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Research Article

Household preferences regarding residential location and commuter choices, depending on household type and teleworking options

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Abstract

Residential location choices and travel behaviour have implications for sustainability. For example, preferences for detached single-family homes in a green environment may lead to longer commutes, mostly by car. In the face of environmental challenges, commuting is essential for developing strategies for a more sustainable future. At the same time, it remains uncertain how commuting distances, car use for commuting, and urbanisation trends will evolve in the future. This study focuses on understanding individual choices and the relationship between residential, work and commuting choices for different household types. It is based on a quantitative online survey of residential location and mode choices of commuters in Germany using discrete choice experiments. The results show that travel time values are significantly lower for teleworkers than for non-teleworkers. Regarding mode choice, walking is perceived more negatively by family households, young households are most sensitive to car travel time, and public transport seems less attractive to them. In general, in a teleworking scenario, the elements of public transport use that are currently perceived as burdensome (especially waiting time) become less important. In terms of modal shift, telework could reduce car use for young households, but not for family households. This study provides an insight into the relationship between residential location, commuting and mode choice and opens a discussion on the impact of teleworking on the sustainability of commuting.

1 Introduction

Urban areas around the world have been growing rapidly in recent years. In Germany, for instance, the population of cities with more than 500,000 residents has increased by about 20% over the past 20 years, with the trend continuing. Worldwide, the share of people living in urban areas is expected to reach 68% by 2050, up from 55% in 2018 (United Nations, 2019). Besides positive effects, such as an influx of younger people and an increase in working and innovative population groups in urban areas, there are also risks associated with these trends. These include an increase in housing prices, displacement, especially of low-income families, an increase in transport demand, and its external effects, such as increased air pollution, land use, and deterioration in quality of life.

Simultaneously, population growth, an increasing housing shortage in major cities, and the preference, especially among families, for detached single-family homes in green environments have led to longer distances between residential and work locations. On these longer commutes, using a car plays a key role. Given environmental challenges, commuting is essential for developing strategies for a more sustainable future. However, it remains uncertain how commuting distances, car utilisation on commuting trips, and urbanisation trends will evolve in the future. This is particularly true in light of the escalating trend of teleworking facilitated by COVID-19 pandemic-related measures and the increasing vehicle automation, which may result in a rise in the willingness to travel for longer commuting durations. Understanding and projecting current and future preferences for residential location and commuting trips is therefore a key element in developing measures to promote more sustainable future commuting behaviour. Previous studies have shown that changes in employment or commuting conditions often trigger residential relocation, typically toward areas offering shorter or more reliable access to work (Schirmer et al., 2014; Dubernet, 2019). At the same time, households frequently accept longer commutes to obtain preferred housing attributes such as larger dwellings or green surroundings (Guo et al., 2020). This reflects a bidirectional relationship in which accessibility constraints and residential preferences interact rather than exerting one-sided effects on location choice (Dubernet & Kolarova, 2024). Even though it is important to understand the relationship between long-term decisions, such as residential location choices, and mid- to short-term decisions, such as commuting-related mode choices, there is still no clear theoretical framework or sufficient empirical evidence in the literature to comprehensively capture these interdependencies.

This study focuses on the analysis of current and potential future preferences for residential location and commuting. Its main aim is to understand individual choices and the relationship between living-, working-, and commuting-related choices across various household types.

2 Literature review

This paper analyses the relationship between residential location choices, commuting behaviour, and mode preferences across different commuter profiles and household types. In the following, we briefly summarise the literature on three main topics: (i) residential location and travel behaviour choices, (ii) the effects of teleworking, particularly in relation to residential location and mode choices, and (iii) potential differences between household types.

Several studies in transport research have sought to jointly examine residential location and commuting-related choices to understand their interdependencies and inform policy. For example, the Value of Time (VoT) study in Germany attempted to capture both dimensions within a single survey (Dubernet & Axhausen, 2020). However, these efforts face significant empirical and methodological challenges, particularly when addressing both long-term (residential) and short-term (commuting) decisions, resulting in limited policy relevance and weak data foundations for future projections (Dubernet et al., 2020; Schmid et al., 2022). Discrete Choice Experiments (DCEs) have been widely used to explore such trade-offs, including relocation-focused (Velvarth et al.,

2022), commuting-integrated (Van Cranenburgh & Garrido-Valenzuela, 2025), and teleworking-related designs (Lara-Pulido & Martínez-Cruz, 2021; Lara-Pulido, 2023). Some studies, such as Guo et al. (2020), have combined residential, job, and transport decisions. Yet, most research still treats these domains separately or integrates them only at the modelling stage.

Research on the relationship between teleworking, residential location, and commuting choices has evolved over the past decade. For example, Zhu (2013) found that telecommuting affects commuting distances and household travel patterns; Asmussen et al. (2024) identified distinct behavioural sequences in how individuals select telework arrangements and residential locations; Anik et al. (2024) highlighted differences in residential location choices between full, hybrid, and non-teleworkers; and Fatmi et al. (2022) demonstrated heterogeneity in telework preferences linked to commute distance and urban proximity. Nevertheless, to our knowledge, no study has fully integrated residential location, commuting choices, and teleworking within a single, comprehensive survey capturing both long- and short-term decision horizons - a key methodological gap, particularly given the growing importance of teleworking in shaping future mobility and spatial patterns.

Evolving societal and technological trends further complicate the relationship between residential location and commuting behaviours. The rise of teleworking has a potentially transformative effect, influencing both mode choice and commuting distance. By reducing the need for daily travel, remote work reshapes spatial preferences. Following the COVID-19 pandemic, several studies revisited this topic. For instance, De Abreu e Silva (2022) found that individuals with longer commutes and suburban residential preferences were more likely to intend to telework, suggesting that teleworking reduces commuting burdens while encouraging suburban relocation. Similarly, Maheshwari et al. (2024) showed that hybrid teleworkers report the highest levels of subjective well-being (SWB), whereas occasional work-from-home individuals report the lowest. Collectively, these findings highlight how residential, work, and commuting choices are closely interlinked, with teleworking reshaping not only urban spatial dynamics but also individual well-being.

