

Article

Price Controls and Platform Ecosystem: A Comparative Analysis of Parking Applications between Beijing and London

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Abstract: As a platform to improve the efficiency of matching supply and demand, parking applications once blossomed in many cities. However, some have achieved success while others quickly withered. By comparing the development of parking applications between Beijing and London, it is found that price controls are a key factor. Price controls include price limits and hourly limits. Flexible price or controlled duration facilitate platform sustainability, as these increase the supply side's digital investment and willingness to access the platform, and also increase demanders' willingness to use the platform. Meanwhile, flat and low pricing or no time limit will make the platform less attractive, since these reduce the supply and its mobility, and also discourage demanders from using the platform. This paper enriches the literature on the digital platform ecosystem and information systems (IS) and provides practical inspiration for urban parking management.

Keywords: price controls; parking demand; parking supply; platform ecosystem; parking applications; comparative analysis

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1. Introduction

The platform is one of the important ways for digital transformation [1]. Many industries have realized digital transformation through platforms and promoted the efficiency of supply and demand matching, for instance, online car-hailing [2] or e-commerce [3], and so on. Parking has also undergone this process in cities. Previously, the supply and demand matching relied on the driver to look around in the street. Drivers looking for parking spaces cause a waste of resources, aggravating congestion, air pollution [4,5] and road safety problems, and waste time in the search process [6,7]. Parking mobile or PC applications (for users mainly use platforms through mobile phones, hereinafter collectively referred to as parking applications) have greatly alleviated these problems and have been universally welcomed by the public and are rapidly blossoming in various cities during the last decade. At present, this results in two outcomes. Applications have been successful in some cities, especially in some big cities, and enable users to reserve parking spaces and clear fees; while they have withered in others. Some modern metropolises do not have a parking application or the application only has a payment function. Why do some cities lag behind in the development of digital platform ecosystem of parking?

Previous literature on IS and platforms has noted that the development of the digital platform ecosystem is influenced by many factors: such as infrastructures, market structures, use intention, technology, supply and demand, and so on (see Table 1). These factors mentioned above cannot fully explain the failure of parking applications in cities with developed platform economies because, in these cities, similar platforms are well developed, such as car-hailing, bike-sharing, carpooling, etc. Better explanatory factors need to be explored.

Literature in the transportation field points out that parking pricing policies affect the efficiency of matching parking supply and demand [8,9]. Therefore, price controls inevitably affect the parking platform ecosystem. As for how it affects it, there is a lack of research. To fill this gap, the research question in this paper is *how do price controls affect the parking platform ecosystem?*

Table 1. The findings from the literature review.

The Findings	Author (Time)	Main Views
Influencing factors of the platform ecosystem	Helmond, 2015	Infrastructures
	Nieborg and Poell, 2018	Market Structures, Governance Frameworks, and Infrastructures
	Wang, Mei, and Feng, 2020; Huo and Li, 2022	Use Intention
	Bonina et al., 2021	Technology, Organizational Structure, and International Standards, Supply and Demand
The impact of parking price policies	Cats et al., 2016	Steer the parking market, Reduce the externalities
	Liu et al., 2018	Ease the pressure on parking
	Yan et al., 2019	Alter travel behavior
	Mingardo et al., 2015	Better regulate and use parking
	Saharan, Bawa, and Kumar, 2020	Improve revenue; Make full use of the parking resources
	Pierce, Willson, and Shoup, 2015	Maximize public benefits
	Piccioni, Valtorta, and Musso, 2019	Not always been proven; A way to “ask for money”; Without creating tangible benefits

Based on the theoretical perspective of the platform, this paper answers this question by comparing parking applications in Beijing and London. The paper is structured as follows. In Section 2, we briefly review prior literature relevant to the topic. The following Section 3 introduces the research data sources and analytical methods; next, Section 4 compares the policy differences between Beijing and London in parking charges and analyzes the impact of parking control on the digital platform ecosystem of parking; and then Section 5 discusses the theoretical contributions of this study and proposes suggestions for optimizing parking price controls and promoting the development of a digital platform of parking; finally, this paper concludes with limitations and suggestions for future research.

2. Literature Review

2.1. Platform Ecosystem

Regarding the topic of platform and platform ecosystem, the current research mainly includes:

(1) Platform

A platform that gathers the supply side and the demand side has a scale effect and network effect [10] as well as a “cross-group network positive externality”, that is, an increase in the number of users on one side of the platform will bring an increase in the number of users on the other side [11,12].

There are two basic ways for digital platforms to create value: facilitating transactions between the supply and demand sides and providing technical components to promote product or service innovation [13,14].

Research has investigated the role of platforms in systematizing the networking, innovation, and operations [15] in services [16].

(2) Platform ecosystem

Regarding platform ecosystem, the related terms are platform development and platformization. Platformization is related to the changes in market structures, governance frameworks, and infrastructures [17].

Literature reports that the success of a mobile platform is inextricably linked to its ecosystem [18]. Like other digital platforms, a parking application has the characteristics of a platform economy, which shows it is a typical platform economy.

Infrastructure and economic model are important factors for platformization [19]; use intention is an important factor affecting the development of platforms [20,21]; the formation of the platform ecosystem is influenced by technology, organizational structure and international standards, supply and demand [22].

