

Retraction

Retracted: Analysis of Consumer Recommendation Behavior and Market Equilibrium in E-Commerce from the Perspective of Social Media

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret 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 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] H. Jiang and L. Chen, "Analysis of Consumer Recommendation Behavior and Market Equilibrium in E-Commerce from the Perspective of Social Media," *Advances in Multimedia*, vol. 2023, Article ID 3512000, 10 pages, 2023.

Research Article

Analysis of Consumer Recommendation Behavior and Market Equilibrium in E-Commerce from the Perspective of Social Media

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Under the strategic goal of building a domestic economic cycle, the development quality of social e-commerce in my country needs to be improved urgently. The main reason for the low quality of social e-commerce development in my country is that the natural advantages of social e-commerce, such as high-efficiency dissemination of information and increased consumer utility due to improper sales model design, cannot play a role. However, the lack of research on social e-commerce systems makes it difficult for retailers to obtain effective theoretical guidance for their sales model design. Based on this, this paper takes the three most important and important social e-commerce sales models in my country at present—recommended reward model, online group purchase model, and online crowdfunding model as the research objects, and systematically analyzes the consumer recommendation behaviors in the three sales models. By analyzing and market equilibrium, while improving the theoretical research of social e-commerce, it also provides theoretical basis and policy guidance for the optimal mode design of social e-commerce under different sales modes. This paper considers the consumer recommendation behavior in social networks and analyzes the main characteristics of the three sales models in view of the development status and specific problems of social e-commerce in my country, and then constructs retailer-existing consumer-potential The three-agent dynamic Stackelberg game model of consumers analyzes the influence mechanism and market equilibrium of consumer recommendation behavior under three sales models.

1. Introduction

In order to cope with the increasingly complex economic and social environment at home and abroad, the Fifth Plenary Session of the 19th Central Committee of the Communist Party of China clearly stated, “Accelerate the construction of a new development pattern with the domestic cycle as the main body and the domestic and international dual cycles mutually promoting each other [1].” This is a major strategy made by our country based on the basic national conditions and current development needs. Accelerating the construction of a domestic cycle is by no means closed to the country, but to deeply cultivate the domestic market and improve the quality of my country’s economic development [2]. As a superpower with a population of 1.4 billion, my country’s market volume and

market potential are huge. For a long time, the quality of my country’s economic development is not high, the economic growth mode is simple and crude, the conversion efficiency between resource consumption and economic growth is not high, and the domestic market has a large room for transformation and quality improvement. As an important part of my country’s economy, the retail industry is the terminal that contacts with the vast number of people [3]. The development of the retail industry has a vital impact on people’s livelihood, the economy, and society. At the time of building the main body of the domestic big cycle, doing a good job in the transformation and optimization of the retail industry and injecting new vitality into the economic development will greatly enhance the domestic market potential and improve the efficiency of the domestic large-scale circulation [4].

In recent years, e-commerce has developed rapidly in my country, and its proportion and role in economic development have become more and more important. According to the 50th “Statistical Report on Internet Development in China” released by CNNIC in 2022, as of June 2022, the number of online shopping users in my country reached 841 million, and the penetration rate reached 80%. 6.3 trillion yuan, an increase of 3.1% year-on-year, was accounted for 25.9% of the total retail sales of social consumption. The report points out that online retailing expands domestic demand through consumption and protects the market, which provides important support for opening up the internal economic cycle. However, the report also points out that in recent years, the overall scale of e-commerce in my country has been increasing, but the growth rate has declined significantly. E-commerce also urgently needs further innovation and application of sales models. Social e-commerce is just an innovative model of e-commerce, and its profit-making method is very different from traditional e-commerce. It is and will certainly inject new vitality into the e-commerce field and the development of my country’s retail industry in the future [5].

However, while social e-commerce is on the rise, we also see the dilemma of social e-commerce: first, the blip of a large number of social e-commerce platforms and retailers. Since 2014, social e-commerce platforms such as Weidian, Mengdian, Yunji, Pinduoduo, Taobao Crowdfunding, and JD Crowdfunding have been launched one after another [6]. However, only a few platforms such as Pinduoduo and JD Crowdfunding have emerged. Secondly, the development quality of the existing platforms is worrying. Among the existing social e-commerce platforms, the poisonous mask exposed by CCTV, Yunji has been fined tens of millions and accused of pyramid schemes, and Pinduoduo fakes are frequent. For a time, social e-commerce has encountered Waterloo, and the entire new e-commerce ecosystem has encountered an unprecedented crisis of trust. “New e-commerce is just a dream, traditional e-commerce is the mainstream.” Almost all public opinions are not optimistic about this new continent [7].

The essence of this problem is that the natural advantages of social e-commerce have not been fully utilized. Compared with traditional e-commerce, the advantage of social e-commerce is that it reduces the search cost of customers and enhances additional network utility. Social e-commerce stimulates users to spread spontaneously through social networks, obtains viral transmission speed, attracts consumption traffic at low cost and efficiently, and increases sales volume. However, the current social e-commerce is still in the stage of using ultralow prices to savagely promote user communication and lack of application to the natural network externalities and information asymmetry of social e-commerce social networks. However, the price of the product is too low, and it is impossible to make too many requirements on the quality of the product, resulting in the flood of fake and shoddy products on various social e-commerce platforms [8].

