

Analysis of the Effectiveness of Traffic Restriction Policies and Public Management

Xinyi Zhao*

School of Finance, Jinan University, Jinan 250022, Shandong, China

**Author to whom correspondence should be addressed.*

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Abstract: With rapid urbanization and motorization, the number of motor vehicles in China has exceeded 430 million as of 2023, leading to severe urban smog and traffic congestion. Many cities have implemented traffic restriction policies to mitigate these issues. This study evaluates the effectiveness of these policies from a public administration perspective, employing literature analysis, case studies, and policy evaluation methods. The findings indicate that such policies significantly improve air quality and reduce traffic congestion in the short term. However, challenges remain in policy design, enforcement, equity, and public acceptance. The study proposes innovative measures such as dynamic restriction mechanisms, enhanced public participation, and integrated governance strategies to improve policy sustainability and scientific rigor.

Keywords: Traffic restriction; Public management; Policy evaluation; Urban governance

Online publication: October 29, 2025

1. Introduction

Rapid urbanization and motorization in China have resulted in a surge of motor vehicles, exacerbating air pollution and traffic congestion. By 2023, China's vehicle population surpassed 430 million, with vehicle emissions contributing significantly to urban smog—exceeding 40% of total pollutants in cities like Beijing and Tianjin. Concurrently, traffic congestion during peak hours has worsened, with a commuter delay index exceeding 2.0 in major cities. In response, traffic restriction policies have been widely adopted as critical public management tools. This study examines the effectiveness, implementation challenges, and social implications of these policies, drawing on cases from Beijing, Shanghai, and other metropolitan areas. By integrating theoretical analysis and empirical evidence, this research aims to propose actionable recommendations for policy improvement.

2. Literature review

2.1. International Research

Globally, motor vehicle restriction policies have been widely implemented as regulatory tools to address air

pollution and traffic congestion. International examples such as Mexico City's Hoy No Circula program and similar policies in Bogotá have demonstrated effectiveness in reducing short-term air pollutant levels and traffic accident rates^[1]. Empirical research indicates that Mexico City's restriction policy contributed to an approximately 11% reduction in airborne pollutants^[2]. In Europe, some cities have enhanced policy outcomes through integrated approaches that combine traffic restrictions with improvements in public transportation systems^[1]. Studies commonly employ quantitative analyses of air quality and traffic data to evaluate policy efficacy. However, international literature also points to limitations such as diminishing long-term effects and the emergence of avoidance behaviors, including the purchase of secondary vehicles^[2]. These findings underscore the importance of supplementing restrictive measures with investments in alternative transport infrastructure and systemic urban mobility solutions to achieve sustainable results.

2.2. Domestic research

In China, research on vehicle restriction policies has evolved from initial effectiveness verification to deeper critical analysis. Domestic studies confirm that policies in cities like Beijing and Shanghai have achieved notable short-term improvements in air quality and traffic conditions. For example, Beijing's odd-even plate policy, implemented since 2008, has contributed to a measurable reduction in PM2.5 levels and peak-hour congestion indices^[3]. However, researchers have increasingly highlighted structural and equity issues, such as the disproportionate travel burden on low-income residents and the spillover pressure on public transportation systems^[3-4]. Scholars, including Gong Zhiwen (2016), have further questioned the legitimacy and long-term sustainability of such policies from a public interest perspective^[3]. Recent academic consensus emphasizes the necessity of integrating traffic restrictions with broader transportation policy packages—including the expansion of metro systems, optimization of bus networks, and promotion of green mobility options—to achieve holistic and sustainable urban governance.

3. Theoretical basis

3.1. Policy tool theory

The motor vehicle restriction policy is a regulatory measure used by governments to alleviate traffic congestion and reduce air pollution through methods such as tail-number restrictions, peak-hour bans, and odd-even schemes. For instance, Beijing's tail-number policy has significantly reduced PM2.5 levels^[4]. While effective short term, studies show diminished long-term efficacy and adaptive citizen behaviors^[6]. International research confirms temporary air quality benefits but limited sustained impact. In China, scholars also examine equity, legitimacy, and governance challenges, proposing improved policy design and integrated transport solutions^[3].

3.2. Public policy evaluation theory

Public administration refers to the activities through which governments and public organizations provide public services and manage public affairs by means of policies, laws, and governance measures. Motor vehicle restriction policies reflect the government's regulatory capacity in resource allocation and social governance^[4]. Effective public administration requires that policies balance efficiency, equity, and sustainability in both design and implementation to meet the needs of diverse groups and enhance the level of urban governance^[5].

4. Current implementation of traffic restriction policies

Major Chinese cities such as Beijing, Shanghai, Guangzhou, and Shenzhen have introduced a variety of traffic restriction policies to combat urban congestion and pollution. For example, Beijing implemented a tail-number restriction policy in 2008, which prohibits 20% of vehicles from driving each day based on their license plate digits. Shanghai, on the other hand, has adopted a combined approach incorporating license plate auctions with geographically specific restrictions, aiming to control both vehicle numbers and their spatial distribution.

A range of methods supports these policies, including rotational tail-number prohibitions, peak-hour bans targeting non-local vehicles, and electronic enforcement mechanisms. Advanced surveillance technologies, such as cameras and big data analytics, are widely used to monitor compliance and improve implementation accuracy. These measures work collectively to reduce traffic volume and vehicular emissions during critical periods.

