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Travel Patterns after the Deutschlandticket: A Combined Tracking and Survey Approach

Dennis Gaus [a*], Heike Link [b]

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Abstract

The Deutschlandticket, introduced in May 2023, offers unlimited travel on all regional public transport in Germany for 49€ per month. This paper provides an overview of how the introduction of the ticket influenced travel behaviour and mode choice based on the GIM Traces panel, a nationwide representative dataset combining GPS tracking data and survey responses. The data, consisting of almost 4 million trips and 3,000 participants between April and December 2023, reveal that the impact of the Deutschlandticket on public transport usage is small, if existent at all. Certain groups of participants, such as those travelling in urban environments, and types of trips, such as those with a distance below 30km, show minor increases in public transport usage with the introduction of the ticket. In addition, the data show that the ticket's lower price point compared to previous monthly tickets makes it attractive for a large share of regular public transport users. Overall, the analysis finds that seasonal fluctuations as well as availability and reliability of public transport have at least as much of an impact on public transport usage as the introduction of the Deutschlandticket.

Keywords: Public transport fares, Travel behaviour, Travel surveys, GPS tracking

JEL classification: C55, C81, R41

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1. Introduction

In May 2023, the German government introduced the Deutschlandticket as a permanent successor of the popular 9-Euro ticket offered in summer 2022. The Deutschlandticket allows for unlimited travel on all local and regional public transport services in Germany at a fixed price of initially 49€ per month (58€ as of 2025). It circumvents the complex structures of public transport pricing in Germany while being cheaper than a regular monthly ticket in most transit districts and fare zones. In contrast to the 9-Euro ticket, it is available only as a monthly subscription and handed out digitally, either as a smart phone ticket or as a chip card.

Even though several studies have been published since the introduction of the Deutschlandticket, there is no clear picture of its impact on mode choice, modal shift, and induced traffic. The majority of studies relies on opinion surveys or interviews (Stated Preference approach, SP), asking respondents whether and how they would have undertaken trips without the Deutschlandticket. The research presented in this paper uses a different approach based on observed travel behaviour using GPS tracking data (Revealed Preference approach, RP), which is combined with survey data. As a comparably comprehensive approach is employed in very few studies (Koch et al., 2025, and Loder et al., 2024) focusing on rather specific cases (trips of at least 30km and the greater Munich area, respectively), generalisable findings on the effects of the Deutschlandticket based on RP data are still missing.

This paper reports and analyses the recorded travel behaviour of a Germany-wide representative sample of 2920 respondents during April and December 2023. The observed period starts one month before the introduction of the Deutschlandticket and covers the first eight months of its availability. As the analysis is mostly descriptive and does not identify causal relationships in a methodological way, it is important to confirm whether potential changes in travel behaviour can be attributed to the fare intervention in future research. We find that certain subgroups – particularly, participants that are unoccupied, come from low-income households, or travel primarily in urban environments – show a consistent increase in public transport usage after the introduction of the ticket, but the overall effect of the Deutschlandticket on our panellists' travel behaviour is very limited. Higher public transport usage in May appears to be the result of a development throughout April, rather than a jump at the introduction of the ticket, suggesting that a large share of the modal split variation in our data can be attributed to seasonal patterns rather than the fare policy.

The remainder of the paper is organised as follows. Section 2 summarises the findings of previous research. Section 3 explains the data collection and preparation process used in our study. Section 4 presents the analysis of the evolution of travel behaviour based on modal split values. A differentiation by trip distance (up to 30 km and above 30 km), ticket types, socio-economic groups, and types of regions sheds light on the heterogeneity in this section. Section 5 draws conclusions and discusses perspectives for future research.

2. Available Research on the Deutschlandticket

Seasonal or season tickets (often also labelled as travel passes or travel cards) are a public transport tariff type allowing travellers unlimited travel within a specified transport type, area, and time period at a (usually pre-paid) fixed price. Economic theory classifies a tariff scheme with seasonal tickets in contrast to single "pay-as-you-go" tickets as a form of non-linear pricing that enables operators to raise revenues in an efficient way by second-degree price differentiation. While there is a sound body of theoretical literature on the welfare-optimality of non-linear pricing (see for example Feldstein, 1972; Faulhaber & Panzar, 1976; Spence, 1977; Littlechild, 1975; Willig, 1978), little research has systematically studied the welfare effects of seasonal public transport tickets. Carbajo (1988) developed an analytical framework for non-linear pricing and derived optimality rules for the price of single tickets and travel passes which has been extended in Jara-Diaz et al. (2016) by including an income effect. Hoercher et al. (2018) and Hoercher & Graham (2020) demonstrate that the positive welfare effects of travel passes might be neutralised when a zero marginal fare (after the fixed price is paid) leads to an overuse of public transport and causes crowding externalities. Such problems of overuse and related crowding effects are particularly relevant if seasonal tickets are priced very low or close to fare-free public transport, as for example with the 9-Euro ticket in Germany (Lu et al., 2024).

While literature modelling the welfare effects of public transport season tickets is scarce, more studies analyse the impacts of travel passes on aggregate demand for public transport. Examples include Fitzroy & Smith (1998), Matas (2004), Abrate et al. (2009) and Grkitza et al. (2011); for more recent studies see Hahn et al. (2024) and Wallimann (2024). While there is consensus amongst these studies that public transport usage usually increases with the introduction of seasonal tickets, the magnitude of the effect depends on local circumstances, price levels of public transport and competing modes, socio-demographic and socio-economic factors, trip purposes, and other contextual factors. The research on the Deutschlandticket available so far, which is reviewed below, belongs to this stream of research.