Household composition and characteristics strongly influence commuting, teleworking, and residential choices. Households with children tend to exhibit more constrained and coordinated travel patterns, as parents balance work, school, and household responsibilities, often resulting in shorter commutes and joint decisions about car use and residential location (Hu et al., 2023). The rise of teleworking allows such families to move to more affordable or spacious areas, though long-term effects on mobility remain uncertain (Hu et al., 2023). In multi-person or dual-earner households, members often adjust commuting distances strategically - one working closer to home while the other commutes farther - to manage childcare and time demands (Echeverría et al., 2024). Complementing this, Mao and Wang (2020) show that household members experience different benefits from residential relocation, as improvements in travel convenience, neighbourhood quality, or social ties may affect each member differently, reinforcing the role of household-level coordination in mobility outcomes. Likewise, Timmermans and Zhang (2009) demonstrate that household size, income, vehicle ownership, and employment structure shape activity-travel behaviours, with dual-income households prioritising accessibility to schools and workplaces, while single-person households retain greater spatial and temporal flexibility. Similarly, Srinivasan and Ferreira (2002) found that household travel behaviours differ systematically by socio-economic and spatial context, reflecting variations in where households live, work, and travel. Collectively, these studies highlight that household heterogeneity – rather than individual preference alone – drives commuting, teleworking, and residential decisions, emphasising its importance in transportation research and policy design.

In summary, no study to date has simultaneously examined residential location, commuting choices, and teleworking within a single, integrated experimental survey and only a few account for household heterogeneity. We suggest that addressing all three areas together is crucial to

generate robust evidence for policy and planning purposes, as this approach captures the interdependencies that shape travel behaviours, residential decisions, and well-being amid evolving work and mobility patterns. This study not only analyses preferences but also aims to quantify effects, providing an empirical basis for travel demand and residential location models that can simulate scenarios, such as the impact of teleworking on specific household segments.

Building on the literature, this study assumes an interdependent relationship between residential location, commuting behaviour, and teleworking, moderated by household type. Residential location sets the spatial context for commuting, while teleworking relaxes time and distance constraints that traditionally shaped these choices. Household type conditions this interaction: families face coordination needs related to childcare and joint travel, whereas younger or adult-only households show greater flexibility. The empirical analysis examines how these factors jointly influence location and mode preferences under teleworking and non-teleworking conditions.

3 Methods

3.1 Study design and set-up

The study focuses on Germany and is based on a quantitative online survey. It is representative of the German working population aged 25 to 60 in terms of age, gender, and living area type (urban, suburban, rural). Respondents were recruited through a professional panel provider, who selected the sample to match the target population shares as defined by microcensus data. The sample was balanced on the selected sociodemographic variables provided to the panel provider. Participants received an incentive for completing the online questionnaire, which took approximately 15 minutes to fill out. The final sample consists of 1,169 respondents. The questionnaire included questions on current residential location preferences, travel behaviour, (tele)working patterns, and socio-demographic variables, as well as two discrete choice experiments: (i) a residential location and commuting trip distance experiment and (ii) a commuting mode choice experiment.

Discrete Choice Experiments (DCEs) are a widely used stated-preference method in transport and behavioural research for analysing how individuals make trade-offs between alternative options characterised by different attributes and levels. We chose to use this method for two main reasons. First, it allows us to analyse preferences regarding residential location and commuting choices in a consistent, structured way. Second, it provides empirical input for both a residential location model and a travel demand model, each of which relies on discrete choice approaches to represent individual decision-making processes—specifically, the choice of residential location and the choice of transport mode. DCEs are grounded in random utility theory and allow estimation of the relative importance of factors influencing decision-making, such as travel time, cost, or residential location. This approach is particularly useful for analysing hypothetical or emerging mobility contexts - such as teleworking - where revealed preference data are limited. In transport research, DCEs have been extensively applied to study commuting, residential, and telework-related choices (e.g., Bliemer & Rose, 2006; Lara-Pulido & Martínez Cruz, 2021; Lara-Pulido, 2023; Fatmi et al., 2022).

The first experiment in our study was a discrete choice experiment, in which respondents were asked to choose between two housing options. These alternatives were characterised by features relating to the dwelling itself, the residential location, and commuting time. Table 1 shows the attributes and levels of the housing options. Figure 1 shows a screenshot of the experiment. The attributes housing cost, dwelling size, residential location, and commuting distance were selected based on focus group discussions with commuters conducted within the same research project. These discussions identified the main criteria influencing individuals' housing choices in relation to commuting time. In this experiment, we focused on housing attributes and commuting time, as the trade-off between these factors was central to the study. Furthermore, the results of the data

analysis were intended to serve as input for a residential location model incorporating these specific attributes.

Table 1. Attributes and levels in an experiment on residential location and commuting trip distance

Alternative	Attribute	Levels
Alternative 1 / Alternative 2	Cost	-20% -10% 0% +10% +20% reference cost ^a
Alternative 1 / Alternative 2	Size in sqm	-20% -10% 0% +10% +20% reference size ^a
Alternative 1 / Alternative 2	Residential location	City Suburban area Rural area ^b
Alternative 1 / Alternative 2	Commuting	15 25 35 45 60 Minutes ^b

^a The reference is to the current cost and size of housing.

^b These values are not related to the current situation.

Overall, respondents were asked to choose between the two alternatives presented six times. The values of the attributes varied between decision situations. Additionally, they received one of two different scenarios: a teleworking scenario where they can work from home 2 days per week and commute to work on the other days and a non-teleworking scenario where they are commuting 5 days a week. The teleworking scenario was presented to respondents who currently have the option to work from home. This experiment aimed to analyse trade-offs between characteristics of the residential location and commuting trip duration. The calculation of the cost and size of the flat/house is based on their current situation as reported in the first (revealed preference) part of the survey.

Bei dieser Aufgabe geht es darum, ausgewählte Charakteristiken der Wohnung / des Hauses gegen eine entsprechende Fahrzeit zur Arbeit abzuwägen.

Stellen Sie sich vor, Sie hätten die Wahl zwischen den folgenden 2 Wohnungen/ Häusern. Bitte wählen Sie aus den 2 Optionen diejenige aus, die für Sie persönlich attraktiver ist.

	Alternative 1	Alternative 2
Kosten Wohnung / Haus	1710 Euro	2090 Euro
Wohnort	Ländlich	Stadttrand
Größe der Wohnung / des Hauses	124 qm	82 qm
Fahrzeit zur Arbeit	45 Min	25 Min
Was würden Sie wählen?	✔	○

Figure 1. Screenshot of the experiment on residential location and commuting trip distance, in the original German version

The second experiment was a choice experiment in which the alternatives were different modes of transport. Respondents were asked to select the option that best represented their typical commute. The attributes and levels for the different modes (i.e., the alternatives) are presented in Table 2. A screenshot of the second experiment is shown in Figure 2.

