

Review Article

The Literature Review of Platform Economy

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Since the 1990s, the increasing development of digital-driven technologies such as the Internet, cloud computing, big data, and the Internet of Things and the popularization of computers and mobile electronic devices have accelerated the evolution of global business organizations, thus making a new form of business organization, platform economy. As the most important form of industrial organization in the new economic era, the development of the platform has received extensive attention from the academia. Through literature analysis and inductive deduction, this paper reviews the connotation of platform economy, the historical context of development, the competition and monopoly (differentiation) of multilateral platforms, the evaluation mechanism of platform, antimonopoly governance, and research methods, and provides theoretical references and new ideas for future research directions.

1. Introduction

What is the “platform economy?” Evans [1] defines platform economy as a study of the unique economic phenomena of specific two-sided markets in traditional market economics. The platform economy studied in this paper refers to a series of digital technologies driven by the Internet, cloud computing, big data, and the Internet of Things, with a large number of platform enterprises as the lead, designing and implementing a complete set of platforms, consumers, and service providers, and influencing upstream and downstream enterprises, to reduce transaction costs of organizational rules and services and to achieve a new type of economic integration in which resources are highly integrated with traditional industries. Since the 1990s, mass platforms applying digital-driven business models show around the world where Google, eBay, Alibaba, Baidu, Tencent, JD.com, and other enterprises have stood out on the Internet, leading the increasing development of various industries and gradually forming the platform economy model, which has profoundly affected all aspects of the national economy and reshaped the market structure and competitive behavior of different industries. Meanwhile, it brings cross-country and cross-region business models and accelerates the global economic integration. This rapid

growth of platform enterprises has inspired vast in-depth research studies in academia.

2. The Historical Development of Platform Economy

McAfee and Brynjolfsson [2] regard the rise of the platform as one of the three iconic events of the “digital revolution.” Its rise has changed people’s production and life and has also changed the way of human thinking. Most successful enterprises now have platform attributes [3]. Platform is the intermediary to realize the exchange between other participants, and most major technology companies can be regarded as platform-based enterprises [4].

Liebowitz and Margolis [5] put forward the conjecture of network externality and call the “market regulation effect” as “(indirect) network effect.” Their conjecture is considered by academia to be the oldest openness issue in network economics. Subsequently, Rochet and Tirole [6], Armstrong [7], and Caillaud and Jullien [8] have pioneered platform research and guided the economics community’s interest in platform research.

At the beginning of the 21st century, with the rapid development of information technology and the further refinement of the social division of labor, the market

operation model based on buyers and sellers has become increasingly mature. The platform enterprises based on buyers and sellers have formed a new market relationship, that is, the two-sided markets in the production and operation market. Caillaud and Jullien [8], Rochet and Tirole [6], and Armstrong [9] believe that the increase of users on one side of the platform will cause the increase of users on the other side. The two-sided “cross-group network externality” is called two-sided markets. Armstrong [9], Evans [1], Evans and Schmalensee [10], and Filistrucchi et al. [11] believe that two-sided market should embody at least one side with “cross-group network externality.” Rochet and Tirole [12] believe that the definition of cross-group network externality in two-sided markets lacks inclusiveness and should be defined from the price structure. Parker and van Alstyne [13] study two-sided markets earlier. They believe that the matching market is two-sided because the matching “platform” (such as dating services) is more important. Hagiu and Wright [14] impose restrictions on two-sided markets: one is the direct trade between the sides of the market, and the other is that each side of the market is “affiliated” to the platform, with higher cost of leaving the platform. Evans [1, 15] divides two-sided markets into three types: market maker, audience maker, and demand coordinator.