Another relevant stream of literature focuses on the phenomenon that travellers often do not choose the most cost-efficient tariff when having a choice between a seasonal ticket and a single ticket. This is labelled as the flat rate bias in behavioural economics, describing a

Table 1: Studies on the impacts of the Deutschlandticket

				Results				
				Increase of public transport trips	Mode shift			Induced trips
						Out of these from:		
Study	Methodological approach	Sample	Period of study		Total	Private car	Walk/bike	
VDV & DB (2024)	Germany-wide representative online survey	14+ years N=107560	03/2023-12/2023	25%	12%	7%	3%	13%
OpinionTRAIN, publ. in KoRat (2024)	Germany-wide representative online survey	18+ years N=2484	09/2023	15%	12%	11%	1%	3%
PSMPlus, publ. in KoRat (2024)	Germany-wide representative online survey	Current and potential Deutschlandticket users, 14+ years, N=2948	07/2024	21%	18%	11%	6%	3%
Korbutt & Krämer (2024)	Representative monthly online survey for hvv[1] area	18+ years N=12000[2]	05/2023-04/2024	16%	13%	9%	No information available	3%
Motzer et al. (2024)	Germany-wide representative online survey	N=3735	08/2023	Not quantified[3]		54%[4]	36%[4]	12%[5]
Follmer & Knie (2024)	Germany-wide representative telephone survey	16+ years N=1005	01/2024	27% (bus) 17% (rail)	25% (bus) 10% (rail)	15% 4%	10% (bus) 6% (rail)	2% (bus) 7% (rail)
Koch et al. (2025)	Cell phone data o2/Telefonica and car movements from INRIX, Diff-in-Diff approach with synthetic control group[6]	German users of o2/Telefonica		33.7%	15%-17%[7]	15%-17%[7]	-	No effect

Notes: [1] hvv is the transport association for the greater Hamburg area.- [2] Cumulated sample size from May 2023 to April 2024.- [3] The study asked respondents only in categories such as more frequent, as currently, less frequent use of public transport.- [4] Percentage refers to the number of trips shifted from other modes for those respondents which indicated a more frequent use of public transport after the introduction of the Deutschlandticket.- [5] Percentage refers to the number of induced trips from those respondents which indicated a more frequent use of public transport after the introduction of the Deutschlandticket.- [6] Without trips below 30km. Excludes therefore walking, cycling and public transport (tram, metro, bus) below 30km. Control group consists of 107 Italian provinces. - [7] Mode shift from private car.

situation where consumers choose a flat rate tariff even though they would be better off on a pay-as-you-go basis. This phenomenon has been observed in many areas (e.g., telecommunications, internet tariffs, fitness studios) and has been frequently reported also for rail and public transport seasonal tickets. The behavioural explanations behind this effect include the taximeter effect (the perception of a higher utility when paying a flat rate instead of paying per unit of use), the insurance effect (the tendency of consumers to avoid price fluctuations), the convenience effect (the reduction of cognitive and financial burden to decide whether each trip is worth its price) and the self-binding effect (the mental obligation to use public transport once a travel pass is purchased).[1] Studies such as Axhausen et al. (1998), Wirtz et al. (2015), and Weibel et al. (2024) show that a remarkable share of season ticket holders would have been better off buying a single ticket.

The majority of available studies on the Deutschlandticket belongs to the second stream of literature that attempts to identify the demand impacts of seasonal tickets. Almost all of these studies are based on SP opinion surveys and interviews, implying that the demand response (consisting of mode shift effects and induced demand) can only be assessed on a hypothetical base, such as by asking respondents whether and how they would have undertaken trips without the Deutschlandticket.[2] To the best of our knowledge, only two studies employ a RP approach where behavioural responses of participants are recorded: the study “Mobilität.Leben” (Loder et al., 2024) based on GPS-tracking in the greater Munich area, and the Ariadne project (Koch et al., 2025) using Germany-wide cell phone data from Telefonica/Teralytics for trips with a distance of at least 30 km. As public transport demand effects of the “Mobilität.Leben” study are not available yet, the currently published demand effects of the Deutschlandticket refer almost completely to survey-based studies, with Koch et al. (2025) as the only exception.

As Table 1 shows, there is a consensus among all studies that the Deutschlandticket has contributed to an increase in public transport use. However, the results diverge with respect to the magnitude of the demand increase and specifically to shares of induced traffic versus trips shifted from other modes to public transport. The overall increase in public transport trips ranges from 15% to 25%, consisting of a modal shift effect in a range between 12% and 18% on the one hand and an effect of induced trips between 3% and 13% on the other hand. In

[1] These behavioural explanations do not necessarily mean that season-ticket holders are generally prone to a flat rate bias. Furthermore, the choice of a flat rate over a single ticket even at higher costs might reflect travellers’ valuation and willingness to pay for the aforementioned effects.

[2] The studies differ in the approach of raising these hypothetical questions. While VDV & DB (2023) combine the two issues of whether and how trips would have been realised in absence of the Deutschlandticket in one single question, OpinionTRAIN, PSMPlus (both published in KoRat, 2024), and Korbutt & Krämer (2024) use two subsequent questions to separate the effects.

addition, there is a considerable divergence in the quantities public transport gains from private car and from walking and biking. Follmer & Knie (2024) distinguish between the effects of the Deutschlandticket on bus trips versus rail trips, demonstrating a higher overall effect of the ticket on bus trips and a higher induced traffic effect for rail. Koch et al. (2025) obtain an overall increase of public transport trips by one third as a causal effect[3] of the Deutschlandticket, based on observed behavioural responses of trips with a distance of at least 30 km. Out of this increase, they estimate that 15% to 17% of all trips conducted with the Deutschlandticket are shifted from private cars. Furthermore, they find no significant induced traffic effect.

3. Data Collection and Processing

3.1. Data sources

For our study, we had access to the GPS tracking data of the GIM Traces panel provided by the market research company *GIM Gesellschaft für innovative Marktforschung*. The participants in this online panel were representatively drawn from the German population by age, gender, household size and region and have agreed to install a geolocation tracking app on their smartphones. Their continuously logged GPS location information was pre-processed into trips (i.e., changes of location with a start point, an end point, and no stops in-between) by the Swiss market research company *intervista*. Furthermore, *intervista* combined the recorded GPS data (speed, roads/routes taken, etc.) with geospatial information such as the location of railway and bus stations to identify the mode of transport taken for the recorded movements, differentiating between walk, bicycle, car, local public transport (bus, tram, subway, metro), train, airplane, and boat. In addition, person-specific movement patterns were analysed to identify the trip purpose (work/education, food/drink, shopping, leisure) via a probability model. The pre-processed tracking dataset provided by *GIM* and *intervista* consists of 3.97 million movements conducted by a total of 5,317 individuals between April 2023 (i.e., the month before the introduction of the Deutschlandticket) and December 2023.

To get a better understanding of the context of the recorded trips, data from several other sources were added. This includes county (NUTS3) identifiers of the start and end locations (Geofabrik, 2020), a regional classification (urban/rural) of the start and end counties based on the Thünen institute (Küpper, 2016), and a dummy variable describing whether a trip took place on a bank holiday (accounting for region-specific holidays). Furthermore, the 2020 list of railway stations of Deutsche Bahn AG was used to identify the closest railway station to each start

[3] Koch et al. (2025) apply a difference-in-differences (DiD) approach based on a synthetic control scenario constructed from data for 107 Italian provinces.

and end location. Data obtained from the Climate Data Centre operated by the German Weather Service[4] were used to identify day- and county-specific information on temperatures and precipitation. Day- and county-specific fuel prices were calculated as a weighted average of gasoline and Diesel prices based on fuel price data accessed through the *Tankerkönig* API[5] and regionally differentiated (NUTS1 level) information on the fleet composition obtained from the National Vehicle Registry (KBA, 2022).