Once again, respondents were presented with six decision situations, with the attribute levels varying each time. The values for the attributes are based on the current trip of the respondents and estimated using average speed and cost per mode of transportation drawn from a passenger travel demand model and existing cost analysis for Germany. We did not consider an opt-out option in either experiment.

Table 2. Attributes and levels in the experiment on mode choice

Alternative	Attribute	Levels
Walk	Travel time	-20% -10% 0% +10% +20% reference time ^a
Bicycle	Travel time	-20% -10% 0% +10% +20% reference time ^a
Car	In-vehicle time	-20% -10% 0% +10% +20% reference time ^a
Car	Cost	-20% -10% 0% +10% +20% reference cost ^a
Public transport	In-vehicle time	-20% -10% 0% +10% +20% reference time
Public transport	Access/egress time	2 5 10 Minutes
Public transport	Waiting time	2 5 10 Minutes
Public transport	Cost	-20% -10% 0% +10% +20% reference cost ^a

^a Reference values for time and cost of the alternatives are derived from existing values for Germany.

The inclusion of two experiments examining commuting travel time preferences was motivated by the idea that people consider both commute duration and transport mode when choosing where to live. In the residential choice experiment, respondents selected between dwellings with different attributes and associated commuting times, allowing analysis of trade-offs between commute duration and housing characteristics. A separate mode choice experiment avoided overloading participants. It provided an additional estimate of the value of travel time savings (VTS) by transport mode, complementing the VTS derived from the residential choice experiment.

In both experiments, respondents were required to choose between the presented alternatives and no opt-out option was included. Although individuals may in reality choose not to select any of the available options, this forced-choice design was adopted to ensure consistency with the intended application of the results, namely a residential location choice model and a travel demand model, which do not incorporate a no-choice alternative. This approach also ensured that respondents made explicit trade-offs between attributes, which is central to the study's objectives.

Stellen Sie sich vor, dass Ihnen alle unten angegebenen Verkehrsmittel für Ihren **Weg zur Arbeit** zur Verfügung stehen. Die Dauer und die Kosten für den Weg mit den verschiedenen Alternativen sind wie angegeben.

Bitte kreuzen Sie an, für welche Option Sie sich in dieser Situation entscheiden würden.

Gehen Sie bitte dabei davon aus, dass Sie 2 Tage die Woche zur Arbeit fahren müssten.				
	zu Fuß	Fahrrad	Auto	ÖPNV
Fahrzeit	337 min	90 min	60 min	75 min
Zu- und Abgangszeit				2 min
Wartezeit				5 min
Kosten			9.62 Euro	3.60 Euro
Gesamte Wegezeit	Gesamte Wegezeit: 337 min	Gesamte Wegezeit: 90 min	Gesamte Wegezeit: 60 min	Gesamte Wegezeit: 82 min
Was würden Sie wählen?	☐	☐	☐	☒

Figure 2. Screenshot of the experiment on mode choices, in the original German version

To enhance the design efficiency of both discrete choice experiments, a Bayesian efficient design (Bliemer & Rose, 2006), using the software Ngene (ChoiceMetrics, 2012), was created. Sample characteristics

In addition to examining overall preferences for residential location and commuting choices, this study focused on identifying potential differences between user segment types. For the segmentation, we used an established classification of household types that has been proposed and applied in the national household travel survey Mobilität in Deutschland (Mobility in Germany; Nobis & Kuhnimhof, 2018). In both the MiD survey and this study, the differentiation between the

household types is made depending on the age of the household members and whether one of the household members is a child. Following this categorisation, we consider three household types:

- Household type 1: young households, i.e., household members are over 18 and under 35 years old
- Household type 2: families, i.e., where at least one person is under 18 years old
- Household type 3: adults (35 years old or older) only household

The MiD (Nobis & Kuhnimhof, 2018) has revealed that there are differences between household types when it comes to the number of cars in the household (families have at least one car), car sharing membership (highest in household type 1), and the number and types of bicycles in the household. Table 3 gives an overview of the sample characteristics. We see a slightly different share of people living in urban areas (6% higher in household type 1, i.e., young households), more cars in household type 3, i.e., families, and the highest share of people who are teleworking in household type 1.

Table 3. Selected sociodemographic characteristics of the sample

Characteristics	All	HH type 1	HH type 2	HH type 3
		Young adults; <35 years old	Families; ≥ child(ren) in hh	Adults; ≥ 35 years old
	[n=1.169; 100%*]	[n=187; 16%*]	[n=444; 38%*]	[n=538; 46%*]
	N (%)	N (%)	N (%)	N (%)
Residential area				
Urban	549 (47%)	101 (52%)	204 (46%)	244 (46%)
Suburban	355 (30%)	54 (28%)	134 (30%)	167 (31%)
Rural	265 (23%)	38 (20%)	102 (24%)	125 (23%)
No. of cars in household				
0 cars	142 (12%)	24 (12%)	35 (8%)	83 (15%)
1 car	640 (55%)	100 (52%)	213 (48%)	327 (61%)
2 cars	360 (31%)	64 (33%)	183 (42%)	113 (21%)
3 cars or more	27 (2%)	5 (3%)	9 (2%)	13 (2%)
No. of household members				
1 person	310 (27%)	7 (40%)	-	233 (43%)
2 persons	408 (35%)	104 (54%)	52 (12%)	252 (47%)
3 persons or more	451 (39%)	12 (6%)	388 (88%)	51 (10%)
Currently teleworking				
Yes	391 (33%)	81 (42%)	158 (36%)	152 (28%)
No	778 (67%)	112 (58%)	282 (64%)	384 (72%)

* Percentage across all households

3.2 Data analysis

Both choice experiments were analysed using a mixed logit model to address some limitations of the MNL, particularly the heterogeneity in the sample and the pseudo-panel effect in the data (Hensher & Greene, 2003; Train, 2009). The final models were obtained using an iterative procedure. The analyses were performed in RStudio using the Apollo package (Hess & Palma, 2019). In the “base model”, we only looked at average preferences across the sample. For the residential location and commuting preferences model, we have estimated random parameters for the commuting duration (in minutes). For the mode choice preferences model, we have only added an error component to capture heterogeneity in the sample and the pseudo-panel effect. As we focused on the analyses of the preferences of different household types, in the “household preference model”, the parameters were estimated for the interaction between the household types

of the respondents and the attribute of interest. Again, random parameters in the first-choice model and error-term components in the second-choice model were added, this time to capture heterogeneity rather than within household types.

