The Influence of License Plate Allocation Mechanism on Urban Traffic Management: A Comparative Study of Beijing and Shanghai

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Abstract. Urban traffic management has grown in importance since China's cities have seen a sharp rise in the number of motor vehicles in recent years. In this context, different cities have launched different license plate allocation mechanisms, among which the license plate auction mechanism in Shanghai and the license plate lottery system in Beijing have a greater impact on urban traffic management. Their roles are undeniable while their drawbacks need to be solved. The license plate allocation system can only alleviate urban road congestion, and it is difficult to fundamentally solve the problem, which also requires the government to continue to study, in order to find a long-term solution to promote the innovative innovation of urban traffic management. This paper focuses on the influence of the Beijing license plate lottery system and Shanghai license plate auction system on urban traffic management, points out the drawbacks of different license plate allocation mechanisms and puts forward suggestions, which can clarify the role of different license plate allocation mechanisms in urban traffic management. In order to improve the license plate allocation mechanism and optimize the development path of the license plate allocation mechanism, it is essential to improve the function mechanism of the license plate allocation mechanism in urban traffic management.

Keywords: License plate allocation mechanism, License plate auction system, License plate lottery system, Urban traffic management.

1. Introduction

In recent years, due to the rapid development of China's social economy and the rapid growth of the number of motor vehicles, the traffic conditions in large and small cities across the country have been deteriorating (see Figure 1). In the past 20 years, the phenomenon of urban traffic congestion has been spreading from megacities and big cities to small and medium-sized cities. Even with the extensive road traffic infrastructure that many cities have constructed thus far, the state of traffic congestion is still becoming worse. In order to change this situation, some local governments have introduced the policy of license plate lottery and license plate auction, trying to limit the rapid growth of urban vehicles through diverse ways, and Beijing and Shanghai's license plate allocation mechanisms are the most noteworthy ones that deserve investigations [1].

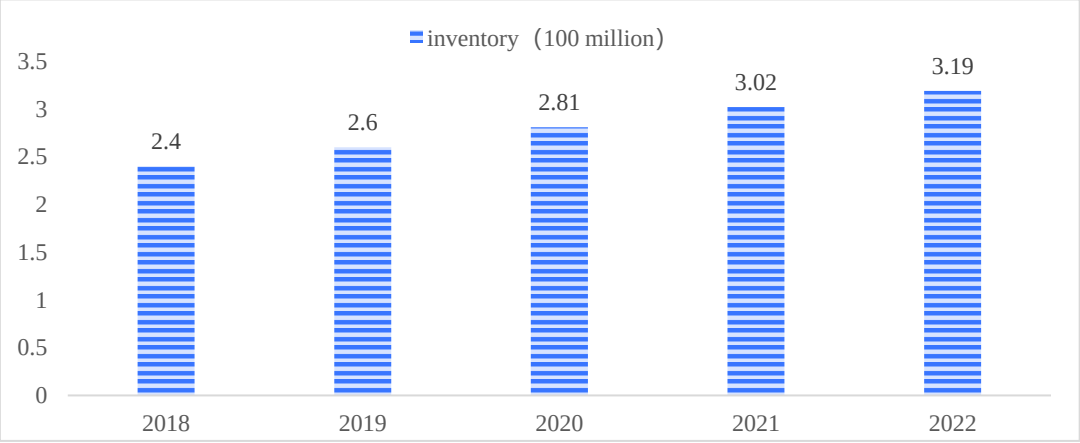


Fig. 1 Statistics of car ownership in China from 2018 to 2022 (Picture Credit: Original)

2. Different Modes of the Two Cities

2.1. Beijing License Plate Auction Mechanism

The development of the license plate drawing mechanism in Beijing can be roughly divided into three stages: the first stage is the simple drawing method adopted from 2010 to 2013, the second stage is the ladder drawing method adopted from 2013 to 2021, and the third stage has been adopted from 2021 to date by drawing lots based on families, sorting points and other allocation indicators [2]. The license plate lottery mechanism in Beijing adopts a fare, just and open way to enable government agencies, enterprises, institutions, social groups and other organizations and individuals to obtain license plates free of charge according to needs, following the principle of average [1]. Although participating in Beijing's license plate lottery policy does not need to pay capital cost on the surface, from the perspective of economics, participating in this policy needs to pay time cost [3].

