Analysis of the Viral Network Effect of Pinduoduo's Social E-commerce and the Dilemma of Counterfeit Goods Governance

Shuyu Liu

School of Economics, Huazhong University of Science and Technology, Wuhan 430000, China
u202310422@hust.edu.cn

Abstract. Pinduoduo has achieved explosive growth in user base and transaction volume by relying on the "social + e-commerce" viral model. Due to information asymmetry and lagging regulation, platforms have rapidly seized the lower-tier markets. Due to the emergence of the "lemon market" and the increasing pressure to combat counterfeit goods. This paper is based on the lemon market theory and risk theory, and combines Python experience for modeling, to construct a multiple linear regression model. The research has revealed that the average transaction price is significantly negatively correlated with the proportion of false complaints, and the type of merchant has a restraining effect on false complaints. Meanwhile, this study reveals that the core governance challenges faced by Pinduoduo present a complex and intertwined situation: The market for lemons forms a self-reinforcing closed loop, wherein the prevalence of low-priced goods invalidates price signals. Branded stores, facing high compliance costs, continue to exist in the market, while low success rates in consumer rights claims further exacerbate the trust deficit. There is an inherent contradiction between the split incentive and the governance of counterfeit goods. Furthermore, insufficient investment in platform supervision, the fact that merchants' profits from selling counterfeit goods are higher than the costs of penalties, and the high cost for consumers to seek redress have led to a passive acceptance of the situation .The mutual reinforcement of the moral hazards among the three parties has jointly created an intractable systemic governance problem that is difficult to solve.

Keywords: Social E-Commerce, Fission-Type Network Effect, Lemon Market, Moral Hazard, Countermeasures for Counterfeit Goods.

1 Introduction

Social e-commerce restructures the traditional e-commerce traffic logic by "finding customers for products". Fission marketing relies on social relationship networks and the herd mentality to achieve viral dissemination. This model deeply activates the underserved market and transforms the consumer decision-making process from "actively searching for products" to "socially influenced recommendations"[1]. Pinduoduo adopts a viral model centered around "group buying and price negotiation" and "social sharing". In the context where the traffic growth benefits of traditional e-

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commerce have peaked, a new logic for obtaining traffic in traditional e-commerce has been broken - new users are introduced through WeChat social network, resulting in a cost for acquiring customers that is only 30% of that of traditional e-commerce. More than 90% of this cost is lower than that of traditional e-commerce [2]. The analysis based on the case of Pinduoduo shows that. It is centered around group booking. Combining interactive forms such as social viral dissemination and sharing of shopping experiences, by deeply integrating the community economy with e-commerce, the user base has expanded rapidly and the stickiness has been enhanced, which confirms the crucial role of interactive behaviors in the development of the community economy [3]. This research is based on the background of the social e-commerce industry. It is grounded on the theories of network effects and bilateral markets, and systematically analyzes the core elements, characteristics and financial performance of Pinduoduo's profit model. Further research indicates that Pinduoduo, with its core strategy of "social contagion + low-price group buying", leverages the cost advantages of the C2M supply chain and gamification operations to enhance user loyalty. Its main sources of profit come from advertising, marketing and transaction commissions [4]. However, the issue of false information has always been the most fundamental controversy behind the platform's rapid growth. The quality monitoring of online sales products by the China Consumers' Association in20%showed that the qualified rate of products sampled from the Pinduoduo platform was 27%.7% is far higher than the industry average inspection pass rate of 15.3%. Among them, the unqualified rates of 3C electronic products, clothing, shoes and bags with false advertising and non-compliant materials and non-compliant safety standards reached 41.2% and 35.5% respectively. Some studies have focused on the phenomenon of users returning to Pinduoduo in the context of China's e-commerce market competition. These studies provide empirical references for e-commerce platforms to optimize user retention and reduce negative word-of-mouth [5].

Based on this, this paper adopts the research path of "theoretical modeling - empirical verification - problem decomposition - solution construction". Systematically review the core viewpoints of the lemon market theory, the network effect theory, and the moral hazard theory, and summarize the shortcomings and gaps in the existing research. And using Python (with the Stats Models and SciPy libraries), a regression model for the lemon market was constructed based on 1500 sample commodities. Parameter estimation and heteroscedasticity test were conducted to verify the correlation between variables.