Based on the above, we found that although social e-commerce has gradually become the most potential retail

form in my country, there are also many problems in the actual development, such as low development quality and full of fake goods. If these problems are solved, social e-commerce will improve. The quality of development in social e-commerce is difficult to make its due contribution to my country’s deep market potential and the promotion of the domestic economic cycle construction in the special period and future economic life [9].

2. Literature Review

2.1. Related Research on Social E-Commerce

2.1.1. Definition of Social E-commerce. The concept of social e-commerce appeared relatively late. In 2005, Yahoo! first coined the term “social commerce” and used it to describe how social media can be used to coordinate business activities. The early definition from IBM believed that social commerce is just a narrow application of word-of-mouth marketing, but other scholars believe that it is the integration of social media and business activities, so that customers can actively participate in network marketing and sales of services and products. Despite these different definitions, social commerce is widely believed to bring together social media, community interaction, and online commerce. A typical example of social commerce is Twitter’s t-commerce, which allows users to shop on Twitter. A typical example of social commerce in China is commerce on WeChat, which allows individuals to sell products to friends. This integration of social media and e-commerce has the advantages of large traffic, recommendation by acquaintances, and economic benefits of group buying [10].

2.1.2. Research Status of Social E-Commerce. The research on e-commerce at home and abroad is endless, and there are too many to enumerate. We mainly focus on the research on the sales mechanism of e-commerce. Broadly speaking, we can divide the research on e-commerce sales mechanism into two categories: (1) research on product matching mechanism; (2) research on product pricing mechanism [11].

The first problem of sales is the matching of different types of consumers with different types of products, that is, what kind of products are sold to what kind of people. Unlike brick-and-mortar stores, online sellers can use detailed online customer data to determine the optimal personalized assortment to increase sales. Using e-commerce reviews as the data source, the method of conditional random field is used to randomly select product candidate terms and combined with deep learning and clustering methods; a conceptual hierarchy of products is generated. Compared with the traditional subjective classification method, this method has high-efficiency, low difficulty in dynamic update, and strong generality. A method was developed to collect purchasing information from customers with similar product preferences and dynamically generate customer segments. By dynamically presenting different kinds of shirts to different customer groups, they found promising results when testing their method using a dataset from an online retailer in Chile [12].

The selling price of a product is something that all sales must pay attention to, and the research on the pricing mechanism is the top priority of the research on the e-commerce sales mechanism. E-commerce subdivides the consumer market, consumers have more options, and the proportion of rational consumers has become more. Therefore, when selling online, sellers may need to dynamically adjust prices by taking advantage of customers' real-time buying behavior [13].

In recent years, with the innovation of e-commerce models, new retail models such as dual-channel and omni-channel have gradually become research hotspots. Considering the retailer's optimal pricing strategy under the online retail and O2O mode; considering the optimal pricing problem of the retailer under the dual-channel, considering the retailer's pricing strategy under the omni-channel, and considering the omni-channel pricing strategy based on the coupon delivery and channel integration issues [14].

2.2. Related Research on Emerging Sales Models of Social E-Commerce. Different from the traditional sales model, in the context of social e-commerce, the emerging sales model pays more attention to the information interaction between producers and consumers, consumers, and the generation and influence of network externalities in social networks. According to the time of rise, the existing main marketing models mainly include recommendation reward model, group purchase model, and crowdfunding model, which will be summarized in the following article [15].

The Referral Reward Program is a new marketing strategy for companies to encourage existing customers to send word-of-mouth recommendations to new customers and recommend company products by paying existing customers material or nonmaterial rewards. Because the recommendation reward plan has lower expenditure, stronger pertinence, and controllability compared with advertising costs, the efficiency of its information dissemination is much greater than that of general advertising. With this advantage, the recommendation reward model has become the most commonly used in the rest of the world. Marketing model analysis of the status quo of the recommendation reward model taking the microbusiness model as an example is shown in Figure 1.

The root of the recommendation reward model is that personal recommendation has a strong influence on consumer decision-making [16]. As early as 1998, studies have found that the role of product information transmitted from person to person is far greater than the impact of traditional advertising on consumers. Subsequently, another study found that the value of personal recommendations can constitute an important part of customer value. With the growth of online platforms, especially social media, we can now measure these impacts with greater precision than ever before. Research in both the computer science literature and the information systems literature uses data from online social networks to assess the extent to which people influence each other in different contexts. More in-depth research will focus on what factors influence this degree of influence and how big its effect is. For example, perceived

recommendation value and perceived social risk perspective, reward conditions and reward distribution, and social relationship strength. It is worth mentioning that we found that the research on influencing factors has gradually extended from the products and plans themselves to the characteristics of the social network, the carrier of the recommendation reward plan, which happens to be the influencing factors that this paper focuses on [17].

With the help of consumer recommendation behavior in social networks, the recommendation planning model provides a method to artificially create network externalities and induce friends to make purchase decisions through complementarity. The equilibrium of the consumer game is mathematically equivalent to the game of network complements. Based on these results, an optimal pricing theory is created for monopoly retailers selling goods to consumer networks [18].

2.3. Related Research on Consumer Behavior in Social Networks. The research on consumer behavior in social network is the ultimate goal of this paper, and it is also the foundation of the emerging sales model of social e-commerce at the meso level. The research on consumer behavior in social networks is summarized and elaborated from three aspects: social networks and consumer behavior, network externalities and consumer behavior, and social recommendation and consumer behavior [19].

