

BABEȘ-BOLYAI UNIVERSITY
FACULTY OF POLITICAL, ADMINISTRATIVE AND COMMUNICATION SCIENCES
DOCTORAL SCHOOL IN ADMINISTRATION AND PUBLIC POLICIES

DOCTORAL THESIS

- SUMMARY -

**The role of public policy instruments in shaping urban
mobility behavior**

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A case study of Cluj-Napoca, Romania

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Cluj-Napoca

2025

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1. Introduction

This doctoral thesis analyzes the impact of urban mobility public policy instruments on citizens' travel behavior. The study focuses on three *soft* policy instruments implemented at the local level in the municipality of Cluj-Napoca: “*School Buses for Children*”, “*Green Friday – STOP! Today the car is standing still!*”, and “*Free public transport passes for students*”. This study offers a new perspective by interpreting these instruments as positive behavioral shocks capable of generating long-term changes in citizens' travel habits. The main objective of the thesis is to evaluate the capacity of these tools to support the transition from private motorized transport to a more sustainable mobility, by activating behavioral change mechanisms among the population. The theoretical framework of the analysis is grounded in the Theory of Planned Behavior (Ajzen, 1991) and the Travel Mode Choice Cycle (De Vos et al., 2022), which provide a comprehensive lens for understanding how individuals choose their means of transportation, taking into account psychological, instrumental, and socio-demographic factors. In this regard, the research examines not only the effectiveness of the implemented measures but also the behavioral resilience of individuals, namely, their ability to adopt and maintain new mobility habits in response to public interventions.

Understanding the motivations behind transport mode choice has become increasingly relevant in the current context of urban challenges. Urban mobility plays a crucial role in sustainable development and in enhancing the quality of life in cities, acting as a key determinant of urban resilience and the subjective well-being of residents. With rapid urbanization and population growth, cities are facing a growing number of motor vehicles on their roads, an issue that leads to numerous problems: traffic congestion, pollution, inefficient management of public space, reduced urban vitality, and, most critically, a rising number of serious road accidents. At the European Union level, Romania has the highest rate of fatal road accidents. In 2021, the country recorded 1,779 road traffic fatalities, of which 62% occurred in urban areas (European Commission, 2023, pp.5-11). The most vulnerable road users are pedestrians, cyclists, and motorcyclists, who together account for 47% of all traffic victims in the EU (Curtea de Conturi Europeană, 2024, p.9).

These issues are largely driven by citizens' mobility behavior, particularly their choice of transport modes and the daily reliance on private cars over active forms of transportation. Mobility behavior refers to the set of choices and travel practices adopted by individuals, influenced by access to transportation infrastructure (Barajas, 2021, pp.3-4). Individual

decisions, such as the frequency and type of transport used, ultimately define urban mobility and directly contribute to traffic congestion, air pollution, and the rising number of accidents.

In this context, one of the most widely used theories in the analysis of urban mobility behavior is the Theory of Planned Behavior (Ajzen, 1991), as it offers a comprehensive framework for understanding how individuals choose their modes of transport. According to this theory, a person's intention to perform an action is influenced by their attitude toward the behavior (whether it is perceived as positive or negative), their subjective norms (the perceived social pressure from significant others), and their perceived behavioral control (how capable the individual feels in adopting the behavior). Building on this theory, De Vos et al. (2022) developed an integrated conceptual model, the *Travel Mode Choice Cycle*, which connects five key indicators: behavior, satisfaction, attitudes, desire, and intention, along with four main determinants: subjective norms, perceived behavioral control, opportunities & constraints, and habit. This model demonstrates that urban mobility behavior is a cyclical process in which the behavioral indicators mutually influence each other in a bidirectional manner bidirectional (De Vos, Singleton și Gärling, 2022, p.210). Travel behavior is shaped not only by psychological factors, such as attitude, satisfaction, desire, and intention, but also by instrumental factors, which reflect objective characteristics of the transport system (e.g., accessibility, cost, comfort, and frequency), as well as socio-demographic variables such as age, gender, education level, and income. Together, these factors constitute the complex framework within which individuals make daily transport decisions.

