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Review of Research on Network Freight Platform based on Two-sided Market Theory

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Abstract

In recent years, the network freight platform has developed rapidly under the background of " Internet +. " Using Internet information technology to transform and promote the transformation of traditional logistics industry has become an important development direction of modern supply chain management. As a new type of bilateral platform, the network freight platform has obvious characteristics of bilateral market. Therefore, this paper expounds the theoretical basis of bilateral market from the perspective of definition, characteristics and platform classification of bilateral market. Then it introduces the current research and pricing strategy of the network freight platform. In the research method, the application of Hotelling model in competitive pricing strategy is introduced. Finally, based on the literature review, the future research is briefly prospected.

Keywords

Network Freight Platform; Two-sided Market; Pricing Strategy; Hotelling Model.

1. Introduction

The network freight platform derived from logistics enterprises is a typical representative of the two-sided market. The new format of the network freight platform has accelerated its growth and has become a new support for building a modern circulation system under the new development pattern. Governments at all levels attach great importance to the development of new forms of online freight transport, and vigorously promote the development of platform economy, digital economy and smart economy[1]. The rapid development of the network freight platform is improving the comprehensive benefits of the logistics industry and promoting the transformation and upgrading of China's traditional logistics industry to the direction of intelligence, platform and service.

Before the rise of online freight platforms, logistics companies relied on contracts to form standardized logistics solutions, but business and technical issues such as process supervision, information sharing, and logistics transparency were difficult to solve[2]. The emergence of emerging technologies has strengthened the data connection of the logistics industry chain. The network freight platform provides solutions to the pain points and difficulties of logistics business from the perspective of information technology and data-driven. Under the mode of rapid development of network freight platform, opportunities and challenges coexist, and the improvement of quality and efficiency of platform enterprises and the supervision and exploration implemented by the government are in parallel. Based on this, this paper expounds the related research in the field of network freight platform based on the two-sided market theory, and finally makes a brief prospect for the future research direction.

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2. Theoretical Basis of Two-sided Market

2.1. Definition of Two-sided Market

The two-sided market theory originated from Baxer's research on bank card organization. It has gradually expanded to various industrial fields and has a strong explanatory power for the development of platform economy in the Internet era. The academia has not yet given a very clear and unified definition of the two-sided market, but there are two explanations in general: one is the " non-neutral price structure " of economists Rochet and Tirole, which emphasizes the pricing of users on both sides of a given platform. If the volume on the platform only depends on the overall price level and is not sensitive to changes in the price structure, it is a unilateral market; if the total price level is constant, the trading volume on the platform changes with the change of price structure, which is the bilateral market[3]. Second, Armstrong's " cross-network externalities, " that is, the net utility of one side of the user in the two-sided market increases with the growth of the size of the other side of the user[4].

2.2. Typical Characteristics of Two-sided Markets

(1) Bilateral user demand complementarity

The demand complementarity between two-sided users is determined by the bilateral nature of the two-sided platform[5], The function of the two-sided platform is to provide transaction matching services for two-sided users. The products or services provided by users on one side of the two-sided market can directly meet the needs of users on the other side. They are interdependent and dependent. If either side of the user has no demand for the products or services provided by the platform, then even if they both exist on the platform, the value of the platform's products or services does not exist[6].

(2) Cross-network externality

Cross-network externalities reflect the relationship between the utility of users added to a network and the size of existing users in the network. The cross-network externality in the two-sided market means that when other conditions remain unchanged, the increase in the number of users on one side of the platform will affect the utility of users on the other side.

(3) Price structure is not neutral.

Cross-network externalities lead to the problem of price structure in two-sided markets. The non-neutrality of the price structure means that the change in the pricing of one user by the two-sided platform will affect the size of the other user, and the price set by the platform does not fully reflect its marginal cost[7]. In practice, most platforms will set different prices for users on both sides, that is, asymmetric pricing, set a low price for users on the side with weak cross-network externalities, and set a higher price for users with strong cross-network externalities, thereby increasing the total number of users attracted by the platform.