This article expands the application boundaries of the lemon market theory in the context of social e-commerce, breaking away from the traditional static research perspective of the lemon market theory that focuses on the information asymmetry and the phenomenon of bad apples driving out good ones. Taking into account the dynamic characteristics of the fission-type network effect, people reveal the cyclic mechanism where the expansion of user scale leads to an increase in regulatory difficulty, which in turn exacerbates information asymmetry. It has enriched the theoretical explanations for market failure in the era of the digital economy. This article also refined the framework for analyzing moral risks involving multiple parties and established a three-party game model involving platform merchants and consumers. Clarify the impact of conflicts of interest among the three parties and the linkage of behaviors on the

governance of counterfeit goods, make up for the deficiency of existing studies that mostly analyze the moral risks of platforms or merchants separately, and at the same time provide a feasible governance solution for Pinduoduo.

2 Theoretical Basis

2.1 Lemon Market Theory

Low-quality goods (referred to as "lemons") will, in the case of information asymmetry between buyers and sellers, gradually drive out high-quality goods from the market, resulting in market contraction or malfunction [6]. The degree of information asymmetry regarding product quality is relatively low. Consumers can obtain such information through trial use and other means in the traditional offline market. However, in the e-commerce context, the presentation of product information through richly illustrated text and images serves as a clear signal transmission method, but it has inherent flaws [7]. Pinduoduo's "ultra-low price" strategy and its focus on the lower-tier market have further exacerbated the information asymmetry. Consumers in the underdeveloped market are highly sensitive to prices. As a result, merchants have formed a "low-price-low-trust" business loop. Often, the costs of raw material compression and quality inspection are reduced to meet the low-price competition demands of the platform. The "acquaintance recommendation" mechanism of social contagion may also mislead consumers, reducing their vigilance against quality issues. Moreover, due to consumers' trust in social connections, the spread of inferior products may even accelerate further.

2.2 Fission-Like Network Effect

The core of network effects is "the positive feedback between the user scale and the product value". It is divided into direct network effects (where an increase in the number of users enhances the value of interactions among users) and indirect network effects (where the expansion of the user base attracts more merchants to join, thereby enriching the supply of goods). Pinduoduo's viral marketing model, through incentives such as "group-buying rebates" and "free items through bargaining", transforms the WeChat social network into a traffic entry point, creating an extremely strong direct network effect. The 2025 annual report shows that the average number of friends invited by Pinduoduo users to participate in group buying is 3.2. The user's reach efficiency of a single group-buying order is 5 times that of traditional e-commerce. However, the "negative externality" of network effects is particularly prominent in Pinduoduo. The expansion of user base will lead to "regulatory dilution". When the number of platform users increased from 100 million to 800 million, the growth rate of regulatory personnel and technological investment (25% per year on average) was much lower than the growth rate of users (42% per year on average), resulting in a decrease in the proportion of regulatory resources per individual user and a reduction in the probability of detecting violations from 35% to 15% [8].This contradiction of

"the larger the scale, the weaker the governance" has become a significant factor contributing to the rampant proliferation of counterfeit goods.

2.3 The Theory of Moral Hazard

Moral hazard stems from "the disparity between responsibility and benefits". In the Pinduoduo ecosystem, there are moral risks among all three parties: the platform, the merchants, and the consumers, which form a mutually reinforcing vicious cycle.

At the platform level, according to the financial report, the core KPIs of Pinduoduo focus on "user growth" and "GMV" (Gross Merchandise Volume). The proportion of sales and marketing expenses has remained above 30% for a long time (33.4% in the first quarter of 2025), and the proportion of regulatory compliance investment is less than 5%. The average compliance cost for merchants on Pinduoduo is 18.76 yuan per item (such as quality inspection certification, traceability labels). The additional revenue from selling counterfeit goods can reach 30% to 50% of the selling price. The fine amount after violations (averaging 2,000 yuan per instance) is much lower than the violation income.

3 Research Design and Model Construction

3.1 Variable Definitions and Data Sources

This paper selects "the proportion of false complaints (%)" as the main explanatory variable, which directly reflects the severity of the lemon market.

