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# 13. The rise of online ride-hailing services and their impact on urban transport in China

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## 1 INTRODUCTION

Online ride-hailing services (ORS) (including tailored taxi services, express taxi services,<sup>1</sup> ride-sharing services, and so on), as a new business mode using mobile Internet technology for ride-hailing and commuting services, started in San Francisco in the US in 2009 and expanded rapidly to major cities across the globe. ORS initiated a revolution against traditional taxi services and has had significant influence on the commuting preferences of city residents and urban transport.

China is one of the pioneers in terms of online ride-hailing services. The first Chinese ORS provider started operation as early as 2010, after which various ride-hailing mobile applications and operating platforms came to the stage. Chinese online ride-hailing markets have experienced the phases of birth, rapid growth and regulation through official supervision by the government. The rise of online ride-hailing services has reshaped the entire landscape of the taxi industry and Chinese cities' traffic dynamics; therefore, it is necessary to have a systemic overview of its developing status in China and discover its effect on policies developed to address the traffic in Chinese cities.

A detailed discussion will follow. Section 2 analyses the reasons for the ORS boom in China from the perspective of its background, developing phases and modes. Section 3 will develop a theoretical model to analyse the impact of online ride-hailing services on city traffic, in alignment with some empirical evidence from a few Chinese cities. Section 4 will briefly introduce the new regulation framework rolled out by the Chinese government in 2016 and discuss its implementation in different cities. The last section will provide relevant discussions and policy propositions.

## 2 THE RISE OF ORS: ORIGINATION, DEVELOPING PHASES AND MODES

### 2.1 Background

#### **Commuting modes in current Chinese cities**

Entering the twenty-first century, commuting modes have transformed significantly across Chinese cities, due to the improvement of city residents' income levels, a diversification of commuting purposes, longer travelling distances, and the enhancement of public transportation facilities. In general, public transportation remains the major component of Chinese city transportation.

Take Shanghai as an example. According to Shanghai's 5th general transportation

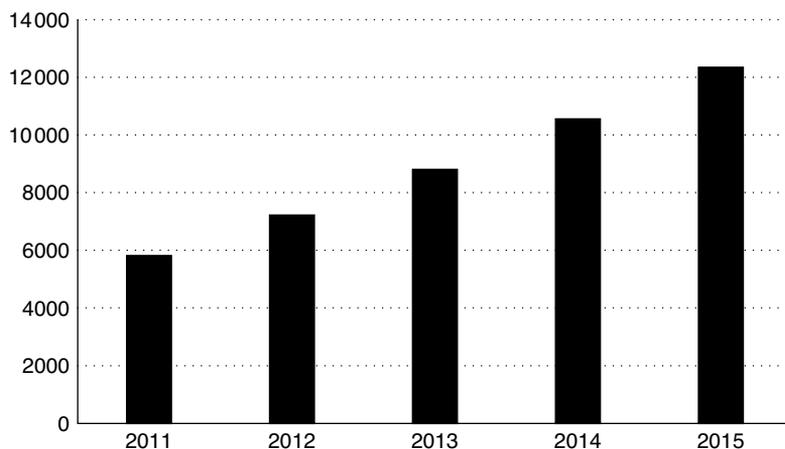
survey (Shanghai research institute of urban and rural development & transportation development, 2015), if we compare the data for 2014 and 2009, the overall commuting population has increased 12 per cent to 55 million person trips per day, the average trip distance for a city resident has increased 0.4 km to 6.9 km, the number of rail transit operating routes has reached 15, total rail length has increased from 355 km to 577.6 km, and personal car possession has doubled to 3.2 million. With all the changes that have taken place, the commuting landscape for the Shanghai city resident has experienced significant changes. Rail transit represented 8.3 per cent of all commuting approaches in 2014, personal cars represented 17.3 per cent and scooters represented 20.2 per cent, up by 3.4 per cent, 5.3 per cent and 3.9 per cent, respectively, compared with 2009. Conversely, bicycles and motorcycles represented 7.2 per cent and 1.5 per cent, down by 6.9 per cent and 2.6 per cent, respectively. In 2014, public transportation including rail transit, bus, taxi service and ferry reached 15.21 million passenger volumes, on average, per day, up by 34.8 per cent compared with 2009. Within the central district, which is defined by outer ring road, public transportation represents 48 per cent of total commuting volume.

Take Beijing as another example. According to Beijing's 5th general transportation survey (Li et al., 2016), as of the end of 2014, Beijing has 18 rail transit operating routes with a total length of 527 km, which has increased by 299 km since 2009. In 2014, the total number of trips within the six-ring area reached 4.445 million per day, up by 14.7 per cent from 2010 levels. The average trip distance for residents is 8.1 km, up 0.5 km from 2010 levels. In this context, among various commuting options for city residents, the proportion of rail jumped sharply from 11.5 per cent in 2010 to 18 per cent in 2014. In 2014, the proportion of public transportation, including rail, bus and taxi service, was as high as 51 per cent, up about 4.5 per cent over 2010 levels, while the proportion of passenger car travelling fell slightly.