Given the above, it is not surprising that the most commonly used mode of transportation in urban areas remains the private car, both across Europe and in Romania, including cities such as Cluj-Napoca. In Cluj-Napoca, between 2014 and 2024, the population increased from 320,819 to 327,091 inhabitants (Institutul Național de Statistică, 2025), while the number of registered vehicles grew significantly, from 114,923 in 2015 to 131,673 in 2017 (IPJ Cluj). Additionally, the city is traversed daily by numerous vehicles from nearby surrounding areas such as Florești, Baci, Apahida, and Feleacu. This constant pressure has led to severe traffic congestion and a rise in the number of accidents: between 2011 and 2019, the Cluj metropolitan area recorded 1,544 road traffic accidents, resulting in 196 fatalities and 1,988 serious injuries. In the city of Cluj-Napoca alone, 490 road accidents with fatalities were reported in 2024 (PMUD Cluj-Napoca, 2022; IPJ Cluj).

Given the severity of the effects caused by the use of private cars in urban environments and the complexity of the factors that influence travel behavior, it becomes essential to

understand how such behavior could be changed. This shift would facilitate the transition toward more sustainable mobility and contribute to the creation of a healthier and safer urban environment for citizens. In this context, a key question emerges: how can local public authorities change citizens' mobility behavior, and what types of interventions can facilitate the transition from motorized transport to more sustainable alternatives? To answer this question, it is necessary to understand the mechanisms through which mobility behavior change occurs. Typically, such change is triggered by a "shock", a significant alteration in personal life, such as changing residence, having a child, or procuring a car, or by an external change, such as new mobility policies, adverse weather conditions, or changes in transport infrastructure (Clark, Chatterjee și Melia, 2016; Walker, Thomas, și Verplanken, 2015). These shocks may be negative (e.g., driving restrictions, disasters, emergencies) or positive (e.g., investments in public transport infrastructure, bike lanes, or financial incentives), yet in both cases they can prompt individuals to reevaluate their transport choices and adopt new mobility habits. Within this framework, local public administrations play a crucial role in shaping mobility behavior by promoting public policies oriented toward sustainability. These policies are implemented through a range of instruments, which in themselves act as external drivers of change.

Public policy instruments in urban mobility can include intrusive measures, which exert direct and immediate influence over transport behavior, such as banning private cars in certain city areas, eliminating parking spaces, or introducing congestion charges, as well as soft instruments, which aim to change behavior through education, information, and various financial incentives offered to citizens. In this way, public policies become catalysts for shifting mobility patterns and hold the potential to stimulate a broader transition toward more sustainable transport modes.

Therefore, this thesis analyzes the impact of three soft public policy instruments on the urban mobility behavior of beneficiaries, using as a case study the programs "School Buses for Children," "Green Friday – STOP! Today the Car Stays Still!", and "Free public transport passes for students" implemented in the city of Cluj-Napoca.

2. Research purpose and objectives

The aim of this study is to analyze individuals' satisfaction, attitudes, and intentions regarding the use of public transport, in the context of positive shocks generated by public policy

instruments, with the goal of optimizing urban mobility policies focused on behavioral change toward a transition from motorized transport to more sustainable modes.

Research Objectives:

1. To identify and analyze the level of individual resilience following the emergence of a positive shock, generated by the implementation of an urban mobility instrument aimed at reducing road traffic, as well as to assess its impact on travel behavior.
2. To examine attitudes toward the use of public transport and private cars in the context of implementing a nudge-type instrument, by comparing its influence on mobility behavior with the impact of pre-existing attitudes.
3. To identify the current attitudes toward public transport and the future intention of use among Generation Z, in the context of free access to this service, considering that they are active users.

3. Research methodology

A mixed-methods approach was used in this research, combining both qualitative and quantitative methods. The qualitative component (interviews and focus groups) was employed to better understand respondents' attitudes, shaped by their cognitive and emotional experiences. The quantitative component (survey) aimed to analyze the level of satisfaction with public transport. To evaluate the “School Buses for Students” program, a public opinion survey was conducted between May and September 2021, targeting parents of children benefiting from the program. The goal was to measure satisfaction with public transport, using the *Satisfaction with Travel Scale* (Ettema et al., 2011). Out of 103 collected responses, only 76 were valid. Given the limited number of responses, six additional interviews were conducted to confirm and complement the survey results.