There are two main reasons to trace the emergence of the platform. Firstly, the platform helps to match. In the sharing economy, the platform provides a new structure to quickly and effectively match with low search cost [16] and acts as an intermediary between the buyer and the seller [17]. In view of the matching background, many scholars have conducted a lot of in-depth research on the competition and pricing strategies in the platform business and gradually focused on the importance of indirect network effects [8, 18–20] and [21]. Secondly, the platform has improved trade efficiency. The platform improves transaction frequency and efficiency by reducing search cost, low replication, and verification cost. Through zero cost replication, the platform enables application providers to quickly provide services for a large number of customers, with interoperability. Simcoe [22] emphasized platform interoperability and the strategic nature of standard decision-making [6, 23], Hanna and Yehezkel [24] tested whether market participants would “multiple” and use multiple platforms through empirical data.

Regarding the research of platform economy, from the perspective of two-sided markets, many scholars focus on market intermediary behavior, especially market pricing; from the perspective of network effects, scholars focus on user adoption and optimal network scale; from the perspective of industry focuses, the media, payment system, and matching market are highly paid attention to the research and literature of two-sided markets, focusing more on high-tech and telecommunication market about network effects.

3. The Competition Effect of Platform Economy

The theoretical economics literature on multisided platforms focuses on competition (differentiation) between antitrust

and multisided platforms serving the same customer group. According to Evans and Noel [25], various platforms face a more complex competitive environment. The existence of the “cross-group network externality” of the platform has led to mutual reciprocity on both sides, and platform enterprises have grown up at an extremely rapid rate. Platform enterprises with “intragroup network externality” will be provided with entrance barriers as their scale grows, and it will be difficult for new enterprises to reenter, often causing winner-take-all issues [1, 8]. Meanwhile, after the platform gains market power, it will become a “modern antitrust” to a great extent [26]. Evans [27] conducts a research on the operating status of the world’s top platforms and finds that their industry rankings have changed greatly in recent years, and antitrust platforms are also facing various challenges.

Platform competition theory has been one of the most active areas in industrial organization research for the past decade [6, 8, 9, 12, 20, 28]. Jacqueline and Jonathan [29] believe that the network effect model is conducive to the competition between platforms. Spiegler [30] studies that there are positive externalities between the two agents. The platform extracts these externalities by using exclusive interactive contracts. If another agent signs a contract with the platform, the payment to one of the agents is accordingly reduced. Caillaud and Jullien [31] believe that there is a market for price competition between the two platforms, and there is no difference between the platforms. When the existing platform has the market power, another new entry platform is difficult to develop. If the platform does not charge transaction fees, even if there is no product differentiation, the platform that has already occupied the market can still obtain profits; with the transaction fee, both platforms can get profits. Rochet and Tirole [6] study the issues of “single destination” and “multiple destination” for multisided platforms. Armstrong [9] shows the importance of “multiple destination” for competition. Armstrong and Wright [32] put forward that if the multisided platforms of competition is regarded as homogeneous by members of one group but differentiated by members of another group, then the “competitive bottleneck” will be endogenous. Economides and Katsamakos [33] study the competition between common platforms and open source platforms and find that the property platform dominates open source platforms by having greater market share and higher profitability. Jullien [34] conducts multifaceted background research studies based on the market of vertical differentiated platforms and sequential games and finds the pricing strategy of competitive platforms. Weyl [35] analyzes the pricing strategy of the platform from the perspective of multifunctional platform and from the perspective of user heterogeneity and platform monopoly, establishes a general theory of network antitrust pricing, and lays the foundation for the platform economic theory. Tiwana [36] and Mukhopadhyay et al. [37] believe that the platform is a dynamic, purposeful, or internal interdependent network, and participants can jointly create value [38] and add complementary products, services, and technologies [39]; Annabelle and Cusumano [40]. McIntyre and Srinivasan [41] believe that the value creation in the platform system is jointly participated by platform

owners, suppliers, and final consumers. This is due to internal competition and cooperation between participants, which occurs in the interaction between independent participants and the evolutionary process. Reiley, Hall [42, 43] believe that the reduction of transaction costs will lead to more flexible platform pricing.