Although private car ownership in China's household sector (mainly urban households) increased by 66 million between 2011 and 2015 (more than doubled, see Figure 13.1), generally, public transportation remains as the major commuting way across Chinese cities. According to "Chinese major urban public transportation data analysis report in 2016" published by Gold Maps (2017), a total of 29 cities have built rail transit lines, with 138 operating lines and a length of 3960 km. Seven cities, including Shanghai, Beijing, Guangzhou, Shenzhen, Nanjing, Dalian and Chongqing, operate transit lines that are over 200 kilometres in length. The bus service for Chinese major cities has a total length of 529,000 kilometres and serves six cities, including Shanghai, Guangzhou, Beijing, Chongqing, Shenzhen and Suzhou, with more than 1,000 bus routes in total. The improvement of urban public transportation infrastructure has ensured the feasibility of public transportation for residents' daily commutes among the major cities in China.

### **The development, regulation and problems of the taxi market**

Since the beginning of the new century, China has experienced rapid urbanization, which has led to the construction of public transport facilities being unable to catch up with the pace of urbanization. To better satisfy the residents, many big cities have adopted a resolution to develop taxi fleets to supplement the shortage of bus and rail transit. After years of development, the taxi service has become an important part of China's urban transportation system. According to "Statistics bulletin of the transport industry development" published by China's Ministry of Transport in 2017, as of late 2016, the



Source: Traffic Control Bureau of the Ministry of Public Security, China (2015).

Figure 13.1 *Private car holdings in China 2011–2015*

number of taxi vehicles in China reached 1.404 million compared to 1.2638 million in 2011, for a growth rate of 9.99 per cent. Passenger volume has grown to 128.515 billion from 116.556 billion in 2011, with a growth rate of 9.3 per cent.

However, the taxi industry in the process of rapid development has experienced several regulatory failures: first, after 2004, cities were required by the central government to strictly control the number of operating taxis, which disrupted the capacity-driven dynamic adjustment mechanism and froze the flexibility of the entire supply in the industry, resulting in the consequence that the increase in the number of taxis could not catch up with the growth of the urban population, and even worse, with a long-term stagnation in taxi numbers, the residents find it more and more difficult to get a taxi. Since 2003, for example, Beijing's permanent population has grown by 40 per cent, but the number of taxis has risen by only 1,000, with a growth rate of only 1.5 per cent over the same period. The number of taxis in Shanghai has been held at around 50,000 for years. As taxi capacity lacks a dynamic adjustment mechanism, one of the consequences derived is the popularity of the "black car".<sup>2</sup> One estimate indicates that the size of the "black car" market almost equals that of normal taxis in Beijing. Sometimes city residents could choose to travel only in black cars, not only paying higher fees but also facing greater safety issues. The shortage of taxis has also led to a much longer waiting period for passengers, and licensed taxi drivers have become quite picky; refusing to serve certain passengers and poor service attitudes have become a common phenomenon, especially on rainy days and during rush hours.

Second, to reduce regulatory costs, in terms of the taxi industry's business operating model, major cities' taxi supervision departments are increasingly inclined to encourage corporate operation rather than individual operation. However, due to a lack of regulatory standards and the enforcement of a profit-sharing mechanism between corporations and taxi drivers under a corporate operating scheme, the drivers' interests have not been

properly considered because of their weak negotiation power, which leads to worsening incomes and working conditions, as well as more conflicts of interest. By charging higher fees for management and services, the taxi companies actually obtain a bigger share of the operating revenue than usual. At present, apart from a small number of individual taxi drivers (which accounts for roughly 16 per cent of the total vehicles), the vast majority of taxis are operated by corporations that use three different forms: contract operation, cooperative operation (or “standard renting operation”) and affiliated operation. Some urban management departments not only supervise but are directly involved in the contracting process between the corporations and taxi drivers, and even decide the fees for the company’s management and service. However, most city managers only review the compliance of the contract and the cost of the company.

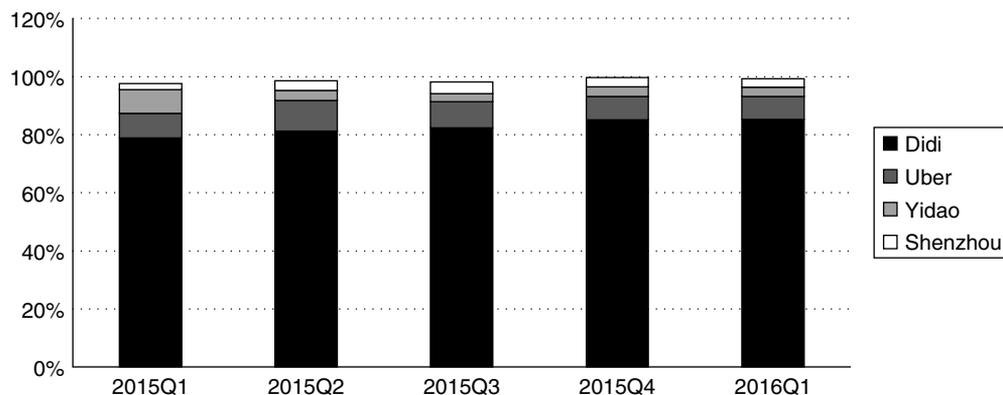
Third, the management of the taxi operating licenses is chaotic. In different stages of development and in different cities, the leasing of taxi licenses has taken place in various forms, including qualification examinations, public auction, and bidding in terms of service quality. In these forms, some of the licenses are paid for, and some are unpaid; some have limited valid periods, while some do not. In general, paid licenses have limited valid operating periods and must be renewed or redistributed at maturity. Although the government has no clear provisions on whether a taxi license can be traded in the secondary market, many cities are now facing problems because licenses have been transferred privately, with increasing market prices. Considering that redistributing the licenses that are expired or about to expire would cause the competition of benefits. For example, how to set standards for the redistribution of licenses. Based on previous experience, redistributing the licenses gives rise to strike of taxi drivers and the operation problem of the taxi company, which affect the stable operation of the city traffic, so some cities have no plans to redistribute them due to pressure from local communities because of concerns related to social stability, which leads to unrestricted licenses and makes it more difficult for the city management to control traffic capacities.