2.2. Parking Price Controls

Regarding the topic of parking price controls, the existing relevant literature mainly includes:

(1) Parking policy and sustainable mobility

Literature that introduces the parking management experiences mainly mentions the park and ride system [23–27], reserved parking spaces for the disabled [28], parking fines [29] and other related measures. Parking management optimization can be realized by a targeted carpooling initiative along with the pricing of single-occupant vehicles and efficiency evaluation [30], etc.

The development of sustainable mobility will generate travel as a derived demand and travel cost minimization [31,32]. The parking supply is far from perfectly elastic [33]. The continued use of minimum parking requirements is likely to encourage automobile use at a time when metropolitan areas are actively seeking to manage congestion and increase public transport use, cycling, and walking [33]. Uneven use of on-street and off-street parking in urban areas reflects household choices [34].

Enforcement policies are defined by the citation fine and level of enforcement [35]. Increasing either the citation fine or level of enforcement will hinder illegal parking but the obtained profit remains approximately constant [35,36].

(2) Intelligent transportation system (ITS) applications for supporting parking

ITS can improve the safety and traffic control of existing and future parking management schemes, and parking applications make parking processes operate more efficiently for matching drivers with available parking spots [37]. To match the development of ITS, states and municipalities need to manage parking supply better by redesigning their parking policies and legal frameworks [38,39]. ITS has many possible applications in urban parking management [9], and it is necessary to note that the applications mentioned in this paper are one of the possible applications of ITS.

(3) Parking price policies

Parking pricing policies can be used as a policy instrument to steer the parking market and reduce the externalities caused by traffic in general and parking in particular [40]. Market-based pricing can ease the huge pressure on parking in China's big cities [41]. Pricing remains the single most effective parking policy to alter travel behavior [7]. Price mechanisms can better regulate and use the existing parking [42]. Dynamic pricing can maximize the expected revenue of the parking manager [9]. Optimizing the price policy for public garages can more effectively manage their parking assets to maximize public benefits [8].

The effectiveness of a pricing policy is not always proven; it is mostly perceived by parkers as a way to “ask for money” without creating tangible benefits for all road users [5].

The existing gap between the theoretical background and parking practices implemented by cities does not allow framing local experiences into a systemic view. The above

confirms the multifaceted and complex nature of this topic. By comparing the parking price policies between Beijing and London, this paper, based on the platform perspective, analyzes the impact of different price controls measures on the ecosystem of parking digital platforms, so as to study the relationship between price controls and the parking platform ecosystem, and propose theoretical contributions and practical inspiration.

3. Data and Methods

3.1. Procedure

The research question of this paper is clearly as follows: how do price controls affect the parking platform ecosystem?

The empirical data for this study were collected by applying a double case study approach [43–46]. The reasons to adopt this methodology are as follows.

(1) The research scope.

Regarding research scope, the case study methodology is consistent with research questions based on “how”. Qualitative research is appropriate when the emphasis is on the development of a conceptual framework and the identification of critical factors and other key variables. Moreover, double cases enable a more generalizable and robust theory than a single case [45,47,48].

(2) The price controls and applications.

A city will have multiple parking price controls and multiple parking applications. Due to competition between applications, there will be a change in market share, as well as new applications and downgraded applications. These objective factors make this study unsuitable for the method of large sample data collection.

The research was conducted according to the guidelines and suggestions for qualitative methodologies provided by the literature [49].

3.2. Case Selection and Case Profiles

This paper focuses on Beijing and London as the objects for the following reasons. Firstly, both are modern international metropolises with a developed digital economy, facing the challenge of parking problems. Secondly, the population and economic scale of the two cities are comparable. Thirdly, the popularity of parking applications in the two cities should differ significantly. Moreover, the first author himself has a long life experience in these two cities. The profiles of the two cities are shown in Table 2.

This study then picks representative applications for each city and summarizes their functions and other characteristics. In Beijing, many parking applications (such as Mengge Parking) that appeared in previous years have now disappeared from major application stores. Even if some parking applications still exist (such as Xiaoqiang Parking), their functions are relatively simple, basically unable to complete the function of online dynamic reservation of parking spaces, and the user experience is poor. The logos of the representative applications are shown in Figure 1.

Table 2. A Comparison of the parking in Beijing and London.

The Profiles		Beijing		London		
Population		22 M *		15 M		
Economic Scale		600 B *		700 B		
Smartphone Penetration		Above 90%		88% **		
Number of parking spaces		4 M (urban area)		1.8 M (urban area)		
Representative applications	Xiaoqiang Parking	Mengge Parking	Beijing Transportation	JustPark	RingGo	Parkopedia
Functions	1. Parking space query	1. Parking space query	1. Parking fee payment	1. Parking reservation	1. Parking reservation	1. Parking reservation
	2. Parking fee payment	2. Parking fee payment	2. Parking location navigation	2. Parking space query	2. Parking space query	2. Parking fee payment
	3. Parking location navigation	3. Parking location navigation		3. Parking fee payment	3. Parking fee payment	3. Parking location navigation
		4. Parking space rental		4. Parking location navigation	4. Parking location navigation	
Operation status	In operation	Cease operation	In operation	In operation	In operation	In operation
User number	0.6 M	0	6 M	5.5 M ***	16 M ****	2 M

Note: 1. Statistics are as of the end of 2021. The data are compiled from the official website and public reports. 2. London as mentioned here refers to the London metropolitan area. * “M” means million, “B” means billion. ** Reference: Plateauing at the peak The state of the smartphone—Deloitte (2019); *** See: <https://diginomica.com/justpark-drives-towards-scalable-future-google-cloud>, accessed on 4 March 2022; **** See: <https://ringgo.co.uk/16-million/>, accessed on 4 March 2022.