4 Results

4.1 Residential location and commuting choices

The results from the models on residential location and commuting choices are summarised in Table 4. The signs and values of the parameters are plausible and in the expected direction. Firstly, the size of the dwelling in square meters (sqm) has a positive effect on the choice, i.e., more sqm increases the probability of choosing the flat/house. There is significant heterogeneity in preferences for dwelling size in the base model and in the household type preferences model (see the σ parameters). Comparing the household types, on the other hand, shows no notable differences.

Secondly, the analysis indicates that people who live in cities prefer cities to suburban or rural areas, and those who do not live in cities do not like living in the city. We did not observe any of these effects among people currently living in suburban areas. We can observe differences between the household types. Young households (hh type 1) that currently live in the city seem to be the ones who do not want to change their residential location, while we do not see significant effects for the other household types. However, when the young households currently live in a suburban area, they do not have strong (and statistically significant) preferences against living in the city, while the other household types do. When people live in rural areas, they show a clear aversion to choosing a dwelling in the city, and this applies to all household types.

Thirdly, for commute time, the results suggest clear differences between the teleworking and non-teleworking scenarios. The travel time values for teleworking are significantly lower than for non-teleworking, and this is consistent across all household types. Travel time savings become less important when teleworking than when commuting to work daily.

Table 4. Model results for residential location and commuting preferences

Coefficient	Base model		Household type preferences model	
	Est.	t-value	Est.	t-value
β_{cost}	-0.003	-19.87 *	-0.003	-19.85 *
λ_{income}	-0.475	-5.09 *	-0.466	-4.97 *
β_{sqm}	0.025	19.72 *		
$\beta_{\text{sqm_hh_type_1}}$ ($n=187$)			0.030	8.46 *
$\beta_{\text{sqm_hh_type_2}}$ ($n=444$)			0.025	13.23 *
$\beta_{\text{sqm_hh_type_3}}$ ($n=538$)			0.025	12.26 *
People living in the city				
β_{city}	0.236	3.05 *		
$\beta_{\text{city_hh_type_1}}$ ($n=101$)			0.516	2.88 *
$\beta_{\text{city_hh_type_2}}$ ($n=204$)			0.151	1.14
$\beta_{\text{city_hh_type_3}}$ ($n=244$)			0.183	1.61
People living in suburban area				
β_{city}	-0.204	-2.08 *		
$\beta_{\text{city_hh_type_1}}$ ($n=54$)			0.306	1.26
$\beta_{\text{city_hh_type_2}}$ ($n=134$)			-0.269	-1.57
$\beta_{\text{city_hh_type_3}}$ ($n=167$)			-0.325	-2.32 *
People living in rural area				
β_{city}	-1.196	-9.60 *		
$\beta_{\text{city_hh_type_1}}$ ($n=38$)			-1.513	-4.54 *
$\beta_{\text{city_hh_type_2}}$ ($n=102$)			-1.250	-6.00 *
$\beta_{\text{city_hh_type_3}}$ ($n=125$)			-1.070	-6.05 *

Coefficient	Base model		Household type preferences model	
	Est.	t-value	Est.	t-value
Scenario: Regular commuting trip				
$\beta_{\text{commuting_time}}(\sigma)$	-2.999 (-.68)	-50.50 *		
$\beta_{\text{commuting_time_hh_type_1}}(\sigma) (n=187)$			-3.393 (-0.96)	-33.08 *
$\beta_{\text{commuting_time_hh_type_2}}(\sigma) (n=444)$			-3.288 (-1.04)	-35.72 *
$\beta_{\text{commuting_time_hh_type_3}}(\sigma) (n=538)$			-3.327 (-0.99)	-43.39 *
Scenario: Teleworking				
$\beta_{\text{commuting_time}}(\sigma)$	-3.330 (-1.01)	-65.18 *		
$\beta_{\text{commuting_time_hh_type_1}}(\sigma) (n=187)$			-2.849 (-0.38)	-20.71 *
$\beta_{\text{commuting_time_hh_type_2}}(\sigma) (n=444)$			-3.041 (-0.86)	-30.81 *
$\beta_{\text{commuting_time_hh_type_3}}(\sigma) (n=538)$			-3.032 (-0.69)	-34.50 *
LL (0)	-4861.73		-4861.73	
LL (final)	-3537.58		-3528.61	
AIC	7095.16		7109.22	
BIC	7163.72		7287.46	
Parameters	10		26	

4.2 Commuting mode choices

The results from the model based on the data from the mode choice experiment are summarised in Table 5. Firstly, looking at the alternative-specific constants, we can see differences by household type: a general preference for a bicycle over a car in young households, and less preference for public transport than for a car in family households. Secondly, regarding the travel times, we again see differences between the teleworking and non-teleworking scenario. In the mode choice model, we have a clearer view of how this effect varies with the mode of transport. In the base model, we see the largest travel time savings for walking (32%) and car (33%), followed by bicycle (24%). For public transport, the reduction in the value of time savings due to in-vehicle time is only 20%. At the same time, however, we can observe notable differences in the value of time savings for access/egress and waiting time. These time elements are important service level parameters for public transport. We see from the model that waiting time becomes even less significant (i.e., not relevant at all) in a teleworking scenario.

Regarding implications for more sustainable commuting due to teleworking opportunities, the results suggest both opportunities and risks. Active modes of transport, such as walking, might become an attractive option for short distances to work. Furthermore, elements of using public transport currently perceived as a burden (here, clearly, the waiting time) become less important in the decision for or against it. However, car use seems to be becoming even more attractive, i.e., longer commuting times are perceived as less bothersome for individuals.

Looking at differences between household types in travel time perception, it is interesting to observe that, for active modes of transport, there are almost no differences in travel time perception across household types in the teleworking scenario. In the non-teleworking scenario, walking is perceived more negatively by persons from family households. In the teleworking scenario, travel time by car is perceived less negatively by young households, whereas in the non-teleworking scenario, the opposite is true. The other two household types are similar in their preferences for travel time by car; in the regular work-trip scenario, a car seems more attractive to them than to younger households. Travelling by public transport seems less attractive in the teleworking scenario for adults-only households, and in the non-teleworking scenario for people from younger households.