The GPS data were complemented by three small-scale surveys among the tracked panellists, conducted in June, September, and December 2023, respectively. These surveys aimed at collecting information on socio-economic characteristics (age, gender, education, household income, household size, number of children), travel behaviour, availability of transport modes (possession of a car, bike, motorcycle, etc.; access to public transport), and possession of public transport discount cards and seasonal tickets including the Deutschlandticket. In addition, participants were asked about experienced delays and cancellations[6] specifically on their last public transport trip as well as generally during public transport trips in the last three months. In total, 2,920 individuals responded to at least one of the three survey waves (1,007 to all three waves), providing data on the time-constant characteristics and month-specific information for at least three months.

3.2. Data Preparation

GPS tracking offers a wealth of data, but requires extensive cleaning and processing efforts (Axhausen et al., 2003), coming along with a significant loss of raw data (see for example Bansal et al., 2021; Tsoleridis et al., 2022). Link et al. (2023) extensively discuss the data preparation process for a dataset collected during summer 2022 for an analysis of the 9-Euro ticket policy. As the data used for the analysis of the Deutschlandticket presented in this paper was obtained from the same provider using comparable methods, our procedures are similar to the ones described in Link et al. (2023). However, the dataset of Link et al. (2023) has certain requirements relevant for mode choice models (cf. Guajardo Ortega & Link, 2025), which is not the case in this paper. Consequently, the dataset used in this paper is subject to less assumptions and less loss of data.

[4] The Climate Data Center (CDC) offers extensive weather data from local measuring stations (see https://cdc.dwd.de/portal/)
[5] "Tankerkönig" is an information service for consumers listed at the Market Transparency Unit for fuels (MTS-K, 2021). Petrol station operators and oil companies are obliged to provide real-time data on fuel prices per station. The data used in this paper were obtained under the Creative-Commons-License (CC BY 4.0).
[6] We also asked for replacement and shuttle traffic, but find that these play less of a role.

Table 2: Validity requirements for observed routes

	Unit	Walk	Bicycle	Car	Train	Bus/Tram
Min Distance	Km	0.2	0.2	0.2	0.2	0.2
Max Distance	Km	40	120	-	-	100
Min Speed Distance	km/h	0.75	5	5	5	5
Max Speed Distance	km/h	15	40	150	210	100
Max Distance for "uncommon" modes	Km	-	5 (e-scooter)	25 (Taxi/Uber)	-	-

Data cleaning consisted mainly of removing routes with a distance of less than 200m (which might be caused by measurement errors or walking around the house) and few routes with a recorded distance shorter than the air-line distance between the start and end location. In addition, mode-specific maximum distances, minimum speeds, and maximum speeds were introduced as shown in Table 2. These thresholds ensure plausibility of the assigned mode of transport, removing a low number of observations. Furthermore, routes with a foreign start or end location were deleted, as the tracking data only cover movements in Germany, and airplane and boat trips were removed due to their overall low number. Further characteristics such as circular trips (with an identical start and end location) and indirect trips (with large detours) were checked and marked to account for them in specific applications (e.g., mode choice models requiring the calculation of alternative travel modes, which is not possible in the case of circular trips).

A concern in the panel is that a significant share of the participants seems to be tracked inconsistently, with no or only a few trips in some months. This could be due to people leaving the house without their phone, (temporarily) uninstalling the app or deactivating GPS tracking, or technical issues. To ensure a consistent and comprehensive representation of the participants' movement behaviour, which also includes days without any routes, a set of continuously tracked participants was constructed: It includes 1,489 participants for whom a geolocation signal (i.e., not necessarily a movement) was received on at least 15 days during each of the nine months.

The consistently tracked trips were used to identify the region type people primarily travel in, differentiating between urban and rural regions based on Küpper (2016). For this, the region types of all start and end locations of a person were combined. If at least 75% of the locations were in one region type, the person was identified as travelling primarily in this region type; otherwise, the person was classified as a mixed region type traveller.

The GPS tracking data were supplemented by individual-specific variables obtained through the surveys such as age, sex, income, occupational status, household-size, and possession of seasonal tickets for public transport including the Deutschlandticket. While most of this information is additional, several variables can be used for further validity checks of the recorded trips: First, reported non-availability of certain transport modes was decisive for removing routes with presumably implausible mode assignment.[7] Second, if respondents reported regular use of both “uncommon” modes such as taxis, Uber, or e-scooters as well as their respective common alternatives (car/bicycle), observed trips with an unclear mode choice were removed.

3.3. Sample Characteristics

The data preparation process leads to multiple samples of trips and survey responses that can be used for an analysis. This chapter compares these samples throughout the process with each other and with external samples to ensure representativeness of our data.

Table 3 presents descriptive statistics of four sample stages and compares them to indicators from the study Mobility in Germany (MiD, 2025) and the German Mobility Panel (MOP, 2022). The first column shows the characteristics of the largest reliable dataset, with only inconsistently tracked trips removed from the raw data. The second column restricts this sample to participants of at least one survey wave, so that information on the availability and use of transport modes can be used for further consistency checks. The third column shows the trips of consistently tracked participants (with a location signal on at least 15 days each month, independent of survey participation). The fourth column presents our most restricted sample, with trips of participants that were consistently tracked and participated in all three survey waves. By definition, the more restricted samples are significantly smaller in terms of participants and trips, which also affects the average trips per day and person. As Table 3 shows, our initial data captures less trips per day and person than the comparison studies (likely due to inconsistent tracking), whereas the consistently observed part of our sample exhibits higher numbers. A potential reason is that the MiD (2025) and the MOP (2022) are self-reported surveys with presumably more weight given to longer trips than in our data capturing also very short trips.

For the remaining trip characteristics, Table 3 outlines stability across the different samples. The average trip duration and length as well as the distribution of trip purposes and transport modes (by trips and km) show very little variation across samples and are largely in line with the comparison studies. It must be noted that the MiD (2025) and the MOP (2022) use different definitions of trip purposes and are therefore only partially comparable. In addition,

[7] The assignment of travel modes through a probability model based on tracking information was plausible in the vast majority of cases. However, a small number of routes was inconsistent, mostly recorded in dense areas with multiple modes of transport using the same infrastructure and moving with similar speeds (e.g., cars, busses, and bikes in busy cities).