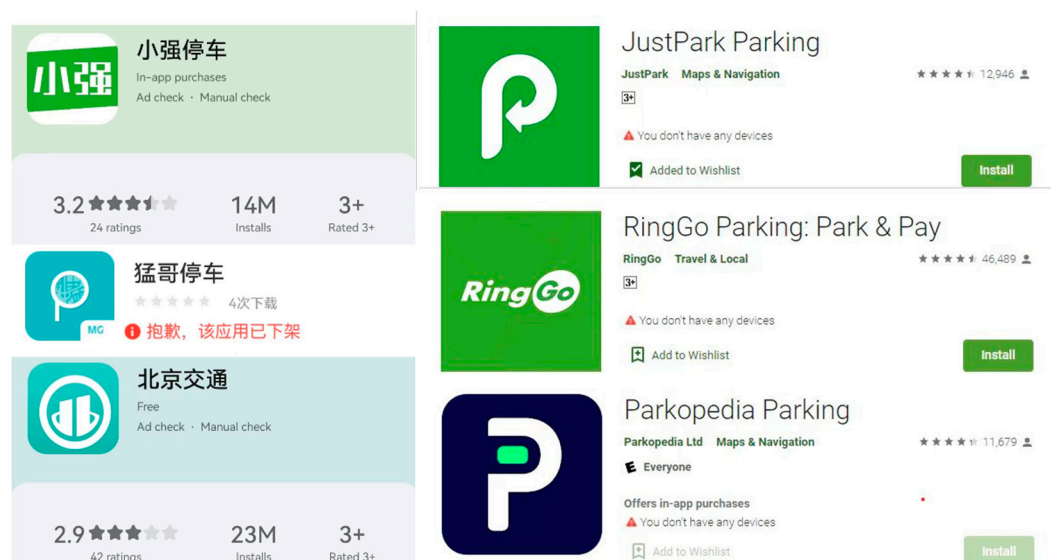


Figure 1. The logos of the representative parking applications. Note: 1. On the left are the applications in Beijing, and on the right are the applications in London. 2. In the left logos, “小强停车” means Xiaoqiang Parking, “猛哥停车” means Mengge Parking, “北京交通” means Beijing Transportation; “抱歉，该应用已下架” means “Sorry, the application has been removed”.

3.3. Data Sources

Urban parking is an important part of government departments in the process of urban management. Therefore, the data sources of this paper are mainly government websites and related policy documents. At the same time, we checked the data information such as the downloads and logos of the parking application in the mainstream mobile

phone application stores. Because the parking control measures of these two cities are different, the data collection methods differ correspondingly.