In general, the license plate allocation mechanism of Shanghai focuses more on "efficiency", while the license plate allocation mechanism of Beijing focuses more on "fairness" [4].

2.2. Shanghai License Plate Lottery Mechanism

Shanghai private car license plate auction began in 1986, and the real sense of the auction system was established in 1992. In order to solve the traffic congestion in Shanghai, in 1994, for the first time, the auction system was implemented for the new passenger car quota. Shanghai began to implement a policy of private car license plates with a reserve price and no public auction. With the amount obtained after winning the auction, car buyers can go to the Department of Motor Vehicles for their purchased vehicles. They also have the right to use motor vehicles in the downtown area of Shanghai (within the Outer Ring Road) [5].

The license plate allocation system in Shanghai is mainly implemented through the market mechanism, mainly through the auction in the free market to allocate this limited resource. Accordingly, the license plate represents a "privilege" that causes traffic congestion. In general, people should take responsibility for their actions, including their impact on the lives of others. Shanghai's license plate auction system embodies this ethic, with the core idea that "the one who causes congestion pays", meaning that the money paid for a citizen's license plate is the price paid for the right to cause traffic jams and inconvenience others. Therefore, the license plate auction system in Shanghai is actually based on a qualification allocation principle [2]. Such characteristics make it have higher distribution efficiency.

3. Comparison of the Influence of the Two Modes

3.1. The Commonality of Mitigation Effects on Urban Traffic

In essence, the two license plate allocation mechanisms start from controlling the number of license plates and thus limiting the number of road vehicles, so that the number of car owners who are finally qualified to use license plates is fixed, the number of license plates is limited, and in a certain sense, the excessive growth of urban vehicle ownership is controlled. Thereby the mechanisms indirectly control the number of road vehicles and alleviate the problem of urban traffic congestion to a certain extent.

It can be seen from Figure 2 that the growth of the number of motor vehicles in Beijing has slowed down significantly since 2009, and the license plate lottery mechanism has been effective, which has played a positive role in alleviating urban traffic congestion. The growth rate of the number of motor vehicles in Shanghai has also been controlled after the implementation of the license plate auction system, and the road traffic congestion has improved.