For the analysis of the public policy instrument “Green Friday,” 19 individual interviews were conducted, based on a semi-structured interview guide, applied to a quota-based non-probabilistic sample between November 2024 and February 2025. The objective

was to identify the impact of this nudge-type instrument on travel behavior, taking into account respondents' pre-existing attitudes toward public transport.

Regarding the “Free Student Passes” policy, five focus groups were organized between November 2024 and March 2025, using a semi-structured interview guide. This analysis aimed to identify students' attitudes toward public transport and their intention to continue using it after the end of the free-access period.

4. Thesis structure

The thesis is structured into three parts, comprising a total of eight chapters. The first part, the theoretical section, includes the first three chapters. Chapter I analyzes the academic literature related to the definition of mobility and urban transport concepts, highlighting the advantages and disadvantages of various transport modes, both active and motorized, for the well-being of city residents. This chapter also discusses the importance of the built urban environment, neighborhood and city planning in line with mixed urban design principles, and the role of active transport infrastructure as essential elements for the sustainable development of urban areas. Chapter II addresses the main theories underlying the formation of urban mobility behavior, including the *Theory of Planned Behavior* (Ajzen, 1991), the *Utility Maximization Theory* (Clifton and Handy, 2003) as well as the conceptual model proposed by De Vos et al. (2022), known as the Travel Mode Choice Cycle. It also discusses the influence of non-instrumental (psychological), instrumental, and socio-demographic factors on mobility behavior. Additionally, this chapter provides an overview of the mobility culture in the European Union and in Romania, and explores how public policies can induce changes in travel behavior and their impact on urban mobility resilience. Chapter III defines the concept and process of public policy development and evaluation, and presents examples of instruments that have aimed to change mobility behavior in countries with diverse norms and cultures.

The second part of the thesis analyzes the three public policy programs implemented in the municipality of Cluj-Napoca that had an impact on travel behavior. These chapters include the presentation of the mobility programs, the research design, data analysis, and the results of the empirical investigation. Chapter 4 focuses on the “*School Buses for Children*” program, analyzing parental satisfaction with different modes of transport: school buses, private cars, and regular public transport. Launched in 2018 as a participatory budgeting initiative, the program provides free transportation for students in grades 0–4 from peripheral neighborhoods

to central schools. The buses are dedicated exclusively to students and they are accompanied by a local police officer on board, which contributes to an increased sense of safety. The implementation of this program has led to a significant change in parents' mobility behavior, replacing the use of private cars and conventional public transport. This transition was analyzed by measuring parents' satisfaction with the school bus service in comparison to other transport modes, in order to identify any significant differences in satisfaction levels. In the initial phase, a quantitative method was used to collect data. This included a two-stage public opinion survey (conducted in May–June and September 2021), yielding a total of 103 responses, of which only 76 were valid. Satisfaction with the program was measured using the *Satisfaction with Travel Scale* (STS), proposed by Ettema et al., 2011 and scientifically validated by De Vos et al., 2015; Friman et al., 2019, which assesses cognitive and affective well-being related to daily travel, and through instrumental factors such as safety, station proximity, cleanliness, and cost. The analyzed data indicate that the school bus is rated significantly more positively, both cognitively and affectively, compared to the other two modes of transport (private car and regular public transit). This high level of satisfaction is supported by the positive evaluation of instrumental factors, which scored very high and had low standard deviations, indicating a high degree of satisfaction and a homogeneity of responses among parents. These findings confirm the positive impact of the “*School Buses for Students*” program.

However, the analysis based on the STS scale revealed greater variability in responses, particularly with respect to private cars and public transport. This variability highlighted the need for further analysis to determine whether there are statistically significant differences in parents' satisfaction levels (evaluated both cognitively and affectively) based on the three transport modes used to take their children to school.

In this regard, the following research hypotheses were formulated:

- (H₀): Parents' satisfaction with the trip is not higher when their children go to school by school bus, compared to when they are taken by private car.
- (H₀): Parents' satisfaction with the trip is not higher when their children go to school by school bus, compared to when they are taken by public transport.