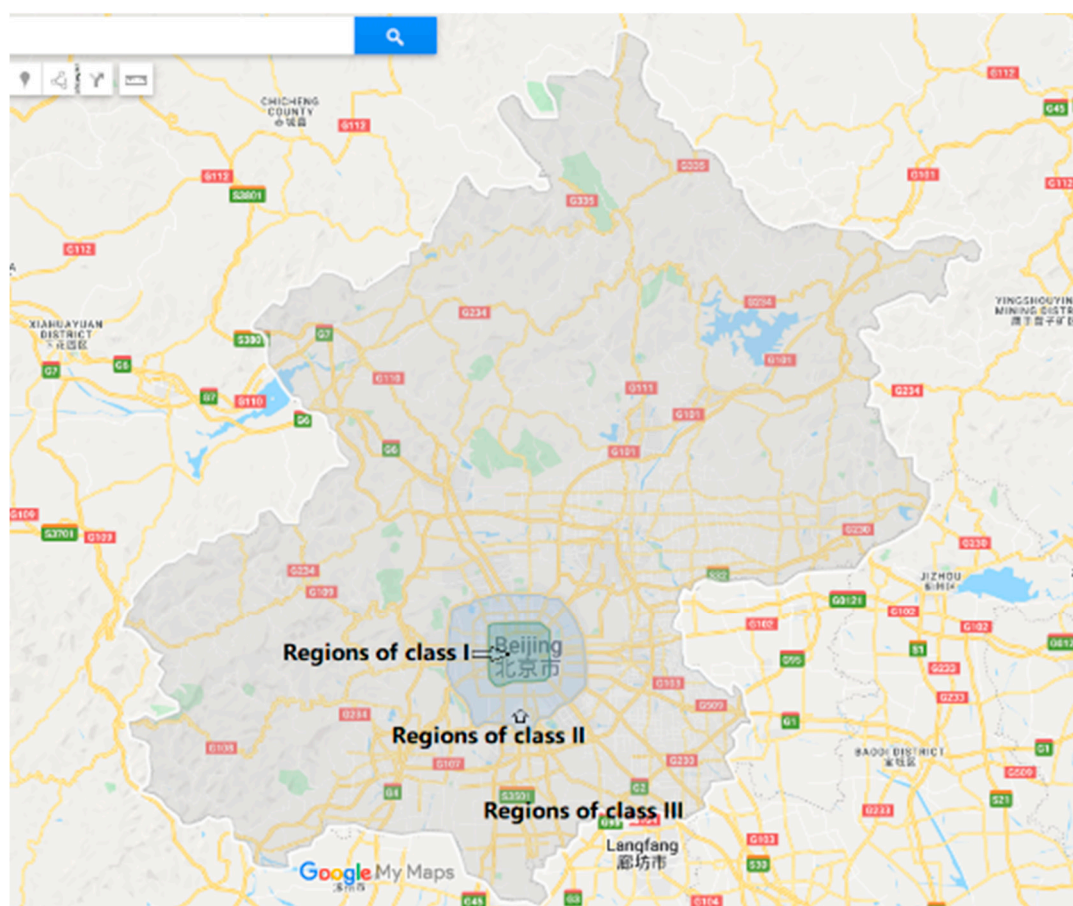
(1) Related data on parking in Beijing

Beijing mainly adopts price controls in parking, and the data comes from government documents. By August 2020, the latest relevant document is the *Notice on Issues Related to Parking Charges in Beijing*, issued by Beijing Municipal Government and has been implemented since 1 May 2018 (see Table 3). The parking resources are divided into three classes in the non-residential area of Beijing (see Figure 2), and each class is uniformly priced. Other types of parking lots can set their own prices, but the charges cannot be higher than this standard.

Table 3. Charge standard of small car parking in Beijing.

Period	Regions of Class I			Regions of Class II			Regions of Class III		
	On-Street	Off-Street Open	Garage	On-Street	Off-Street Open	Garage	On-Street	Off-Street Open	Garage
Daytime	¥2.5/15 min (within 1 h)	¥2/15 min	¥1.5/15 min	¥1.5/15 min (within 1 h)	¥1.25/15 min	¥1.25/15 min	¥0.5/15 min (within 1 h)	¥0.5/15 min	¥0.5/15 min
	¥3.75/15 min (over 1 h)			¥2.25/15 min (over 1 h)			¥0.75/15 min (over 1 h)		
Nighttime	¥1/2 h	¥1/2 h	¥2.5/0.5h	¥1/2 h	¥1/2 h	¥2.5/0.5 h	¥1/2 h	¥1/2 h	¥2.5/0.5 h
	Monthly rates: ¥150		Market Pricing	Monthly rates: ¥150		Market Pricing	Monthly rates: ¥150		Market Pricing
	Yearly rates: ¥1600		Market Pricing	Yearly rates: ¥1600		Market Pricing	Yearly rates: ¥1600		Market Pricing

Notes: 1. Daytime mentioned in the table refers to 7:00–21:00, and nighttime refers to 21:00–7:00. 2. Regions of class I to III refer to Figure 2 (on the above).



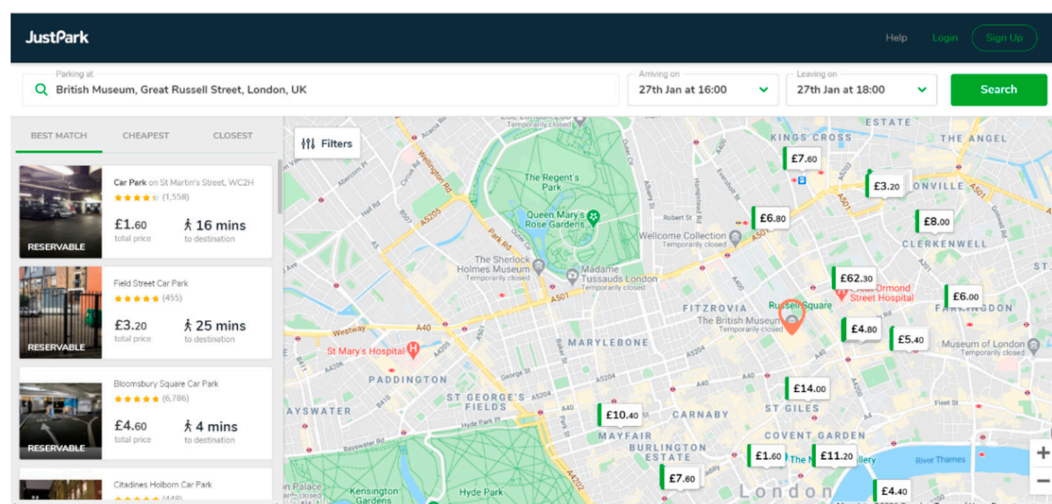


Figure 2. Comparison of Beijing and London parking maps. Note: Above are the three classes of parking regions in Beijing according to different charging standards, and below is parking information on the parking application JustPark (the search time is London time of 8:47 a.m., 17 January 2021).

Beijing currently does not have a widely used parking application. Although almost at the same time as online car-hailing, various parking applications appeared in Beijing in succession, some of which have also received venture capital or government pilot policy support, at present, most of them have ceased operation. Beijing's parking applications include Mengge Parking, Xiaoqiang Parking, etc., but they are not commonly used and have imperfect functions. Mengge Parking's functions include navigation of nearby parking lots and query of free parking spaces in the parking lot. Presently, it is no longer available in the application store. Xiaoqiang Parking is used to reserve airport parking and railway station parking, but its market scale is small. In general, the development of Beijing parking applications is still relatively primitive. In order to promote electronic charging and reduce corruption, the "Beijing Transportation" application, launched by the Beijing Municipal Commission of Transport, only has the function of charging and is unable to serve parking information inquiries or parking reservations.