The attributes of social networks are different. In different regions, at different time points, and for different events, social networks have their own special endowments. Correspondingly, consumers, as the main body of behavior in purchasing activities, have high heterogeneity and particularity, and their behaviors are also different when they are influenced by different external factors in social networks. As the constituents of social networks, different behaviors of consumers will have different effects on social networks. This is a mixed and complex dynamic system. Therefore, consumer behaviors in social networks have long been the focus of academic research. difficulty [20].

Network externality is a natural attribute of social network. Different from the definition of externality in traditional economics, network externality pays more attention to the influence of consumer psychology on consumer utility and highlights the additional network that consumers obtain in herd buying behavior, information externalities, and network payment externalities.

The essence of social network lies in the association and information transfer between individuals in the network. As the main way to generate externalities, recommendation behavior is widely used in the emerging sales model of social e-commerce. The interaction of friends in social media such as Weibo and WeChat will have an impact on an individual's cognition, belief, and behavioral tendencies. In the social network friend recommendation reward program, the structural capital, relationship capital, and cognitive capital among social network friends are used to influence the purchase intention of social network friends, and the same behavior also appears in the online group buying and online crowdfunding models.

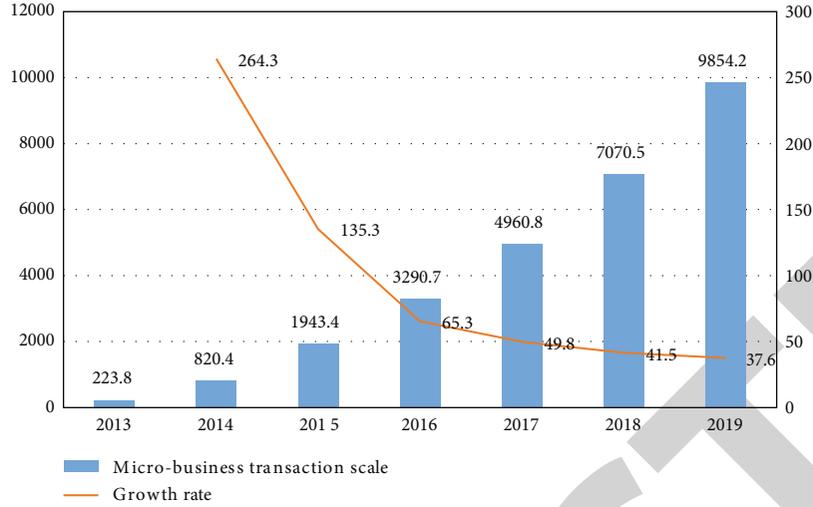


FIGURE 1: Changes in the market size of the microbusiness model.

3. Related Technologies

3.1. Characterization and Basic Settings of Social Networks. Consider a retailer that wants to market through a referral reward model. The social networks that consumers are in are generated, and each social network has its own special attribute, the number of friends. Without loss of generality, we set the distribution of social network connectivity as G , that is, the probability that any consumer has n friends is (n) , and $g(n)$ obeys the distribution G . Retailers conduct referral reward marketing in social networks, and consumers also refer and receive referrals in this social network.

In the basic model, we assume that the product price has been exogenous p , and retailers hope to attract more potential consumers to purchase products through the recommendation of existing consumers on the basis of the original consumer group through recommendation rewards. To this end, retailers are willing to pay a certain amount of remuneration, which may be cash, gifts, coupons, etc. We assume that this payment cost is α , which can be converted into remuneration for the original consumers, and potential consumers bring additional utility, which is divided into β and γ , according to the different distribution methods of different modes:

$$\gamma \leq \alpha, \quad \alpha = \beta + \gamma. \quad (1)$$

According to the reverse induction method, this chapter first discusses how consumers' friends are transformed into recipients and analyzes the formation mechanism of recipients. The specific utility of the recommender depends on whether the friends who receive the recommendation can be converted into whether the recipient purchases the recommended product. The game flow chart is as follows (Figure 2):

First, similar to the research by Biyalogorsky and Kornish, we assume that friends who receive the recommendation information estimate the value of the product as a

uniformly distributed random variable $v \sim (0, u)$. When the recommendation information of the product is passed to the friends, for the given price and reward mechanism, if the friends choose to receive the recommendation, the utility obtained by purchasing the product is

$$U_F = v_F - p + \delta + \gamma. \quad (2)$$

So, when will friends who receive the recommendation information choose to buy the product? Obviously, only if

$$U_F > 0, \quad v_F - p + \delta + \gamma > 0. \quad (3)$$

So friends accept referrals The probability is

$$P_R(U_F > 0) = \frac{u - p + \delta + \gamma}{u}. \quad (4)$$

Obviously, the probability of recommender's friends accepting a recommendation is affected by both network externalities and retailer rewards, both of which can promote the conversion of recommender's friends into acceptors.

For retailers, they naturally hope that more friends who receive recommendations will be converted into recipients. Therefore, choosing a market with a larger network externality for recommendation rewards or appropriately increasing the degree of reward for recipients can improve the retailer's reputation. Sales volume, but an increase in sales volume does not mean an increase in profits. Increasing the recipient's reward level also increases the retailer's cost in the referral reward. Therefore, whether increasing the recipient's reward can increase profits needs to be discussed.