Table 5. Model results for mode choices

Coefficient	Base model		Household type preferences model	
	Est.	t-value	Est.	t-value
β_{cost}	-0.283	-5.56 *	-0.2810	-5.44 *

Coefficient	Base model		Household type preferences model	
	Est.	t-value	Est.	t-value
λ_{income}	-0.026	-0.18	-0.062	-0.40
ASC_walk				
ASC_walk_hh_type_1 ($n=187$)			4.670	1.43 *
ASC_walk_hh_type_2 ($n=444$)	2.764	1.89 *	3.106	1.25 *
ASC_walk_hh_type_3 ($n=538$)			2.533	1.19 *
ASC_bicycle	1.079	4.27 *		
ASC_bicycle_hh_type_1 ($n=187$)			2.192	3.45 *
ASC_bicycle_hh_type_2 ($n=444$)			0.890	2.04 *
ASC_bicycle_hh_type_3 ($n=538$)			0.870	2.52 *
ASC_car	Ref.	--		
ASC_car_hh_type_1 ($n=187$)			Ref.	--
ASC_car_hh_type_2 ($n=444$)			Ref.	--
ASC_car_hh_type_3 ($n=538$)			Ref.	--
ASC_public_transport	-1.35	-5.21 *		
ASC_public_transport_hh_type_1 ($n=187$)			-0.941	-1.64
ASC_public_transport_hh_type_2 ($n=444$)			-1.925	-4.87 *
ASC_public_transport_hh_type_3 ($n=538$)			-1.044	-2.82 *
σ_{panel}	-2.808	-25.89 *		
$\sigma_{panel_hh_type_1}$ ($n=187$)			0.078	0.18
$\sigma_{panel_hh_type_2}$ ($n=444$)			2.777	20.42 *
$\sigma_{panel_hh_type_3}$ ($n=538$)			0.615	1.72 *
Scenario: regular commuting trip				
β_{time_walk}	-0.431	-6.01 *		
$\beta_{time_walk_hh_type_1}$ ($n=187$)			-0.432	-2.83 *
$\beta_{time_walk_hh_type_2}$ ($n=444$)			-0.558	-3.82 *
$\beta_{time_walk_hh_type_3}$ ($n=538$)			-0.438	-4.05 *
Scenario: teleworking				
β_{time_walk}	-0.295	-5.24 *		
$\beta_{time_walk_hh_type_1}$ ($n=187$)			-0.371	-2.67 *
$\beta_{time_walk_hh_type_2}$ ($n=444$)			-0.312	-3.17 *
$\beta_{time_walk_hh_type_3}$ ($n=538$)			-0.288	-3.48 *
Scenario: regular commuting trip				
$\beta_{time_bicycle}$	-0.213	-23.57 *		
$\beta_{time_bicycle_hh_type_1}$ ($n=187$)			-0.271	-12.60 *
$\beta_{time_bicycle_hh_type_2}$ ($n=444$)			-0.217	-15.51 *
$\beta_{time_bicycle_hh_type_3}$ ($n=538$)			-0.198	-17.16 *
Scenario: teleworking				
$\beta_{time_bicycle}$	-0.162	-16.06 *		
$\beta_{time_bicycle_hh_type_1}$ ($n=187$)			-0.179	-8.19 *
$\beta_{time_bicycle_hh_type_2}$ ($n=444$)			-0.167	-11.37 *
$\beta_{time_bicycle_hh_type_3}$ ($n=538$)			-0.156	-11.76 *
Scenario: regular commuting trip				
β_{time_car}	-0.116	-15.19 *		
$\beta_{time_car_hh_type_1}$ ($n=187$)			-0.154	-7.99 *
$\beta_{time_car_hh_type_2}$ ($n=444$)			-0.110	-9.29 *
$\beta_{time_car_hh_type_3}$ ($n=538$)			-0.116	-10.33 *
Scenario: teleworking				
β_{time_car}	-0.078	-7.52 *		
$\beta_{time_car_hh_type_1}$ ($n=187$)			-0.059	-2.29 *
$\beta_{time_car_hh_type_2}$ ($n=444$)			-0.082	-5.10 *
$\beta_{time_car_hh_type_3}$ ($n=538$)			-0.082	-5.19 *
Scenario: regular commuting trip				
$\beta_{time_public_transport}$	-0.111	-16.44 *		
$\beta_{time_public_transport_hh_type_1}$ ($n=187$)			-0.137	-8.21 *
$\beta_{time_public_transport_hh_type_2}$ ($n=444$)			-0.096	-9.66 *
$\beta_{time_public_transport_hh_type_3}$ ($n=538$)			-0.123	-11.13 *
Scenario: teleworking				
$\beta_{time_public_transport}$	-0.089	-9.10 *		

Coefficient	Base model		Household type preferences model	
	Est.	t-value	Est.	t-value
$\beta_{\text{time_public_transport_hh_type_1}}$ ($n=187$)			-0.077	-3.51 *
$\beta_{\text{time_public_transport_hh_type_2}}$ ($n=444$)			-0.084	-6.04 *
$\beta_{\text{time_public_transport_hh_type_3}}$ ($n=538$)			-0.098	-7.07 *
Scenario: regular commuting trip				
$\beta_{\text{access_time}}$	-0.134	-5.82 *		
$\beta_{\text{access_time_hh_type_1}}$ ($n=187$)			-0.234	-3.90 *
$\beta_{\text{access_time_hh_type_2}}$ ($n=444$)			-0.136	-3.79 *
$\beta_{\text{access_time_hh_type_3}}$ ($n=538$)			-0.100	-3.02 *
Scenario: teleworking				
$\beta_{\text{access_time}}$	-0.086	-4.29 *		
$\beta_{\text{access_time_hh_type_1}}$ ($n=187$)			-0.188	-3.61 *
$\beta_{\text{access_time_hh_type_2}}$ ($n=444$)			-0.122	-3.79 *
$\beta_{\text{access_time_hh_type_3}}$ ($n=538$)			-0.027	-0.93
Scenario: regular commuting trip				
$\beta_{\text{waiting_time}}$	-0.108	-5.12 *		
$\beta_{\text{waiting_time_hh_type_1}}$ ($n=187$)			-0.192	-3.48 *
$\beta_{\text{waiting_time_hh_type_2}}$ ($n=444$)			-0.149	-4.56 *
$\beta_{\text{waiting_time_hh_type_3}}$ ($n=538$)			-0.040	-1.30
Scenario: teleworking				
$\beta_{\text{waiting_time}}$	-0.02	-1.24	-0.025	-1.27
LL (0)	-9723.47		-9723.47	
LL (final)	-3772.99		-3747.2	
AIC	7581.97		7590.4	
BIC	7705.37		7919.47	
Parameters	18		48	

In the next step of the analysis, the value of travel time savings (VTTS) was calculated using the estimated coefficients from the mode choice experiment. The Value of Travel Time Savings (VTTS) was estimated using the delta method implemented in the R package Apollo (Hess & Palma, 2019). This approach enables the computation of functions of estimated model parameters - such as ratios of coefficients - to derive marginal rates of substitution (e.g., travel time and cost). When the cost coefficient is used as the denominator, these ratios represent measures of willingness to pay (WTP); in this context, they correspond to the willingness to save travel time, or the Value of Travel Time Savings (VTTS).