Table 3: Characteristics of trip sample at different stages of data processing

	Cleaned routes[1]	Unbal-anced panel[2]	Consistent tracking[3]	Final sample[4]	MiD (2025)	MOP (2022)
Individuals	5261	2157	1489	492	420,979	1957
Number of routes	3,440,509	1,370,146	1,843,394	548,413	1,087,393	40,762
Trips per day and person	2.38	2.31	4.50	4.05	3.0	2.99
Trip characteristics						
Average trip duration (min)	16.69	17.19	16.78	17.66	28.0	26.2
Average trip length (km)	7.51	7.67	7.52	7.74	11.7	12.7
Trip purpose (%)						
Work/education	19.46	19.30	19.50	18.38	39	14.4
Food/Drink	3.44	3.43	3.38	3.27	-	-
Shopping	11.31	11.40	11.30	11.75	13	18.1
Leisure	65.79	65.86	65.83	66.60	29	13.4
Modal split by trips (%)						
Walk	37.43	39.31	36.90	39.59	26	25.6
Cycling	5.42	5.21	5.35	5.53	11	17.4
Car	42.31	41.50	43.31	40.87	53	47.0
Public transport	14.84	13.99	14.44	14.00	11	9.6
Modal split by km (%)						
Walk	3.89	4.14	3.92	4.26	4	3
Cycling	2.22	2.28	2.20	2.44	4	5
Car	78.58	78.72	78.85	78.82	73	65
Public transport	15.30	14.86	15.03	14.49	19	24
Mode availability (%)						
Car as Driver	-	84.69	-	84.01	85	81
Regional public transport	-	85.56	-	86.61	-	-

Notes: [1] All tracked trips incl. those of individuals not having responded to the survey.- [2] Trips of individuals who participated in at least one survey wave.- [3] Trips of individuals who were tracked consistently (at least 15 days/month).- [4] Trips of individuals who were tracked consistently (at least 15 days/month) and participated in all 3 survey waves.

the category "leisure" in our sample captures all trips that cannot be assigned to one of the other purposes, including errands, appointments, and other purposes that are specific categories in the comparison studies.

As can be expected, the modal split of walking (similarly for cycling) is a lot higher by trips than by km, as walking is only an option for short trips (and in this case often the chosen option). In terms of km, car trips cover almost 80% of the total distance travelled, complemented by public transport with another 14%. This is in line with the high availability of these modes: 85% of all trips are conducted by participants with an available car (as driver) and regional public transport access, respectively. The comparison with the MiD (2025) and the MOP (2022) shows that cycling trips seem to be underrepresented in our sample, while walking trips are slightly overrepresented. Again, this could be explained by the GPS tracking capturing short walking trips in a more comprehensive way than the survey-based comparison studies. In addition, both studies present a higher modal share of public transport with respect to km travelled than our data, even though our public transport share by trips is slightly higher than the respective study values. Unfortunately, neither of the two studies provides an availability share of public transport for a comparison.

Table 4 focuses on the survey responses, presenting socio-economic characteristics of four different stages of our process and of the German Socio-economic Panel (SOEP, 2022), a fully randomly drawn sample without any quota design. The first column refers to the full survey sample, including all participants that answered at least one survey wave. The second column restricts this sample to those participants that have a least one consistent trip in the tracking data. The third column represents the balanced sample of participants that answered all three survey waves. The fourth column corresponds to the most restrictive sample of participants that answered all three survey waves and were tracked consistently.

With a mean age of 47 years, our initial sample has a slightly higher average age than the SOEP sample, which is increasing further in the restricted samples. The age distribution also shows that our dataset is skewed towards an older sample compared to the SOEP. In a similar fashion, the share of male participants increases with increasing sample restrictions. Overall, the group of younger and non-male panellists seems to be subject to fluctuation in the panel, posing a challenge for a consistent observation over time. Presumably as a consequence of an online panel, the share of full-time workers is higher than in the SOEP sample, while the share of people staying at home is significantly lower. However, the categories for the occupational status are not fully comparable, as the SOEP-category “Education” refers only to apprenticeships and “part-time worker” also includes occasional and marginal employment. Despite the higher share of full-time employed, our income distribution is not skewed to the right – instead, we have a higher share of people with a household income between 2000€ and 4000€ per month, and a lower share of households with an income of more than 4000€. Furthermore, households in the SOEP are larger than in our sample, and a larger share of them has children.

Finally, we asked the participants how often they experienced irregularities (delays, cancellations, replacement service, shuttle service) in their public transport trips during each month. These data, for which a summary is included in Table 4, show that roughly half of the participants experience public transport irregularities on a regular basis (at least “sometimes”), with delays being slightly more common than cancellations. In addition, regular public transport users seem to experience delays and cancellations more often than less frequent users, with a particular difference in the share of users never experiencing issues. While these data can

Table 4: Socio-economic characteristics of the sample at different stages of data processing

	Unbalanced panel[1]	Unbalanced with trips	Balanced panel[2]	Final sample[3]	SOEP (2022)[4]
Individuals	2920	2157	1007	496	32,022
Of these: no consistent routes	763	0	45	4	-
Answered surveys	6536	5560	3021	1488	-
Total observations	19,608	16,680	9063	4464	-
Age (mean)	47.49	47.92	50.64	52.05	44.0
Categories (%)					
Below 18	0.47	0.28	0.26	0.00	4.3
18 – 35	21.23	20.06	14.53	11.90	33.6
36 – 60	58.40	59.29	59.58	59.95	43.2
Above 60	19.90	20.37	25.62	28.16	21.2
Sex (%)					
Male	50.12	50.69	54.42	56.59	50.6
Non-male	49.88	49.31	45.58	43.41	49.4
Occupation (%)					
Full-time worker	55.60	56.16	54.45	54.84	38.6
Part-time worker	16.39	16.14	16.29	14.58	19.1
Education[5]	4.88	4.65	2.78	2.08	3.4
Retired	14.51	14.65	18.40	20.56	13.9
At home/not occupied	8.61	8.39	8.07	7.93	24.8
Income groups (%)					
Not declared	7.94	8.14	7.22	6.32	7.0
Below 1000€	6.57	6.32	5.79	4.30	5.2
1000-2000€	18.45	18.72	19.20	18.88	18.0
2000-3000€	25.83	25.75	25.98	27.15	21.4
3000-4000€	20.37	20.32	20.39	21.10	17.5
Above 4000€	20.84	20.75	21.42	22.24	30.9
Household size					
Persons in household (mean)	2.43	2.42	2.29	2.28	3.13
Children (<6 years) (%)	10.27	9.43	7.91	6.79	15.0
Children (at school) (%)	24.34	24.09	22.01	22.38	33.8
PT Irregularities (%)					
Never	22.45	23.31	25.60	27.64	-
Rarely	20.88	21.44	22.10	24.51	-
Sometimes	28.10	27.47	25.58	23.90	-
Often	20.91	20.19	18.89	16.91	-
Always	7.66	7.59	7.82	7.04	-