For consumers who have purchased or have not yet purchased the product, regardless of whether it is recommended or not, if the cost of purchasing the product is always p , the basic utility obtained is $V - p > 0$, where V is the estimated value of recommender, and $V > u/2$.

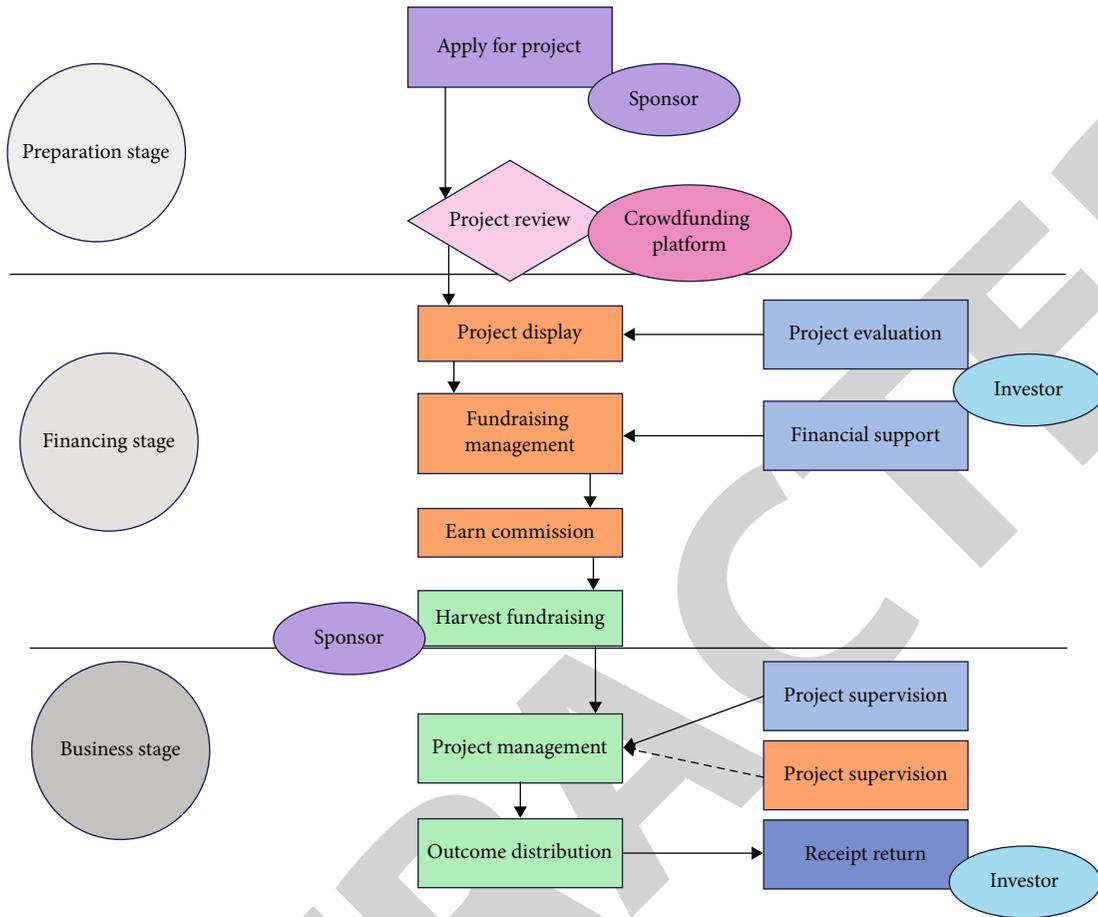


FIGURE 2: Game flow chart of online crowdfunding mode.

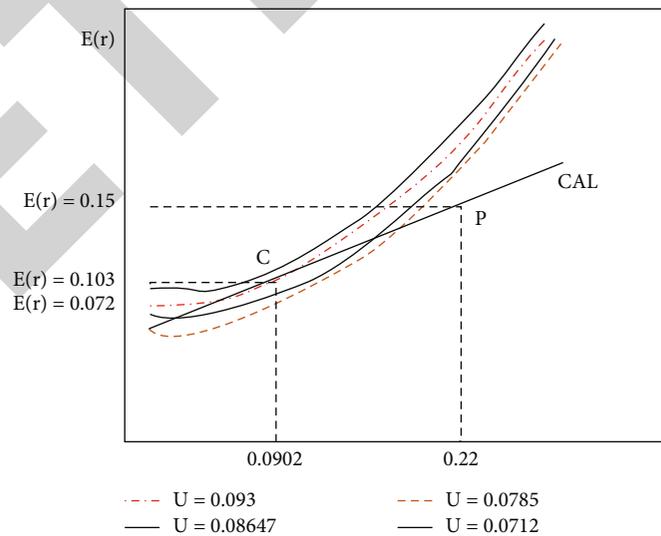


FIGURE 3: Three cases of key consumer utility functions.

