - (1-t)a. \tag{2}$$

As retailers are rational people, they pursue the maximization of profits under established conditions. Therefore, the retailer's profit function is

$$\max_a \pi_r = \rho_p (\beta a^{-\gamma} q^{-\delta}) - (1-t)a. \quad (3)$$

The optimization condition of this problem is  $\partial \pi_r / \partial a = 0$ :

$$\gamma \rho_r \beta a^{-(\gamma+1)} q^{-\delta} - (1-t) = 0, \quad (4)$$

$$a = \left[ \frac{\gamma \rho_r \beta}{(1-t)q^\delta} \right]^{1/(\gamma+1)}. \quad (5)$$

Now, let us think about stage one, where the manufacturer is also a rational person, and he also seeks to maximize his own profit. Therefore, the manufacturer's profit function is

$$\max_{q,l} \pi_m = \rho_m (a - \beta a^{-\gamma} q^{-\delta}) - ta - q, \quad (6)$$

$$\max_{q,l} \pi_m = \rho_m \left\{ a - \beta \left[ \frac{\gamma \rho_r \beta}{(1-t)q^\delta} \right]^{-\gamma/(\gamma+1)} q^{-\delta} \right\} \quad (7)$$

$$- t \left[ \frac{\gamma \rho_r \beta}{(1-t)q^\delta} \right]^{1/(\gamma+1)} - q, \quad (8)$$

$$t^* = \frac{\rho_m - (1+\gamma)\rho_r}{\rho_m - \gamma\rho_r},$$

$$q^* = [\delta^{\gamma+1} \beta \gamma^{-\gamma} (\rho_m - \gamma\rho_r)]^{1/(\delta+\gamma+1)}, \quad (9)$$

$$a^* = [\delta^{-\delta} \beta \gamma^{\delta+1} (\rho_m - \gamma\rho_r)]^{1/(\delta+\gamma+1)}. \quad (10)$$

Manufacturer and retailer profits are

$$\pi_m^* = \rho_m a - [\beta \delta^{-\delta} \gamma^{-\gamma} (\rho_m - \gamma\rho_r)]^{1/(\delta+\gamma+1)} (\delta + \gamma + 1), \quad (11)$$

$$\pi_r^* = \rho_r a - [\beta \delta^{-\delta} \gamma^{-\gamma} (\rho_m - \gamma\rho_r)]^{1/(\delta+\gamma+1)} (\delta + \gamma + 1), \quad (12)$$

where  $\beta$ ,  $\gamma$ , and  $\delta$  is a normal number. The greater the  $\gamma$ , the greater the influence of local advertising level on sales volume. The greater the  $\delta$ , the greater the influence of national advertising level on sales volume.

The basic theory of game and the classic game model are discussed, and then, the probability sales theory is introduced, including the definition of probability products and probability sales, dealer behavior, and consumer behavior, and the optimal strategy under the probability sales strategy is given. The fundamental feature of dynamic game is that each player does not choose or act at the same time, but successively and sequentially. The latter actor can observe the behavior of other actors before his or her own action so that he or she can have more information to help him or her make choices and reduce the blindness of decision-making. If we apply the advertising input of enterprise A and enterprise B to the dynamic game model and take whether to increase the advertising input as the credibility condition, one party plays the dynamic game according to the information of the other party already possessed; then, we can construct

the dynamic game model of advertising input under the complete information state.

### 3. Advertising Game Strategy Model and Demonstration

Suppose there are two firms in the market that produce homogeneous products. As it is known to all, advertising can help enterprises expand market share and increase sales volume, thus increasing profits of enterprises. Therefore, enterprises need to regularly put advertisements in the market to improve their competitiveness and gain greater profits. However, since two enterprises produce homogeneous products, the advertising of one enterprise not only affects its own market size (or its own product price) but also has a certain impact on the market size (or product price) of its competitors, which is often called the spillover effect of advertising [26–32].