Notes: [1] Participation in at least one survey wave.- [2] Participation in all 3 survey waves.- [3] Participation in all 3 survey waves and consistent tracking (at least 15 days/month).- [4] Sample consists of individuals older than 15 years.- [5] School, university, apprenticeship, job training.

provide valuable insights into multiple aspects of peoples' mode choice and mobility behaviour, they underline that public transport in Germany in subject to significant unreliability.

4. Modal Split and Mode Choice

In this chapter, we analyse and discuss the evolution of public transport usage before and after the introduction of the Deutschlandticket based on the GPS tracking data of our study participants. It must be mentioned that this is not a causal analysis, as this would require a suitable control group and a respective methodological approach, but that we rather show the general development of travel patterns around the introduction of the ticket in a descriptive form. Based on the assumption that the data loss due to inconsistent tracking is not systematic, we use the dataset presented as “unbalanced panel” in Table 3 for the analysis, including 1,370,146 consistent trips of 2,157 panellists that completed at least one survey wave.

Figure 1 visualizes the weekly mode share of public transport by trips and km as well as the average public transport trip distance from April to December 2023. The dashed vertical line marks the introduction of the Deutschlandticket on May 1st. On first sight, it appears that the public transport shares in May and the subsequent months are higher than in April. This is also supported by the data: While 12.85% of all trips were conducted by public transport in April (13.39% of all km), it was 14.22% by trips and 15.21% by km between May and December. However, it is debatable whether this development can be attributed to the Deutschlandticket for multiple reasons. First, a consistent increase in the share of public transport can be seen throughout April, before the introduction of the ticket, even though there is no explanation for why the policy should have had effects before its implementation. Second, the temporary

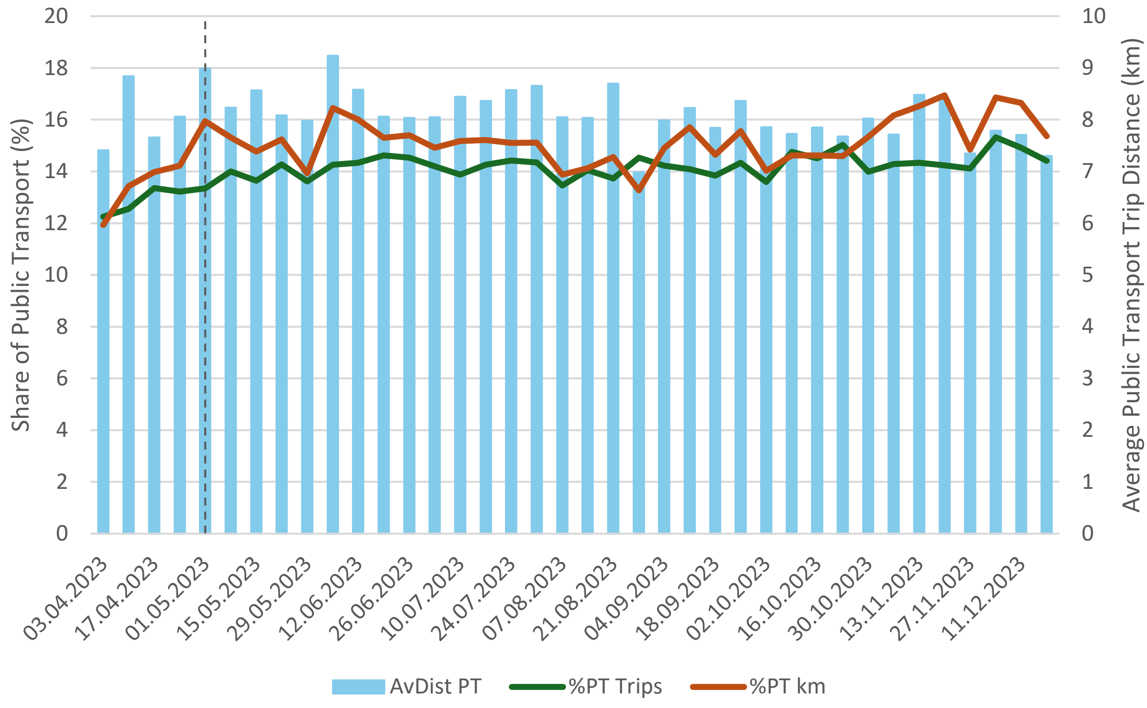

Figure 1 - Public transport share and average trip length

peak in the first week of May (by km) is followed by an immediate decline until the end of the month, even though the flat-rate nature of the ticket would suggest that owners increase their use of public transport rather than decrease it. Third, neither of the two shares reaches a stable growth path in our observation period, even though some studies suggest that the ticket needed some months to gain momentum after its introduction. In contrast, the share by trips stayed within one percentage point between 13.5% and 14.5% from May 8th until October 9th.

Finally, Figure 1 shows no clear pattern of the average trip length: Even though several low values are found in April, the second week presents a positive outlier, and a general increase can be seen before the introduction of the Deutschlandticket. Significant fluctuation with both positive and negative outliers and no clear development is also found after the new ticket. In contrast to some of the existing research, our data do not suggest a strong increase in the usage of public transport after the introduction of the Deutschlandticket – neither by distances travelled, nor by mode share.