(4) Diversity of user attribution

Single attribution means that users only register transactions on one platform ; multi-homing means that users register transactions on multiple platforms at the same time. The attribution behavior of users in a two-sided market can be divided into three types[8]:

1) Single-homing: the user group only registers transactions on one platform;

2) Multi-homing: user groups register transactions on a competitive platform at the same time;

3) Partial multi-homing: some users in the user group choose single-homing, while others choose multi-homing.

If there is only one monopoly two-sided platform in the market, users on both sides of the platform only have to join or not to join these two choices, and the user behavior that chooses to join the monopoly two-sided platform is single-homing; if there are other competing two-sided platforms in the market, users on both sides can choose to join any platform or even join

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multiple platforms at the same time according to their own preferences or utilities. At this time, the user's behavior is multi-homing; for a competitive platform, if there are both multi-homing users and users who belong to the platform alone, the user behavior of the platform belongs to partial multi-homing[9]. Poolsombat and Vernasca first proposed the concept of " partial multi-homing " of users, and the results show that : compared with the user's single-homing, the user's partial multi-homing behavior promotes the platform to increase pricing[10].

3. Research Summary of Network Freight Platform

3.1. Research on the Field of Network Freight

Some foreign scholars have mainly carried out some research on the new organization form of network freight transportation in road freight transportation to reduce costs and increase efficiency. Brown analyzed the current state of U.S. transportation, arguing that truck brokers help shippers find the right carrier more quickly at a lower price, and that government deregulation of trucking can improve transportation efficiency and competitiveness[11]. Wang et al. constructed a crowdsourcing logistics distribution optimization model to study how to reduce transportation costs, and substituted it into actual data to verify its model[12]. Kafle et al. proposed a crowdsourcing logistics system for urban parcel transit and distribution that can effectively reduce transportation costs[13]. Lindsey et al. believed that third-party brokers who assume transportation responsibilities in the freight market can effectively integrate the resources of the freight market[14]. Zhao et al. think that the car-free transportation mode and the " car-free transportation platform are new things that combine modern Internet technology with traditional logistics, which can effectively match the vehicle and cargo resources, and analyze the problems of car-free transportation[15].

There are also some scholars who mainly study the optimization of capacity resources of car-free carriers. Chang Lianyu et al. studied ways to reduce the operating costs of non-vehicle carriers and optimize their capacity resources, and constructed an optimization model for the organization of non-vehicle carrier capacity resources[16]. On the basis of expounding the development status and business characteristics of car-free transportation, Li Shu analyzed the conditions of railway integrated development of car-free transportation from three aspects: development demand, development conditions and congenital advantages, and put forward the optimization countermeasures of railway integrated car-free transportation organization[17]. Wang Xiaowen believes that the capacity scheduling problem is the core problem in the development process of the non-truck operating platform, so he established a dynamic scheduling optimization model for the non-truck operating platform[18]. Li Lin designed the overall scheme of multimodal transport scheduling with non-vehicle carriers as the main body[19].

3.2. Research on the Pricing Strategy of Network Freight Platform

A few foreign scholars have studied the pricing problem of the network freight platform. Scholars use game theory knowledge to build a pricing model to analyze the optimal pricing strategy of the platform. Based on the two-sided market theory and network externalities, Chen analyzes the optimal market structure and pricing strategy of the regional logistics information platform from a dynamic perspective, and establishes a pricing model for the two stages of user aggregation and stable operation. Finally, it is concluded that the pricing decision of the regional network freight platform is mainly affected by platform services, network externalities and the scale of users on both sides[20]. Ji believes that the charging and pricing mechanism of most online freight platforms in China is not perfect. The pricing model is constructed by using game theory to calculate the reverse regression of three rounds of bargaining for the customized

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service pricing of logistics software, which provides management enlightenment for the service pricing decision of logistics information platform[21].