Therefore, when considering the product and advertising competition between two enterprises, the two-stage game model should be used for analysis and research. In the first stage, the two enterprises decide the amount of advertising input and carry out advertising competition. In the second stage, the two enterprises choose the output that can maximize their profits according to their own situation. The fundamental feature of dynamic game is that each player does not choose or act at the same time, but successively and sequentially. The latter actor can observe the behavior of other actors before his or her own action so that he or she can have more information to help him or her make choices and reduce the blindness of decision-making. If we apply the advertising input of enterprise A and enterprise B to the dynamic game model and take whether to increase the advertising input as the credibility condition, one party plays the dynamic game according to the information of the other party already possessed; then, we can construct the dynamic game model of advertising input under the complete information state.

As can be seen from Figure 4, the retail price and wholesale price increase monotonously. The retail price in both cycles is greater than the wholesale price in the same cycle, and the retail price increases slightly faster. At the same time, the wholesale price and retail price in the second cycle are not only always greater than the corresponding wholesale price and retail price in the first cycle, but also faster than the corresponding wholesale price and retail price in the first cycle. This shows that the more sensitive consumers are to advertising, the higher the commodity price is. The difference between retail price and wholesale price is always greater than zero and will increase slightly with the increase of advertising sensitivity, that is, the retailer's profit per unit commodity will increase slightly.

As can be seen from Figure 5, the demand of the two cycles increases monotonously. The demand of the second cycle is greater than that of the first cycle and the demand of the second cycle grows faster. This indicates that the more sensitive consumers are to advertisements, the greater the market demand will be. Meanwhile, on the basis of the established customer groups in the first cycle, some new

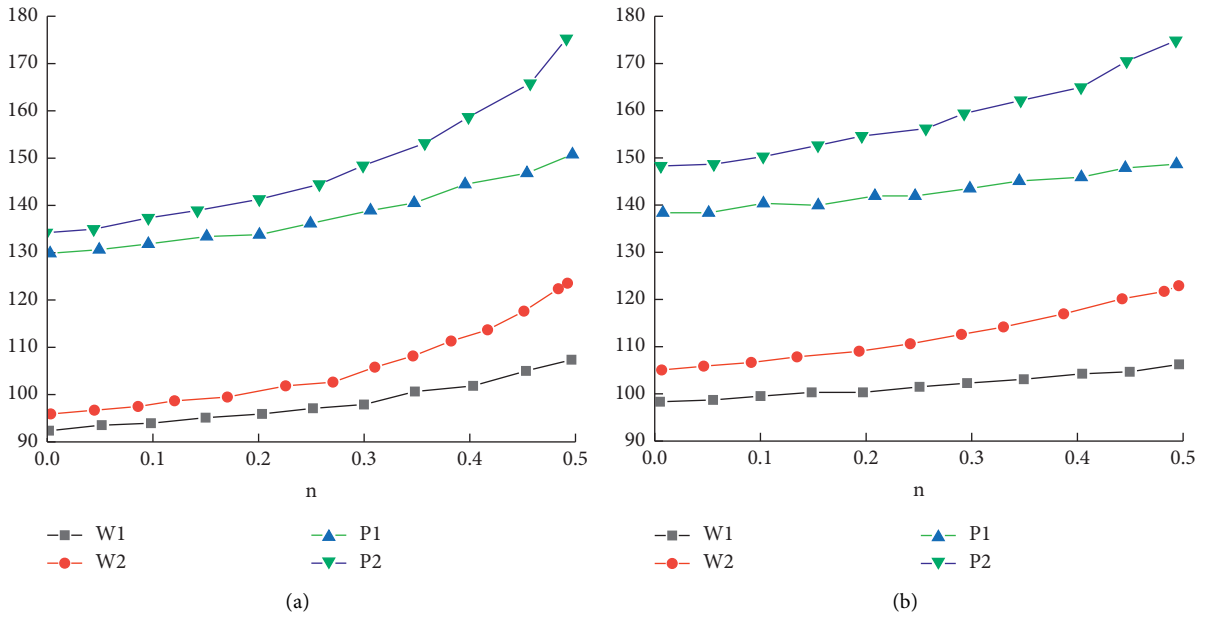


FIGURE 4: Relationship between retail price, wholesale price, and advertising sensitivity. (a) Short-term advertising sensitivity and (b) long-term advertising sensitivity.