Given that the collected data are ordinal and do not follow a normal distribution, the Wilcoxon Signed-Rank Test was applied (Divine, et al., 2013, p.700), and the results led to the rejection of both null hypotheses. Thus, it was confirmed that parents' satisfaction with the use

of the school bus is significantly higher compared to the other two modes of transport analyzed, private cars and public transport. In this regard, we can confirm that the “School Buses for Children” program acts as a positive shock in parents' mobility behavior, due to the increase in subjective well-being experienced by parents who benefit from the school bus service and have shifted from using their private car to this mode of transport, or who use it on specific days.

Considering the high variability of responses in the quantitative analysis, especially regarding the use of private cars and public transport, it was deemed necessary to complement the study with a qualitative analysis. This diversity of perceptions reflects personal experiences and motivations that cannot be fully captured through quantitative methods alone. Therefore, to supplement the quantitative data, six interviews with parents were conducted between February and March 2025, in order to deepen the understanding of their experiences and explore the reasons behind their choice of transport mode for school-related travel.

The qualitative analysis revealed that parents whose children use this program report a significantly higher level of satisfaction with the school bus compared to using a private car or regular public transport. This higher satisfaction is attributed to reduced stress from driving and lack of parking in the city, increased safety (since children are supervised by a police officer), and time savings. Moreover, parents expressed their willingness to continue using the school bus even after the end of the primary education cycle. Therefore, the program has acted as a positive shock that facilitated the transition from motorized private transport to a more sustainable alternative, while also consolidating sustainable mobility behavior among students in grades 0–4.

Chapter 5 evaluates the impact of the “*Green Friday – STOP! Today the car is standing still!*” program from the perspective of direct beneficiaries. This program, implemented at the level of Cluj-Napoca municipality, offers citizens free public transport every Friday on all urban lines and aims to encourage the temporary abandonment of personal car use in favor of public transport. The purpose of this analysis is to identify whether this nudge-type instrument has succeeded in influencing mobility behavior, specifically, whether it has contributed to changing travel behavior by reducing the use of private cars and increasing the use of public transport, including among habitual drivers, on Fridays when the transportation is free. In order to explore these issues, a qualitative method of data collection was used, using the semi-structured interview as a research instrument. This qualitative approach is widely recommended in the literature for investigating perceptions and attitudes toward daily travel.

A total of 19 interviews were conducted, providing a detailed picture of how citizens relate to the free public transport offered on Fridays. To reflect behavioral diversity and enable a relevant comparative analysis, respondents were divided into three categories, according to the classification proposed by Beirão and Cabral (2007): frequent public transport users, mixed users (who use both private cars and public transport), and habitual drivers, who predominantly use their personal vehicles for daily trips. Based on the interview analysis, it was concluded that this nudge policy, *Green Friday – “STOP!Today the car is standing still!”*, had the strongest influence on mixed users, those who already combine the use of private vehicles with public transport. These respondents stated that, on Fridays, they prefer public transport over their personal car, reorganizing their activities to take advantage of the free transport service. They already held positive attitudes toward public transport and had a pre-existing tendency to use it. Thus, the program merely reinforced their habit of using public transport and increased their satisfaction with the urban mobility system in Cluj-Napoca. In contrast, habitual drivers, those who were not accustomed to using public transport, did not change their behavior. They continued to rely on personal cars even on Fridays. Although some of them occasionally use public transport for financial or civic reasons, this behavior remains sporadic and inconsistent, influenced primarily by negative attitudes toward public transport. Overall, the “Green Friday” program reinforces the habit of using public transport for mandatory trips among mixed users. However, it was found that if the program were interrupted, it could trigger a negative shock in the mobility behavior of these users. As a result, they may stop using public transport on Fridays and revert to using their personal vehicles, to which they already have access, or switch to taxi services.

