

Between Urban and Rural: A car ownership perspective on suburbanisation in post-socialist cities

1. Introduction and research motivation

Since the collapse of the centrally planned system in 1989, Poland has undergone profound political, economic and spatial transformations. Among the most notable of these changes has been rapid suburbanisation. Under the socialism regime, urban development was centrally planned, compact, and closely integrated with public transport and essential services. Large housing estates were constructed within city boundaries and were typically accompanied by schools, kindergartens, healthcare facilities and retail services. Private car ownership was relatively low and constrained by both economic factors and state policy priorities favouring collective transport.

The transition to a market economy fundamentally altered these patterns. Liberalisation of land and housing markets, deregulation of spatial planning, and the decentralisation of responsibilities to local governments with limited financial and institutional capacity led to dispersed residential development in suburban municipalities. New housing estates were often built on greenfield sites without adequate public transport, schools or commercial services. As a result, suburban residents increasingly relied on private cars to meet everyday mobility needs.

This process coincided with Poland's accession to the European Union in 2004, which facilitated the mass import of inexpensive second-hand cars from Western Europe. Car ownership increased sharply across the country. While in 2005 motorisation rates were similar in cities, suburbs and rural areas (approximately 220 cars per 1,000 inhabitants), by 2021 suburban areas exceeded urban cores by more than 80 vehicles per 1,000 inhabitants. This divergence raises important questions about the determinants of car ownership in different territorial contexts and about the specific character of post-socialist suburbanisation.

The aim of this study is to identify the determinants of high car ownership in the suburbs of Polish cities and to compare these determinants with those observed in urban cores and rural areas. The central hypothesis is that, despite their spatial proximity and functional integration with cities, suburban areas resemble rural areas more closely than urban areas in terms of mobility patterns and car ownership drivers.

While extensive international literature exists on car ownership determinants, this study focuses specifically on factors shaping spatial variation in motorisation and accounting for high car ownership in suburban areas of post-socialist cities. Specifically, we examine the effects of income, population density, household size, commuting intensity, public transport policy, and service accessibility.

2. Data and methodology

Empirical research aimed at revealing the determinants of car ownership in Polish suburbs and comparing their influence with urban and rural areas was performed with the use of regression modelling. The research procedure assumed the estimation of three independent models using observations extracted from a dataset of Polish municipalities:

- Model ‘Cities’ – based on a group included urban municipalities with a population exceeding 50,000 inhabitants (90 units in total);
- Model ‘Suburbs’ – the sample included municipalities directly neighbouring cities (sharing borders) (392 units in total);
- Model ‘Rural areas’ – the model embraced municipalities whose population did not exceed 20,000 inhabitants, and which were situated more than 30 km from a city (1,482 units in total).

The dependent variable is car ownership, measured as the number of cars per 1,000 inhabitants. The data were obtained from the Central Vehicle Register, which contains information on all vehicles registered in Poland. At the end of 2021, the register comprised more than 16.7 million passenger cars owned by natural persons, of which nearly 13.5 million were registered in the analysed spatial units.

The explanatory variables include:

- **Income** – the average income of the population was calculated based on local budget revenues from personal income tax (Statistics Poland data in PLN per person).
- **Population density** – used as an indicator of the level of urbanisation and the built environment, measured by the number of people per km² at the municipal level (Statistics Poland data).
- **Household size** – measured by the average number of people in a household, retrieved from the National Population and Housing Census 2021.

- **Work commutes** – measured by the number of commuters travelling to work outside their home municipality per 1,000 inhabitants (data from the National Population and Housing Census 2021).
- **Local public transport policy** – illustrated by the local authorities' expenditures on collective transport (data from the Ministry of Finance in PLN/person).
- **Service accessibility** – time accessibility to service facilities is represented here by the average time of travel to kindergartens (in minutes) (Statistics Poland, 2018).

To ensure robustness and account for potential violations of classical OLS assumptions, parameter estimates and standard errors were obtained using bootstrap resampling (5,000 replications).

3. Results

The results reveal substantial differences in the determinants of car ownership across territorial types.

Income is statistically insignificant in both cities and suburbs but significant and positively related to car ownership in rural areas. This suggests that urban and suburban areas have reached a level of motorisation where marginal income differences no longer translate into additional cars. In contrast, rural areas, characterised by lower income levels and lower initial saturation, still exhibit a positive income-motorisation relationship.

This finding indicates that the saturation hypothesis, often tested at the international level, also applies within a single country at the local scale.

Population density has a negative and statistically significant effect on car ownership in all three models (though weaker in rural areas). Higher density reduces distances between residences, workplaces and services and enhances the feasibility of collective transport. This confirms the importance of the built environment as a structural determinant of motorisation.

Average **household size** significantly increases car ownership in suburbs and rural areas but not in cities. Suburban municipalities are characterised by larger, often family-oriented households. Combined with limited public transport and service accessibility, this results in multiple-car ownership. In urban cores, where smaller households are more common and services are easily accessible, this relationship is not statistically significant.

The number of residents **commuting** outside their municipality positively affects car ownership in suburbs and rural areas but not in cities. Suburban residents frequently commute to urban cores for employment, and in the absence of efficient inter-municipal public transport

systems, private cars become the dominant mode. Rural residents face similar constraints due to limited local employment opportunities. In cities, higher job density and better transport options reduce this dependence.

Public transport expenditure per capita negatively affects car ownership only in cities. In suburban and rural municipalities, no statistically significant relationship is observed. This suggests that urban public transport systems may effectively moderate motorisation, whereas suburban and rural transport policies are either too limited or too fragmented to influence car ownership decisions.

Longer travel times to kindergartens significantly increase car ownership in suburbs and rural areas, but not in cities. This underscores the role of local **service accessibility** in shaping mobility needs, particularly in less dense and more dispersed settlement patterns. In urban cores, where service networks are denser and travel distances shorter, accessibility constraints are less likely to translate into higher levels of motorisation.

4. Discussion and conclusion

The comparative analysis demonstrates that suburban municipalities in Poland are more similar to rural areas than to urban cores in terms of car ownership determinants. In both suburbs and rural areas, unlike in cities, household size and commuting intensity exert a strong influence on car ownership, local public transport expenditure has no measurable impact, and service accessibility remains a significant factor.

Despite their spatial proximity and functional integration with cities, suburbs display structural characteristics associated with peripheral territories: dispersed settlement patterns, limited public transport, and service deficits.

The results also suggest that post-socialist suburbanisation in Poland followed a different trajectory from Western experiences. Rather than being enabled by widespread car ownership, suburban expansion created conditions that necessitated motorisation. Residential relocation to peripheral municipalities – motivated by housing aspirations and lower land prices – preceded and stimulated car ownership growth.

Fragmented governance and weak metropolitan coordination have further reinforced car dependency. Public transport systems are typically organised at the municipal level, and cross-boundary integration remains limited. As a result, suburban residents face structural barriers to reducing car dependence.

From a policy perspective, the findings highlight the need for integrated metropolitan planning. Without coordinated investment in public transport, compact development strategies and improved local service provision, suburban municipalities are likely to remain structurally car-dependent. Addressing this challenge is essential not only for transport efficiency but also for environmental sustainability and social equity.