Fourth, the taxi pricing mechanism is not reasonable for two main reasons. First, there is lack of a dynamic price adjustment mechanism. As a consequence, taxi prices have remained unchanged for years, although there has been a significant increase in domestic prices index. This is fuelling too much demand for taxis and increasing the gap between supply and demand in the industry; On the other hand, it also continuously deteriorates the drivers’ income; they must work longer hours and suffer damage to their health and passenger safety because of driving fatigue. Second, taxis that operate in the same city are priced in a uniform pattern, resulting in the unbalanced allocation of taxis in different areas. Drivers are more willing to do business in regions with crowds rather than work at the edge of the city or low-income regions, which reduces the feasibility that taxis, as an important part of the public transport system, offer a universal service.

## **2.2 Development Phases of ORS**

Thanks to a wave of mobile Internet technology, China’s taxi industry, which badly needs to reform, has encountered a formidable challenge in the form of online ride-hailing services.

In 2010, Yidao, the first online ride-hailing services platform, was founded. In the following four years, online ride-hailing services platforms such as Kuaidi, Didi, Shenzhou



Source: CNIT-Research (2016).

Figure 13.2 Market share of online ride-hailing platforms in China in 2015Q1–2016Q1

and Uber China, came to the stage and started strategic operations. However, due to the limited initial user base, the development of the ride-hailing market was slow at the beginning. After 2014, with the development of mobile Internet technology, there has been explosive growth in various service industries based on mobile Internet, and the market for ride-hailing has also entered a period of rapid development. To improve market penetration, the ride-hailing platform companies, which are valued based on network traffic flow, have launched several rounds of marketing battles by using subsidy as a weapon. After fierce market competition, the online ride-hailing services eventually formed a relatively stable industry, by the first quarter in 2016, the four major players, including Didi, Uber, Yidao and Shenzhou, represented 99 per cent of the overall online ride-hailing services market (Figure 13.2).

When Didi acquired Uber China in August 2016, the landscape of the entire business was determined. By the second quarter of 2017, according to a survey conducted by a think tank research advisory group,<sup>3</sup> Didi dominated the market with more than 90 per cent of the market share, followed by Yidao, Shenzhou and others. In 2015, the Geely group introduced Caocao Car (an online hailing services) with 100 per cent new energy cars in operation, which was backed by subsidy policies of the Chinese government for new energy cars. Geely also relied on its own technical support and professional drivers, finding its own way of development and it gets a lot of attention from the market now.

The development process of the online ride-hailing market can be divided into three stages: the market formation stage from 2010 to 2013; the rapid development stage from 2014 to 2016; and a period of regulated development since 2016.

### **The stage of market formation: 2010–13**

During this stage, the growth of the ride-hailing market is constrained by various factors. First, because the mobile Internet was relatively low in popularity, the supply of service is clearly inadequate to drive the growth of the mass market. Second, the habit of using mobile Internet for commuting was yet to be developed, leading to the slow development

of the online ride-hailing market. Finally, the government's policy guidance on the nascent ride-hailing market was unclear, leaving market participants wary of policy uncertainty.

### **The stage of rapid market development: 2014–16**

The online ride-hailing market has experienced explosive growth since 2014 because of a number of factors: first, due to the continuous improvement of China's mobile Internet penetration, the mobile user base has doubled to reach 600 million, compared with the market beginning in 2010; second, the business of the ride-hailing platform is opening up to more users, which promotes the broadening of the user base; and third, there are more than 100 million private cars in Chinese cities, and this large number of private cars in China ensures that the high-end demand will be satisfied, which has become a considerable advantage for expanding the supply of vehicles. Finally, the consumers' habits of using mobile communications to meet the needs of commuting are gradually formed, and strong demand is also an important driver for the rapid expansion of the market.