The study selected five variables as the core explanatory variables: average transaction price, merchant type, reward intensity, platform user count, and success rate of rights protection. Each variable is assigned a specific symbol, and the definitions and measurement methods are clearly defined. Moreover, the data sources are all based on solid grounds. The symbol for the average transaction price is "Price", and it is measured based on the midpoint of the price range of the goods. The data is from 1500 product samples collected in this article from January to December 2024The symbol for merchant type is "Seller", and it is in the form of classification coding. The coding for individual stores is 0, for enterprise stores it is 1, and for brand stores it is 2. The symbol for reward intensity is "Reward", which refers to the proportion of the cashback amount that users receive after a group-buying success compared to the product price. The data is derived from the public group-buying activity rules and order data of the Pinduoduo platform. The symbol for the number of platform users is "User", representing the annual active user count of the platform, measured in billions. The data is sourced from Pinduoduo's financial reports from 2019 to 2024. The symbol for the success rate of rights protection is "Success", which represents the proportion of cases that were successfully protected among the total number of complaints. The data is derived from the 12315-complaint platform in Henan Province and the rights protection system of Pinduoduo.

This paper selects "regional gross domestic product (GDP)" as the control variable. The total production value of the region reflects the consumption capacity of the lower market, which in turn affects consumers' willingness to pay for quality.

3.2 Specification of Model

To verify the influencing factors of the lemon market, this paper constructs two types of regression models.

The first category is used to examine the linear influence of variables such as average order price and merchant type on the proportion of counterfeit product complaints. The model form is as follows.

$$Fake_Rate = \beta_0 + \beta_1 Price + \beta_2 Seller + \beta_3 Reward + \beta_4 User + \beta_5 Success + \beta_6 Region + \sum_i \gamma_i \, Category_i + \varepsilon \quad (1)$$

Considering that there might be a non-linear relationship between the intensity of rewards and the proportion of counterfeit product complaints (once the intensity of rewards reaches a certain threshold, the growth rate of counterfeit products accelerates), an exponential regression model was constructed.

$$Fake_{Rate} = \alpha_0 e^{\alpha_1 Reward + \alpha_2 User} + \alpha_3 Price + \alpha_4 Seller + \alpha_5 Success + \mu \quad (2)$$

4 Research Design and Model Construction

4.1 Descriptive Statistics

This study conducted descriptive statistics on the key variables.

Table 1. Descriptive statistics.

variable name	mean value	standard deviation	least value	maximum value	Observation count
The proportion of counterfeit product complaints (%)	18.76	6.32	3.25	45.68	1500
Average Order Value (Yuan)	156.82	89.45	20.00	600.00	1500
Business Type (Code)	0.87	0.75	0.00	2.00	1500
Reward intensity (%)	8.35	3.21	2.00	20.00	1500
Number of platform users (in billions)	6.23	1.87	4.12	8.81	6

Success rate of rights protection (%)	28.35	7.12	19.25	39.45	1500

As can be seen from Table 1, except for the observation number of platform users which is 6 (annual data), the observation numbers for all other variables are 1500.The extreme values of the proportion of counterfeit complaints vary significantly, indicating that the manifestations of counterfeit issues for different products are quite different. The average value of merchant types is close to the code values of individual stores, indicating that the platform mainly consists of individual stores and enterprise stores, with brand stores accounting for a relatively low proportion. The average reward intensity is within the range of 8% to 10%, which is the core level of the platform's fission incentive mechanism. The overall success rate of consumer rights protection is relatively low, which indicates that it is quite difficult for consumers to protect their rights.

4.2 Analysis of Regression Results

Table 2. Descriptive statistics

Variable name	Coefficient	Standard error	t-value	P-value
constant term	57.219	0.595	96.218	0.000
Price	-0.0589	0.002	-39.091	0.000
Business Type	-20.066	0.379	-53.011	0.000
Reward intensity	0.732	0.115	6.365	0.000
Number of platform users	1.875	0.325	5.770	0.000
Success rate of rights protection	-0.521	0.142	-3.669	0.000
Regional GDP	-0.025	0.011	-2.273	0.023
after adjustingR^2	0.736	-	-	-
F-statistic	2094.888	-	-	0.000
White statistic	408.203	-	-	0.000