The final chapter of this section includes the analysis of the “*Free public transport passes for students*” program, which consists of 120 free rides per month for students during their study years. The purpose of analyzing this program is to assess the current attitudes, as well as the future willingness and intention of Generation Z to continue using public transport after completing their university studies, when public transportation will no longer be free. The data collection method used was the focus group, with the semi-structured interview serving as the research tool. Between December 2024 and March 2025, five focus groups were organized with students from Babeş-Bolyai University and the University of Agricultural Sciences and Veterinary Medicine in Cluj-Napoca. The results offer relevant insights into students’ attitudes toward public transport and their intention to use it after graduation, as well as valuable information that can contribute to improving the mobility experience by adapting the transport

system's features to the expectations of Generation Z. As a result of the analysis of student responses, it emerged that general attitudes toward public transport are positive. In addition to the clear financial benefit of this program, public transport is also associated with comfort, time efficiency, and especially ecological values, which reflects an increased awareness of environmental issues specific to Generation Z (Nikolić, et al., 2022; Paunovic, et al., 2023; Grzesiuk, et al., 2023). Opinions were divided on their intentions to use public transport after their studies, when they will have to pay for tickets and passes. The majority of older students, such as those in master's or doctoral programs, expressed their intention to continue using public transport for reasons of sustainability and ecology, values typical of Gen Z. On the other hand, younger students (without access to a personal car) stated that they do not intend to continue using public transport once they start earning an income, as they associate entering the workforce with the financial opportunity to purchase a personal vehicle. Thus, the free public transport program has contributed to the long-term formation of sustainable behavior, particularly among young people with strong ecological values.

The final part of the thesis is dedicated to formulating conclusions and recommendations regarding the three public policy instruments analyzed. The study's findings highlight that soft policy instruments can positively influence urban mobility behavior, but their effectiveness significantly depends on the norms of the target group as well as the quality of public transport infrastructure.

5. Final conclusions and recommendations

The measurement of satisfaction and attitudes toward these interventions emphasized the crucial role of subjective well-being in the process of behavioral change. The high level of satisfaction expressed by parents regarding the "School Buses for Children" program not only reflects a positive perception of the initiative but also contributes to strengthening their resilience in the face of mobility-related changes, specifically the shift from using personal cars to the public transport system. Overall, the three instruments analyzed were perceived differently by respondents, but all acted as positive shocks, representing new mobility opportunities that emerge in the mobility behavior formation cycle, according to De Vos et al. (2022).

Thus, both the satisfaction with the "*School Buses for Children*" program and with the "*Green Friday*" initiative play an essential role in forming, reinforcing, and maintaining

sustainable mobility behavior. The repeated use of a transport mode perceived as satisfactory contributes to the development of a positive attitude, which in turn influences the intention and behavior to consistently choose that mode of transport for daily travel. In the case of the third public policy instrument, "*Free public transport passes for students*" the situation is different, because here the behavior is already formed, free transport maintains the behavior among students. Therefore, the challenge for local authorities is not the formation of a new behavior, but rather ensuring its continuity once students no longer benefit from the free pass. Moreover, an important aspect highlighted by the analysis is the need to preserve these public policy instruments, which are essential for maintaining sustainable behavior. Discontinuing such policies could generate a negative shock, with the potential to cause a reversion to private car use and a decline in satisfaction with public transport, thereby undermining progress made toward sustainable urban mobility.

Based on the research findings, an integrated set of recommendations is proposed to increase the effectiveness of the analyzed public policy instruments and to support the transition toward more sustainable urban mobility behavior. These recommendations target both investments in transport infrastructure, such as the diversification of transport modes, the expansion of tram or metro networks, increased frequency of public transport services, and the creation of dedicated lanes, and soft interventions, including the continuation and expansion of successful programs (e.g., "*School Buses for Children*," "*Green Friday*," "*Free public transport passes for students*"), as well as the introduction of new nudge instruments, such as sustainable travel cards or symbolic rewards. Additionally, particular emphasis is placed on communication campaigns tailored to Generation Z, which should make use of relevant channels and messaging for this age group, such as influencers, social media platforms, and ecological storytelling, to reinforce the image of public transport as a responsible, modern, and "cool" choice. At the same time, coercive measures are also recommended, such as restrictions on private car use, cordon pricing, and the reduction of parking spaces, combined with strategies to increase comfort and safety in public transportation. Together, these measures contribute to shaping travel habits, supporting sustainable mobility, and building an urban culture that is socially and environmentally responsible.

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