Only a few domestic scholars have studied the pricing strategy of online freight platform. Dai Yong constructed the pricing strategy model of the fourth party logistics platform under the two market structures of monopoly and competition. He believes that network externalities, service differentiation and user demand elasticity are the main factors affecting the pricing of the fourth party logistics platform[22]. Xing Daning et al. first analyzed the optimal price strategy of monopoly network freight platform under unilateral pricing and bilateral pricing respectively, and made a comparison and sensitivity analysis of different price influencing factors. Then the model is extended to the competitive network freight platform. The pricing model of the competitive network freight platform only considers the case of charging registration fees, and assumes that the owner and the owner can only join one platform (i.e., complete single ownership). He concluded that the network externalities of shippers and car owners have a greater impact on the pricing decisions of online freight platforms. Due to the current situation that demand is greater than supply in China 's road freight market, the platform should focus on the owner 's side[23]. Based on the theory of information asymmetry, Nie Fuhai et al. constructed a price game model between the network freight platform and the truck owner, studied the service pricing strategy of the network freight platform, and further analyzed the influence of the parameters such as the latest delivery time of goods and the quantity of goods on the expected profit of the non-vehicle carrier platform[24]. Wang Zhihong constructed the pricing model of the freight sharing platform, focusing on the analysis of the pricing mechanism of the freight sharing platform under the membership fee and the two-part charging mode. The results show that the supply and demand matching level of the freight sharing platform, the remuneration paid by the shipper and the network externality intensity of the actual carrier jointly determine the service price of the platform, and the ownership behavior of the shipper and the actual carrier is mainly affected by the level of platform differentiation[25]. Zhou Yongwu et al. established a mathematical model to study the optimal pricing decisions of freight service sharing platforms under transaction system and membership system respectively, and analyzed the impact of network externalities on pricing strategies. The study found that the optimal price under the membership system is less than the optimal service price under the trading system, and the network externality affects the platform pricing by affecting the number of supply and demand[26].

4. Application of Hotelling Model in Competitive Pricing Strategy

Under the competitive market structure, scholars mainly consider the platform competition pricing of platform market behavior and user characteristics. The pricing model mainly draws on the traditional Hotelling model. The main considerations are platform exclusive behavior, platform product or service differentiation level, user attribution behavior, user transfer cost, etc.

Several foreign scholars' research on the pricing of competitive bilateral platforms is groundbreaking and representative. Calliaud and Jullien constructed a price model under the two-step tariff model, focusing on the impact of platform exclusivity on platform pricing. They believe that more rational dominant platforms often do not take exclusivity measures[27]. Armstrong and Wright proved that in the registration fee model, the level of platform differentiation has a great impact on the price, and the increase in the level of differentiation enables the platform to implement higher price markups[28].

Some scholars have focused on the impact of factors from the perspective of bilateral platforms on the pricing of competitive platforms, such as the degree of platform informatization, the level of matching technology, and the degree of platform differentiation. Wu Siqi takes indirect

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network externalities, platform matching technology, and the degree of differentiation between platforms as variables, and improves the Hotelling model. The conclusion is that the level of platform matching technology is positively correlated with user access fees and negatively correlated with developer revenue sharing. Indirect network externalities and attribution characteristics determine the impact of platform differentiation level on price[29]-[30]. Different from the past, she also uses case studies to verify model inferences, making the research conclusions clearer, more specific and more convincing. Liu Weiqi and Zhang Su considered the influence of network externalities on the choice of platform merger mode, and obtained the equilibrium price, market share and profit of bilateral platforms under different merger structures[31]. Based on the premise that manufacturers provide users with basic products, Zhang Qianfan et al. constructed a duopoly competition model. They mainly discussed the influence of users value-added utility, platform differentiation level and inter-group network externalities on the number of platform users, price and platform profit when Internet bilateral platforms provide value-added services to users on both sides[32]. Wang Ya considers the homogeneous platform competition and heterogeneous platform competition under the competitive market structure. In addition, a two-stage dynamic model is established under the market structure of homogeneous platform competition, and the relationship between the network externality intensity and the profit of the two platforms under different pricing strategies is considered[33].

Other scholars mainly consider the influencing factors of competitive platform pricing from the perspective of bilateral users. Zhu Hongqiao et al. take the customer choice theory as the theoretical basis of the research, and construct a product price model with vertical differentiation characteristics. In the process of model derivation, they discuss how the different quality products provided by the competitive platform to users will affect the price, profit and market share of the competitive platform[34]. Luke et al. studied the pricing problem of the platform under the two attribution characteristics of single-homing and single-homing of drivers and multi-homing of users in the duopoly competition[35]. Gui Yunmiao et al. constructed an oligopoly competitive platform game decision-making model based on Hotelling, and discussed the pricing of online freight platform from four different user ownership perspectives[36].