As shown in Table 2, the core variables have a strong explanatory power for the proportion of counterfeit product complaints. All the core explanatory variables passed the 1% significance test. The coefficient of average transaction price was -0.0589. It indicates that for every 1 yuan increase in the average order value, the proportion of fake product complaints significantly decreases. This confirms that low prices are a major cause of the fake product problem on Pinduoduo. The coefficient for merchant type is -20.066, indicating that enterprise stores and brand stores have a significant inhibitory effect on complaints about counterfeit goods. Brand management and standardized operation can effectively reduce the occurrence of counterfeiting. The coefficients for the reward intensity and the number of platform users are both positive, being 0.732 and 1.875 respectively. This means that the greater the scale of the viral promotion rewards and the larger the platform user base, the higher the proportion of fake product complaints. This reflects an inherent contradiction between viral growth

and the management of counterfeit products. The regulatory dilution effect caused by the expansion of the user base has exacerbated the problem of selling counterfeit goods. The success rate coefficient for rights protection is -0.521, indicating that an increase in the success rate of rights protection can significantly reduce complaints about counterfeit goods. Currently, the low success rate of rights protection is a major obstacle in the fight against counterfeit goods.

Table 3. Regression results of the index

Variable name	Coefficient	Standard error	Z-value	P-value
Constant term （α_0）	12.357	1.258	9.822	0.000
Reward intensity （α_1）	0.087	0.012	7.250	0.000
Number of platform users （α_2）	0.152	0.025	6.080	0.000
per customer transaction （α_3）	-0.056	0.003	-18.667	0.000
after adjustingR^2	0.796	-	-	-

Table 3 shows the results of the index regression analysis. After model adjustment, the R^2 value reached 0.796, indicating a better fit than that of the linear regression. A more nonlinear correlation feature that better aligns with the intensity of the rewards and the proportion of counterfeit complaint cases. The core variables were all statistically significant at the 1% level. The reward intensity coefficient is 0.087 and is positive, which confirms that there is an exponential positive correlation between the two. Once the intensity of the rewards exceeds the threshold, the proportion of counterfeit product complaints will accelerate its increase. Highlight the amplifying effect of the split incentive on the proliferation of counterfeit goods. The platform user ratio coefficient of 0.152 is positive, indicating that an increase in user scale will significantly boost the number of counterfeit product complaints, further verifying the negative externalities caused by regulatory dilution. Average transaction value coefficient - 0.056; the coefficient for merchant type is negative, which is consistent with the conclusion of linear regression, proving that the increase in average transaction value and standardized operation of merchants have a robust effect in suppressing counterfeiting behavior. The coefficient of the success rate of rights-protection is negative, indicating that its increase can effectively reduce the proportion of counterfeit product complaints. This conclusion is also reliable. Overall, the index regression more accurately captured the nonlinear impact of the fission incentive, providing a more practical empirical basis for resolving the contradiction between fission growth and counterfeit goods governance.

5 The Core Governance Dilemma of Pinduoduo

5.1 The Consolidation of the Lemon Market

The empirical results show that the lemon market on Pinduoduo has formed a self-reinforcing closed loop. From the previous text, it can be seen that the price signal has failed. The negative correlation between average transaction price and the proportion of false complaints indicates that low prices have become a synonym for "poor quality". However, the average purchase amount of most products on Pinduoduo is below 100 yuan. Consumers find it difficult to distinguish the quality based on the price, and they can only assume that "low price = low quality", which further reduces their expectations for quality. The number of high-quality merchants withdrawing has increased, and the proportion of counterfeit goods complaints in brand stores is significantly lower than that in individual stores. However, the proportion of brand stores on Pinduoduo is only 12%. The reason is that the compliance costs of brand stores (such as quality inspection and traceability) cannot be covered by low prices.

5.2 The Core Contradiction between Fission Incentives and Counterfeit Goods Governance

The core governance dilemma of Pinduoduo is mainly reflected in the inherent conflict between the viral promotion mechanism and the management of counterfeit goods, which creates an irreconcilable logical paradox. The platform adopts a "social group-buying + commission rewards" model for its viral expansion. By maintaining low acquisition costs, it achieves an explosive growth in user base. Its incentive mechanism is highly dependent on the appeal of the dissemination of low-priced goods, which provides fertile ground for the proliferation of counterfeit products. To achieve the extremely low prices required for viral growth, merchants often reduce costs by selling both genuine and counterfeit products and passing off inferior goods as good ones. However, the massive number of product links and the decentralized merchant ecosystem brought about by viral growth have significantly increased the difficulty of the platform's pre-audit and in-process supervision. More importantly, the immediacy of the incentive mechanism for splitting up and the lagging nature of counterfeit goods control form a stark contrast. Users can receive immediate rewards by sharing the group-buying link. The platform is inclined to maintain the efficiency of the viral spread in order to ensure the growth of traffic. The problem of counterfeit goods usually becomes apparent only after the user receives the goods. Although compensation measures taken afterwards can soothe consumers, they are ineffective in preventing such violations at their source. This "emphasis on growth while neglecting governance" kind of incentive mechanism has led some merchants to be willing to sell counterfeit goods at the risk of being held accountable. Meanwhile, the low-price mindset that is firmly established under the fission model has also led compliant merchants into the predicament of "bad money driving out good money". This further complicates the issue of counterfeit goods control, becoming a major obstacle for the platform in its transition to high-quality development.

