

Implications of Singapore's Congestion Pricing Policy for China's Transportation Governance

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Abstract. With the advent of the post-epidemic era, traffic congestion in urbanized areas around the world is showing a serious trend. China, as the world's largest developing country, faces serious traffic problems during urbanization. In contrast, Singapore, as one of the Asian countries, has successfully implemented a series of traffic management policies, including congestion pricing. The main theme of this paper is to study the inspiration of Singapore's congestion pricing policy on China's transportation governance. This paper mainly analyzes the reasons for the success of Singapore's congestion pricing policy. At the same time, according to the current situation of traffic congestion in China and related research results, it summarizes the three aspects of congestion pricing in China to implement the proposal. First, congestion pricing policies should be implemented in parallel with other means of transportation management. Secondly, the congestion charging policy should be flexibly adjusted in the light of urban conditions. Finally, the congestion charging policy should focus on publicity and recognition by the public. Through this study, it is hoped that it can provide the right direction guidance and reference suggestions when the Chinese government considers the implementation of congestion pricing and similar policies in the future, and it is hoped to come up with more comprehensive and universal reference suggestions if further studies are conducted.

Keywords: Traffic congestion, Congestion pricing policy, China, Singapore.

1. Introduction

With the advent of the post-epidemic era, traffic congestion in all urbanized areas around the world is showing a trend of severity. According to a report on global traffic congestion in 2022 published by INRIX, 58% of the world's cities face the threat of increasing traffic congestion [1]. Among them, China, the most populous country in the world, faces transportation problems such as congestion and environmental pollution. On the contrary, another Asian country, Singapore, is known globally for its achievements in urban planning, especially transportation. Singapore's construction of a public transportation system, control of private transportation, and congestion pricing policy have provided valuable experience to the field of global transportation planning in recent years. After the initial implementation of the congestion pricing policy in 1998, Singapore's traffic speed, traffic volume, and congestion time have been improved year by year, which has triggered discussions and concerns among scholars at home and abroad [2].

Singapore was ranked third in the list of overall global city competitiveness previously published by the Economist Intelligence Unit of the United Kingdom [3]. In contrast, China's economically prosperous Beijing and Shanghai, cities of comparable size, lagged very far behind in the city competitiveness rankings. One of the reasons for this is that these cities generally lag in terms of overall transportation performance. Congestion in Chinese cities is generally normalized and a regional spreading trend. However, China's traffic management mode is currently dominated by direct management modes such as traffic engineering, such as improve the carrying capacity of road networks [4]. Scholars have called on the government to solve China's traffic problems from the supply and demand sides, such as macro policies, infrastructure, and so on.

In this paper, we will deeply sort out and interpret Singapore's traffic management experience, represented by congestion pricing, and analyze the reasons behind its success. At the same time, combined with the current situation of urban transportation in China and the comprehensive analysis

of related research, it aims at the possibility and practical significance of the implementation of congestion pricing policy in China.

2. Congestion Pricing Policy

2.1. Analysis of Congestion Pricing Policy in Singapore

Singapore's "congestion charge system" refers to the use of certain technical means by urban traffic managers to impose certain charges on road users in certain areas during congested hours, to use the pricing mechanism to limit the density of traffic on urban roads during peak hours, alleviate congestion in the city and improve the operational efficiency of the entire urban traffic.

In 1998, Singapore was the first country in the world to implement Electronic Road Pricing (ERP), a system that is often installed on roads leading to the heavily trafficked central city, where tolls are automatically deducted from vehicles that pass-through toll gates located on top of the road during toll collection hours (rush hour). Different types of vehicles are charged different rates, with trucks and cars being more expensive. By charging additional fees, it enables users to avoid entering the controlled area when it is not necessary to reduce the cost of transportation, thus achieving congestion mitigation. Currently, there are nearly 100 ERP electronic gates in Singapore, and about 97% of the vehicles are equipped with electronic card reader devices [2, 5]. Vehicles entering the city center sometimes need to pay multiple "tolls", so some people will not choose to enter the city center during peak hours to reduce the burden. The fewer vehicles that enter the city center during peak hours, the smoother the flow of vehicles in the area. Although the high congestion charge levied (ranging from S\$0.50 to S\$6.50 per charge) has caused some dissatisfaction among motorists, it has indeed resulted in a 13% reduction in traffic flow in downtown Singapore and a 20% increase in average speed during peak hours [2, 6], and the revenue generated from this system can also be used for road and public transportation construction and maintenance.