(2) Related data on parking in London

The municipal government of London attaches great importance to parking management. In 2018, it released the report of Benefits of London Parking Management, detailing the background of the related measures and the benefits and problems brought by them (full text URL <https://www.londoncouncils.gov.uk/node/34485>, accessed on 4 March 2022). London has relatively more sophisticated parking controls. There is no official document on parking charging standards, and parking charging mechanisms in different parking lots differ greatly from each other. Parking prices vary at different times, and even two adjacent parking lots have different charging standards. In general, the price of public parking lots or parking spaces is relatively low, and there will be parking duration or interval restrictions; private parking lots charge more, having no limit on parking duration and intervals.

Parking applications widely used in London include Parkopedia, JustPark, Ringgo, etc. These applications are very popular in the UK and even the European Union. Parkopedia does not have a reservation function and is mainly used to query information such as the location and price of parking resources. This paper will take JustPark as an example, to show London parking prices and reservation information (see Figure 3). JustPark is a technology platform established in 2006 in London that connects drivers and parking resources. Its services can be accessed through both PC and mobile phones. For example, if searching for parking information near the British Museum on 27 January 2021, the total price for 4 h is £1.6–£62.3. Parking spaces available include public parking spaces, on-street

parking spaces, private parking spaces, and individually shared parking spaces. If a suitable parking space has been found, you can reserve and pay in advance. Upon arrival at the parking lot, you can park directly.

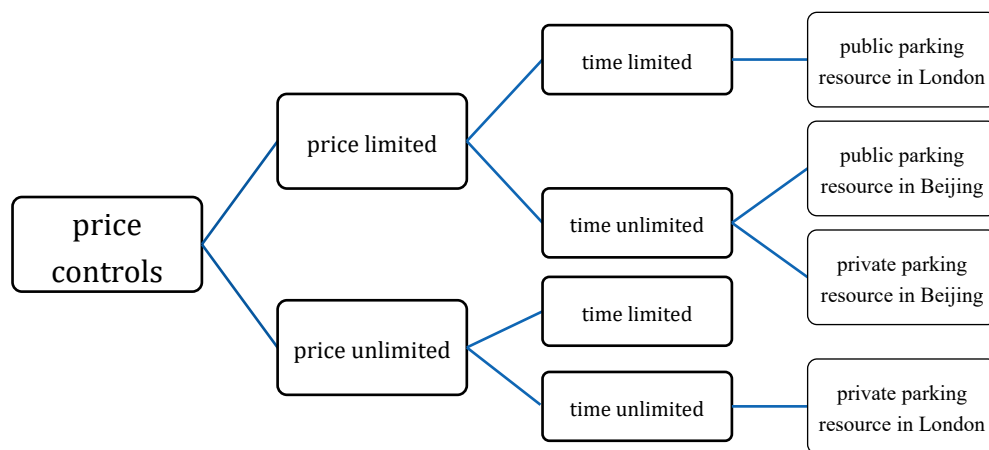


Figure 3. Parking Price Controls Differences between Beijing and London.

3.4. Analysis Method

Based on the platform perspective, this paper analyzes the impact of price controls on the behavior of the supply side (including public parking resources, private parking resources, and various shared parking spaces), the demand side (mainly individual users), and the platform (parking applications), thereby revealing that price controls have an impact on the digital platform ecosystem of parking. At the same time, through comparative analysis, this paper will study the different effects of parking digital platforms in Beijing and London under different price control measures.

4. Results

Among many factors that affect the establishment and improvement of the digital ecosystem of parking platforms, it is clear that infrastructure construction and smartphone penetration are not the main reasons for the large differences between Beijing and London (see Table 2). Through case analysis and literature search, this paper proposes that price controls are a key factor in this process. The macro-environment of Beijing is friendly to the digital platform. Beijing has released relevant documents and even piloted parking space sharing. However, these platforms have not been able to operate sustainably. This shows that organizational inertia and employee resistance are obviously not the key reasons that restrict the development of parking applications. Then, the parking price controls, as a key factor affecting the process, will be analyzed below.

4.1. Parking Price Controls Differences between Beijing and London

From Table 3 and Figure 2, the main differences in parking price controls between Beijing and London are shown in Figure 3. In general, parking resources in London are priced flexibly, while similar areas in Beijing are almost uniformly priced.

The “public parking” and “private parking” mentioned below are defined in this way. Public parking is regulated through the *Traffic Management Act* (British). Public car parks are managed by local authorities. Private car parks are managed by a private parking company, these can be at train stations, retail parks, healthcare facilities, universities, private residential areas, and railway stations to name a few (full text URL <https://www.britishparking.co.uk/News/Page-10/how-parking-is-managed/81026>, accessed on 4 March 2022).

4.2. Impact on the Suppliers

The supply side includes public parking resources provided by the government, private parking resources, and shared parking spaces for social organizations or individuals.

(1) The impact of Beijing's price controls on the supply side

First, the mobility of public parking resources has been reduced, for there is no limit on parking duration and interval. In addition, a parking space in the downtown area is hard to get and the charge is affordable, so once drivers get a parking space, they will park as long as possible and are not likely to move, which greatly affects the resource utilization rate.

Secondly, parking resources are used for other purposes. A standard parking space covers an area of 6 square meters. In the regions of class I in Beijing, which are the highest-priced, the monthly rates of parking are ¥150; if it is charged by the hour, taking into account the vacancy rate of 30%, the monthly rates are ¥2457. Compared with the high housing and shop rent in the same area, the monthly income of parking fees is only ¥150–2457. The value of parking spaces is obviously underestimated. Therefore, if used for other business activities, the parking space will bring higher income. Even the parking resources specified in the city plan may be used for other purposes. Some residents even rented parking spaces nearby to use as storage spaces.