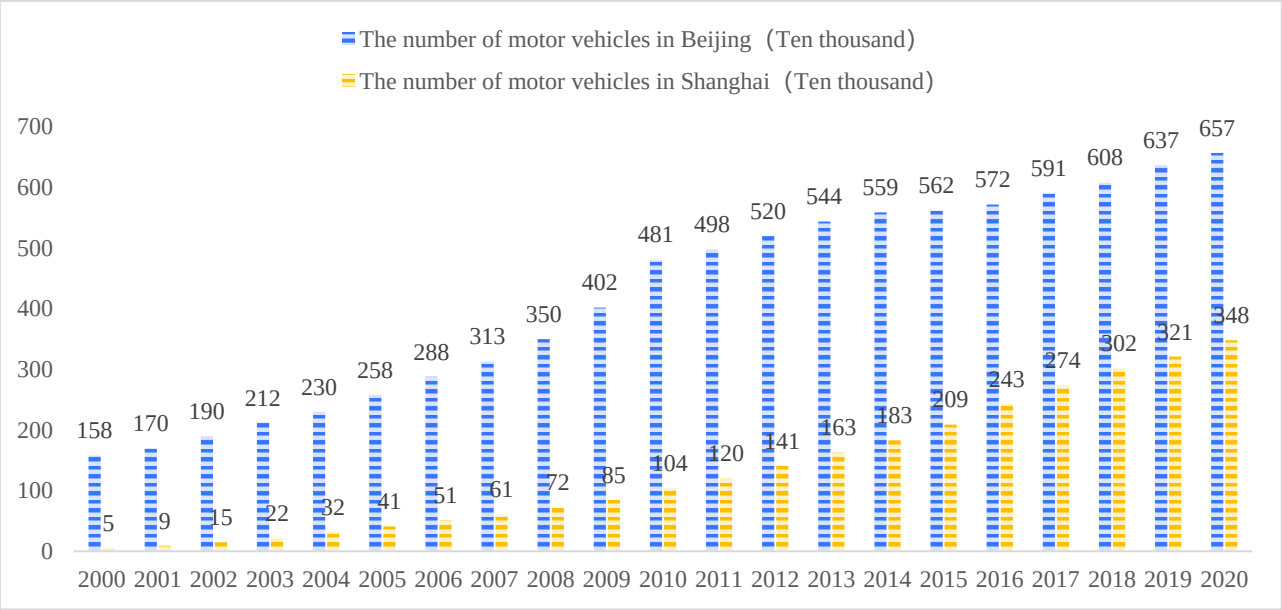


Fig. 2 Number of motor vehicles in Beijing and Shanghai from 2000 to 2020 (Picture Credit: Original)

3.2. Different Influential Factors of Urban Traffic Governance

3.2.1 Number of motor vehicles

Beijing maintains strict control on the quantity of motor vehicles and issues few license plates, both of which contribute significantly to reducing traffic congestion. There are differences in the number of license plates, resulting in different control intensities of the growth rate of motor vehicle ownership, so the degree of relief of traffic congestion is different. The monthly average number of license plates issued in Shanghai is about 11,000, while the monthly average number of license plates issued in Beijing is about 6,000, and the number of license plates issued in Shanghai is relatively large (see Figures 3 and 4). Therefore, the control of the increase in the number of motor vehicles is relatively small, so that the concept of using the license plate allocation system to strengthen traffic governance has a longer time and a smaller degree than that in Beijing.



Fig. 3 Number of license plates issued in Beijing from February to December 2020 (Picture Credit: Original)

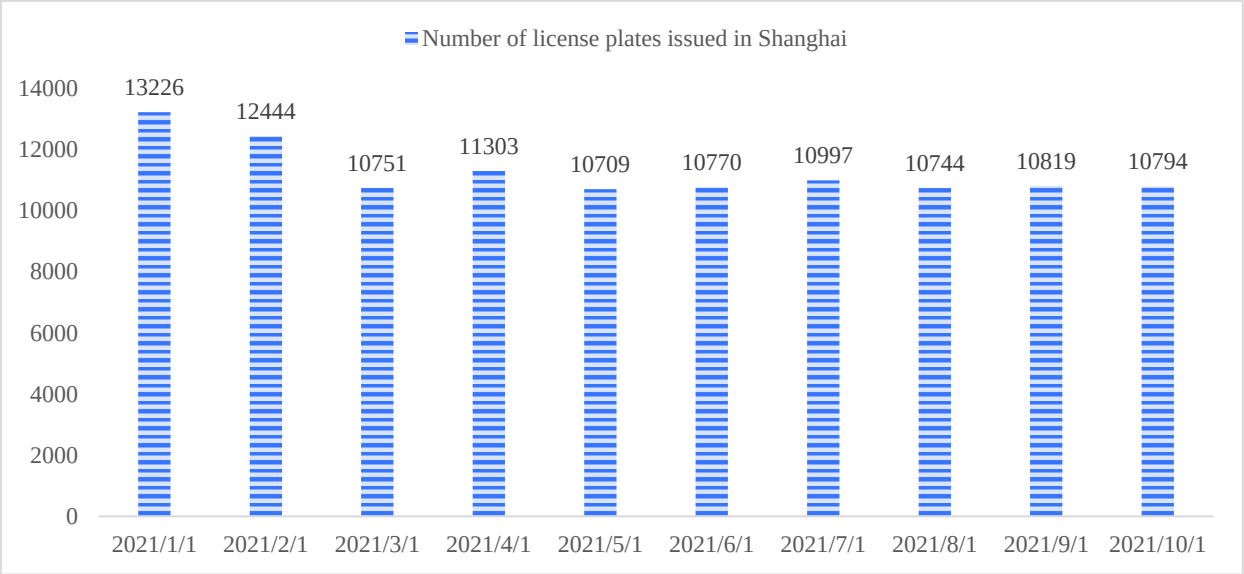


Fig. 4 Number of license plates issued in Shanghai from January to October 2021 (Picture Credit: Original)