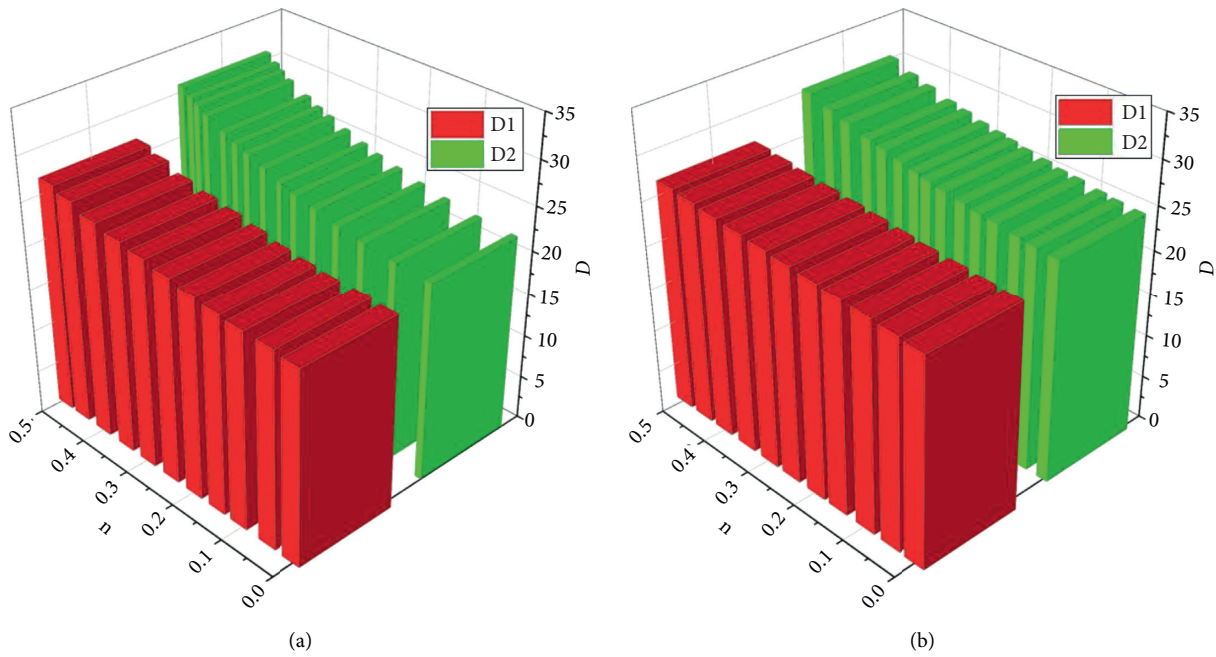


FIGURE 5: Relationship between cycle demand and advertising sensitivity. (a) Short-term advertising sensitivity and (b) long-term advertising sensitivity.

customer groups will be added in the second cycle, and the newly added customer groups will also expand with the increase of advertising sensitivity. The reason for the increase in market demand may be the decrease in price or the increase in advertising. The retail price of the second cycle is higher than that of the first cycle, so the increase of market demand in the second cycle is more influenced by the increase in advertising investment. Meanwhile, although the influence of advertising in the first cycle is

weakened in the second cycle, it still has a certain effect. In summary, advertising sensitivity has an impact on demand in both cycles but has a greater impact on market demand in the second cycle. The curve corresponding to short-term advertising sensitivity is steeper than that corresponding to long-term advertising sensitivity, indicating that short-term advertising sensitivity has a greater impact on demand than long-term advertising sensitivity [33–38].

