Platform Economy as an Important Organizational Form in the Digital Economy Era: A Game Theory Perspective on Dynamic Competition Strategies in Multisided Markets

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Abstract: **The platform economy, as a significant organizational form in the digital economy era, exhibits unique characteristics of multisided markets that render traditional competition theories for one-sided markets inadequate. This paper systematically reviews theoretical models and empirical research on dynamic competition strategies in multisided markets from a game theory perspective, and analyzes the long-term equilibrium path of platform competition using evolutionary game theory. The study finds that the core of platform competition lies in the dynamic coordination of cross-side network effects and the positive feedback mechanism of user scale, and that strategic choices need to balance short-term gains with long-term ecological evolution. Future research needs to further integrate dynamic game theory with complex systems theory to address the new challenges of data-driven platform economies.**

Keywords: Multisided Markets; Game Theory; Dynamic Competition Strategies; Evolutionary Equilibrium; Cross-Side Network Effects

1. Introduction

The platform economy, as a highly forward-looking and innovative economic model, successfully connects multiple user groups such as consumers, suppliers, and advertisers through its unique operational mechanism, weaving a vast and intricate value network. This economic model not only optimizes resource allocation and promotes efficient resource utilization but also significantly enhances market efficiency, facilitating smoother circulation of goods and services and enabling consumer needs to be met more quickly and effectively [1]. Cross-side network effects (Cross-side Network Effects) are one of the most notable features of the platform economy. They reveal a profound law: when the number of users on one side of the platform increases, it attracts the attention and participation of users on the other side, creating a virtuous cycle that continuously elevates the platform's value. The existence of this effect brings a steady stream of growth momentum to the platform and grants it a valuable advantage in the fiercely competitive market. Additionally, price asymmetry (Price Asymmetric) is another distinctive feature of the platform economy. Different user groups on the platform may face different pricing strategies, which is not unfair but rather aims to maximize the platform's overall revenue and maintain ecosystem balance. Through clever pricing strategies, the platform can attract more users to join while ensuring its own profitability. Furthermore, dynamic economies of scale are a highlight of the platform economy. As the platform scales up, its marginal costs gradually decrease, while service quality and user experience continue to improve. The existence of this scale effect enables the platform to expand its market share while continuously enhancing its competitiveness. However, the complexity of multisided markets also poses significant challenges to the development of the platform economy. Due to the intricate interaction relationships among multisided users, traditional static equilibrium analysis often falls short in predicting market behavior and outcomes [2]. Therefore, to more accurately grasp the operating laws of the platform economy, this paper argues that more advanced analytical tools, such as dynamic game theory and evolutionary equilibrium theory, need to be introduced. These tools can help users delve into the dynamic evolution of various parties' behaviors in the platform economy, predict market trends, and provide a scientific basis for formulating platform strategies. Only in this way can the platform economy steadily move forward in a complex and ever-changing market environment, continuously create value, and contribute more wisdom and strength to the development of human society.

2. Theoretical Foundation

2.1 Economic Characteristics of Multisided Markets

Multisided markets, as the core of the platform economy, exhibit a series of unique economic characteristics that not only shape the logic of market operation but also provide an important basis for formulating platform strategies. In multisided markets, an increase in the user base on one side can significantly enhance the utility of users on the other side. Taking Didi as an example, as the number of drivers increases, passengers experience shorter waiting times and more service options, thereby improving passenger satisfaction and travel efficiency; conversely, an increase in the number of passengers also incentivizes more drivers to join the platform, creating a win-win situation. This effect promotes the rapid growth of the platform and its market share. To balance the demand of bilateral markets, platforms often need to guide user behavior through subsidy or pricing strategies. For instance, in the early stages of the platform, to attract a large number of users, the platform may provide subsidies to one user group (such as passengers) while imposing moderate fees on the other user group (such as drivers) to maintain platform operation and profits. As the market matures, the platform will gradually adjust its pricing strategy to achieve long-term stability and win-win outcomes in the bilateral market. In multisided markets, it is not uncommon for users to join multiple platforms simultaneously. This increases the complexity of the market and intensifies competition among platforms. To attract and retain users, platforms need to continuously innovate and improve service quality to form unique competitive advantages [3].

2.2 Application of Game Theory Tools

Game theory, as a mathematical theory for studying strategic decision-making, plays a crucial role in the platform economy. By applying game theory tools, users can gain a deeper understanding of competition behavior among platforms, adjustments in user strategies, and the formation of platform alliances. In multisided markets, platforms often engage in strategic competition such as price wars and user acquisition battles. Non-cooperative game theory provides a framework for analyzing these competitive behaviors, helping users understand how platforms make optimal decisions with limited resources and how these decisions affect market structure and user behavior. User group strategies are constantly changing, influenced by market environment, platform strategies, and user needs. Evolutionary game theory studies the long-term dynamic adjustment process of user group strategies, providing strong support for platforms to predict user behavior and formulate adaptive strategies. In the fiercely competitive market, platforms may also seek cooperation, forming alliances or ecological synergies. Cooperative game theory explores how platforms can achieve win-win outcomes through cooperation and how to avoid potential conflicts and competition through effective cooperation mechanisms. This is of great significance for building a healthy platform ecosystem and promoting sustainable industrial development [4].