5.3 Interaction and Enhancement of Tripartite Moral Risks

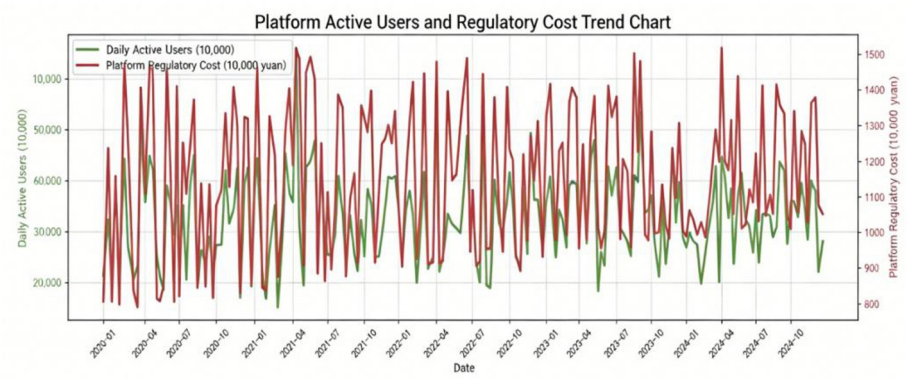


Fig. 1. Trend chart of platform active users and regulatory costs.

As shown in Figure 1, the overall daily active user count (green line) and the platform supervision fees (red line) exhibit a synchronous growth trend, which directly validates the logic that "an expansion in user scale will inevitably lead to an increase in supervision costs". The core dilemma of "higher costs as the scale expands" in social e-commerce is reflected in the increasing difficulty of regulating the explosive growth of platform users and the continuous rise in the demand for resource investment. These two factors are correlated with fluctuations, and the regulatory costs also show a significant increase during the period of rapid growth in user volume, such as in some peak intervals. This demonstrates the "negative externality of the fission-type network effect" - the faster the user growth, the stronger the immediate regulatory challenges become. This will directly translate into the need for continuous resource investment by the regulatory platform to cope with the governance pressure brought about by user growth. However, due to the fact that the proportion of regulatory investment by Pinduoduo is less than 5%, the penalty for violating merchants is relatively weak. The 2024 annual report data shows that Pinduoduo imposes an average fine of 2,000 yuan per time on fake merchants, while the average profit of fake transactions per customer reaches 15,000 yuan [9, 10]. The platform takes measures to prevent the loss of merchants, aiming to protect its GMV (Gross Merchandise Volume). Even for some merchants who violate the rules, it adopts a "look the other way" approach.

6 Conclusion

This study reveals that the market characteristics of Pinduoduo Lemon are distinct. The lower the average transaction price, the higher the reward intensity, and the higher the proportion of false complaints on the user base. One of the significant forces that have been suppressing the lemon market is that the quality control capabilities of brand stores are significantly better than those of individual stores. Fission incentives and counterfeit goods governance have a natural contradiction. The intensity of rewards is exponentially positively correlated with the proportion of counterfeit complaint cases.

The expansion of user scale leads to "regulatory dilution". The platform's "emphasis on growth while neglecting governance" has further exacerbated the conflicts. The three-party moral hazard creates a vicious cycle, and the expansion of user scale leads to an increase in regulatory costs. Therefore, it is necessary to overcome the platform's regulatory inertia, the rationality of merchants' violations, and the passivity of consumers' tolerance, in order to jointly promote the solidification of the lemon market.

Subsequently, further research can be conducted in two aspects. One is to expand the scope of cross-border research, analyzing the challenges of counterfeit goods governance in the overseas market of Temu, and comparing the impact of different national regulatory policies on the lemon market of social e-commerce. Second, explore the path of technology-driven governance. Utilize the immutable feature of blockchain technology to optimize the product traceability system, enhance the credibility of traceability information, and further reduce information asymmetry in the market.

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