When the retailer gives the recommendation reward mechanism, consumers decide whether to recommend or not depends on the utility brought by the recommendation. The ultimate purpose of the recommendation is to maximize

its own recommendation utility, namely

$$\max E(U_R) = \beta x P_R + \delta x P_R - xc. \tag{5}$$

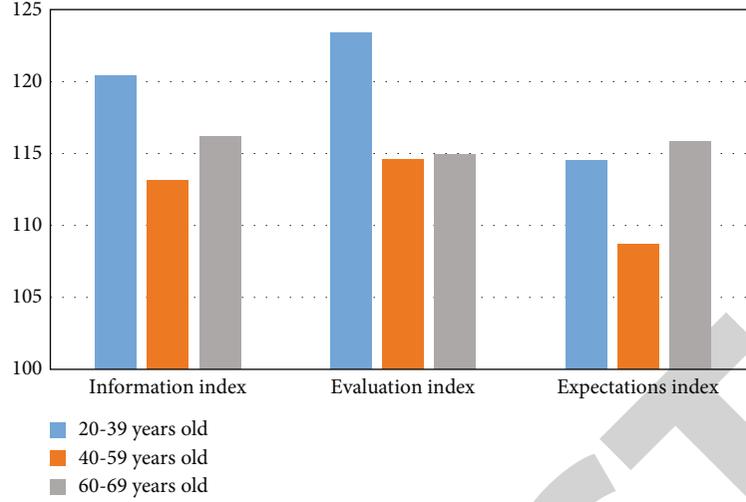


FIGURE 4: Reward amount.

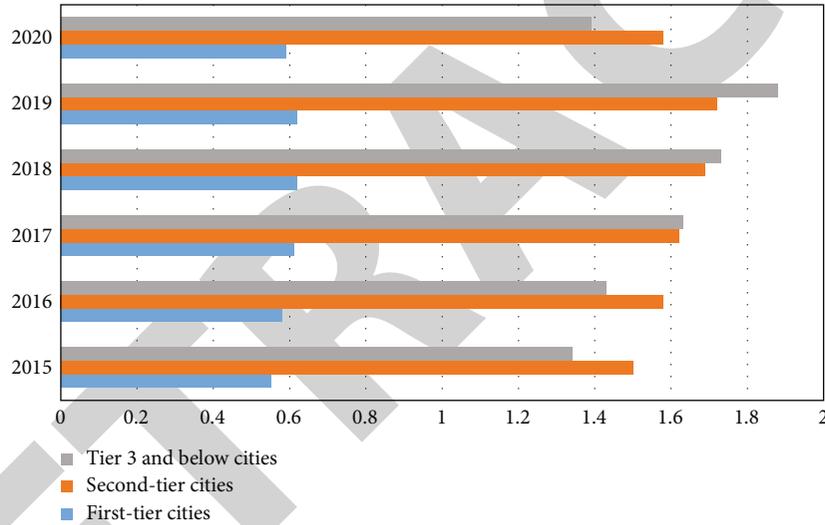


FIGURE 5: Distribution in first-tier cities, second-tier cities, and third-tier cities from 2015 to 2020.

Among them, x is the recommended number of recommenders, xP is the estimated number of successful recommendations recommended by consumers, c is the unit cost recommended by the recommender, and the recommendation cost c is similar to the network externality coefficient δ , which are formed by social networks and products basic properties.

Obviously, when $\beta P + \delta P_R - c > 0$, $E(U_R)$ is an increasing function of the number of recommendations x , the more friends the recommender recommends, the higher the recommendation utility; otherwise, it is a decreasing function, and the recommendation utility increases with the number of recommendations and decrease. Bringing in Equation (5) can be simplified to get

$$\beta > \frac{uc}{u - p + \delta + \gamma} - \delta \stackrel{\text{def}}{=} \bar{\beta}. \quad (6)$$

Therefore, when $\beta < \bar{\beta}$, $E(U)$ is an increasing function of the number of recommendations x , in order to obtain the maximum recommendation utility, the recommender will recommend to all his friends; when $\beta < \bar{\beta}$, $E(U)$ is the number of recommendations x , a decreasing function, and $U(x=1) < 0$, consumers will not recommend. Obviously, the referral reward model fails when $\beta < \bar{\beta}$, so $\beta > \bar{\beta}$ must be satisfied for the referral reward model to work smoothly.

3.2. Analysis of Consumer Recommendation Behavior under the Threshold Recommendation Reward Model. Different from the threshold-free recommendation reward model, there is also a threshold-based recommendation reward model in actual marketing. In this threshold recommendation reward model, retailers often set a minimum number of successful referrals for recommenders, which we call the “reward threshold”. Only when the number of recommenders successfully

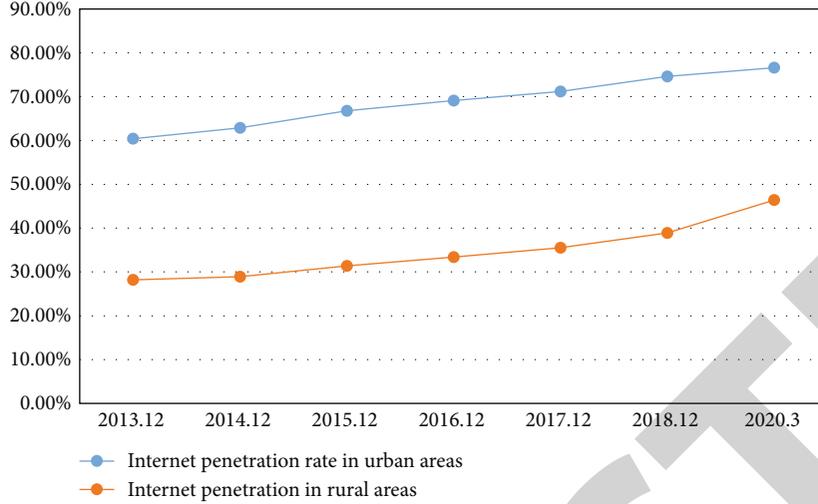


FIGURE 6: Scale of Internet users and Internet penetration rate in my country from 2013 to 2020.