5. Theoretical Review

Through the combing of previous literature, it can be found that there are few studies on the pricing strategy of online freight platforms at home and abroad, and the research on online freight platforms at home and abroad focuses more on theoretical concept research, mainly on the integration of online freight platforms. The contribution of resources, improving logistics efficiency, and promoting logistics cost reduction and efficiency. With the rapid development of the network freight platform, some domestic scholars have carried out more in-depth empirical research and quantitative analysis, but mainly focus on the partner selection of the network freight platform, the establishment of the risk early warning mechanism, the optimization of the capacity scheduling, etc. There are few research fields on the pricing strategy of the network freight platform. As a typical two-sided platform, the network freight platform can learn from the more mature research in the field of two-sided market pricing to study the price strategy in the field of network freight, but it must be analyzed in combination with the current situation of the network freight industry.

References

[1] Liu Ruiqiang. The new format of online freight has accelerated growth [N]. Shanxi Daily, 2021-01-18 (010).

ISSN: 2692-7608 DOI: 10.6981/FEM.202311_4(11).0047

[2] Zhang Xuan, Zhao Jun. Cross-organizational collaboration, supply chain electronic integration capability and supply chain performance-demand uncertainty and the moderating effect of internal information technology. Business Economics and Management, Vol, 39 (2019) No.8, p.5-19.

[3] Rochet J C, Tirole J. Two-sided markets: a progress report [J]. The RAND journal of economics, Vol, 37 (2006) No.3, p.645-667.

[4] Armstrong M. Competition in two-sided markets [J]. The RAND Journal of Economics, Vol, 37 (2004) No.3, p.668-691.

[5] Ji Hanlin, Wang Xiaofang. Bilateral market competition with platform differentiation and multi-homing of users [J].System Engineering Theory and Practice, Vol, 34 (2014) No.6, p.1398-1406.

[6] Wu Hanhong, Meng Jian. Review of Two-Sided Market Theory and Application [J]. Journal of Renmin University of China, Vol, 28 (2014) No.2, p.149-156.

[7] Lin M, Wu R, Zhou W. Platform Pricing with Endogenous Network Effects[J]. Research Collection School of Information Systems, Vol, 2 (2016), p.1-39.

[8] Dai Yong. Research on the Operation Strategy of Fourth Party Logistics Platform Based on Two-Sided Market Theory [J].Business Economics and Management, (2019) No.2, p.12-17.

[9] Filistrucchi L. Market definition in multi-sided markets[J]. Rethinking Antitrust Tools for Multi-Sided Platforms, (2018), p.37-64.

[10] Poolsombat, R. and G. Vermasca. Partial Multihoming in Two-sided Markets. Discussion paper of the University of York, 2006.

[11] Brown, Terence A. Deregulation and new technology: The case of truck brokers[J]. International Journal of Services, Technology and Management, Vol, 1 (2000), p.205-208.

[12] Wang X, He F, Yang H, et al. Pricing Strategies for a Taxi-Hailing Platform[J]. Transportation Research Part E, Vol, 93 (2016), p.212-231.

[13] Kafle N, Zou B, Lin J. Design and modeling of a crowd source-enabled system for urban parcel relay and delivery[J]. Transportation Research Part B: Methodological, (2017) No.99, p.62-82.

[14] Christopher Lindsey, Hani S. Mahmassani. Sourcing truckload capacity in the transportation spot market: A framework for third party providers[J]. Transportation Research Part A, Vol, 6 (2017) No.3, p.23-35.

[15] Zhao Y, Duan X, Gao J. Platform Research on Car Free Carrier Based on the "Internet+"[C]//IOP Conference Series: Earth and Environmental Science. IOP Publishing, Vol, 186 (2018) No.6, p.12-42.

[16] Chang Lianyu, Chen Haiyan. Research on the optimization of capacity resource organization of non-truck operating carrier [J].Road traffic science and technology, Vol, 33 (2016) No.10, p.152-158.