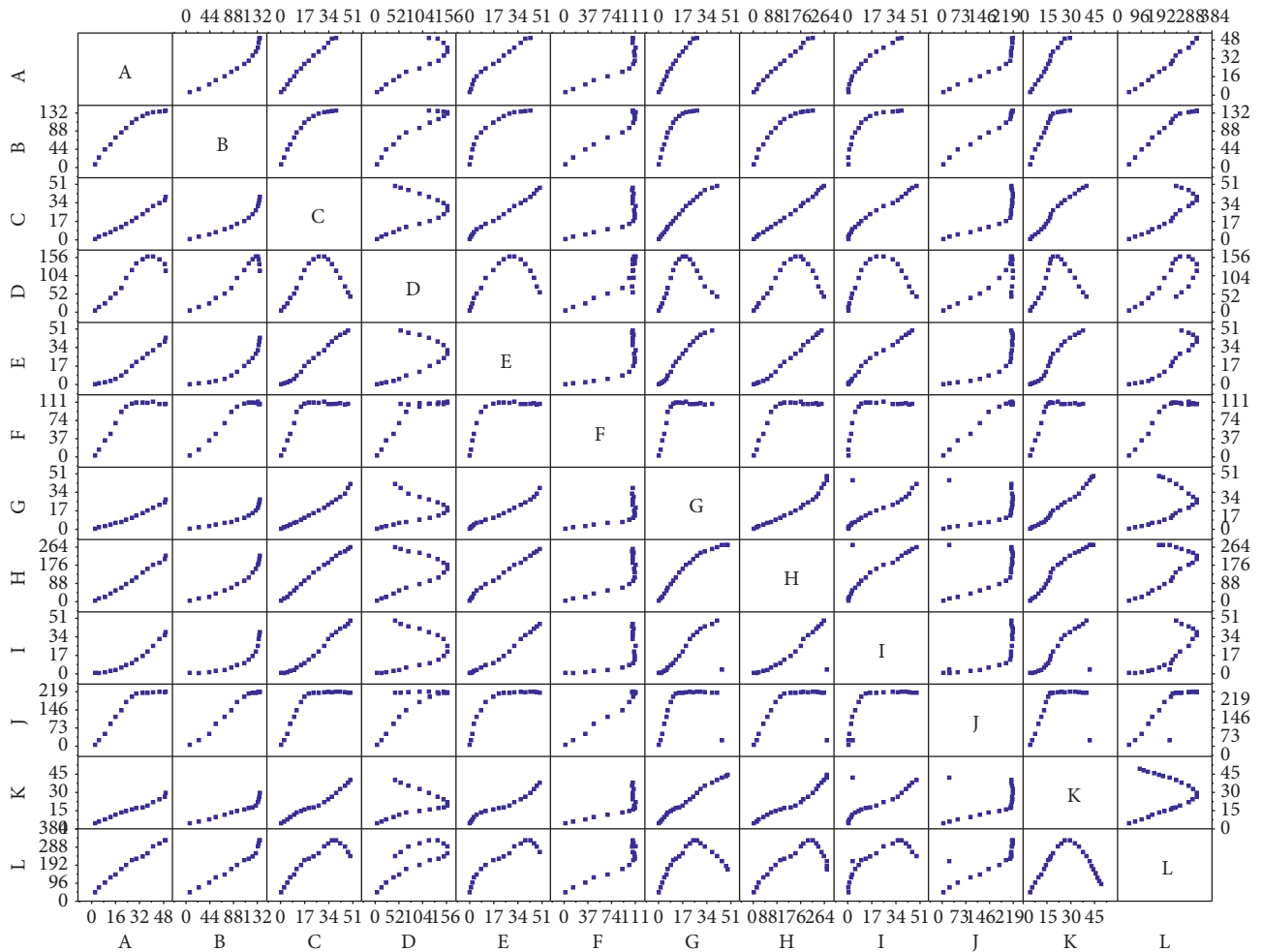


FIGURE 6: Mixed value function.

As can be seen from Figures 6–9, the recovery rate increases slightly with the increase of advertising sensitivity. Relatively speaking, short-term advertising sensitivity has a greater impact on the improvement of the recovery rate. Wholesale price, retail price, market demand, and profit all increase with the increase of market sensitivity, which indicates that manufacturers not only need to invest heavily in advertising to expand product awareness but also need to improve the recovery rate to reduce costs while increasing their profits. Overall, short-term advertising sensitivity has a greater impact on wholesale price, retail price, market demand, and profit and therefore has a relatively greater impact on recovery rates. The level of advertising increases monotonously over two cycles. When consumers are more sensitive to advertising, advertising will play a greater role in promoting sales growth. In order to achieve the same level of profitability, advertising expenditure can be appropriately reduced. When the advertising sensitivity is higher, manufacturers should improve the long-term and short-term advertising levels in order to maximize the profits of all parties in the supply chain. There is a threshold of short-term advertising sensitivity; when the short-term advertising sensitivity is