3. Analysis of Dynamic Competition Strategies in Multisided Markets

3.1 Dynamic Game of Price and Subsidy Strategies

Competition among platforms in multisided markets is increasingly fierce. To maintain competitive advantages and market share, platforms need to continuously adjust their competition strategies. The following is an analysis of several key aspects of dynamic competition strategies in multisided markets. Considering user multi-homing, Armstrong (2006) extended the Hotelling model to analyze the equilibrium state of platform pricing. This model reveals how platforms attract and retain users through pricing strategies when users can use multiple platforms simultaneously. In this case, platforms may need to adjust prices more flexibly to address the challenges posed by user multi-homing. Platforms often use subsidies in the early stages to attract key user groups, such as Didi's reward policies for drivers. This subsidy strategy aims to rapidly expand the user base and create network effects. However, as the market develops, platforms need to gradually reduce subsidies and instead achieve profitability through value-added services. This staged subsidy design is an important strategy for platforms in dynamic competition. The subsidy war between Meituan and Ele.me in the food delivery sector is a typical example, demonstrating how subsidy efficiency depends on differences in cross-side elasticity. When subsidies to one user group (such as consumers) significantly influence the behavior of the other user group (such as merchants), the efficiency of the subsidy is higher. Therefore, platforms need to precisely identify and subsidize the user groups that can bring the greatest cross-side effects [5].

3.2 Technological Standards and Ecological Competition

Platforms' choices in technological compatibility have a significant impact on their ecological competition. The game equilibrium between closed systems (such as iOS) and open systems (such as Android) demonstrates the influence of different technological paths on platform development. Closed systems may focus more on user experience and security, while open systems emphasize flexibility and scalability. Platforms need to choose appropriate technological paths based on their positioning and strategic goals. By opening APIs, platforms can attract developers to build ecosystems, thereby forming competitive barriers. For example, WeChat Mini Programs have attracted a large number of developers by opening APIs, building a vast ecosystem. This strategy not only enhances the platform's competitiveness but also provides users with more diversified service options [6].

3.3 Data-Driven Dynamic Strategies

Based on big data analysis, platforms can build user profiles to achieve precise pricing. This price discrimination strategy can maximize platform profits while meeting users' personalized needs. For example, Amazon adjusts product prices dynamically based on users' purchase histories, browsing behaviors, and other factors. However, with the widespread application of machine learning algorithms in pricing strategies, there may be a risk of implicit collusive pricing among platforms. Calvano et al. (2020) found that machine learning algorithms may form collusive pricing by observing and imitating competitors' behavior without explicit agreements. This algorithmic collusion may negatively impact market competition and requires regulatory attention [7].

4. Evolutionary Equilibrium Analysis Framework

4.1 Evolutionarily Stable Strategies (ESS) in Multisided Markets

In multisided markets, an Evolutionarily Stable Equilibrium (ESS) requires that the strategy combination be resistant to perturbations, meaning that when a small portion of users change their strategies, these users cannot obtain higher returns as a result. This equilibrium state gradually forms through a process of continuous learning, imitation, and strategy improvement among market participants [8]. Taobao, as one of China's largest e-commerce platforms, owes much of its success to the buyer-seller positive feedback mechanism it has established. This mechanism ensures an evolutionarily stable equilibrium in the market: 1) Taobao establishes a seller reputation system based on indicators such as buyer evaluations, transaction volume, and refund rates. Sellers with good reputations can receive more exposure and trust, thereby attracting more buyers. 2) Taobao provides buyers with safeguards such as return and refund policies and fake-for-real compensation, enhancing buyers' shopping confidence. This safeguard system encourages buyers to be more willing to shop on Taobao, thus bringing more orders to sellers. 3) Positive transaction experiences between sellers and buyers reinforce each other, forming a virtuous cycle. Sellers provide high-quality goods and services, receive positive evaluations from buyers, and thereby enhance their reputation; buyers have a good shopping experience on Taobao and are more willing to shop again and recommend it to others. Under this mechanism, the Taobao market gradually forms an evolutionarily stable equilibrium. A small number of sellers or buyers changing their strategies (such as sellers lowering product quality or buyers leaving malicious negative reviews) will find it difficult to obtain higher returns and may even suffer losses due to damage to their reputation. Therefore, most market participants tend to maintain the current strategy combination, ensuring market stability and development [9].