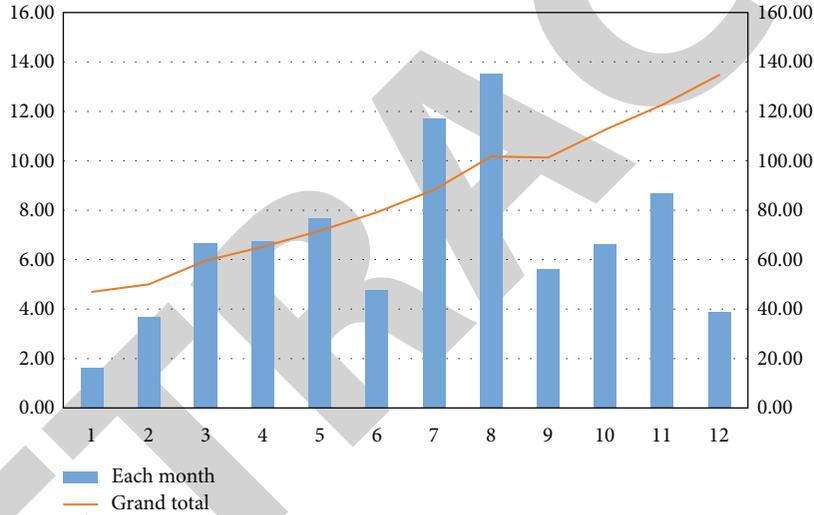


FIGURE 7: Statistical proportion of financing amount of each crowdfunding platform in 2019.

recommended reaches the reward threshold, the retailer will one-time pay a certain amount of reward to the referrer. Remember that the reward threshold is M , and the one-time threshold reward is μ .

First of all, assuming that the existing consumer has enough friends, the number of his recommendations can reach the recommendation threshold, and the recommendation utility of the existing consumer is

$$\max E(U_R) = \mu + \delta x P_R - xc. \quad (7)$$

Finding the first-order partial derivative of x shows that when $\delta P - c > 0$, the recommendation utility of existing consumers increases as the number of recommendations increases, and vice versa; it decreases as the number of recommendations increases. Next, we first discuss whether the recommendation utility of existing consumers who are converted into recommenders can be greater than 0 when the threshold is reached. When $\delta P - c < 0$, let $\mu + \delta P_R x - cx > 0$,

we can get

$$x < \frac{-\mu}{\delta P_R - c}. \quad (8)$$

If the recommender is forced to recommend more than $-\mu/\delta P_R - c$ in order to reach the recommendation threshold, the utility of the recommendation is less than 0, so the recommender must give up the recommendation. To sum up, we have the upper limit of the threshold setting when $\delta P - c < 0$:

$$M < \frac{-\mu}{\delta P_R - c} P_R = \frac{-\mu(u - p + \delta + \gamma/u)}{\delta(u - p + \delta + \gamma/u) - c} \stackrel{\text{def}}{=} \bar{M}. \quad (9)$$

Then, we discuss whether the recommender can reach the recommendation threshold, which depends on the network structure of the recommender (the number of friends of the recommender), and for a given reward threshold M ,

the number of friends the recommender must recommend to his friends is

$$X = \frac{M}{P_R} = \frac{M}{u - p + \delta + \gamma/u}. \quad (10)$$

For the condition \bar{M} , it determines whether the recommender's utility is greater than 0 after obtaining the threshold reward. As a recommender, he hopes that \bar{M} can be larger, because only the larger \bar{M} can give the recommender more space for the recommended utility to reserve. Therefore, for the larger the \bar{M} and \bar{M} , the stronger the recommender's willingness to recommend.

The first-order partial derivatives of network externalities δ , referral cost c , product price p , reward threshold M , recommender threshold reward μ , and the reward γ of the recommender can be obtained from the above three equations.

$$\frac{\partial \bar{M}}{\partial \delta} > 0; \frac{\partial \bar{M}}{\partial c} < 0; \frac{\partial \bar{M}}{\partial p} < 0; \frac{\partial \bar{M}}{\partial \gamma} > 0; \frac{\partial \bar{M}}{\partial \mu} > 0. \quad (11)$$

3.3. Market Equilibrium Analysis under the No-Threshold Recommendation Reward Model. In the no-threshold referral reward model, retailers need to decide the price of the product and who to reward (the recommender or the recipient) and how much to reward. In order to more intuitively analyze who to reward (recommender or receiver) and how much to reward, we first assume that the price is given exogenously.