### **The period of regulated development since 2016**

In July 2016, the Chinese government formally issued "guidelines on deepening the reform to promote the healthy development of the taxi industry" and "interim measures for online ride-hailing services", officially bringing online ride-hailing services development and regulation into the government legal framework. By the end of 2016, some cities issued their own regulatory rules, and online ride-hailing services moved to the orderly regulated development stage. Not only does the company need to obtain a business license, but the drivers and cars must meet the corresponding requirements.

## **2.3 Development Modes of ORS**

ORS offer taxi booking services using mobile Internet technology, but they still belong to taxi industry. In accordance with the management system of taxis at all levels of government in China, companies engaged in the leasing of car services must obtain business licenses and meet the corresponding requirements; otherwise, they are operating illegally. However, because of new technology, the ride-hailing model has many new features that are difficult to regulate. Therefore, before the release of relevant laws and documents from the government, online ride-hailing services are operating in the grey zone, and companies operating within the development model are trying to avoid confrontations with current laws and regulations. In general, before July 2016, there were two types of development modes for each platform company.

The first mode is the Business-to-Customer (B2C) mode, which has two types. One is traditional B2C, such as Caocao Car and Shouqi car service which operate in a heavy asset business mode, where each company hires its own cars and drivers. The second is B-B-C, which is a collaboration between an online ride-hailing service platform, a car rental company and a labour dispatch enterprise. When passengers request commuting services using the platform, the platform company will initiate a car renting request to the car rental company and a driver hiring request to the labour dispatch company, on the behalf of passengers, to meet the demand. In this mode, the platform company acts as an intermediary by providing a matching service of car renting and driver hiring, without creating a new form of business by the law. The passenger pays the rental fee, the driving

fee and the brokerage fee in one package to the platform company, which then settles with the other two parties. Shenzhou is an example of this; it has its own car rental company and ride-hailing services. In the B2C mode, drivers are officially hired and trained and act under the company's supervision, which provides better security to the customers. Drivers are also paid a base salary and a bonus, which offers better job security and more job satisfaction. B2C businesses normally push through orders to drivers to make sure customers' orders are responded to quickly. Because it offers higher service quality than the Customer-to-Customer platform, the B2C platform charges a higher rate.

The second mode is the C2C mode, which involves private car owners who register on the online ride-hailing service platform to receive information regarding the commuting demand. Passengers pay the fees to the platform, which then settles with the car owners and other parties after the service has been provided. C2C platform registered drivers are not official employees; they do not have stable incomes and drive their own cars, which may raise more security issues. These platforms have lower registration criteria, so they can attract more registrations. Drivers' income mainly consists of driving fees and subsidies from the platforms. C2C platforms push through orders to a group of drivers and let the drivers pick the customers up. The C2C mode also includes ride hitching services, where private car owners state that they are just sharing the ride with the passengers, and the passengers are only sharing the costs, which is not a commercial business. We compare the two different modes in Table 13.1.

In the process of development, especially after 2014, various online ride-hailing service providers have subsidized the drivers and passengers at the same time to gain an advantage and increase the market share of personal car owners and passengers. This competition is known as the "money burning war" because of the massive operating costs incurred by each platform. Subsidies have boosted drivers' incomes for every ride, encouraging more private car owners to join the service team. In addition, at the same time, subsidies have greatly reduced city residents' travel costs by using online ride-hailing services for each trip, encouraging more people to use the services rather than considering other travel options. As a result, the "two-way subsidy" has driven the demand curve and supply curve of the ride-hailing service market to the right at the same time, leading to a rapid expansion of the market size of the ride-hailing services in the short term.

*Table 13.1 B2C mode and C2C mode comparison*

Mode Difference	B2C		C2C
	B-C	B-B-C	
Driver source	Employed by platform	Labour dispatching company	Self employed
Driver income	Base salary + bonus	Base salary + bonus	Commission + subsidy
Vehicle source	Owned by platform	Car rental company	Owned by drivers
Order management	Push through orders	Push through orders	Push + Driver pick up
Typical company	Caocao, Shouqi cars	Shenzhou Cars	Didi, Yidao

*Source:* Author.

### 3 THE IMPACT OF ORS ON CITY TRAFFIC

#### 3.1 Theoretical Model

The emergence of online ride-hailing services has greatly affected Chinese city residents' travel options. In the short term, the price subsidy of this new mode of transportation has changed the relative prices of the different travel options; some residents who used to choose public transport (rail transit or bus) now use non-intensive ride-hailing services.<sup>4</sup> This change will undoubtedly increase the load on the city's ground roads, especially during peak hours. At the same time, some of the original private car users may reduce the use of their own cars and use more cost-effective ride-hailing services, thereby easing the degree of traffic congestion. To better describe the aggregate impact of the online ride-hailing services on the city traffic, we tend to use the following fundamental theoretical models.

##### Travel cost function and work utility

We count personal commuting costs, time costs and the comfort-level differentiation of different commuting options together as travel cost. We note the initial travel cost for using private cars and public transport as  $\bar{C}_d$  and  $\bar{C}_p$ , respectively, assuming  $\bar{C}_d > \bar{C}_p$ . In addition, we note the corresponding real travel cost<sup>5</sup> as  $C_d(Q_d)$ , and  $C_p(Q_p)$ , and the total compensation for working as the work utility, noted as  $U_{work}$ .