[17] Li Shu. Discussion on Optimization of Railway Transportation Organization Based on Non-Truck Operating Common Carrier [J].Railway Transportation and Economy, Vol, 40 (2018) No.2, p.1-5.

[18] Wang Xiaowen. Research on dynamic scheduling optimization of vehicle-free carrier capacity (MS.D.Chang 'an University, 2019), p.26.

[19] Li Lin. Research on multimodal transport scheduling scheme for car-free carriers (MS.D. Beijing Jiaotong University, 2019), p.25.

[20] Chen J J, Zhang S B, Ji S W, et al. Study on Regional Logistics Information Platform Pricing Strategy Based on Bilateral Market Theory[C]//Advanced Materials Research. Trans Tech Publications, Vol, 69 (2013) No.4, p.3596-3599.

[21] Ji S W, Feng Q, Wang Y Z, et al. The Research on Pricing Customizing Services of Logistics Information Platform[C]//Advanced Materials Research. Trans Tech Publications, Vol, 774 (2013), p.2004-2007.

[22] Cheng, X, Mu, L, Sun, Y, et al. Optimal Pricing Decisions for the Online Video Platform Under Customer Choice[J]. Asia-Pacific Journal of Operational Research, Vol, 35 (2018) No.1, p.1-21.

[23] Xing Daning, Zhao Qilan, Gao Honghu. Research on the pricing strategy of logistics information platform based on two-sided market theory [J]. Business Economics and Management, (2018) No.6, p.5-15.

ISSN: 2692-7608 DOI: 10.6981/FEM.202311_4(11).0047

[24] Nie Fuhai, Li Diansheng. Research on the pricing strategy of carless carrier platform under asymmetric information [J]. Industrial Engineering and Management, Vol, 12 (2019) No.2, p.1-12.

[25] Wang Zhihong, Fu Changtao. Research on pricing strategy of freight sharing platform under different user attribution behaviors [J]. Journal of Management, Vol, 16 (2019) No.7, p.1081-1087.

[26] Zhou Yongwu, Guan Xinxin, Cao Bin, Lin Xiaogang, Lin Qiang. Research on price strategy selection of instant freight service sharing platform [J]. China Management Science, Vol, 31 (2023) No.8, p.111-121.

[27] Caillaud B, Jullien B. Chicken & egg: Competition among intermediation service providers[J]. RAND Journal of Economics, (2003), p.309-328.

[28] Armnstrong M, Wright J. Two-sided markets, competitive bottlenecks and exclusive contracts[J]. Economic Theory, Vol, 32 (2007) No.2, p.353-380.

[29] Wu Siqi. Research on user pricing strategy of two-sided platform leading enterprises (MS.D. Hunan University, 2016), p.20.

[30] Sun Yaowu, Wu Siqi. Research on user pricing strategy of two-sided platform leading enterprises-Taking software platform as an example [J].System Engineering, Vol, 35 (2017) No.6, p.74-81.

[31] Liu Weiqi, Zhang Su. Analysis of pricing issues under the two-sided platform merger strategy [J]. China Management Science, Vol, 25 (2017) No.5, p.17-24.

[32] Zhang Qianfan, Dong Xue. Pricing strategy of Internet platform in the case of providing value-added services [J].System Engineering, Vol, 36 (2018) No.2, p.47-54.

[33] Wang Ya. Research on pricing strategies of two-sided platforms based on different market structures (MS.D. Jiangnan University, 2019), p.42.

[34] Zhu Hongqiao, Shi Xue, Xu Qing. An analysis of two-sided market pricing based on vertical differentiation of products [J]. Business Economics Research, (2018) No.3, p.63-67.

[35] Luke, Zhou Jing, Lin Xiaowei. Research on market pricing of ride-hailing platforms considering cross-network externalities [J]. Operation and Management, Vol, 28 (2019) No.7, p.169-178.

[36] Gui Yunmiao, Cheng Jing, Gong Bengang. Research on the pricing of competitive online freight platforms under different information strategies [J]. China Management Science, Vol, 31 (2023) No.5, p.176-186.