less than the threshold, the advertising input level in the first cycle is greater than that in the second cycle. When the value of short-term advertising sensitivity is greater than the threshold, the level of advertising input in the second cycle is greater than that in the first cycle. This is because advertising plays a large role in expanding market demand and improving profits in the short term. Advertising based on the first cycle plays a significant role. While advertising information resources play a positive role in the allocation process, there are also some negative effects, which not only affect the normal economic order and bring inestimable economic losses and spiritual harm to the majority of consumers but also go against the development and progress of the society. The purpose of our advertising information resource optimization configuration is to add disseminator, form a state of relative balance between objects, and dispel the asymmetric phenomenon in the advertising information in the configuration process, not only to maximize the interests of the advertisement source but also to reduce the cost of advertising object search information at the same time and increase revenue. Finally, realize the benefit maximization between advertising source and advertising object, namely, “win-win” goal.



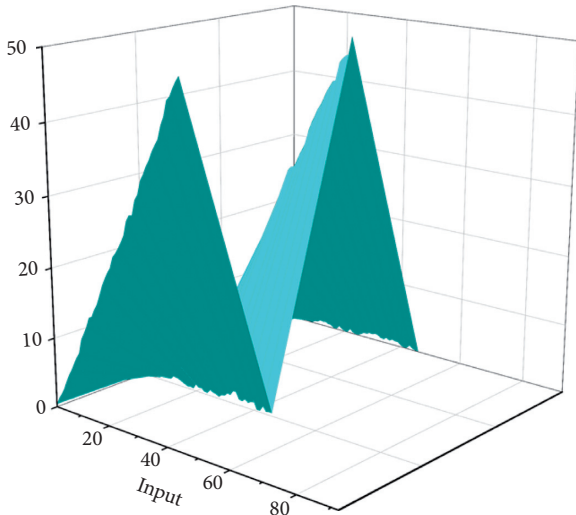


FIGURE 7: Relationship between reputation and investment level.

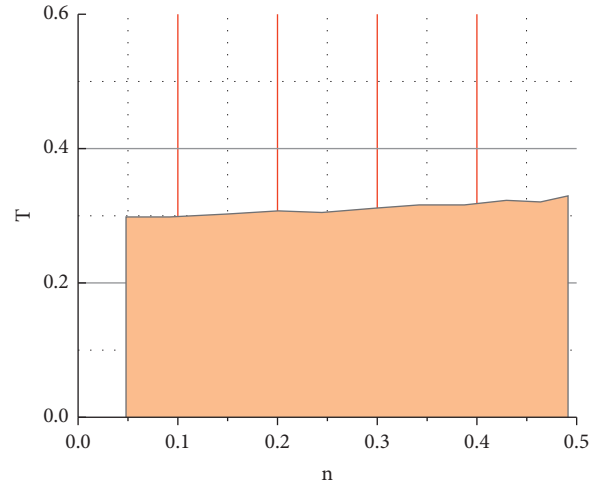


FIGURE 9: Short-term advertising recovery rate.

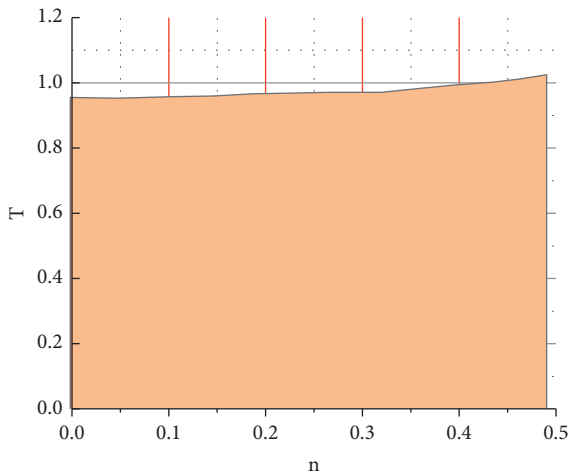


FIGURE 8: Long-term advertising recovery rate.