3.2.2 Diversity of the license plate owner

The different people who finally get the license plate make the utilization degree and way of license plate resources different, which in turn have different impacts on traffic management. The license plate lottery system in Beijing focuses on adjusting the owner group of license plates and limiting the number of license plates through reasonable allocation of license plates. First of all, Beijing's license plate lottery system clearly gives priority to the allocation of minibuses to "car-free families", which is essentially a restriction on the number of new minibuses, giving priority to meeting the basic travel needs of families, rather than continuing to expand the number of private vehicles, which will narrow the number of private car licenses and relieve road congestion. Secondly, Beijing's license plate lottery system gives citizens equal opportunities to obtain license plates, avoiding excessive competition among some citizens, and the situation that one owner has multiple license plates and multiple vehicles, better allocates social resources, so that the number of road vehicles can be effectively controlled, and road traffic congestion can be alleviated on the premise of ensuring citizens' travel as much as possible. The license plate auction system of Shanghai focuses on controlling the number of license plates by increasing the cost of license plates and the allocation mechanism of scarce resources in the free market, so as to reduce the pressure of traffic control. By increasing the acquisition cost of license plates, the negative externalities of road resources can be reduced, so as to better avoid the "tragedy of the commons" and reduce the overuse of road resources [6]. By making it more expensive for residents to obtain license plates, Shanghai's license plate auction system reduces the excessive demand for license plates among residents in accordance with the law of supply and demand, lessens the waste of social resources, and eventually lowers the number of vehicles on the road and eases traffic congestion.

3.2.3 Financial subsidies for future urban governance

The license plate auction system of Shanghai has obtained sufficient financial subsidies for the transportation department, which can promote the management innovation of the transportation management department and improve management efficiency. Different subsidies to traffic management departments affect the use of funds for urban traffic management, thus affecting the efficiency and level of urban traffic management. The license plate auction system in Shanghai has obtained stable and sufficient management funds for the traffic management department, so that it can invest more funds in urban traffic management and road infrastructure improvement and focus on solving the traffic congestion problem from the management aspect (see Figure 5). The license

plate lottery system in Beijing is provided by the government free of charge, and the relevant administrative departments cannot obtain relevant financial subsidies.