For a rational worker, if  $U_{work} > C_p(Q_p)$ , he should choose to work, otherwise he should choose to work at home or not to work at all. Especially when  $U_{work} > C_d(Q_d)$ , he could choose to drive to work. In addition, if  $\bar{C}_d > U_{work} > \bar{C}_d$ , he should prefer to use public transport for commuting.

##### Commuting mode selection decision

Assuming that the entire city working population is  $N$ , the following would be the commuting choice in different scenarios:

*People choose private cars (own car or taxi) for daily commuting to workplace:*  $Q_1$  All the workers who meet  $U_{work} > C_d(Q_d)$  and  $C_p(Q_p) > \bar{C}_d$  would choose this way, who are normally a high-income group and have a high standard for commuting quality. They do not rule out the option of public transport.

*People choose public transport to work:*  $Q_2$  All the workers who meet  $\bar{C}_d > U_{work} > C_p(Q_p)$  would choose this way, including some of the private car owners who prefer public transport because of its lower cost.

*People choose to walk, cycle to work or work from home:*  $N - Q_1 - Q_2$  When the work utility is lower than the public transport cost, this group would choose to walk or cycle to work or work from home.

##### Urban road traffic congestion

To discuss the impact of city residents' commuting choices on traffic congestion, first, we need to define some parameters that need to be calculated and estimated but remain fixed over a short period of time.

- (1) Maximum number of private cars that the city can load:  $Q_{\max}$

In the long run, the more roads the city has, the more cars it can load, and the higher  $Q_{\max}$ . Given a fixed number of roads in a city,  $Q_{\max}$  remains unchanged in the short term, indicating the full capacity of the roads.

- (2) Number of passenger cars in the city:  $Q_t$

If  $Q_t < Q_{\max}$ , then the city is still functioning, although it may still have the possibility of serious congestion, depending on the difference of these two parameters. If  $Q_t > Q_{\max}$ , then the city must suffer from serious congestion, and we need to discuss the various possibilities of urban congestion. We assume that  $Q_t$  is also a fixed parameter in the short term.

- (3) Number of cars on the road at an acceptable comfort level:  $\bar{Q}$

When the number of cars on the road is  $\bar{Q}$ , the congestion level is the upper limit, which is acceptable. Despite the longer commuting time, the work utility of private car commuters is still greater than the travel cost. In addition, when the number of cars on the road exceeds  $\bar{Q}$ , undesirable congestion occurs, which would affect most workers' utility, adding more pressure to the city traffic and may even result in serious air pollution, and so on.

When the number of cars on the roads exceeds  $\bar{Q}$ , the supervision department would have to focus on reducing the number of  $Q_t$ , which is the number of private cars on the road.

At present, to control the number of  $Q_t$ , city supervisors mainly focus on quantity control. In Shanghai, the government sets the restrictions on non-local car plates in rush hours, while in Beijing, the government set restrictions based on the last digit of car plates. Some foreign cities incorporate congestion charges or have auctions for the usage of certain roads.

When the city's car ownership  $Q_t < \bar{Q}$  which generally only occurs in third or fourth tier cities where the road supply is sufficient and the population density is low, this implies that there are fewer driving needs and less car ownership. Even if all the city's private cars were driving on the road, it would not produce congestion or serious congestion. That is, the regulators do not need to supervise traffic in this scenario, and it is beyond the scope of our discussions here.

- (4) The decision-making mechanism of personal car owners providing ride-hailing services

We assume that the market price of the ride-hailing is  $P$ , that is, the cost of ride-hailing for passengers, and according to the actual situation, the price of the ride-hailing is between the public transportation cost and the driving cost (including the taxi price),  $C_d > P > C_p$ .

First, private owners who provide online ride-hailing services can earn an additional revenue, thereby increasing the effectiveness of driving trips. Assume that each owner is the recipient of the market price  $P$ , which means that the provision of services is equivalent to its utility, which moves upwards as a whole. On the other hand, because picking up a customer will include detours and sharing the enclosed space with strangers, hygiene issues and other issues, such as the owner's travelling costs, would increase as well. However, it cannot move up the cost curve directly because this part of the cost for the individual is different. Individual differences have

been explained in the model by the different utilities of travelling to work; therefore, the cost of providing the car service can be set as a function of work utility. The higher the work utility, that is, the higher the income of the group, the greater cost they would perceive the provision of car service. Let  $V$  be the cost of providing the car service, then  $V = V(u)$ , and  $V$  is an increasing function with respect to  $u$ , the work utility. According to the work utility and driving cost described above, we can calculate the net utility when driving the car.

$$\tilde{U}_{\text{ride-hailing driver}} = U + P - V(u) - C_d(Q) \tag{13.1}$$

For the users of online ride-hailing services, the net utility  $\tilde{U}_{\text{ride-hailing user}} = U - P$ , which means that when the personal car owners decide whether to either provide a service or to be served, the equilibrium would be  $\tilde{U}_{\text{ride-hailing driver}} = \tilde{U}_{\text{ride-hailing user}}$ .