Brynjolfsson et al. [2] found that online prices are much lower than offline prices by comparing the products of four pure Internet retailers, four offline retailers, and four “hybrid” retailers with both online and offline stores. Orlov [44] found that the platform will increase the price dispersion within the enterprise, but it does not have a great impact on the price dispersion among enterprises. Instead, the search cost reduces the price dispersion [45–47].

Regarding information asymmetry in platform competition, Damiano and Li [48], Ambrus and Argenziano [49], Peitz et al. [50], Weyl [20], and White and Weyl [51] focus on the research of ex-ante asymmetric information. Based on this issue in the two-sided markets, Hanna and Yaron [24] used multiple destinations to solve the market failure caused by information asymmetry and empirically studied the influence of ex-ante uncertainty of new technology value and ex-post asymmetric information on platform strategies and results.

The focus of the platform economy is to solve the problem of how platforms can price both sides of the market at the same time. Rochet and Tirole [12] focus on the price structure when defining two-sided platforms, which has the characteristics of using externality and member externality. Evans and Schmalensee [10] define two-sided platforms, grasping the key features of the platform business, namely, (a) having two or more customer groups, (b) to some extent need each other, (c) unable to obtain value from mutual attraction, and (d) the platform creates more value. Evans [52] believe that the pricing of one side of the market depends not only on the demand and costs brought by consumers but also on how their participation affects the other party and the profits derived from the participation. In one-sided market, the elasticity of demand and marginal cost can be used to describe price cost increase, but in two-sided markets, the pricing decision also needs to consider the flexibility of the other party’s response and the price increase charged to the other party. Rochet and Tirole [53] point out that if the services provided to consumers and merchants are completely competitive, then the exchange fee does not affect the profits of members but affects the terms and total transactions faced by merchants and consumers. Rochet and Tirole [6, 12] and Weyl [54] believe that prices on both sides of the market depend on the elasticity of demand and the marginal cost of each party. A platform acting as an intermediary is regarded as antitrust that has access to members who do not use other platforms. Enterprises using a single network compete fiercely in order to charge antitrust price to the other party trying to reach it [9].

An important issue of platform research is price discrimination in the case of heterogeneous demand. Weyl [35] has empirically found that, by manipulating the prices of participation and use, the platform can obtain more profits. Discrimination increases the value of one party, which

causes the decreasing price of the other party. Caillaud and Jullien [8] empirically study how the new platform uses price discrimination to achieve success when market participants expect new entrants to fail.

Regarding the research on platform antitrust competition, Rochet and Tirole [6] and Armstrong [9] study antitrust pricing and price competition of platforms. Rochet and Tirole believe that the platform is priced based on transaction fees. Jullien [55] believes that there are more than two consumer subgroups and intragroup network externality on the platform, constructing a duopoly model. Evans [1] points out that, in many industries, enterprises act as catalysts to set prices below marginal costs, sometimes even zero, such as on some software platforms, advertising-supported media, exchanges, and payment systems.

Regarding the research on heterogeneity in platform competition, Ellison et al. [56] conduct a study on the competition between two auction websites and find that even if there is a lack of heterogeneity of products and agents, multiple platforms coexist. Damiano et al. [48, 57] [61] believe that consumers are heterogeneous in the platform economy, and different types of consumers can be distinguished through registration fees. Caillaud and Jullien impose monotonicity on the consumer demand, assuming that the full market coverage under equilibrium conditions is selected among equilibriums. Ambrus and Argenziano [58] study the conditions for the coexistence of multiple asymmetric networks in a bidirectional market with network externality from the perspective of consumer heterogeneity and find that one side of a network platform is cheaper and larger, the other side is even cheaper and larger. Weyl [54] believes that, in the case of heterogeneous demand, the platform can obtain more profits by operating participants and prices. Rochet and Tirole [6] put out that customers with prestige and influence will have significant direct or indirect externality.