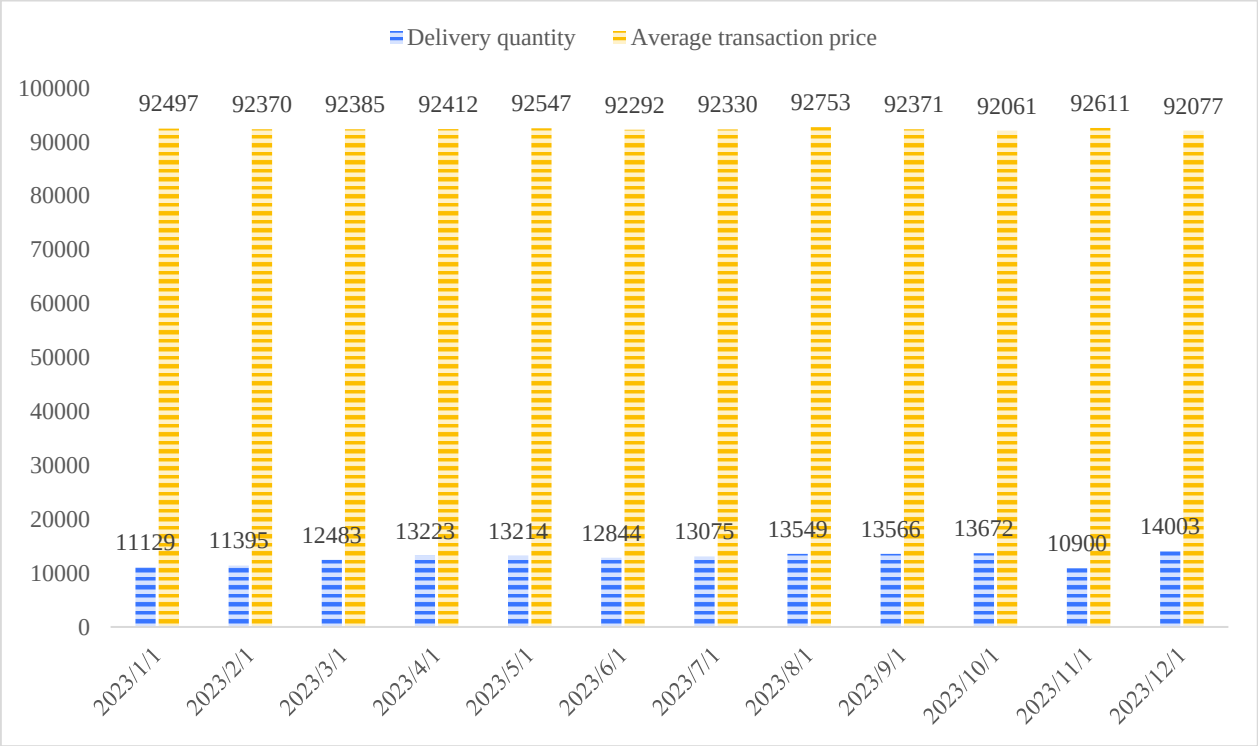


Fig. 5 Shanghai 2023 license plate monthly number and transaction price (Picture Credit: Original)

4. Problems and Dilemmas Based on Existing Policies

4.1. Drawbacks of Beijing License Plate Lottery System

During the implementation of the license plate lottery system in Beijing, there are some shady problems such as secret operations, and a small number of people use their own social resources and background relations to violate rules and regulations to obtain license plate numbers. License plate lottery has gradually become a new means of interest exchange. In this case, the license plate number has become a very scarce market resource, forming a benefit-conveying channel with the license plate exchange as the core content. This does not realize the reasonable allocation of license plate resources, and it is difficult to control the number of road vehicles, at the same time, it adds difficulties to the governance and control of government traffic departments.

In order to meet the needs of some consumers who are unable to lottery but are willing to buy cars, many car sellers have implemented a new type of “rent for sale” business, claiming that the public can buy cars first, and then borrow the license plate of the car rental company or 4S shop, and then handle the transfer formalities after signing in the lottery. This phenomenon makes it difficult for citizens to buy motor vehicles limited by the license plate lottery system, so many citizens can still buy motor vehicles and get on the road when they are not “signed” in the lottery, and the number of motor vehicles on the road is still difficult to be effectively controlled, ultimately making road congestion and other problems difficult to solve.

The distribution of vehicle purchase permits and the number of permits will have an impact on the expansion of the electric vehicle market. The results show that: the distribution method and the number of permits purchased will significantly affect the use of electric vehicles, which will have an impact on vehicle emissions, energy consumption and urban infrastructure; Compared with the baseline scenario, the spatial distribution of vehicle owners, transportation facilities, vehicle emissions and charging demand in the two scenarios are significantly different under multiple resolutions [7].

4.2. Disadvantages of Shanghai License Plate Auction System

The license plate auction system cannot effectively allocate the scarce resources of license plates, confusing the acquisition cost and the use cost of vehicles. As a result, families with higher license plate use value cannot participate in the market bidding due to the limitation of their own capital budget, while families with higher paying ability but lower use value obtain license plates, resulting in the ineffectiveness of the configuration results [7, 8]. This will make some citizens still buy motor vehicles without restriction, resulting in a waste of public resources, and the number of motor vehicles is still difficult to truly and effectively control, which not only cannot meet the needs of citizens to drive motor vehicles but will aggravate the problem of urban traffic congestion and cause trouble to traffic governance.

The high cost of obtaining license plates will affect consumers' desire to buy cars and stimulate their choice of buying cars, making them more inclined to choose cars with higher prices, which in a sense also compresses part of the domestic low-end car market [9]. In addition, the flow of funds from license plate auctions is not transparent, and it is difficult for the public to assess whether the funds are mainly used for traffic governance, which makes it difficult to fully and effectively use the funds and reduces the efficiency of traffic governance.