Figure 2 differentiates the overall development between trips with a distance up to 30 km and trips with a distance of more than 30km.[8] For the shorter trips, an increase in the public transport share can be seen after the introduction of the Deutschlandticket. Subsequently, the mode share of public transport remains higher than in April throughout the entire rest of the observation period. The picture is more ambiguous for trips with more than 30 km distance, with weekly values fluctuating between 9% and 17%. A strong increase is seen before the

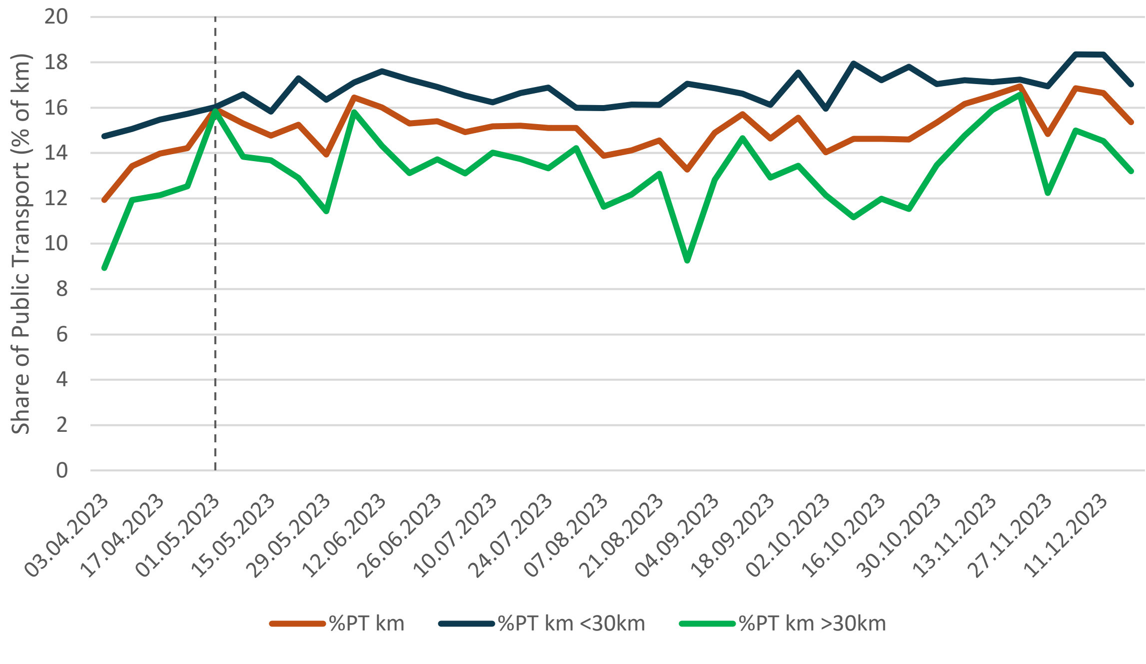

Figure 2 - Public transport share by trip length

[8] As the share by trips and the share by km follow a similar pattern, but the share by km is subject to more fluctuation and heterogeneity, we focus on the km-based share in the subsequent analysis.

introduction of the Deutschlandticket, whereas the introduction is followed by a decline in May and a continuous up and down throughout the entire observation period. While the average share between May and December (13.40%) is higher than in April (11.39%), it is difficult to attribute this increase to the Deutschlandticket, as the impact of seasonal and calendar effects (e.g., holidays and vacations) seems to be quite strong in the context of longer trips. However, the vast majority of trips is shorter than 30 km (95% in our data). A study on the impact of the Deutschlandticket needs to acknowledge this and focus on shorter trips, which has consequences for the data requirements: Cell phone location data, as used for example by Koch et al. (2025), are not sufficiently detailed to identify short trips, and can therefore only draw conclusions about the small share of trips that are longer than 30 km.

Figure 3 visualises the heterogeneity in the use of public transport with respect to the ownership of public transport season tickets. It differentiates between participants not owning a season ticket and those owning a ticket with a validity of at least one week (including the Deutschlandticket), with an additional line for the Deutschlandticket owners specifically. As can be expected, the mode share of public transport is considerably higher for users with seasonal tickets. This can be observed already in April before the introduction of the Deutschlandticket, but the gap sees a significant increase with the new offer. Two effects come into play here: On the one hand, people with a high share of public transport held season tickets before the Deutschlandticket, and most of these switched to the new offer once it was available. While some regions (e.g., Hamburg) forced such a switch by discontinuing their regional season tickets, most users found the Deutschlandticket to be cheaper than regional alternatives while

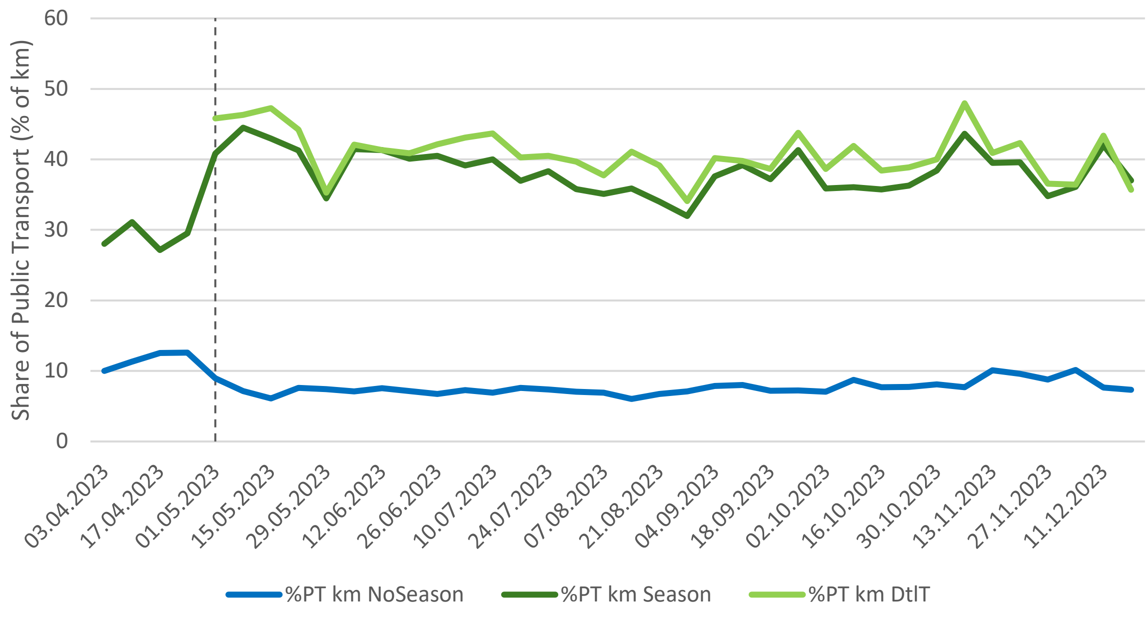

Figure 3 - Public transport share by season ticket ownership

providing higher value. Consequently, season tickets besides the Deutschlandticket are a sensible choice only in very specific circumstances (e.g., in some regions they allow taking a bike/dog/other person during certain times of the day, or they can be shared), explaining why the public transport shares of season ticket holders and Deutschlandticket owners are almost identical. On the other hand, the Deutschlandticket was bought by regular public transport users for whom other alternatives (e.g., daily tickets, tickets for multiple trips) were cheaper than a season ticket in the past. With the introduction of the Deutschlandticket, these people became season ticket owners, explaining the consistent drop in the public transport share of people without a season ticket after the introduction of the new fare option.