Then, we have  $2P = C_d(Q) + V(u)$

$$P = \frac{C_d(Q) + V(u)}{2} \tag{13.2}$$

For the individuals with a work utility of  $u$ , when the price of ride-hailing  $P > \frac{C_d(Q) + V(u)}{2}$ , they would choose to provide the services. In addition, when the price of ride-hailing  $P < \frac{C_d(Q) + V(u)}{2}$ , they would choose to become passengers.

**The impact of ride-hailing services on congestion and its uncertainty**

For the determined ride-hailing price  $P$ , the decision of the individual travel mode is affected by the car owners' cost to provide service  $V(u)$ , which is the elasticity of supply.<sup>6</sup>

- (1) When the price of online ride-hailing services is low: uncertain influence on the city's congestion level

As the price is reduced, a group of workers who use public transport for commuting or drive to work previously would turn to online ride-hailing, resulting in increasing demand.

On the supply side, if the supply elasticity is low, increasing the price would not increase the supply of cars, and a low price has little incentive for the drivers. Therefore, the number of cars on the road would decrease, which would ease the congestion. In contrast, if the elasticity is high, the increasing price would increase the number of cars on the road and the congestion level. In addition, in the long run, some people may purchase private cars for this business, increasing the total number of cars in the city and on the road, which would increase the congestion level.

- (2) When the online ride-hailing price is high: a significant increase in congestion

Assuming that the price of the ride-hailing is high, the  $U_{\text{work}}$  of the workers who provide the service is increasing.

There is a very large supply of vehicles, as many car owners who did not previously drive cars are now joining the service team. On the other hand, similar to the previous analysis, the demand side is limited. If the market is effective in the long term, it

can automatically adjust back to its equilibrium state. However, in the short term, a large number of car owners are out on the roads, causing congestion.

### **Discussion: The two-way subsidy from the platform**

If a platform company subsidizes the driver and the passenger at the same time, just as the practice taken by most of the platform companies in the money burning wars in China, it increases the price of the service for the driver to induce more private owners to join the service fleet and may even encourage some people to purchase new cars for this business. But at the same time, it is reducing the price of the service for the passengers to induce more original public transport workers to switch to taking ride-hailing services. The end result is a significant increase in the city's congestion.

## **3.2 Empirical Evidence**

Based on a questionnaire survey completed by residents of Beijing in July and November 2015, Gao et al. (2016) estimated that the total number of ride-hailing vehicles travelling in Beijing in November 2015 was 3.526 million per day, accounting for 11 per cent of an entire day's travel (excluding walking), of which the use of tailored cars, express cars, and ride-sharing accounted for 553,000, 1.45 million and 1.52 million people, respectively. Further analysis shows that the ride-hailing service has a significant impact on public transport users; roughly 50 per cent of the ride-hailing users were previously public transport users, which is equivalent to 12 per cent of previous public transport volume. Private car commuting is much less affected. This result shows that the online ride-hailing services have decreased the number of public transport passengers and reduced the proportion of urban intensive travel, thereby reducing the city's travel efficiency. In addition, as online ride-hailing falls into the car commuting category, which is at relatively higher travelling frequency, after conversion, the ride-hailing services have increased traffic by 330,000 car trips per day, based on a daily rate of 2.43 trips per car. This is the equivalent of more than 169,000 cars on the roads in Beijing in 2015. In addition, these changes coincide with Beijing traffic index monitoring data. During the first three quarters of 2015, the Beijing traffic index increased by 20 per cent, which is much higher than the average annual increase of 6 per cent since 2011. Considering that there was no sustained abnormal weather and there was steady population growth and motor vehicle ownership in 2015, the main factor leading to this result should be the impact of the rapid development of the online ride-hailing services on the structure of city traffic.

Chen and Xu (2016) studied the influence of the online ride-hailing services on the urban traffic in Guangzhou. As a result of the restrictions on the issuance of car licenses in Guangzhou, while there are no restrictions on non-locally licensed vehicles in Guangzhou City, as online ride-hailing services grow, a large number of non-locally licensed cars have entered Guangzhou, which has increased the city residents' car travel share of entire traffic. Compared to 2014, in 2015, the share of rail transit in Guangzhou increased by 0.3 percentage points, the share of conventional bus travel dropped by 0.5 percentage points, and the share rate of traditional taxis dropped by 1.6 percentage points. Under the premise of limited road resources, an increase in the car travel share undoubtedly exacerbates the pressure of road congestion.

In the second quarter of 2015, "China's major urban traffic analysis report in the

second quarter of 2015” published by Gold Maps suggests that the increase in the online ride-hailing services has aggravated the congestion of urban road traffic. Comparing the traffic congestion indexes of Beijing, Guangzhou, Hangzhou and Shenzhen in the second quarter of 2014 and 2015 and excluding weather factors, this report indicates that the calculated congestion delay index of these cities has increased by 13 per cent, 15 per cent, 17 per cent and 11 per cent, respectively. Increases were particularly noted in April 2015, when the express car and ride-sharing services were booming, and Beijing’s traffic index increased by more than 40 per cent.