Thirdly, the supply of private parking resources has been restrained. Price controls make the return of social capital investment in parking lots lower than that in other areas. Therefore, the supply of private parking resources on the market is becoming less and less.

Fourthly, the investment in parking resource digitization has been depressed. To join the digital platform requires the payment of certain digital costs, for example, sensors need to be installed in parking spaces, the application needs to be installed on mobile phones, and the platform needs revenue-sharing after charging. On the other hand, parking resources are in short supply, therefore, the parking space suppliers are unwilling to put parking resources on the platform.

(2) The impact of London's price controls on the supply side

First, the mobility of public parking resources has been improved. Due to time limits and high fines, drivers will not occupy parking resources inefficiently for a long time, thus parking spaces can serve more citizens.

Secondly, a supervision mechanism is automatically formed to resist illegal use. If a subsequent vehicle discovers that the preceding vehicle parks over the time limit, even if the regulatory agency does not detect it, the latter will report the case to protect his interests. Therefore, it is unlikely that parking resources may be used for other purposes.

Thirdly, the supply of private parking resources is increased. No restrictions on price stimulate social capital to invest, thereby increasing the supply of parking spaces. For example, NCP (National Car Parks) has parking garages in all the prime locations and airports in major cities in the UK. The charge is relatively high and there is no time limit. The company has also created more than 20 parking lots in the core area of London. If a driver needs to find a parking space urgently, he can park directly in a high-charging parking lot of a professional parking company, without needing to search or wait for a parking space. Instead of using the ordinary traffic sign "P" in the parking lot, NCP uses its own sign to help consumers to distinguish.

Fourthly, digital investment is encouraged. As long as there are enough users on the platform, the suppliers will have the motivation to carry out infrastructure construction, including the installation of sensors and the implementation of unmanned management. In order to improve competitiveness, private parking resources also have the incentive to join the platform to get access to more users.

4.3. Impact on the Demanders

The demand side mainly considers individual drivers, for other types of users make up only a small proportion.

(1) The impact of Beijing's price controls on the demand side

No differences among parking spaces mean users have no motivation to use the parking application. From the perspective of the demand side, uniform pricing and no time limit make each parking space the same for the users. Therefore, users do not have to turn to a parking application if all they have to do is to find a parking space nearby; if they cannot, they might just park illegally.

(2) The impact of London's price controls on the demand side

Huge differences in parking space prices and time limits make it necessary for the users to use the parking application. The public parking lots in London have relatively lower charges, but the charging mechanism of different parking lots varies greatly. Parking charges differ at different time intervals, and even two adjacent parking lots have different charging standards (see Figure 3). In addition, the parking price mechanism is flexible, with both changes in the pricing time unit and price fluctuation during peak and off-peak hours. In Figure 1, the parking price ranges from £1.6 to 62.3. Using an application can save users money. In addition, most public parking lots and public on-street parking spaces have time intervals and duration limits. For example, a common sign is "Monday to Friday 8:00 to 18:00 two hours no return". In order to avoid the manual checking of these sophisticated management regulations, drivers have to use an application to select suitable parking spaces.

4.4. Impact on the Platform

The platform mainly refers to parking applications. Similar to online car-hailing or e-commerce platforms, operators generally charge a certain percentage of the parking fees traded on the platform, or charge a fixed fee. Different control measures have different effects on the development of the platform.

(1) The impact of Beijing's price controls on the platform

First, it is difficult to form a platform ecosystem. From the above analysis, it can be seen that both the supply and demand sides of parking in Beijing do not have a high willingness to use the platform. At present, the Beijing Municipal Commission of Transport has developed an application called "Beijing Transportation", which only has the function of electronic toll collection. It can neither be used to search nor reserve parking spaces. With no bilateral market, it can only be regarded as a payment tool instead of a platform.

Second, the platform is difficult to operate sustainably. With few supply and demand sides on the platform, few transactions can be facilitated. Platform operation and maintenance rely on the commission of transaction fees, and it is difficult for developers to profit from operating a platform that has few transactions. Therefore, no one in the market is willing to provide platform services, or the platform provided is difficult to operate sustainably. Over 10 parking applications appeared one after another in Beijing and almost all of them have ceased operation.

(2) The impact of London's price controls on the platform

First, it is easy to form a platform ecosystem. From the above analysis, it can be seen that both the supply and demand sides of parking in London have the need to settle on the platform. Large transaction volumes on the platform enable the platform operator to achieve great benefits, which, in turn, attract more operators to enter. In fact, there are various parking applications in London, and many of them are developing steadily, such as JustPark and Ringgo.

Second, it promotes product or service innovation. The bigger the number of entry supply and demand sides, the greater the value of the platform, and the more diverse and efficient the services that can be provided. Through innovation, the platform further

improves the efficiency of resource allocation. For example, JustPark has developed a parking lot dynamic pricing system that optimizes charges based on historical occupancy rates and search data, decreasing charges during off-peak hours to encourage drivers to park, and increasing charges during peak hours to reduce reservations and ease congestion.