When the price is given exogenously, the retailer only needs to decide how and how much to distribute the reward (β, γ). From the proposition, if the retailer wants to profit from the referral reward, the premise is that the referrer makes the referral, i.e., $U > 0$. If this condition is met, the recommender will recommend as many as possible, and the expected number of recommendations is

$$\int_1^N ng(n)dn = E(n). \quad (12)$$

If it cannot be satisfied, the recommended number is 0. Therefore, the recommender's expected number of referrals is

$$E(x) = P(U_R > 0)E(n). \quad (13)$$

The retailer's expected sales volume is

$$E(q) = E(x)P_R(U_F > 0) = P_R(U_F > 0)P(U_R > 0)E(n). \quad (14)$$

Through the proposition, we find that the optimal reward setting is closely related to product price, network externalities, and referral costs. When the price is low and the network externality is greater than the referral cost

$$p < \min\left(\frac{u + \delta}{2}, u + \delta - \frac{uc}{\delta}\right). \quad (15)$$

Retailers do not need to set referral rewards, and consumers can spontaneously recommend the product in pursuit of network externalities. This is because when the price is low, after the existing consumer recommends to his friends, the friend's probability of accepting the recommendation will be very high. At this time, since the network externality is higher than the recommendation cost, the consumer can obtain more recommendations through more recommendations. More network externalities, so no incentives to take.

4. Experimental Results and Analysis

4.1. Analysis of Consumer Recommendation Behavior. In online group buying, the role of key consumers is also the purpose of retailers to guide key consumers into "sales agents". Key consumers are the link between retailers and ordinary consumers, and their decisions have a strong impact on the sales of enterprises and the purchasing strategies of ordinary consumers. Induced by the obtained utility, in order to obtain products at a discounted price for group purchases, key consumers will serve as "sales agents" to recommend products. We divide the nature of the key consumer utility function into three cases for discussion, as shown in Figure 3 below:

When a retailer sets a threshold for group purchases, it is rational for key consumers to still obtain maximum utility, but the premise of obtaining products is that they can complete group purchases, which is the premise for discussing their utility. Therefore, in the two situations represented by curve b and curve c in Figure 1, the setting of the threshold can directly determine whether key consumers recommend it.

In Figure 4, under different satisfaction levels, with the increase of the reward amount, the curve graph of consumers' willingness to comment online. According to Figure 4, it can be concluded that when the product satisfaction reaches a certain value, the effect of high-amount reward can also be achieved when the reward amount designed by the merchant is low. At this time, the merchant can save a part of the investment cost, and at the same time, through the analysis in the figure, it can be concluded that the influence of different reward amounts. The advantages of high rewards are more obvious when consumers are not satisfied with the product.

4.2. Distribution of Physical Retailers. The development of online retailers has squeezed the existing consumer market, especially the existing brick-and-mortar retail market space, forcing first- and second-tier brick-and-mortar retailers to close existing stores, or turn to third- and fourth-tier cities for development. It is found that some bookstores and department stores are located on city streets rather than traditional commercial centers, which also shows that the existence of online retailers has changed the location characteristics of brick-and-mortar retailers. As can be seen from Figure 5, for the bases in second-tier cities, the number of stores in second-tier cities continues to decline, while the number of stores in third-tier cities increases year by year;

the number of stores in first-tier cities decreases, the growth rate of stores in second-tier cities decreases, and the number of stores in third-tier cities decreases. It is a significant increase.

Figure 5 shows that the spatial location of some large-scale physical retailers in my country has changed, which is largely due to the development of e-commerce in China. In fact, when considering the development of e-commerce, we must consider the development of the Internet in our country. According to the 41st “Statistical Report on Internet Development in China” published by CNNIC in 2018, the scale of netizens in my country has maintained steady growth. As of December 2017, the scale of netizens in my country reached 772 million, with a total of 4,074% new netizens throughout the year. The Internet penetration rate was 55.8%, an increase of 2.6 percentage points from the end of 2016, as shown in Figure 6. At the same time, the continuous innovation of my country’s Internet model, the accelerated integration of online and offline services, and the acceleration of the online model of public services will further become the driving force for the growth of my country’s netizens.

Moreover, the number of mobile phone online shopping users reached 506 million, a year-on-year increase of 14.7%, and the usage ratio increased to 67.2%. The increase in the number of mobile phone users will further promote the development of online shopping in China. In 2017, my country’s online retail sales reached 7.18 trillion yuan, an increase of 32.2% over 2016. Among them, the online retail sales of physical goods reached 5,480.6 billion yuan, an increase of 28.4%. %, accounting for 15.0% of the total retail sales of social consumer goods.

At present, the development of online crowdfunding in China belongs to a transitional stage from barbaric growth to high-quality development in order to eliminate falsehoods and preserve truth. At this stage, the development of JD.com crowdfunding, which is dominated by product returns, is obviously more powerful than the development of other crowdfunding models. It occupies a major position in the financing market, as shown in Figure 7 below:

5. Conclusion

Taking social e-commerce as the research object, this paper analyzes the consumer recommendation behavior and market equilibrium under the three main sales models of social e-commerce in my country—recommendation reward mode, online group purchase mode, and online crowdfunding mode. Due to the improper design of the sales model, the natural advantages of social network information dissemination and extra utility cannot be exerted, resulting in retailers’ overreliance on low-price competition and low development quality of social e-commerce platforms. In order to solve this problem, based on the existing research, this paper innovatively develops a relatively complete research framework, taking the social network as the background, considering the natural endowments of the social network such as network structure, network externality, and recommendation cost, and integrating the recommendation unique attributes

of reward model, online group purchase model, and online crowdfunding model.