Table 6 presents the results in euros per hour across two different modes - car and public transport - for the three household types with separate values for the two scenarios. In general, VTTS are higher for regular commuting than for teleworking across all household types, suggesting a greater desire to reduce travel time when commuting more often.

Table 6. Calculated value of travel time savings for in-vehicle time [Euro/hour]

Mode of transport and scenario	HH type 1 Young adults; <35 years old	HH type 2 Families; ≥ 1 child(ren) in hh	HH type 3 Adults; ≥ 35 years old
Car			
VTTS regular commuting	32.95 *	23.46 *	24.73 *
<i>Rob. Std. Error</i>	(9.61)	(6.05)	(5.78)
VTTS teleworking	12.63 *	17.46 *	17.56 *
<i>Rob. Std. Error</i>	(5.25)	(5.07)	(5.73)
Public transport			
VTTS regular commuting	29.34 *	20.60 *	26.25 *
<i>Rob. Std. Error</i>	(8.06)	(4.89)	(5.44)
VTTS teleworking	16.53 *	17.89 *	21.07 *
<i>Rob. Std. Error</i>	(4.65)	(3.98)	(4.63)

For young adults under 35 (HH type 1), VTTS for car in both scenarios is the highest, indicating a strong preference to save travel time in private vehicles. In contrast, adults over 35 (HH type 3) show a slight preference for reducing time in public transport. Families with children (HH type 2) have relatively lower VTTS values for both car and public transport in both scenarios, perhaps due to more flexible commuting needs or different prioritisation for time savings.

The standard errors, indicated in parentheses, are relatively high, which may reflect the inherent variability in individuals' valuation of travel time across diverse commuting and household contexts. This variability might stem from differences in income, work flexibility, personal preferences, and situational factors affecting travel. But they may also suggest sample heterogeneity within each household group, where individual differences lead to broader ranges in VTTS estimates.

Finally, we used the estimated coefficients to calculate the modal split for each household type across the scenarios (regular commuting vs teleworking), with the results shown in Figure 3. For both young adult and adult households, there is a 5-6 percent shift away from car use, primarily favouring bicycles. Changes in public transport use are minimal, reflecting the reduced significance of waiting and other time elements in the teleworking scenario. Interestingly, family households show only a limited reduction in car use, even with teleworking, but are somewhat open to switching to bicycles as an alternative mode of individual transport. This suggests that families are more reliant on cars in daily life than other household types, as reflected in their highest car share in the modal split. It should be noted that these modal shift calculations are specific to the study sample. However, they illustrate potential changes in modal split based on user preferences identified in the study.

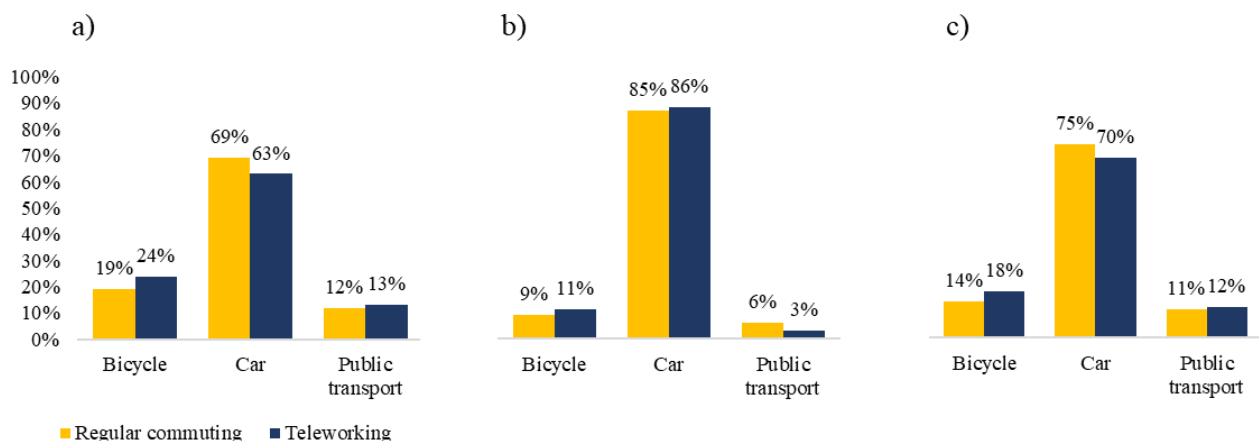


Figure 3. Calculated modal split results by household type for regular commuting vs. teleworking scenarios using the estimated model coefficients: a) Young Adults, b) Families, c) Adults. Note: The modal split for walking has been excluded, as it accounts for less than 1 percent.

5 Discussion and conclusions

This study examines how teleworking changes the relationship between where people live, how they commute, and how they choose to travel. It demonstrates that the availability of teleworking options reduces the perceived value of travel-time savings and the cost of commuting. By linking residential and mode-choice decisions, the paper reveals that teleworking encourages adults to adopt more active modes of travel, whereas families remain largely dependent on cars. Regarding residential locations, single households may prefer urban areas for their access to amenities, whereas families tend to favour suburban areas that offer schools and green spaces.

The findings align closely with the established body of research on telework and travel behaviour. Consistent with Zhu (2013) and De Abreu e Silva (2022), it confirms that teleworking lowers the

perceived cost of commuting and increases tolerance for longer travel distances. The household-based differences - particularly the continued car dependence among families - mirror results from Hu et al. (2023), Echeverría et al. (2024), and Timmermans and Zhang (2009), which show how childcare and joint trip-chaining sustain automobile reliance. The observed reduction in the disutility of travel time and waiting time under telework echoes the behavioural adaptation patterns identified by Anik et al. (2024) and Asmussen et al. (2024), who found that telework shifts mobility from routine commuting toward more flexible, lower-stress trips. Methodologically, the paper extends the approach of Dubernet et al. (2020) and Schmid et al. (2022) by quantifying the value of travel time savings (VTTs) across both short-term mode choice and long-term residential contexts, offering finer segmentation by household type and telework status.

To obtain predictions of total demand, it is generally important to allow for a no-choice response in the experimental design (Louviere & Hensher, 1983). In the present study, however, no opt-out option was included in order to ensure consistency with the intended application of the results in residential location choice and travel demand models, which do not incorporate a no-choice alternative. While this forced-choice design facilitates clearer identification of attribute trade-offs, it may limit realism in contexts where individuals can abstain from choosing, suggesting a direction for future research.