The 2015-2016 annual report released by the Land Transport Authority (LTA) of Singapore shows that the vehicle fleet in Singapore has been slowly increasing, but traffic operations have been improving over the last 10 years [7].

2.2. Reasons for the Success of Congestion Pricing in Singapore

Statistics show that since the ERP levy, traffic volume in Singapore's city center has decreased by 13% and the average speed during peak hours has increased by 20% [2, 6] In 2014, the average speed on Singapore's highways was 64.1 km/h, and the speed on the CBD and urban arterials was 28.9 km/h, which are up to the standards set by the Land Transport Authority [2]

Reasons for the good results of congestion charging policies. Firstly, the congestion pricing policy has been successful in diverting traffic away from private cars.

Congestion pricing as a macro policy of urban traffic regulation, from the space to play a role in dispersing congestion points. According to the existing survey of road congestion in Singapore, it was found that Singapore is not easy to appear with its equal number of cities are very prone to centralized congestion, Singapore's road burden is relatively decentralized, and the morning and evening peaks are less obvious [3]. Similar phenomena can also be observed in other countries around the world that have successfully implemented congestion pricing.

Secondly, the success of the policy cannot be separated from the improvement of Singapore's public transportation system.

The success of the congestion pricing policy cannot be implemented without the improvement of Singapore's public transportation system. According to the theory of existing economic studies on congestion pricing, traffic congestion is an economic phenomenon caused by the contradiction between traffic demand and traffic supply [8]. Congestion charging unilaterally raises the cost of small car travel based on the Singaporean government has built a perfect public transportation, and made a macro-adjustment to the public's choice tendency as a result.

Finally, the government on congestion charging rules, the price of macro-control.

Congestion pricing is designed to ease traffic congestion by increasing people's travel costs, but the stable implementation of the government cannot be separated from the charging system and the macro-control of prices, compared to the high cost of congestion, and other car costs, road congestion pricing only accounted for 6.7% of the total cost of traveling in a car [6].

3. Transportation Issues in Peer Cities in China

3.1. Current Status of Transportation Issues

According to the survey on traffic congestion in Chinese cities in recent years [3], the following problems are common in cities with a population of more than 10 million. First, traffic congestion is normalized and a regional spreading trend. Secondly, the main arterial roads are seriously congested during commuting time. Finally, the transportation infrastructure is not perfect.

Currently, China's overall traffic congestion has increased over time as the country's urbanization and population migration have intensified. At the same time, because China's major cities span a wide range of spaces, topographies, and populations, successful management of congestion requires solutions at the level of urban planning and layout, as well as urban transportation development patterns.

Shanghai central area congestion research, for example, the area congestion presents circle characteristics and tidal phenomenon, scholars Song Bo and other scholars through the construction of the urban road network model, found that the Shanghai scale expansion of the structural contradiction brought about by the road traffic resources is a major cause of traffic congestion, and puts forward the top-down transportation policy, such as the development of Singapore's congestion charging policy and other economic level of the solution is likely to have a relatively good effect[9].

3.2. Beijing Congestion Pricing Survey Results

In recent years, many cities in China, such as Beijing and Chengdu, have proposed to learn from and study Singapore's advanced experience to implement their congestion pricing policies.

To understand the public's attitudes and perceptions towards Beijing's congestion pricing policy, Beijing Transportation University (BJTU), with the support of the World Resources Institute (WRI), has conducted a three-year public opinion tracking survey since 2016. The survey covered all areas within the sixth ring road of Beijing, with a total of 39,848 participants over the three years, and a total of 26,181 valid questionnaires were collected [10].

The percentage of respondents in Beijing who are opposed to the congestion pricing policy is lower than the percentage of pre-implementation opposition in international cities that have successfully implemented the policy, such as London (55%) and Milan (48%), and the percentage of support for congestion pricing has been on the rise in major cities in China with the increase in governmental publicity in recent years [10].

In general, the existing survey shows that the people of Beijing have a certain degree of adaptability to the implementation of congestion pricing policy. However, according to related research, scholars have questioned the effectiveness and fairness of the policy in Beijing[11]. The vast majority of Chinese cities, such as Beijing, do not have the infrastructure and per capita income necessary to implement congestion pricing in cities such as London and Milan, and therefore may face social opposition to its implementation.