#### 4 CHINESE GOVERNMENT REGULATION ON ONLINE RIDE-HAILING SERVICES: FRAMEWORK AND IMPLEMENTATION

Online ride-hailing services (ORS) (including tailored taxi services, express taxi services,<sup>7</sup> ride-sharing services, and so on), as a new business mode using mobile Internet technology for ride-hailing and commuting services, started in San Francisco.

The Chinese government attaches great importance to the regulation of online ride-hailing services. Officials from the Ministry of Transport have expressed their concerns regarding the regulation of online ride-hailing services since its inception. In 2014, with the rapid development of ORS, the lack of supervision has led to a variety of increasingly important issues, such as traffic jams caused by the rapid development of services in some cities, passenger safety issues due to the lack of qualification standards for vehicles and drivers, the unfair competition of traditional taxis because of the two-way subsidies from the platform, and so on. In October 2015, the Chinese government proposed the “Guidelines on deepening the reform and promoting the healthy development of the taxi industry” and the “Interim measures for the administration of the online ride-hailing services”, and issued the official version of the two guidelines<sup>8</sup> in June 2016 (The General Office of the State Council, China, 2016a, 2016b), which were followed by “Online ride-hailing service operating specifications (draft)”, “Taxi driver qualification management principles” and other documents. Some cities also announced the implementation of the two documents as local interim regulations. Currently, the regulation framework and implementation mechanism have been formally established.

In accordance with the relevant provisions published in the “Interim measures for the administration of the online ride-hailing services”, the regulatory framework proposed by the Chinese government for the ride-hailing services includes the following aspects:

The carrier nature of the platform company has been made clear. Platform companies not only provide information-matching services but also directly organize the operation of vehicles, assign tasks, determine service prices, develop service standards, determine the distribution of benefits, implement driver management and service evaluation. These platform companies act as passenger service carriers and should assume the responsibility of passenger service carriers.

The terms and conditions as well as procedures for establishing a platform company have been made clear. Regarding the licensing conditions, the restrictions on the platform have been eased. Personally-owned cars are not required to meet the requirements of a light-assets business. For the licensing process, “two-level work, one license” will be

implemented, which means that the capability of the online service will be authorized by the province where it is registered, and once it is recognized, it will be effective across the country.

The new regulations specify the vehicle standard as a passenger car with seats for at most seven passengers. The vehicle must have a satellite positioning device installed and must have a recording function and an emergency alarm device. In addition, the nature of the vehicle and the conditions for retirement are clearly defined. Vehicles will be registered as “reserved rental cars”, which are commercial vehicles. While considering that the car use intensity is less than that of a traditional taxi, a new retirement criterion has been set, namely, mandatory retirement at 600,000 km. If the mileage is not up to 600,000 km, but the vehicle has been used for eight years, it will be forced to retire and should no longer act in a commercial capacity.

The regulations added more stringent conditions on the drivers’ license to maintain public safety. The company can negotiate with the drivers regarding working hours, frequency of service, and sign various forms of labour contracts or agreements to meet the employment needs of flexible drivers, and they may allow drivers to be part-time.

The new regulations implement a market price adjustment, except when city governments think it is necessary to have guidance for prices.

Regarding the information obtained from the operation, the platform company has been clearly required to use the data only for the purposes of providing the service. It is not allowed to pass on the information to third parties, except the lawful requirement of the government. The platform company is not allowed to leak any information related to national security. Passengers have the right to know the purpose, methods and range of data collecting. Any relevant information and related business data collected must be stored in China and cannot be exported to foreign countries.

As the main law enforcement agencies are city governments, and as required, they must develop specific rules for the implementation of these regulations based on the relevant documents. Since the regulations were enacted, Beijing, Shanghai, Shenzhen, Guangzhou, Hangzhou, Chengdu and other places have announced drafted local interim measures for online ride-hailing services. As of June 2017, more than 50 cities have promulgated or formally implemented interim measures for the management of online ride-hailing services. In general, each city proposes their different requirements regarding driver’s access conditions and vehicle access conditions based on the characteristics of the city and the transport situation (see Table 13.2).

## 5 DISCUSSION AND CONCLUSION

The impact of online ride-hailing services on China’s urban transport is an important issue. This chapter has discussed the background, the development stages and the development mode of online ride-hailing services. Based on a theoretical model, we have explored the possible influential mechanisms, along with the corresponding empirical evidence. In addition, we have discussed the regulatory framework established by the Chinese government and its implementation by city governments. At present, there are various different views on the next step in the development of China’s online ride-hailing services and how the government should regulate them. In the last part of

