Article

2025 3rd International Conference on the Sociology of the Global Economy, Education, Arts and Humanities (GEEAH 2025)

Analyze the Feasibility of Implementing Traffic Congestion Tax in the First-Tier Cities

Zixuan Yang [1,*]

[1] Shanghai Maritime University, Shanghai, China
* Correspondence: Zixuan Yang, Shanghai Maritime University, Shanghai, China

Abstract: With the economic expansion of first-tier cities and the increase of car ownership in recent years, the road congestion in first-tier cities is not optimistic. This paper will review the current domestic congestion situation and countermeasures, and refer to foreign countries that have successfully implemented congestion tax to illustrate the demand and legitimacy of charging congestion tax in China's first-tier cities. At the same time, with reference to the specific programs of other countries, make a preliminary conception and design for the content of the policy, and draw an appropriate charge based on scientific calculation and principle. It does not mean that charging congestion fees would abolish the construction of the public transport system, and urban residents' travel still depends on the subway and the bus to a considerable extent. Therefore, we emphasize that we should pay equal attention to the implementation of congestion tax policy and the construction of public transport system to achieve the purpose of solving road traffic congestion to the greatest extent under the joint action of the two.

Keywords: public transport system; car ownership; relevant traffic policies; foreign countries; countermeasures; the content of the policy

1. Introduction

Chinese mainland's first-tier cities include Beijing, Shanghai and Guangzhou. The congestion problem in the first-tier cities is very serious, and it is urgent to solve urban congestion. According to the 2020 China Urban Traffic Report, "China ranks among the top 10 traffic congestion of 100 cities, and all four first-tier cities are listed". "Taking Beijing as an example, Baidu Map Smart Transportation shows that in Beijing during the third quarter of 2020, it can only drive more than 400 meters a minute during the commute peak". Taking Shanghai as an example, the cost of time delay caused by traffic congestion in 2014 was 16.572 billion yuan [1].

According to Statistical Review of Beijing on National Economic and Social Development in 2019, "Car ownership has increased: In 2019, the car ownership in Beijing reached 6.365 million, an increase of 281,000 over 2018". (an increase of 4.6%) During peak hours, more than 70% of the cars in first-tier cities take only two people or less. The capacity of rail transit in China's first-tier cities is highly saturated during commutation peak periods. According to the 2019 Annual Report of Beijing Transportation Development, 17 of Beijing rail transit have exceeded 100% and 7 over 120%; Shanghai metro peak reached 100%, some even reached 130%, which is in almost overload operation. The buses' situation is not bad. Taking Shanghai as an example, the full load rate of buses in high

Received: 05 April 2025
Revised: 12 April 2025
Accepted: 21 April 2025
Published: 29 May 2025

direction and high section in peak hours in the city is about 60.6%. The public riding environment is more comfortable. Based on the above situation, the congestion situation in first-tier cities urgently needs to be solved. Ground congestion is not optimistic, and the capacity of the subway is also highly saturated, but buses still have a large room for capacity.

The goal of implementing congestion tax is to reduce the degree of congestion in first tier cities. In first-tier cities, charging a congestion tax on private cars will reduce people's willingness to drive, thus forcing people to choose buses as a way of travel and improving the full load rate of buses to achieve the purpose of alleviating traffic congestion. By introducing the function model of Fudan University and calculating the time delay cost, additional fuel cost, traffic accident cost and environmental pollution cost, the tax that should be imposed on private cars and taxis is obtained. By levying a congestion tax, we can reduce private car travel and force people to choose buses and other travel modes [1].

2. Literature Review

According to the background above, it can be revealed that the first-tier cities in Chinese mainland to implement the congestion tax have urgency. Next, I will discuss the need for implementing this tax from 4 aspects. The public transportation system, the policies have already been implemented in China, legal safeguards for policy implementation and the results of the implementation of congestion tax abroad. Then, introduce the specific policy content.

2.1. Public Transportation System

First-tier cities have been taking a number of measures to improve their urban public transport systems. In terms of public transport system construction, approved in 2018, Shanghai rail transit phase 3 construction plan is construction nine new public transit rail, which will expand the coverage of urban rail transit, making the choice of travel routes greatly increased. However, because the rail transit system has still been under improvement, urban traffic is still too much dependent on ground traffic, which is the cause of congestion in first-tier cities long-term problems. Take Tokyo as an example. The urban area is a quarter of that of Shanghai, while the density of rail transit is more than four times that of Shanghai. In terms of rail mileage, China's first-tier cities still have great development space, which includes the site-setting, the number of stations reached within 500 meters, site and the most commonly used road and business circle overlap. According to the data survey of the unified development level in the same year, the bus sharing rate of commuter transportation similar to Shanghai is as high as 80%, and the metropolitan area has also reached 55%. As compared, the commuting transportation sharing rate in Shanghai Central City is only 33%, and there is still a large development gap. In other words, there is still a lot of room for the public transportation system in China's first-tier cities, but it takes too long to solve congestion problems. Moreover, based on the comfort and flexibility of private cars, people are often not willing to take the initiative to take the subway and bus during peak periods, so that it is essential to set up a congestion tax to reduce people's willingness to drive private cars, forcing people to choose public transportation to achieve the purpose of diverting the ground traffic flow [2].