4.2 Equilibrium Shift under Policy Intervention

Forced Data Sharing or Breakup May Disrupt Existing Equilibrium (Such as the EU's Penalties Against Google). Antitrust regulations are a series of measures taken by governments to maintain market competition order. These measures may include mandatory data sharing, breaking up large enterprises, etc. However, these measures may also disrupt the existing evolutionarily stable equilibrium in the market. Taking the EU's penalties against Google as an example, the EU believes that Google has abused its dominant market position in the search engine market, harming competitors and consumers[13]. Therefore, the EU imposed heavy fines on Google and required it to change certain business practices. Although these measures aim to maintain market competition order, they may also impact Google's business model and market position, thereby disrupting the original market equilibrium. In this situation, Google may need to reassess its market strategies and business practices to adapt to the new regulatory environment. At the same time, other search engine providers may also face new market opportunities and challenges. Therefore, the shift in market equilibrium under antitrust regulations requires joint attention and response from governments, enterprises, and consumers [10]. Digital Services Tax (DST) is a form of taxation imposed on multinational digital service providers. The implementation of this tax policy may have a profound impact on the evolutionary path of cross-border competition among platforms[14]. On the one hand, DST may increase the operating costs of multinational digital service enterprises, forcing them to reassess their market strategies and pricing strategies. This may lead to a decrease in the competitiveness of enterprises in certain markets or even their withdrawal from the market. On the other hand, DST may also provide more opportunities for local digital service enterprises, promoting their development and innovation. This helps enhance the competitiveness of local enterprises in the international market and promotes market diversification and balanced development. However, the implementation of DST may also trigger international trade disputes and frictions[15]. Differences may exist among countries regarding the standards and scope of DST imposition, which may lead to the rise of trade barriers and trade protectionism. Therefore, when implementing DST, it is necessary to fully consider its impact on market equilibrium and international trade, ensuring the rationality and effectiveness of the policy.

5. Research Challenges and Future Directions

5.1 Limitations of Existing Research

In current research on multisided markets, many models are based on the assumption of user homogeneity, i.e., assuming that all users are similar in terms of preferences, behavior, etc. However, in reality, user behavior and preferences often exhibit significant heterogeneity. This heterogeneity may lead to differences in user choices and behavior among different platforms, thereby affecting the market equilibrium state and competitive dynamics. Therefore, ignoring the impact of user heterogeneity in behavior may result in deviations between the conclusions of existing research and actual situations; the dynamic game in multisided markets involves multiple platforms, various strategies, and user behavior, and its solution complexity is often very high. This poses a significant challenge for existing research in portraying multi-platform competition scenarios. Although some researchers attempt to solve dynamic games by simplifying models or using numerical methods, these methods often fail to fully reflect the complexity and dynamic nature of the market. Therefore, how to reduce the complexity of solving dynamic games and more accurately portray multi-platform competition scenarios is an important issue facing current research [11].

5.2 Emerging Research Directions

With the continuous development of complex network theory, more and more researchers are applying it to the study of multisided markets. By constructing topological structure models of platform ecosystems, researchers can analyze the connection relationships between platforms, user distribution, and flow patterns, thereby revealing the robustness and stability of the platform ecosystem. This research approach helps users gain a deeper understanding of the competitive dynamics and evolutionary laws of multisided markets, providing strong support for the formulation of platform strategies; the rapid development of artificial intelligence technology has provided new ideas and methods for the formulation of dynamic pricing strategies. Deep reinforcement learning, as an advanced machine learning method, can learn optimal pricing strategies through simulation and training. In multisided markets, platforms can use deep reinforcement learning algorithms to dynamically adjust prices to maximize profits and market share. This research approach not only helps platforms more flexibly respond to market competition and changes in user demand but also improves the accuracy and efficiency of pricing; with the increasingly severe global climate change, carbon neutrality has become a common pursuit of governments and enterprises worldwide. In multisided markets, platforms, as important economic entities, have a significant impact on carbon emissions and environmental protection through their operations and competitive behavior. Therefore, studying the impact of carbon footprint constraints on evolutionary equilibrium has important practical significance. By constructing an evolutionary game model that includes carbon footprint constraints, researchers can analyze the competitive strategies and equilibrium states of platforms under carbon neutrality goals, providing theoretical support for platforms to achieve green and sustainable development [12].

6. Conclusion

This study delves into the dynamic competitive strategies in multilateral markets, encompassing pricing and subsidy strategies, technological standards and ecosystem competition, as well as data-driven dynamic strategies. Furthermore, through an evolutionary equilibrium analysis framework, the paper explores the formation of market equilibrium states and the equilibrium shifts under policy interventions. Although the current research has achieved certain results, there are still limitations, such as the neglect of user heterogeneity behavior and the high complexity of solving dynamic games. In the future, emerging research directions such as complex network theory, artificial intelligence technology, and carbon neutrality goals can be leveraged to further explore the competitive dynamics and evolutionary laws of multilateral markets, providing a scientific basis for platform strategy formulation and market regulation. This will facilitate the steady progress of the platform economy in a complex and ever-changing market environment, continuously creating value.

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