#### 4. Optimization Strategy

Current advertising regulatory related policies and regulations is not perfect; as soon as possible, from the main body of clear advertising laws and regulations and regulatory responsibilities and obligations, further exploring perfectly all kinds of advertisement carrier-clear indicators of category, they publish or broadcast advertising regulation from the government supervision and accountability to all social supervision and government transformation in the form of cases accepted and heard complaint. We will further clarify the objectives and responsibilities of social and public participation in regulation, make the whole process of social supervision more transparent and open for the competent units of advertising and broadcasting carriers, corporate legal persons and responsible persons for commercial conduct, promote the construction of the “Internet Plus” regulation model, and make the channels for the public to participate in regulation more convenient and efficient in Figure 10.

Establishing appropriate incentive measures is a necessary means to attract social forces to participate in public management activities. We should focus on attracting public participation channels to increase incentives for first participation, further improve the public participation rate, and increase the coverage and recognition of public participation in advertising supervision. In the process of public participation, we should set up typical models around us and perfect corresponding incentive policies for enterprises actively participating in enhancing their corporate value. Abundant rewards channels give prominence to guide as the main body with preferential policies and material rewards as the auxiliary and increase the incentives. The implementation of the regulation and social propaganda already lets the value of work pay fully shown in the advertising activities, to implement the system of incentives’ mechanism in the process of expanding the social impact vitality. The optimization system of advertising information resource allocation should actively adapt to the changes and development of the external environment, establish a feedback system composed of receiver information database and monitoring institutions, and interact with advertising sources, advertising information, and advertising objects to form a dynamic structure, which should have the function of construction and interpretation. This model not only takes the initiative to adapt to the external environment but also has the coordination between the internal components of the interaction and mutual influence.

The relevant content should be further clarified in the laws and regulations to guide enterprises to participate in the benign competition, and adequate countermeasures should be formulated to protect the enthusiasm and initiative of enterprises to participate in vicious competition. We should not only enrich the introduction policies but also improve the protection measures, so as to avoid the disappointment of entrepreneurs and the loss of important forces to participate in social supervision. At the same time, we should synchronize the perfect loophole and destroy the market operation behavior punishment regulations, guide enterprises, and social organizations to participate in activities

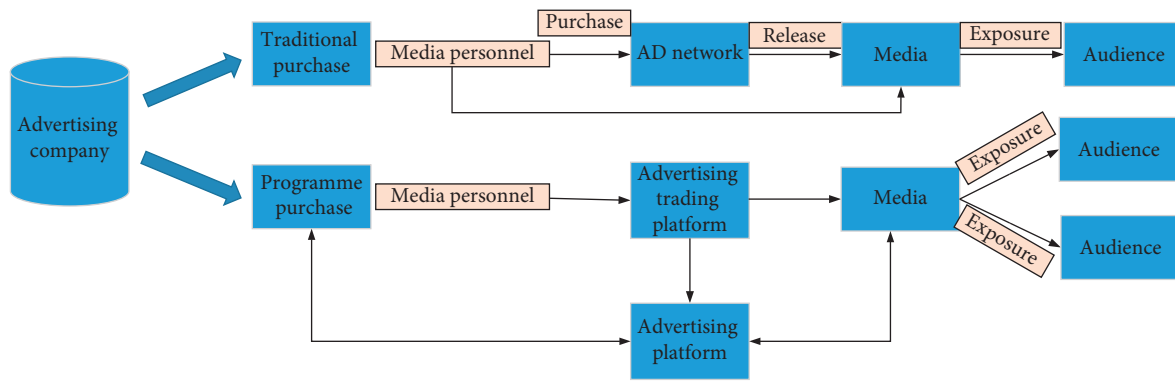


FIGURE 10: Programming.

gradually form a healthy standard mechanism, make social participation in power constantly enrich, be in long-term protection of laws and regulations, and gradually form the specialized market operating mechanism, from competition to spurt the energy innovation unceasingly. We will continue to improve the capacity of people participating in social activities.