Figure 4 visualises the public transport share by occupational status and the absolute mobility of staying-at-home and unoccupied participants. It clearly shows that people in education have a consistently higher public transport share than other groups. This can be explained by the fact that they often either have to purchase a season ticket (e.g., university students forced to purchase a semester ticket with their enrolment) or can purchase season tickets at reduced rates (usually for apprenticeships). In addition, university students usually live in larger cities with good public transport and limited parking space. Consequently, the introduction of the Deutschlandticket did not have an impact on the already high public transport usage of this group. Similarly, both working and retired people have not changed their behaviour after the introduction of the ticket. In contrast, the unoccupied or staying-at-home participants of our

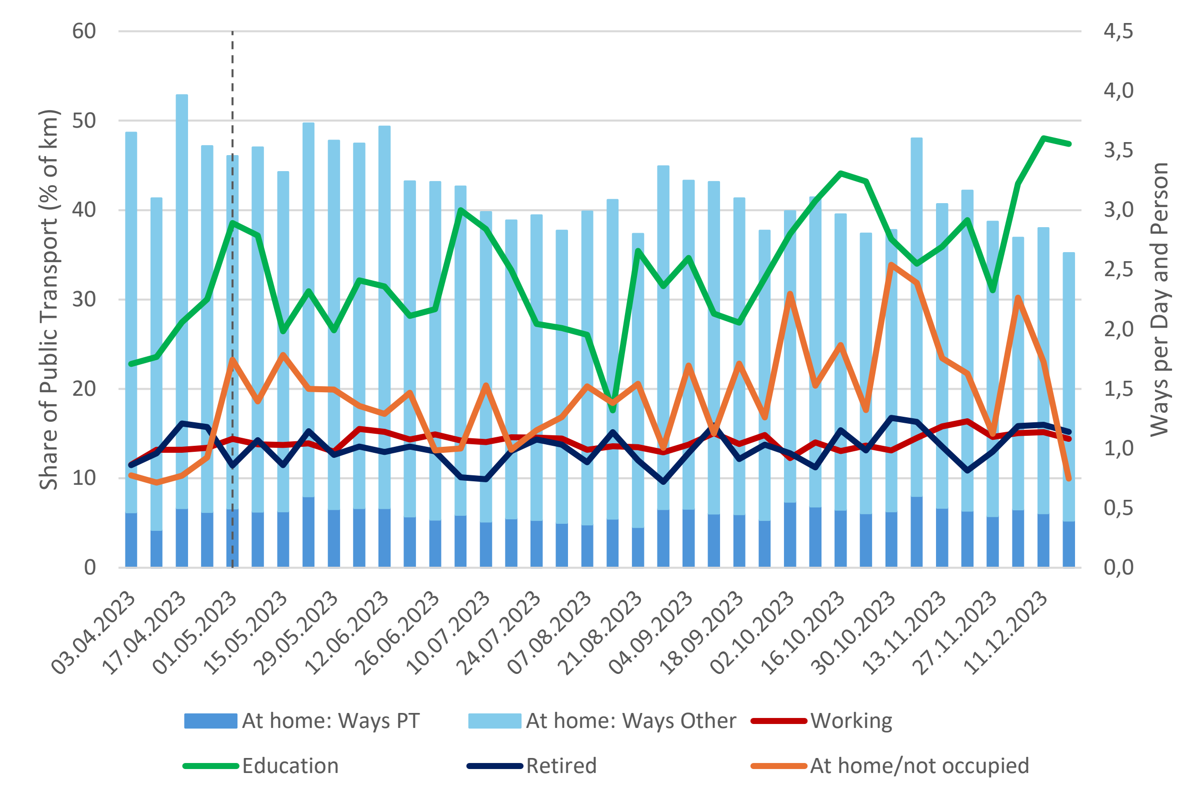

Figure 4 - Public transport share by trip purpose and mobility of unemployed

sample show a significant and consistent increase in their public transport usage after May 1st, suggesting that the new ticket could actually have had an effect on the travel behaviour of this specific group. This could be an income effect: If unoccupied people are subject to a systematically lower household income than other groups, the Deutschlandticket could allow them to do trips they could not afford before. However, Figure 4 shows that the mobility of this group, measured as the average trips per day and person, did not increase – neither for public transport specifically, nor overall. In addition, their public transport share fluctuates strongly throughout the entire observation period, and especially from September onwards.

To get a better understanding of a potential income effect of the Deutschlandticket, Figure 5 visualizes the public transport share for four income groups. On the upper end, the share of households with a monthly income of more than 2000€ is stable without significant changes throughout the entire observation period. Below this threshold, two patterns are visible: First, households with an income between 1000€ and 2000€ increase their public transport usage between May and July slowly, but steadily from 13% to 20%. A large part of this growth happens between middle of June and middle of July, which coincides with the beginning of the summer holidays. This suggests that lower-income households used the Deutschlandticket particularly during the holidays (e.g., to go on vacation). Secondly, households with an income below 1000€ show a sharp increase in public transport usage with the introduction of the Deutschlandticket, almost doubling the public transport share from one week to another.