4. The Application and Implications of Congestion Pricing Policies in China

From the above observations, it can be concluded that the implementation of congestion pricing policy in China needs to be considered from policy design to public acceptance to ensure its feasibility and ultimate effectiveness. It can be roughly categorized into the following parts.

4.1. Congestion Pricing Policy Should Go Hand in Hand With Other Modes of Transportation Management

Singapore's congestion pricing model does play a good role in the relationship between supply and demand at the economic level. However the implementation of congestion charging has many prerequisites, and the successful implementation of Singapore's congestion charging policy cannot be separated from the many policies of the Singaporean government and the construction of the public transportation system. Taking public transportation in Singapore as an example, Singapore has constructed more than ten subway lines and dense bus stops in 719 km² of land, which makes public transportation an optional way for citizens to travel. Therefore, congestion pricing should be synchronized with other transportation management methods to ensure its feasibility and efficiency.

4.2. Congestion Pricing Policies Should Be Flexible and Locally Adapted

Flexibility and universality of policies are prerequisites for their wide application. First of all, Chinese cities show considerable differences in terms of geography, history, and urban structural conditions. Therefore, congestion pricing policies should be tailored to the actual development of the local context, except for Singapore, Stockholm is considered to be the most successful city in terms of the effect of congestion pricing, but also because of the government's adaptive planning of the policy. In addition, flexibility is also reflected in the updating of policies over time, as Singapore has been monitoring and adjusting the timing and geographic location of the fees over the years to ensure that implementation is adaptable. China should also develop implementation plans with local characteristics, as well as utilize technology to monitor the effectiveness of implementation and ensure the efficiency of the policy.

4.3. Congestion Pricing Should Ensure Public Advocacy and Recognition

When the planning of the policy meets the economic and institutional conditions mentioned above, publicity at the public level becomes the next goal for the successful implementation of the policy. In Singapore, the successful implementation of congestion pricing in Stockholm cannot be separated from its publicity and popularization education for the general public. On the one hand, publicity can enhance the public's awareness of the policy and ensure feasibility and acceptance. On the other hand, through the policy publicity can get the feedback from the residents to collect public opinion and enhance the participation of the residents to further optimize the policy. Therefore, the implementation of congestion pricing cannot be separated from successful publicity.

5. Conclusion

This paper explores the advantages of congestion pricing in improving transportation problems by interpreting Singapore's congestion pricing policy and exploring the advantages of congestion pricing in improving transportation problems according to China's national conditions. This paper first finds that the successful implementation of congestion pricing cannot be separated from the combination of other means of traffic management after the investigation of Singapore's policy and transportation facilities. Urban activities cannot be separated from land resources, and the travel demand of citizens will not be changed simply because of congestion pricing policies. Congestion pricing policy as a means of intuitive regulation of road travel, needs to be combined with the construction of public transportation, limiting the ownership and use of private cars, and other deeper means of traffic management to play a maximum role.

Given the existing domestic traffic congestion situation in China and the current general perception of congestion pricing among Beijing citizens, this paper learns about the adaptability and limitations of congestion pricing policies in China. Accordingly, this paper puts forward a proposal for the implementation of a congestion charging policy in China. From the macro level, it should be synergized with other means of traffic management. On the meso level, the congestion pricing policy should be adapted to the specific situation of the place where the policy is implemented. At the micro

level, it is important to ensure that the ultimate recipients of the policy, i.e., the citizens, accept and cooperate with the policy. This paper brings the congestion pricing policy into the Chinese background for analysis and research, hoping to provide the right direction guidance when the government considers the implementation of congestion pricing and similar policies in the future. At the same time, some generalized traffic congestion problems and suggestions for improvement put forward in this paper can also provide some suggestions for other developing countries about congestion pricing policies.

Starting from the existing transportation problems in China, this paper considers the polls on congestion pricing in Beijing, etc. However, it lacks in-depth analysis and conceptualization of the specific patterns and operational relationships that may be formed by congestion pricing and fails to provide more specific questions and suggestions. Future research can think more deeply about the specific patterns that congestion pricing policies may form in similar developing countries, and provide more universal reference suggestions for congestion pricing policies

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