5. Identifying key challenges in policy implementation

5.1. Challenges: Combating evasion tactics and overcoming inconsistent enforcement

During the design phase of vehicle restriction policies, many cities conducted insufficient research, leading to poorly targeted measures. When defining restricted areas and periods, some failed to adequately consider road capacity and traffic flow distribution, inadvertently worsening congestion within these zones. Such data-deficient policy design reduces the practical effectiveness of traffic restrictions.

5.2. Equity issues: Disparate impact on low-income groups and privileged exemptions for official and high-income vehicles

Low-income households, often reliant on aging vehicles in areas with inadequate public transit, face disproportionate financial and time burdens due to travel restrictions—whether from costly alternative commutes or lost income^[7]. In contrast, affluent residents can often circumvent these policies by acquiring additional or new-energy vehicles. Furthermore, exemptions granted to government and certain corporate fleets reinforce perceptions of inequity, undermining both the fairness and public trust in such measures.

5.3. Public transport overload

The implementation of traffic restriction policies has significantly increased public reliance on mass transit; however, many urban public transportation systems lack the capacity to handle this surge in demand. For instance, following the restrictions, Beijing's subway system experienced a noticeable rise in peak-hour passenger flow, leading to extreme crowding on certain lines. Similarly, bus load rates also climbed substantially, resulting in diminished commuter comfort and efficiency^[9]. This strain on public transport highlights a critical infrastructural shortfall during restriction periods. At the same time, the growing use of unregulated electric mobility devices—such as low-speed electric vehicles for the elderly—has introduced new safety and management challenges. Often operating outside formal traffic management systems, these vehicles frequently travel in motorized lanes or against traffic flow, increasing the risk of accidents and further complicating urban traffic governance.

6. Causes of problems

6.1. Policy design deficiencies: Inadequate research and structural rigidity in urban traffic management

During the design phase of vehicle restriction policies, many cities fail to conduct comprehensive and scientific

research, resulting in measures that lack precision and relevance ^[8]. A notable example is the Tianjin license plate restriction mix-up, where inadequate assessment prior to implementation led to public discontent due to erroneous measures. Furthermore, when establishing restricted zones and time windows, urban road capacity and the distribution of traffic flows are often overlooked, sometimes exacerbating congestion within these areas. Such policy design, lacking empirical support, significantly undermines the intended effectiveness of traffic restrictions. Moreover, existing policies frequently adopt a rigid “one-size-fits-all” approach without mechanisms for adaptive adjustment based on actual conditions. Beijing’s tail-number restriction policy, for instance, has remained largely unchanged since its introduction in 2008, despite significant shifts in urban mobility patterns and commuter behavior. This inflexibility hinders the policy’s ability to accommodate emerging travel modes and diverse public needs. Additionally, inadequate consideration for vulnerable groups—such as low-income families and individuals with disabilities—further highlights the design shortcomings. To enhance equity and efficacy, future policy formulation must incorporate more sophisticated data analysis, account for varied social impacts, and ensure better integration with public transportation systems to promote sustainable urban governance.

6.2. Insufficient supporting environmental protection

Although many cities have adopted electronic surveillance to enforce traffic restriction policies, significant loopholes remain in practice. In some areas, insufficient density of monitoring equipment fails to cover all roads, allowing non-compliant vehicles to avoid penalties ^[10]. Furthermore, the use of fake or cloned license plates in certain cities further weakens the restriction’s enforceability. These regulatory gaps greatly diminish the intended impact of the policy, reducing both its effectiveness and deterrence, while also encouraging further violations through imitation. In addition, inconsistent enforcement—particularly toward privileged vehicles—undermines public perception of fairness and diminishes the policy’s legitimacy and overall efficacy.

6.3. Low public participation: Insufficient government communication and low public awareness of policy rationale

The successful implementation of traffic restriction policies relies heavily on effective public communication and outreach. However, in many cities, governments have failed to adequately interpret and publicize policy details prior to rollout. As a result, a significant portion of the public remains poorly informed about the objectives, specific rules, and penalty standards of the policy, leading to misunderstandings and resistance during enforcement. Moreover, there is a noticeable lack of public awareness regarding the long-term environmental benefits of such measures, with many residents focusing instead on short-term personal inconveniences. Some even perceive the policy as a temporary fix rather than a substantive solution to pollution and congestion. This superficial public understanding undermines both social support and the overall effectiveness and sustainability of the policy.

7. Recommendations

7.1. Improve policy design: Dynamic and response mechanisms informed by data and air quality metrics

To boost scientific rigor, restrictions should be dynamically tuned to real-time traffic and air-quality data, exempting essential trips and incorporating global best practices that blend market incentives with regulation.

7.2. Promote public engagement: Digital communication and feedback integration

Governments should transparently communicate the rationales behind traffic restrictions through diverse channels such as social media and public forums, while actively soliciting ongoing public feedback. It is also essential to implement supportive measures—including improved transit options, compensatory mechanisms, and phased implementation schedules—to mitigate impacts on vulnerable communities. Such practices not only enhance policy credibility but also foster long-term public acceptance and compliance.

7.3. Integrated governance: A holistic strategy with global insights

Vehicle restriction policies should be implemented alongside eco-compensation measures for affected communities, urban greening initiatives, and industrial emission reductions. Drawing on models such as Singapore's congestion pricing system, such integration combines economic incentives with administrative regulation, fostering more systematic and sustainable pollution control.

Acknowledgments

I am deeply grateful to my family for their unwavering support and understanding, which kept me motivated. Thanks also to friends for their encouragement during tough times. I appreciate researchers whose prior studies laid a solid foundation for this thesis.

Disclosure statement

The author declares no conflict of interest.

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