A notable divergence from some post-pandemic studies - where part-time telework modestly increases public transport use - is that here, cycling gains most of the modal share, likely reflecting Germany's strong active-mobility culture and telework's dampening of waiting-time sensitivity. Overall, the results integrate and extend existing evidence by showing how telework not only reduces the marginal disutility of travel but also reshapes inter-household mobility preferences in ways consistent with broader behavioural trends in post-COVID mobility research.

Differences between household types reveal that car dependence among families stems less from preference than from structural constraints related to childcare, school access, and time coordination. Policy responses should therefore focus on spatial and service design rather than individual behaviour. As children grow older and escorting needs diminish, these constraints relax, creating an opportunity for modal shift. Enabling this transition requires safe cycling routes, accessible local services, and reliable public transport for occasional commuting (Hu et al., 2023; Echeverría et al., 2024). Promoting sustainable modes among families thus depends on spatial accessibility and timing conditions rather than willingness alone (Dubernet & Kolarova, 2023).

As teleworking becomes more widespread, planners must adapt infrastructure and services to shifting commuter profiles. Family households remain reliant on private cars, often combining commuting with school drop-offs, while adult-only households are more inclined toward cycling and public transport. Teleworking reshapes the relationship between residence and work, reducing the perceived cost of travel but also encouraging longer commutes and suburbanization. This highlights the need for household-sensitive, coordinated land-use and transport policies that foster accessibility-oriented neighbourhoods and multimodal systems.

Planning should be understood not merely as a reaction to these trends but as an active means of shaping them. By integrating land-use regulation and transport policy, urban development can be steered toward compact, mixed-use areas that limit additional travel demand even as teleworking extends feasible commuting distances. Strengthening local accessibility through continuous cycling and pedestrian networks supports short-distance travel from telework-compatible neighbourhoods, while coordinated land-use and mobility planning ensures that behavioural flexibility reduces rather than disperses travel demand (De Abreu e Silva, 2022; Dubernet & Kolarova, 2024).

Hybrid work patterns also call for a reorientation of transport policy and service design. Instead of expanding peak-hour capacity, the emphasis should shift toward adaptive, reliable public transport operations that respond to the irregular rhythms of hybrid commuting. The reduced

sensitivity to waiting time found in this study suggests that reliability and connectivity are now more important than further speed gains. Supporting families through coordinated school mobility services, integrated active-travel networks, and improved bike–public transport connectivity can further reduce car dependence while benefiting all commuters.

Ultimately, integrating residential development, accessibility, and sustainable mobility ensures that teleworking reduces travel demand and supports more resilient urban development. In this way, land-use regulation becomes a key instrument for achieving low-carbon, equitable, and adaptable cities.

A common argument in discussions about teleworking is its potential to reduce traffic congestion. This perspective suggests that combining a shift toward more sustainable modes of transport with fewer commuting trips could enhance transportation sustainability. However, two key findings from our study challenge this optimistic view or at least temper its anticipated impact. Firstly, we observe a decrease in the value placed on travel-time savings from car use in the teleworking scenario compared to regular commuting. This shift may encourage longer commuting distances, even if trips are less frequent. Secondly, data show that teleworkers generally prefer a hybrid model rather than full-time remote work, meaning commuting trips – though reduced to a few days per week – remain regular. This preference led us to model a teleworking scenario where individuals still commute twice per week.

The observed variation in the value of travel time across teleworking and non-teleworking contexts highlights the importance of adapting transport policy to more heterogeneous commuting patterns. Lower VTTS values under teleworking imply that time savings become a weaker driver of mode choice, while factors such as comfort, reliability, and accessibility gain relative importance (De Abreu e Silva 2022). For planning and policy, this shift suggests that investments aimed solely at reducing travel times may yield diminishing returns, whereas improving the quality and reliability of public transport and the attractiveness of active modes becomes more effective. The differentiation by household type further indicates that such measures need to be tailored: flexible, demand-responsive public transport services may better address hybrid commuters, while dense and safe active-mobility networks can accommodate those who increasingly travel short distances from telework-compatible residential locations. By recognising the contingent nature of travel-time valuation, transport planning can better align investment priorities with changing behavioural realities (Dubernet & Kolarova, 2024).

Though teleworking will influence some aspects, the core decision drivers stem from household characteristics. Future research is recommended to further understand these distinct household preferences and their implications for urban planning. Finally, future research should apply longitudinal and gender-sensitive approaches to capture how telework and life-stage transitions interact with residential and mobility decisions, ensuring that emerging transport and planning strategies foster sustainable, inclusive, and resilient commuting systems across all household types.

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Data Access Statement

The data underlying this study were collected through an online survey conceived, designed, administered, and analysed by the project partners. The dataset is currently not available for access by third parties due to confidentiality and project-specific data governance restrictions.

Author and Contributor Statement

Viktoriya Kolarova: Conceptualisation; Methodology; Investigation; Data curation; Formal analysis; Writing – original draft; Writing – review & editing; Ilka Dubernet: Conceptualisation; Investigation; Formal analysis; Writing – review & editing.

Use of AI

During the preparation of this work, the authors used ChatGPT for proofreading and grammar correction. After using this tool, the authors reviewed, edited, made the content their own and validated the outcome as needed, and take full responsibility for the content of the publication.

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Conflict of Interest (COI)

There is no conflict of interest.