5. Countermeasures and Suggestions

5.1. Public Information

It is needed to constantly improve the information disclosure mechanism for license plate issuance. Implement government transparency, ensure citizens' right to know, and strengthen the monitoring of license plate allocation processes. First and foremost, in order to ensure the transparency and fairness of the lottery process, allay public concerns about the process and boost public support and recognition of the policy, it is imperative that the license plate lottery regularly publicize the allocation process of car purchase indicators, strengthen public-private media interactions, provide thoughtful answers to inquiries from the public, and pay close attention to the smallest details. Second, the lottery policy should be equitable, legitimated, open, and follow proper procedures, all while enhancing the public's right to know about, oversee, and participate in the supervisor selection process. In addition, in order to minimize opposition and ensure that the public fully understands the essential facts, the license plate auction's cause and objective should be made public as soon as it is implemented [1].

5.2. Second-Hand License Plate Market

It is needed to restrict the second-hand license plate market, cancel the policy of incorporating the second-hand license plate market into unified management, and restrain the speculative demand in the second-hand license plate market by limiting the bidding qualification and the transfer period [10]. Whether it is license plate lottery or auction, the current lack of effective participation and withdrawal restrictions, results in license plate second-hand dealers not needing to bear excessive costs, resulting in the urgent need for license plates to obtain license plates and licensed citizens having difficulty to effectively use the license plate situation. Government departments need to improve the upstream and downstream of the license plate allocation process so that the license plate can be effectively used and improve the efficiency of urban traffic management.

5.3. Earmarking of the Fund

The government should ensure that the funds obtained from the auction of license plates by the government are dedicated and transparent, set up a special fund project, and ensure that the funds are mainly used for the construction of transportation infrastructure, the development and research of vehicle electronic identification equipment, etc., conduct financial disclosure, let the public know about the auction revenue and its use, and ensure that the public believes that the auction is indeed for the public interest, rather than private interests. As a result, public recognition and support

increased. Consider using all the license plate auction revenue for the road traffic accident social assistance fund, and jointly supervised by the municipal finance, civil affairs, social security and public security departments, so as to give citizens more opportunities to participate in the supervision and evaluation of the government, improve the government's traffic management capacity, and expand urban traffic capacity. The government can set a congestion tax to control the number of motor vehicles in the city, and at the same time reasonably control the use of vehicles by citizens, reduce the number of unnecessary trips by citizens, and alleviate traffic congestion.

5.4. Adopting Frequency License Auction Technology

Auction of the frequency license plate is a forceful measure that the radio management department uses marketization mode to distribute frequency resources to realize effective management of frequency resources, which promotes sustainable development of use right market of frequency resources [11].

5.5. Car Sharing

Consumers who are participating in the car license plate lottery are more likely to choose car sharing, and car sharing can largely compensate for the loss of accessibility caused by the car license plate lottery policy, which implies that car sharing, and the car license plate lottery policy are indeed complementary policies [12].

6. Future Expectations

This paper analyzes and studies the license plate auction system in Shanghai and the license plate lottery system in Beijing from the perspective of the mechanism of license plate allocation to urban traffic management. The research mainly focuses on the situation of urban traffic governance in recent years, the basic principles of the two distribution mechanisms, the impact on urban traffic governance, the drawbacks of its own existence and the corresponding solutions. Both of the license plate allocation methods have benefits and drawbacks, but they are only band-aid fixes; as such, the government must keep collaborating to develop long-term solutions for managing urban traffic.

7. Conclusion

The demand for license plates is expected to continue growing, so the mechanism for allocating license plates must be made to allow for some degree of license plate mobility. This implies that the overall number of license plates will progressively rise over time in order to accommodate later arrivals and guarantee their access to license plates. Under the current license plate allocation system, the degree of road traffic congestion is significantly proportional to the total number of license plates. Therefore, though strict control of the number of license plates can slow down the deterioration of road congestion to a certain extent, such measures cannot fundamentally avoid the increasing urban traffic congestion. The basic logic of the license plate allocation mechanism determines that it cannot completely solve the problem of urban road congestion. From this perspective, the license plate allocation mechanism can only be used as a short-term solution to temporarily alleviate traffic congestion, rather than a long-term solution strategy. In the future, the government not only needs to improve the license plate allocation mechanism but also needs to start from other aspects to solve the problem of urban traffic congestion from a long-term perspective.

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