Data Availability

The figures used to support the findings of this study are included in the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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References

- [1] A. Singh and S. Shaw, “Optimizing approach of recommendation system using web usage mining and social media for e-commerce,” *International Journal of Computer Applications*, vol. 176, no. 40, pp. 34–38, 2020.
- [2] R. A. Abumalloh, O. Ibrahim, and M. Nilashi, “Loyalty of young female Arabic customers towards recommendation agents: a new model for B2C e-commerce,” *Technology in Society*, vol. 61, no. 78, p. 101253, 2020.
- [3] R. Balasubramanian, V. Mani, A. Mathur, S. Kumar, and K. Achan, “Variational inference for category recommendation in e-commerce platforms,” vol. 38, no. 1, pp. 141–160, 2021, <http://arxiv.org/abs/2104.07748>.
- [4] I. W. Wijaya, “Development of conceptual model to increase customer interest using recommendation system in e-commerce,” *Procedia Computer Science*, vol. 197, no. 19, pp. 727–733, 2022.
- [5] M. Maher, P. M. Ngoy, A. Rebricks et al., “Comprehensive Empirical Evaluation of Deep Learning Approaches for Session-based Recommendation in E-Commerce,” vol. 63, no. 10, pp. 3514–3529, 2020, <http://arxiv.org/abs/2010.12540>.
- [6] J. P. Cabrera-Sánchez, I. Ramos-de-Luna, E. Carvajal-Trujillo, and Á. F. Villarejo-Ramos, “Online recommendation systems: factors influencing use in e-commerce,” *Sustainability*, vol. 12, no. 21, pp. 44–58, 2020.
- [7] J. Y. Hsu, W. K. Tseng, J. Y. Hsieh, C. J. Chang, and H. Chen, “The recommending agricultural product sales promotion mode in e-commerce using reinforcement learning with contextual multiarmed bandit algorithms,” *Mathematical Problems in Engineering*, vol. 2020, Article ID 8836000, 10 pages, 2020.
- [8] R. V. Karthik and S. Ganapathy, “A fuzzy recommendation system for predicting the customers interests using sentiment analysis and ontology in e-commerce,” *Applied Soft Computing*, vol. 57, no. 8, pp. 1354–1372, 2021.
- [9] A. Suresh, M. J. Carmel, and M. Belinda, “A comprehensive study of hybrid recommendation systems for e-commerce applications,” *International Journal of Advanced Science and Technology*, vol. 29, no. 3, pp. 4089–4101, 2020.

- [10] F. Hussien, A. Rahma, and H. B. Abdulwahab, "An e-commerce recommendation system based on dynamic analysis of customer behavior," *Sustainability*, vol. 13, no. 19, article 10786, 2021.
- [11] P. Ebrahimi, K. A. Hamza, E. Gorgenyi-Hegyey et al., "Consumer knowledge sharing behavior and consumer purchase behavior: evidence from e-commerce and online retail in Hungary," *Sustainability*, vol. 13, no. 9, pp. 2025–2040, 2021.
- [12] M. Dubey, S. Saini, and S. Umekar, "Study and analysis of consumer buying behavior in retail market," *International Journal of Engineering Technologies and Management Research*, vol. 47, no. 2, pp. 1–6, 2016.
- [13] X. Chen, Y. Xue, and Y. Shiue, "Rule based semantic reasoning for personalized recommendation in indoor O2O e-commerce," *International Core Journal of Engineering*, vol. 6, no. 1, pp. 309–318, 2020.
- [14] A. Bczkiewicz, B. Kizielewicz, A. Shekhovtsov, J. Wątróbski, and W. Sałabun, "Methodical aspects of MCDM based e-commerce recommender system," *Journal of Theoretical and Applied Electronic Commerce Research*, vol. 16, no. 6, pp. 2192–2229, 2021.
- [15] P. Virdi, A. D. Kalro, and D. Sharma, "Consumer acceptance of social recommender systems in India," *Online Information Review*, vol. 44, no. 3, pp. 723–744, 2020.
- [16] S. S. Alrumiah and M. Hadwan, "Implementing big data analytics in e-commerce: vendor and customer view," *IEEE Access*, vol. 9, 2021.
- [17] H. Wu, C. Ma, B. Mitra, F. Diaz, and X. Liu, "Multi-FR: a multi-objective optimization method for achieving two-sided fairness in e-commerce recommendation," vol. 9, no. 2, pp. 53–82, 2021, <http://arxiv.org/abs/2105.02951>.
- [18] J. Y. Moerth-Teo, V. Bobek, and T. Horvat, "The effects of consumers' buying behavior on the e-commerce in highly developed emerging market and developed market: the case of Singapore and Austria," *Naše gospodarstvo/Our economy*, vol. 67, no. 4, pp. 56–73, 2021.
- [19] C. Zhou, M. Leng, Z. Liu, X. Cui, and J. Yu, "The impact of recommender systems and pricing strategies on brand competition and consumer search," *Electronic Commerce Research and Applications*, vol. 53, no. 9, article 101144, 2022.
- [20] M. Xiong and Y. Li, "Analysis of consumer behavior and computer consumption demand of small enterprises," *Journal of Physics: Conference Series*, vol. 1992, no. 3, article 032098, 2021.