4. The Governance Issues of Platform Economy

Platform governance is jointly constructed by the platform, its participants, and the government and revolves around three issues: “who sets the rules,” “how to allocate rights and obligations,” and “how to resolve disputes.” The idea of platform governance includes spontaneous organization of platform subjects, participation in governance, government-led regulation, and consumer supervision. Jin and Kato [59], through empirical research on eBay’s rating system, find that credibility is an effective means of identifying integrity platforms. Avery et al. [60] started the research on the recommendation system earlier and devoted to building the evaluation system. Jacqueline and Jonathan [29] conduct an empirical study on eBay, establishing a communication mechanism to encourage other users to evaluate the quality of sellers or products by setting up a communication mechanism that encourages and aggregates user feedback, thus building the evaluation system of a platform reputation. Dellarocas [61] has empirically found that sellers with higher feedback scores enjoy some benefits when prices and sales rates are higher.

Cabral and Hortacsu [62] and Saeedi et al. [63] find that the evaluation mechanism set up by the platform to increase the evaluation rate will breed strategic behavior of evaluation. The existence of strategic behavior will distort the reputation mechanism and affect its effectiveness. Rieder and Sire [64] have empirically found that if the platform's search accepts advertising sponsorship, it may affect the objectivity of the platform's search.

In the fields of economics, management, and strategic management, a large amount of literature on platform antitrust governance has appeared, especially because of the research on pricing issues in the field of platform economics, which provides an important reference for antitrust governance. Rochet and Tirole [53] find that if the antitrust law is not violated when setting the exchange fee, but the equilibrium result deviates from the social optimal value, the reasonable solution is price regulation. Evans [65] believes that, with the increasing revolution of the Internet, mobile devices, and information technology and the increasing emergence of global large-scale multisided platforms, antitrust will become a key link in governance issues.

Evans [52] studies how platforms develop governance systems to reduce platform participants' undesirable behavior that may reduce the value of the platform. Hagiu [66] discusses the use of platform regulations to increase positive externality and reduce negative externality. Ruhmer [67] raises the issue of whether multisided platforms can increase profits by colluding to charge only part of the price. Evans and Schmalensee [15] believe that the fierce competition between the two platforms may eliminate the profitability of colluding with each other's prices. Rysman [28] believes that predatory pricing and overpricing will lead to anticompetitive platforms.

5. The Method Research of Platform Economy

Rochet and Tirole [53], Jullien [55], Armstrong and Aendorff [68], and Parker and Van Alstyne [69] conduct empirical research on the entry, pricing, and other strategies of the platform industry, providing a research background for the emerging economic theory of platform. Rysman et al. [70] provides the empirical and policy [1] research for multisided platforms market. Rochet and Tirole [6] take the lead in constructing one of the two most basic models of two-sided platforms pricing. It is assumed that two-sided antitrust platforms have no member externality. Only by using externality and charging usage fees for each transaction while without charging, member fees can the cost bonus be lowered with the higher demand elasticity. Armstrong [9] proposes the second model, two-sided antitrust platforms do not use externality, only the externality of members, no user fees, only member fees, and the price of maximizing profits. Hagiu [66] modifies the Armstrong [9] model, and the size of the profit share of the antitrust platform comes from the consumer's preference for varieties. Jacqueline and Jonathan [29] conduct empirical research on platform and platform competition and construct a platform competition model for analyzing platform pricing, competition, and market tilt issues. Rochet and

Tirole [6] carry out empirical research on both sides of the platform, which finds that, from the perspective of maximizing profits or maximizing social welfare, the optimal price may cause the pricing to be lower than the marginal supply cost of one party and higher than the marginal supply cost of the other party.