Third, it further enhances the attractiveness of the platform. On the one hand, the platform has the ability and willingness to invest more funds to promote the market on the demand side, and attract users through various preferential or personalized services to raise net flow in the platform; on the other hand, the platform has the ability to empower the suppliers by carrying out digital investment to support the installation of sensors in parking spaces. In addition, the empowerment by the platform on the supply side enables many traditional suppliers to enter the market. For example, the parking spaces of individuals, churches, or other social organizations can be easily shared through the platforms. Drivers can reserve a parking space and pay for the parking duration via the application in advance, and upon their arrival at the parking lot, they can park directly. The price of booking a shared parking space is generally higher than that of a public parking space, but cheaper than a private parking lot. There are many shared parking spaces available for reservation near airports, football clubs, and popular attractions.

4.5. The Influence Mechanism of Price Controls on the Digital Platform Ecosystem

Digital platforms combine and deploy these technologies in new ways to incubate and coordinate an ecosystem of supply and demand [50]. Through the comparative analysis of Beijing and London, the influence mechanisms of different price controls strategies on the ecosystem of digital platforms are as follows (see Figure 4):

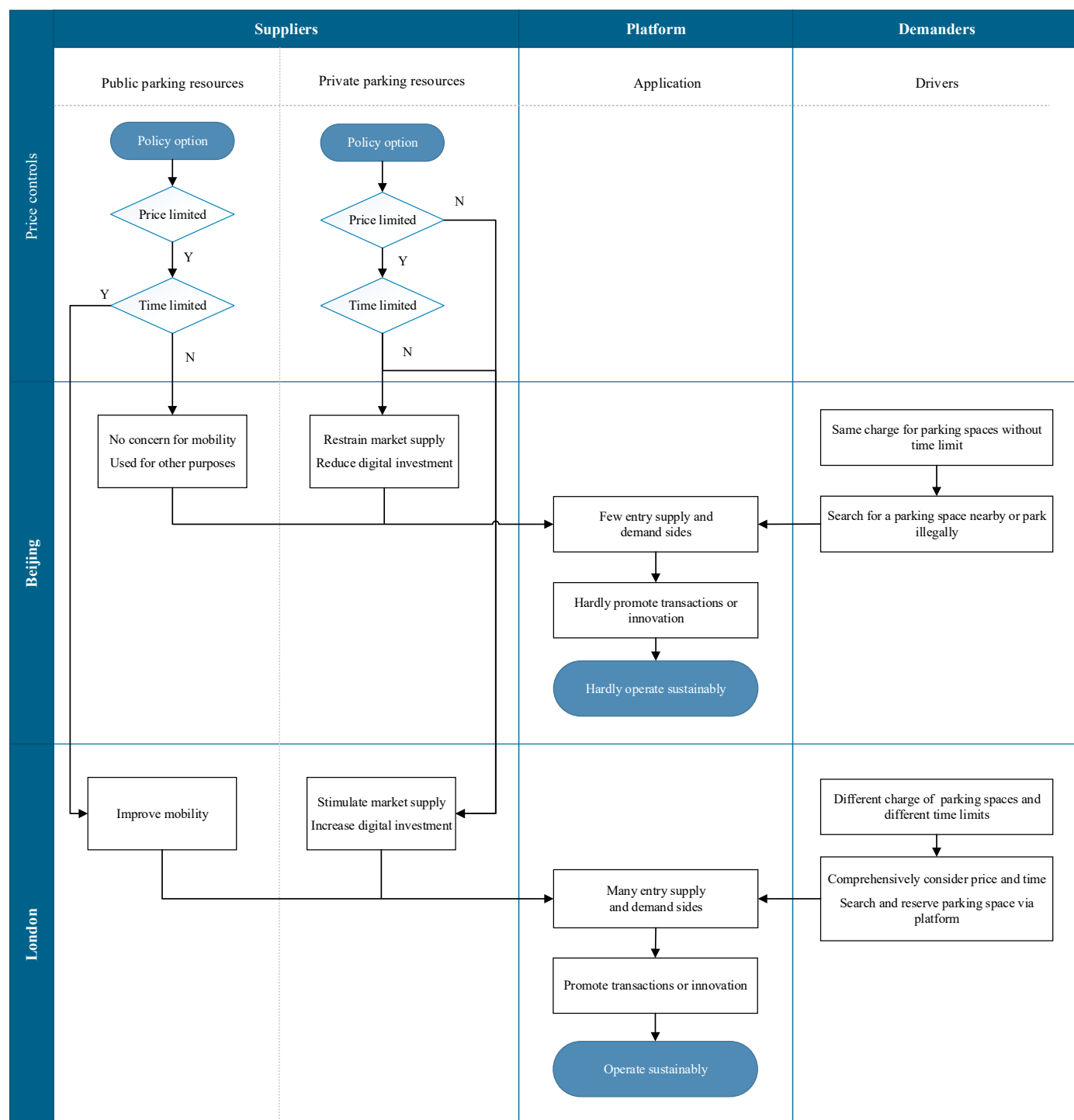


Figure 4. Price controls and the ecosystem of parking platforms.

When the price is uniformly limited and time unlimited, for the public parking resource suppliers, the mobility of parking spaces is reduced, and parking spaces can easily be used for other purposes; for private parking resources, the supply of parking spaces is restrained, and their digital investment is depressed. For users, as the parking space charges are the same and time is unlimited, they will search for one nearby or park illegally, having no demand for a platform. For the platforms, few entry supply and demand

sides make it difficult for them to promote transactions and innovation or to operate sustainably.