References

- Anik, M. A. H., Khan, N. A., & Habib, M. A. (2024). Mapping the interplay of work-arrangement, residential location, and activity engagement within an integrated model. *Transportation Research Part A: Policy and Practice*, 190, Article 104294. <https://doi.org/10.1016/j.tra.2024.104294>.
- Asmussen, K. E., Mondal, A., & Bhat, C. R. (2024). The interplay between teleworking choice and commute distance. *Transportation Research Part C: Emerging Technologies*, 165, Article 104690. <https://doi.org/10.1016/j.trc.2024.104690>.
- Bliemer, M. C. J., & Rose, J. M. (2006). Designing stated choice experiments: State-of-the-art. In R. Kitamura (Ed.), *Proceedings 11th IATBR conference, The expanding sphere of travel behaviour research* (pp. 1–35). Kyoto University. <https://research.tudelft.nl/en/publications/designing-stated-choice-experiments-state-of-the-art/>
- ChoiceMetrics (2021). *Ngene 1.3.: User manual & reference guide*. ChoiceMetrics.
- De Abreu e Silva, J. (2022). Residential preferences, telework perceptions, and the intention to telework: insights from the Lisbon Metropolitan Area during the COVID-19 pandemic. *Regional Science Policy & Practice*, 14(1), 142–161. <https://doi.org/10.1111/rsp3.12558>.
- Dubernet, I. (2019). *Understanding the value of travel time: Advanced modelling techniques applied to the National German Value of Travel Time and Travel Time Reliability Study* [Doctoral dissertation, ETH Zurich]. Research Collection. <https://doi.org/10.3929/ethz-b-000347412>
- Dubernet, I., & Axhausen, K. W. (2020). The German value of time and value of reliability study: the survey work. *Transportation*, 47(3), 1477–1513. <https://doi.org/10.1007/s11116-019-10052-4>.
- Dubernet, I., Dubernet, T., & Axhausen, K. W. (2020). Comparing values of travel time obtained from workplace and short-term decisions. *Travel Behaviour and Society*, 20, 83–90. <https://doi.org/10.1016/j.tbs.2020.02.002>.
- Dubernet, I., & Kolarova, V. (2024, January 7–11). *Unveiling the teleworking effect: How remote work alters residential choices and commuting preferences* [Paper presentation]. 103rd Annual Meeting of the Transportation Research Board (TRB), Washington, DC, United States.

- Echeverría, L., Giménez Nadal, J. I., & Molina, J. A. (2024). Commuting in dual-earner households: international gender differences with time use surveys. *Review of Economics of the Household*, 1-23. <https://doi.org/10.1007/s11150-024-09726-5>.
- Fatmi, M. R., Orvin, M. M., & Thirkell, C. E. (2022). The future of telecommuting post COVID-19 pandemic. *Transportation Research Interdisciplinary Perspectives*, 16, Article 100685. <https://doi.org/10.1016/j.trip.2022.100685>.
- Guo, J., Feng, T., & Timmermans, H. J. (2020). Modeling co-dependent choice of workplace, residence and commuting mode using an error component mixed logit model. *Transportation*, 47(2), 911–933. <https://doi.org/10.1007/s11116-018-9931-1>
- Hensher, D. A., & Greene, W. H. (2003). The mixed logit model: The state of practice. *Transportation*, 30(2), 133–176. <https://doi.org/10.1023/A:1022518621075>
- Hess, S., & Palma, D. (2019). Apollo: A flexible, powerful and customisable freeware package for choice model estimation and application, *Journal of Choice Modelling*, 32, Article 100170. <https://doi.org/10.1016/j.jocm.2019.100170>.
- Hu, Y., van Wee, B., & Ettema, D. (2023). Intra-household decisions and the impact of the built environment on activity-travel behavior: A review of the literature. *Journal of Transport Geography*, 106, Article 103485. <https://doi.org/10.1016/j.jtrangeo.2022.103485>.
- Lara-Pulido, J. A., & Martínez-Cruz, A. L. (2021). *Teleworking from a near-home shared office in Mexico City: A discrete choice experiment on office workers* (CERE Working Paper No. 2021:2). SSRN. <https://doi.org/10.2139/ssrn.3763703>
- Lara-Pulido, J. A. (2023). Stated benefits of teleworking in Mexico City: A discrete choice experiment on office workers. *Transportation Research Part A: Policy and Practice*, 168, 1–12. <https://doi.org/10.1016/j.tra.2023.103577>
- Louviere, J.J. & Hensher, D.A. (1983). Using discrete choice models with experimental design data to forecast consumer demand for a unique cultural event. *Journal of Consumer Research*, 10(3), 348–381. <https://www.google.com/search?q=https://doi.org/10.1086/208970>
- Maheshwari, R., Van Acker, V., & Gerber, P. (2024). Commuting vs teleworking: How does it impact the relationship between commuting satisfaction and subjective well-being. *Transportation Research Part A: Policy and Practice*, 182, Article 104041. <https://doi.org/10.1016/j.tra.2024.104041>.
- Mao, Z., & Wang, D. (2020). Residential relocation and life satisfaction change: Is there a difference between household couples? *Cities*, 97, Article 102565. <https://doi.org/10.1016/j.cities.2019.102565>.
- Nobis, C., & Kuhnimhof, T. (2018). *Mobilität in Deutschland – MiD: Ergebnisbericht* [Mobility in Germany – MiD: Result report]. Bundesministerium für Verkehr und digitale Infrastruktur.
- Schirmer, P.M., van Eggermond, M.A.B., & Axhausen, K.W. (2014). The role of location in residential location choice models: a review of literature. *Journal of Transport and Land Use*, 7(2), 3–21. <https://doi.org/10.5198/jtlu.v7i2.740>
- Schmid, B., Schatzmann, T., Winkler, C., & Axhausen, K. W. (2022). *A two-stage RP/SP survey to estimate the value of travel time in Switzerland: Short- versus long-term choice behavior* (Arbeitsberichte Verkehrs- und Raumplanung No. 1724). IVT, ETH Zürich.
- Srinivasan, S., & Ferreira, J. (2002). Travel behavior at the household level: understanding linkages with residential choice. *Transportation Research Part D: Transport and Environment*, 7(3), 225–242. [https://doi.org/10.1016/S1361-9209\(01\)00021-9](https://doi.org/10.1016/S1361-9209(01)00021-9).
- Timmermans, H. J., & Zhang, J. (2009). Modeling household activity travel behavior: Examples of state of the art modeling approaches and research agenda. *Transportation Research Part B: Methodological*, 43(2), 187–190. <https://doi.org/10.1016/j.trb.2008.06.004>.

- Train, K. E. (2009). *Discrete choice methods with simulation* (2nd ed.). Cambridge University Press. <https://doi.org/10.1017/CBO9780511805202>
- United Nations. (2019). *World urbanization prospects: The 2018 revision* (ST/ESA/SER.A/420). United Nations Department of Economic and Social Affairs, Population Division.
- Van Cranenburgh, S., & Garrido-Valenzuela, F. (2025). Computer vision-enriched discrete choice models, with an application to residential location choice. *Transportation Research Part A: Policy and Practice*, 192, Article 104300. <https://doi.org/10.1016/j.tra.2024.104300>.
- Velvart, J., Dato, P., & Kuhlmeier, F. (2022). *Tailored interventions in a major life decision: A home relocation discrete choice experiment* (WWZ Working Paper No. 2022/03). Center of Business and Economics (WWZ), University of Basel. <https://doi.org/10.5451/unibas-ep87754>
- Zhu, P. (2013). Telecommuting, household commute and location choice. *Urban Studies*, 50(12), 2441–2459. <https://doi.org/10.1177/0042098013476077>