2.2. Current Traffic Policy

In recent years, China has adopted a number of policies to restrict private cars to travel, including charging fuel tax, wagging and licensing policies, and the single and double number traffic restriction policy which has been implemented in Beijing. In 2018, the lowest transaction price of Shanghai license plate auction has reached 80000. Not only that, parking fees are also rising. In May 2020, some media reported that the maximum standard of parking charges in major areas of Beijing was 15 yuan per hour. Even if the price rises so high, the parking spaces in Beijing's parking lots are still in short supply,

and even in the Third Ring Road of Beijing, the parking spaces are seriously vacant. After the implementation of single and double number traffic restrictions in Beijing, the traffic flow has been reduced by 45%, but the degree of congestion in Beijing still ranks among the top ten in China. It was shown that although many policies are multi-pronged, the congestion problem is still serious. As a result, a new policy congestion tax needs to be adopted.

2.3. Achievements in the Implementation of Congestion Tax Abroad

In 2021, Andrea Baranzini noted that Singapore is the first country to adopt an electronic congestion tax in the central business district [2]. As a result, traffic entering the zone decreased by 25% and travel speed doubled in the morning peaks [3,4]. After Singapore, Bergen and Oslo in Norway also started to collect congestion tax, which not only helped to alleviate congestion, but also 45% of the revenue generated by congestion tax dare to invest in road infrastructure. And the rest was used to improve environmental quality and road safety. In 2003, London implemented a congestion charge of £5 per vehicle per day for either entering, or circulating within central London [5]. Residents paid only 10% of the charge when crossing or traveling within the London congestion charge zone. The main objective of the London congestion charge was to reduce traffic and congestion. The drop in traffic between 2002 and 2003 has been estimated at about 30%, exceeding expectations. Average travel speeds also increased in central London, from 8.9 miles per hour to 10.4 miles per hour, based on a simple before-after comparison for 2003 [5]. In Stockholm, following the implementation of the congestion charge, traffic volume decreased by about 20% and kilometers driven in the inner city by about 15% [6-8]. Travel times decreased between one third and one half during the peak periods and a 4.5% increase in the number of passengers by public transit was attributed to the road toll.

2.4. Legal Safeguards for Policy Implementation

In the implementation of congestion charging policies in megacities, legal challenges primarily arise from ambiguous legal authorization, unclear definition of charging nature, and conflicts with existing regulations. Systematic solutions can be achieved through the following pathways

2.4.1. Legal Authorization and Procedural Legitimacy

Pursuant to China's Legislation Law and the State Council's Guidelines on Comprehensively Promoting Law-Based Governance, congestion charging qualifies as an administrative act that "impacts citizens' rights or imposes obligations", necessitating legal authorization via local regulations or government rules formulated by municipal people's congresses or governments. For instance, the Beijing Municipal People's Congress Standing Committee could adopt the Beijing Traffic Congestion Charging Regulation to specify charging zones (e.g., inner Fifth Ring Road), time slots (e.g., weekday rush hours), and pricing mechanisms (e.g., dynamic pricing). Policy Coordination is critical. Regulations must address overlaps with existing measures, such as Shenzhen's proposal to substitute a portion of parking fees with congestion charges, which requires explicit legal guidelines to prevent policy duplication or contradictions.

At the same time, international experience can be referred to when formulating detailed policy contents and laws and regulations. London's congestion pricing policy demonstrates effective legislative design. The London Transport Act authorizes the London Transport Authority to collect fees and directs revenues toward public transport upgrades (e.g., bus service expansion and metro infrastructure improvements). At the same time, the bill authorizes the transportation bureau to adjust the fee standard through the hearing, reflecting the "dynamic legislation" thinking [9].

2.4.2. Procedural Legality Guarantee

The introduction of public hearings and public opinion surveys, the collection of congestion tax requires the procedures of public participation, expert demonstration and risk assessment, and an interdisciplinary expert team to assess the social and economic impact of policies, such as the potential impact on low-income groups and small and medium-sized enterprises, and make a risk assessment report available to the public.