Economists have developed various models to help analyze whether certain business practices may harm consumers by excluding competitors from the market, or benefit consumers by lowering prices or improving quality. Segal and Whinston [71] demonstrate that, under the condition of economies of scale, monopolistic enterprises can effectively prevent competitors from entering by signing exclusive transaction contracts. Armstrong and Wright [32] build a platform competition model, which is regarded as a differentiated platform by one customer group and a homogenized platform by another customer group. Exclusive transactions can be used to prevent the latter's multihoming and exclude competitors, but antitrust equilibrium may be effective. Doganoglu and Wright [72] demonstrate the effectiveness of this strategy without economies of scale but with network effects. Leung and Lee [73] conduct empirical research on the video game industry, finding that exclusive contracts can facilitate entry rather than prevent entry. Rochet and Tirole [74] simulate the situation that tying increases social welfare and found that tying in a simple model helps to enhance welfare, but in a more complex model, the net effect of tying on welfare is ambiguous. Choi [75] proposes a theoretical model based on the influence of the combination of Microsoft Windows media player and Windows. Bundling as a means of price discrimination will reduce costs, and the network effect will make the price optimal. Then, Chao and Dardenger adopt video games to carry out empirical analysis of pricing and reach a conclusion consistent with the theoretical model. Amelio and Bruno [76] conduct a case study. Assuming the profit-maximizing price of a party is negative, it is not feasible to actually charge a negative price. It is found that tying can both make profits and increase welfare. Ruhmer [67] constructs a single-destination two-sided model. The indirect network effect increases the benefits of price reduction, making collusion difficult to maintain.

Hagiu [77] provides a duopoly model of two-sided platforms. Armstrong and Wright [32] establish a bottleneck model of two-sided competition. The empirical platform can charge the producers of the market for user fees. Spulber [78] proves the choice of buyers and sellers and finds that they should either search in a decentralized market or search through an intermediary. Hagiu [66] constructs a competitive model for platform pricing. By analyzing the economic and strategic factors in the optimal access pricing structure of the two-sided platforms connecting consumers and producers, the competition between producers is introduced.

Farrell and Klemperer [79] construct a network effect model based on three factors: the degree of substitution of competitive platforms, the intensity of positive network effects, and the degree to which production is characterized by economies of scale. Rysman [28] believes that the single

destination preference, the scale and intensity of network effects, and the price elasticity system are all key parameters of the platform competition network effect model. Brown and Morgan [80] demonstrate the competition between eBay and Yahoo through auctions. Edelman [81] and Hal [42] give the modeling formula of auction market. Levin [82] studies a related model and show that there is a near-effective equilibrium of mixed strategies. Gawer and Cusumano [83] demonstrate the pricing strategies of Microsoft, Apple, IBM, Palm, and other operating system enterprises.

Baye and Morgan build a price competition model where consumers can search by price. Einav et al. [84] empirically study auction pricing and additional prices and find that fees and prices have no significant impact on consumers. Gentzkow and Shapiro [85] empirically study the personal consumption of online media and discover the long tail demand theory of platform economy. Roberts and Sweeting [86] construct a platform dynamic pricing model. Rysman [28] constructs a differentiated platform competition model to solve the platform antitrust issue.

Regarding the issue of dynamic competition, Doganoglu [87] and Mitchell and Skrzypacz [88] derive the Markov perfect equilibrium of the indefinite game where the consumer utility is a growth function of market share in the past. Markovich and Moenius [89] develop an industry computing model including “hardware” and “software” components, which assumes that consumers live for two periods and benefit from indirect network effects through the quality of existing products. Chen et al. [90] develop a computational dynamic model in which it is assumed that consumer benefits are a growing function of the size of the network at the time of purchase (consumers are not forward-looking). These assumptions assume that consumer behavior is relatively simple. Driskill [91] constructs a deterministic and continuous-time model where consumers are forward-looking. Cabral [92] builds a dynamic model of price competition based on balanced symmetry and network effects.

6. Research Outlook

As one of the three landmark events of the digital economic revolution [93], the platform economy will become the most important form of economic organization in the foreseeable future when the academia will not only be limited to the research of platform economy such as economics, management, econometrics, law, and sociology, but also possible to conduct cross-field and multifield research. One of the main focuses of two-sided markets economy is to solve the issue of how the platform can price both sides of the market at the same time. Platform opening, market access, pricing analysis, governance supervision, and antitrust are all significant directions for future research.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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