Table 13.2 Major cities' access conditions for drivers and vehicles

City Condition	Beijing	Shanghai	Shenzhen	Chengdu
Family Register	Local	Local	Local or Residential Permit	Local or Residential Permit
Driver's License	Local	Local	Obtain "Driver's license for ride-hailing", and promise to serve himself/herself	Obtain "Driver's license for ride-hailing", and promise to serve himself/herself
Vehicle	Own vehicle	Own vehicle and only one used for service	Own vehicle	N/A
Driver	More than 3 years of driving experience, age below 60 for men and 55 for women. No more than 5 traffic violations in the past year	No more than 5 traffic violations in the past year	More than 3 years of driving experience	More than 3 years of driving experience. Clean background
License Plate	Local	Local	Local	Local
Vehicle Type	Wheel base no less than 2,700 mm for traditional motors, no less than 2,650 mm for new energy motors	Wheel base no less than 2,700 mm for traditional motors, no less than 2,650 mm for new energy motors	Wheel base no less than 2,700 mm for traditional motors, no less than 2,650 mm for new energy motors	N/A
Engine Displacement	No less than 1.8T	Comply with Shanghai standards	No less than 1.8T	No less than 1.4T
Additional Requirement	Uniform Label	No operation at the airport or railway station	Car is less than 2 years old	N/A

Source: Collected from public media by author.

this chapter, we explore a number of factors that need to be considered when addressing this issue.

First, we should pay attention to the impact of China's urban form on the residents' commute. Reducing traffic congestion is usually a top priority of urban public traffic policies. A number of megacities and large cities are emerging in China, having over ten

million people each, with a more rapid pace of development and higher density than western cities. According to an empirical study on 30 major cities in China (Engelfriet and Koomen, 2017), the size of a city has a significant effect on the commute time and distance that residents must travel; the average commuter distance and commute time increases caused by population increases are significantly higher than those in the United States and Europe. In addition, it is important to note that while increasing urban density in Europe and the United States shortens commute distances and times (Newman and Kenworthy, 1989), it does not work in China. The high average density of Chinese cities does not translate to shorter commute distances or times. The congestion effect will offset the shortening of commute time as the city density increases beyond a certain point (Levinson and Kumar, 1997; Yang et al., 2012). Therefore, easing the congestion of large cities always comes first in terms of designing the regulatory framework for online ride-hailing services.

Second, based on the previous point, the control mechanisms of price or quantity should not be easily abandoned. In the long run, road congestion charges as a price mechanism should be introduced into traffic management systems of many mega and large cities in China. However, before the congestion charge is implemented, the price or quantity control of the taxis, including the online ones, is a sub-optimal mechanism to mitigate traffic congestion. The theoretical model and empirical evidence of this chapter shows that the two-way subsidy method of the ORS exacerbates congestion by affecting urban residents' decision-making regarding commutes. For such cities, the use of price control mechanisms and setting up strict access conditions on the vehicles and drivers is necessary.

Third, to ease city traffic congestion through online ride-hailing, an important mechanism is to encourage residents to improve the efficiency of car travel, that is, to increase the number of passengers travelling each time. In addition, the platforms must be encouraged to engage in the carpool (ride) business and offer non-commercial "co-rides". At present, the average number of passengers in urban cars in China is 1.5 person/times, and if private car owners are willing to carpool or co-ride, this will undoubtedly increase the number of passengers and reduce the number of cars at the same time, which will significantly improve urban traffic efficiency.

Finally, the regulation of online ride-hailing services was completed under the goal of optimizing the entire urban transport system. With the further spread and popularization of mobile Internet technologies, a newly emerging phenomenon is affecting urban traffic, shared bicycles. Shared bicycles are widely welcomed by consumers because they are an effective solution for the "last-mile" phenomenon of urban transport. The development of shared bicycles complements the different modes of urban transport used for commuting. At present, there are also a number of problems with shared bicycles, such as the lack of pavement, lack of cycling paths, serious bicycle damage, and so on. To address these issues, we need a more robust and efficient urban management and enforcement system.

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## NOTES

1. A tailored taxi is a premium taxi service with better vehicle conditions and more experienced drivers, while an express taxi is a cheaper option.
2. Black car here means those illegally operating cars that are not registered with the transportation management department for business purposes.
3. The data is from the survey called “Analysis of competition pattern of China’s special car industry in 2017”.
4. The ride-hailing service is non-intensive because a passenger using such service would occupy more road resource than those using traditional public transportation such as bus or transit routes.
5. The difference between the initial cost and the real cost is the congestion cost, which includes time cost, money cost and a cost related to the downgrade of comfort level. The congestion cost is an increasing function of the number of the passengers,  $Q_d$  or  $Q_p$ .
6. Supply elasticity is the short for elasticity of supply on price, which is the changing sensitivity of supplying quantity over price changes and represents the increasing or decreasing percentages of supplying quantity when the price increases or decreases 1 per cent.
7. A tailored taxi is a premium taxi service with better vehicle conditions and more experienced drivers, while an express taxi is a cheaper option.
8. The guidelines are the policies about transportation, which are made by China’s government. The Chinese version of the two documents can be downloaded respectively from the Chinese government’s official website: [http://www.gov.cn/zhengce/content/2016-07/28/content\\_5095567.htm](http://www.gov.cn/zhengce/content/2016-07/28/content_5095567.htm), and [http://www.gov.cn/xinwen/2016-07/28/content\\_5095584.htm](http://www.gov.cn/xinwen/2016-07/28/content_5095584.htm). Accessed 26 October 2019.

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