Establish and improve the accountability and restraint mechanism, establish the authority of government supervision over advertising, increase the human and financial input of government supervision and accountability, and promote the sound development of the supervision and restraint mechanism of advertising. Perfect the system complete about beam system, foster the subject of advertising person fear in the heart of constraint mechanism, and continuously promote the advertisement published; they publish or broadcast into the main body consciousness of responsible behavior around the government of our country, connecting the demand for advertising and promoting urban advertisement propaganda environment to decorate, and still should take positive and effective measures according to the reality.

Stable market funding is an important guarantee for the healthy development of advertising supervision mechanisms. The proper intervention of the government in performing its advertising duties can effectively assist the establishment of advertising supervision organizations with credibility and gradually break the financial difficulties of relying on government subsidies to ensure the operation of activities. In the advertising supervision system of our country, we should actively explore the establishment of market operation management system in the multiparty linkage of government, enterprises, and media. On the one hand, let the advertising construction keep a continuous vitality, to achieve the interests of participants and social interests and to maintain ecological balance. On the other hand, enterprises continue to carry out publicity activities, conducive to the formation of a good social reputation and image.

Optimize the advertising development strategy of the integration of advertising and commercial advertising, realize the organic coordination of management and distribution, pay attention to the integration of content, inject elements into the core content of commercial advertising

design, and guide all kinds of commercial advertising into the slogan and content. To tie in the spread of activities at the same time, within the scope of the security responsibility to carry out the requirements, advertising purity, at the same time, pays attention to improve the effectiveness of advertising social communication, strengthen the advocacy of ideological and moral construction and molding city reputation, explore the pure commercial information which is fused together with the main topic, and make advertisement covers all aspects of business promotion. Through advertising, the commercial behavior of the enterprise boosts the image of the enterprise in the social benevolence and constantly promotes the penetration of advertising to the whole society, so as to establish the consciousness and responsibility of the whole society to jointly supervise advertising.

## 5. Conclusion

- (1) In order to achieve the most effective advertising effect, the advertising investment of retailers or the joint advertising investment of members can also be considered in future articles. The scrap rate only considers the relationship between investment recovery and investment and has not introduced environmental indicators. Advertising investment does not consider the impact on recycling, market demand, and member profits while publicizing environmental protection. In the future, it can be considered that when studying advertising investment in logistics activities and natural environment, the social environment is the basis for the common development of the closed-loop supply chain. The level of advertising investment is adjusted according to the sensitivity of long-term and short-term advertising.
- (2) Enterprises can adopt the optimal pricing and advertising strategy according to the results of this model. Advertising can deal with the adverse effects of strategic consumers and increase corporate profits. The advertising effect increases with the reduction of advertising cost and the improvement of advertising effect, but decreases with the improvement of consumer strategy. When two

competing enterprises produce alternative products in the market, the quality difference between strategic consumers and enterprises will reduce the profits of enterprises.

- (3) The stability region of Nash equilibrium point is discussed by numerical simulation, and the synchronous dynamic behaviors of two enterprises are analyzed. The existence of Milnor attractor is found, which indicates that the behaviors of two enterprises are consistent even when the system is in chaos state. Through multi-initial bifurcation and attraction basin, the analysis shows that selecting different initial values, that is, different amounts of advertising input, will lead to the change of system stability. Enterprises generally hope to run stably, so they generally do not make the adjustment speed too large, which means that the amount of advertising input in each period will not change too much. The enterprise will make the advertising investment strategy within the advertising investment scope that can make the enterprise stable operation.
- (4) From the discussion of the impact of advertising investment on corporate profits, we learn that when an enterprise's advertising intensity is too high, its profits may decline. If you change the speed at which advertising is adjusted, the average profit of a business can be up and down. In addition, we found that the real cause of the decline in average profits was excessive adjustment of advertising spending. Chaos is not always bad for markets, and even firms that are slow to adjust their advertising spending can benefit from chaos.

## Data Availability

The 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 known conflicts of interest or personal relationships that could have appeared to influence the work reported in this paper.

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