In addition, legal relief channels should be established, the handling mechanism of the payer's objection to the charging behavior should be clarified in the regulations, and the administrative reconsideration or litigation should be allowed to ensure procedural justice. Information is fully disclosed.

From the perspective of public power, the transparency of charging basis is very important, and the congestion data, environmental cost calculation model and charging formula should be published regularly. For example, the Singapore ERP system publishes the road congestion index and charging logic in real time, enhancing the public's real understanding of the collection method of congestion tax and thus accelerating the implementation of the policy. At the same time, the legislation should stipulate that the toll revenue must be specifically used for traffic improvement (such as bus subsidies and slow traffic system construction), and should be disclosed to the public through annual audit reports to build an open and transparent government.

2.4.3. Technology and Privacy Protection

In the implementation of congestion pricing, electronic toll systems such as license plate recognition and GPS positioning serve as the core technological means for collecting congestion fees. However, the collection, storage, and use of personal data involved may pose risks of privacy breaches and misuse. Therefore, it is essential to establish a dual safeguard system through legal regulations and technical standards to ensure the legality and security of technology application. The Netherlands has implemented congestion pricing in Amsterdam and established a stringent privacy protection framework under the Traffic Data Management Act. By adopting data anonymization techniques, license plate information is encrypted, retaining only desensitized data such as traffic time and road segments. Additionally, the algorithm logic and data processing procedures of the charging system are disclosed, allowing public access to technical documents. Moreover, car owners can query their personal access records at any time and request the deletion of non-essential data. Drawing on both domestic and international experiences, policy implementation requires legal norms to define data boundaries and technical standards to ensure operational reliability and maintain policy fairness through social supervision, thereby achieving a balance between efficiency and equity.

2.4.4. Summary

Legal safeguards are pivotal to the successful implementation of congestion charging policies. By clarifying legal authority, refining regulatory details, and ensuring procedural justice, a policy framework integrating legality, reasonableness, and sustainability can be established. Drawing on the experience of London and other international cities and combining with the practice of rule of law innovation in Shenzhen and other places, China's first-tier cities are fully able to realize the legal transformation of transportation governance tools and provide Chinese solutions for the global megacities governance.

2.5. Policy Content

Referring to the charging methods adopted by countries that have implemented congestion tax and the calculation of traffic congestion tax designed by Fudan University taking Shanghai as an example, we can adopt ETC electronic non-stop fee deduction in congested sections of the city during the morning and evening peak hours of working days

in first-tier cities, for private cars that are not fully loaded and buses without special official business to collect congestion tax. Combining the time delay cost, additional fuel cost of private cars, traffic accident cost, environmental pollution cost and external cost of traffic congestion, it is concluded that the tax payable under the principle of economics is 22 yuan [1].

Taking Shanghai as an example, the areas with long congestion time on weekdays throughout the year are mainly distributed in the inner ring and central ring, especially near office buildings, large business districts and hospitals. The congested trunk roads in the urban area are mostly concentrated in the southwest of Shanghai and Hongkou District. The morning congestion period is from 7:30 to 9:30, from 4:30 to 6:30 in the afternoon. The collection period is 4 hours in total. Furthermore, in order to encourage economic growth and tourism consumption on weekends and holidays, congestion tax will not be charged on holidays. At the same time, in order to promote the improvement of road utilization and to make people choose public transportation, tax exemption could be adopted for fully loaded vehicles and buses. In addition, other basic travel needs shall be taxed normally.

3. Conclusion

Based on the above situation of China's first tier cities, although the current public transport system is developing, it is far from fully meeting people's needs. And public transportation is too long to cope with the imminent problem of congestion. Secondly, although some relevant policies adopted by the first-tier cities, such as the single and double number traffic restriction policy, are effective, it is difficult to completely solve the problem of congestion. Therefore, the legitimacy and rationality of implementing the congestion tax are established. As for the specific content of the policy, China can refer to the successful experience of some foreign countries that have implemented congestion tax, such as London and Singapore, whose congestion has also been alleviated stably for a long time. As for relevant supporting measures, such as road planning and setting, ETC station construction and satellite real-time observation of road congestion, we still need to continue to strengthen research in relevant fields to lay a solid foundation for the implementation of the congestion tax. Another factor that needs attention is the people's psychological acceptance of the new policy. Although there will be some resistance at the beginning, when the policy is implemented for a long time, people's psychological acceptance will be greatly improved. Just like Beijing's single and double number traffic restriction policy, the psychological acceptance of the people has also been greatly improved in the later stage of implementation. Therefore, charging congestion tax in China's first tier cities can not only effectively alleviate the problem of congestion, but also react on urban road infrastructure, and finally serve the people.

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