When pricing and time limits are differentiated, for the public parking resources, the mobility of parking spaces is improved, and the subsequent vehicle can supervise the preceding vehicle; for private parking resources, no price restraint stimulates the supply of parking spaces and increases their digital investment. For users, the price difference and time limits require them to search and reserve a parking space via the platform. For the platforms, many entry supply and demand sides can promote transactions and innovation, and enable them to operate sustainably.

5. Discussion and Policy Recommendations

5.1. Theoretical Contribution

The digital platform ecosystem of parking involves multiple research fields such as urban management, platform economy, and information system. By comparing the parking price controls and the development of the digital platform ecosystem in Beijing and London, this paper has the following main theoretical contributions:

(1) Enriching the literature on the digital platform ecosystem and IS

The existing literature on the digital platform ecosystem is mainly from the perspective of economics, technology management, and information systems [51]. This paper regards applications as the main representatives of the digital platform and combines the supply and demand to study the digital platform ecosystem, which enriches the research on the digital platform ecosystem and the information system.

(2) Accelerating the establishment and improvement of the platform ecosystem

Existing literature has long discussed platform concepts from a non-digital worldview [52]. Digital platforms are changing processes over the entire digital transformation landscape. User interactions with organizations are changing as digital platforms facilitate online communities of consumers [53]. The fundamental reason for the rapid transformation of value creation and delivery in the platform ecosystem has been the popularization and application of applications that are tied to their respective platforms. This paper takes price controls as an entry point. It accelerates the establishment and improvement of the digital platform ecosystem by promoting the development of parking applications.

(3) Enriching the research perspectives of urban parking management

The existing literature reports more research on the regulation policies on either the supply side or the demand side [4], while less is from the platform perspective. A platform can not only promote transactions, improve the efficiency of supply and demand matching, but also promote product or service innovation [54], such as promoting the development of shared parking spaces, researching and developing dynamic pricing mechanisms, etc., which will become one of the effective ways to solve the contradiction between parking supply and demand. Even though our work refers to Beijing and London, our findings comply with the findings of other case studies [9,40] regarding the impact caused by price limitations, while expanding on the research of time limitations.

(4) Expanding the research objects of digital transformation

Existing literature focuses more on digital transformation at the organizational level, with enterprises being the core, while research at the industrial or social level is comparatively insufficient [1,55]. In the research of parking digital transformation, this paper makes an analysis from the perspective of the industry and the entire digital platform ecosystem, which expands the research objects of digital transformation.

5.2. Practical Inspiration

The digital platform ecosystem of parking is of great significance to the sustainable development of cities. A smart parking system can help London save £183.6 million worth of gasoline each year and reduce its annual CO₂ emissions by 642,978 tons [56]. The widespread phenomenon of illegal parking has not only disrupted the normal order of the city and aggravated urban congestion but also cultivated the mentality that the law does not punish numerous offenders, which will affect the credibility of the government and the prestige of the law. To promote the development of the digital platform ecosystem of parking, the key lies in optimizing price control measures, adjusting the bilateral market of the supply and demand sides, and fostering a parking platform ecosystem. The specific suggestions are as follows:

(1) Optimize the controls of public parking resources

First, to limit parking duration and accelerate the flow of vehicles in parking spaces. For on-street parking spaces, it is recommended to stipulate the parking duration according to the characteristics of the road, for example, for the three basic user categories—residents, employees, and visitors of the parking management program in urban areas—2 h limits on ordinary roads and 1 h or even half an hour on important traffic roads to facilitate citizens to handle business in banks, eat in restaurants, and pick up children, for those places are usually located on the roadside. For public parking lots, time limits can also be selectively implemented.

Second, to relax price controls and use differentiated pricing to meet diversified needs. The price mechanism can be used to separate long-term and short-term parking needs, avoiding those with different needs from queuing together, to serve more drivers and reduce the waste of social time caused by queuing [57].

(2) Cancel price limitation of private parking resources and encourage them to increase the supply

If private parking resources are restricted to the charging standard of public parking resources, the return on investment will be limited, which, in turn, affects the enthusiasm of social capital for providing parking spaces.

First, to abolish price limitations on private parking lots and encourage parking companies to establish networks in core areas. While providing affordable and time-limited public parking resources, private parking networks that operate on the market should also be vigorously encouraged. Operators are responsible for their own profits and losses, therefore, they will actively explore sustainable pricing and operation methods.

Second, to encourage social organizations or individuals to share parking spaces. According to current laws and regulations in China, charged parking spaces that are supplied without permission are “illegal”, and fees charged higher than the government guide price may be reported and investigated. London has no price controls on the parking resources on the market. It attracts social organizations and individuals to actively provide parking resources. For example, there are many individuals who have shared parking spaces on JustPark (see Figure 1). Price and access restrictions should be lifted, and social organizations or individuals should be encouraged to share parking spaces when they are vacant.

6. Conclusions

From the perspective of the platform, this paper compares the differences in parking price controls between Beijing and London, analyzes the impact of price controls on the ecosystem of the parking digital platform, enriches the research literature on digital platform ecosystem, urban parking management, etc. at the theoretical level, and puts forward policy suggestions on urban parking digital platform at the practical level. This paper also has limitations. First of all, there are differences between public and private parking resources. Second, according to the principle of cross-experimental design, there are some scenarios that have not been considered, such as the uniform pricing of public

parking resources with time limits, or the uniform pricing of private parking resources with permission of higher prices. Under these circumstances, what kind of situation will occur in the digital platform ecosystem needs more systematic and in-depth research in the future.

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