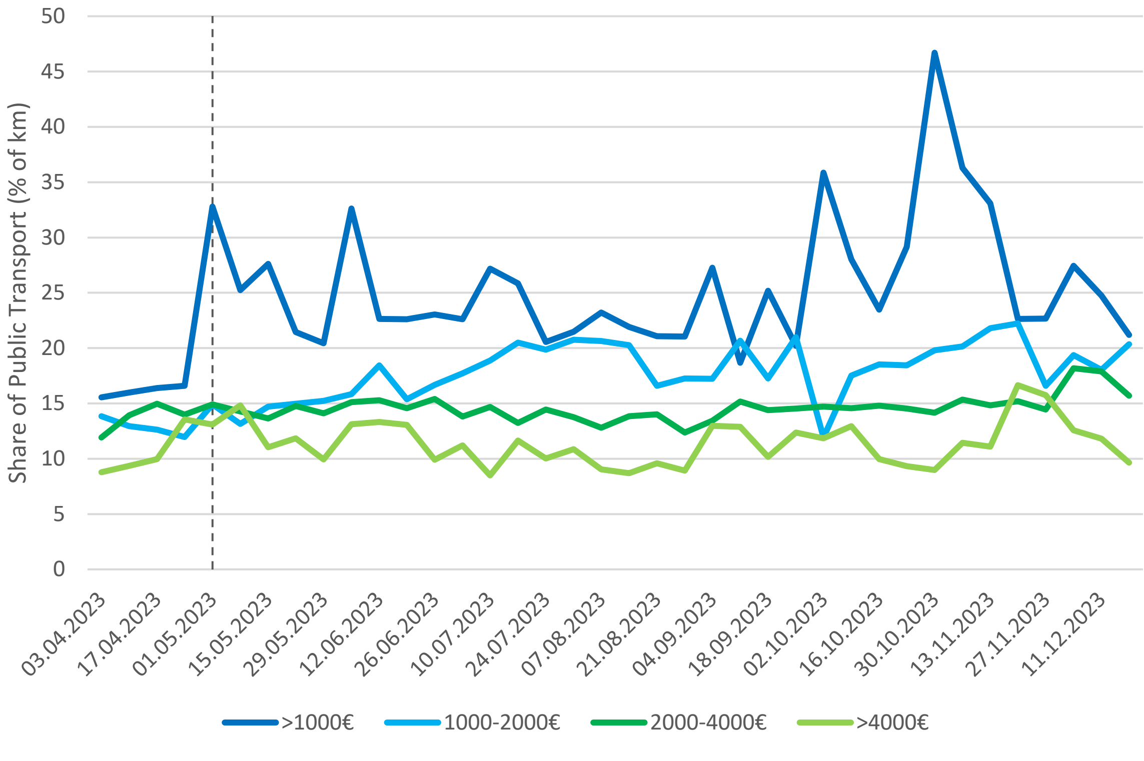

Figure 5 - Public transport share by household income

Despite significant fluctuations (which are most likely caused by the sample composition and inconsistent tracking of participants in this relatively small group) throughout the observation period, the share remains consistently higher while the ticket is available. The data thus suggest that the Deutschlandticket led to a consistently higher public transport share in both daily mobility and one-time events for lower-income households.

Figure 6 displays the public transport share of our panel participants differentiated by the region type they primarily travel in (cf. chapter 3.2). If at least 75% of a participants' trips happen in either urban or rural counties, the respective type is defined as the person's primary type; otherwise, the person is classified as a mixed region type traveller. As can be expected, the figure shows clear differences between region types, with the public transport share being significantly higher for participants travelling in urban areas. With respect to the Deutschlandticket, the graph shows a consistent increase in public transport usage for urban travellers. While the well-connected public transport networks in urban environments already facilitate high usage levels, the price decrease for regular users caused by the Deutschlandticket led to a further increase in the public transport share. In contrast, we find no effect for panellists travelling primarily in rural areas or in both region types. In existing studies, this is often attributed to poor access to public transport in rural regions. While this surely holds in some German regions, 78% of the primarily rural travellers and 87% of the mixed region type travellers in our sample claim to have access to regional public transport. In a more detailed analysis, it should be differentiated between trips where reasonable public transport connections are available and trips without a public transport alternative. Guajardo Ortega & Link (2025) show that transport mode choice is subject to significant inertia, meaning that previous car users are unlikely to change

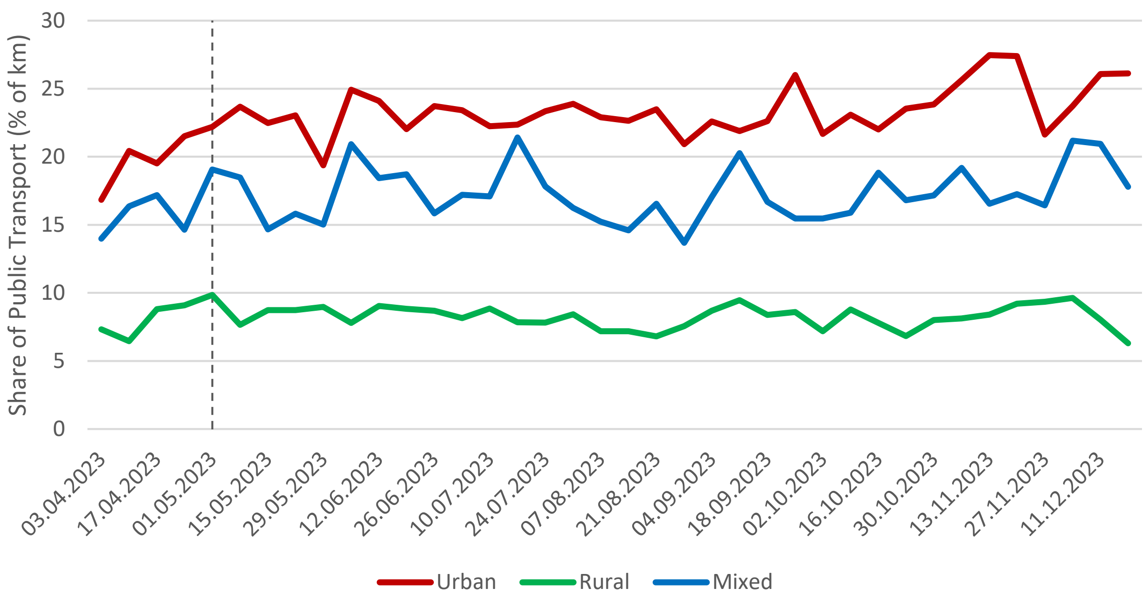

Figure 6 - Public transport share by primary travel region type

their mode choice due to better public transport availability or a price decrease in public transport season tickets.

Overall, we find very limited effects of the Deutschlandticket on the travel behaviour of our panel participants. While there are specific subgroups that increased their public transport usage after the introduction of the ticket – particularly, participants that are unoccupied, come from low-income households, or travel primarily in urban environments –, the effects on the entire sample are very small and cannot per se be attributed to the Deutschlandticket.

5. Conclusions

The Deutschlandticket, allowing for unlimited travel on all local and regional public transport services in Germany at a fixed price of initially 49€ per month, was introduced in May 2023 with the expectation of a significant modal shift from individual (especially car) transport to public transport. This paper presents the results of a comprehensive descriptive analysis based on a dataset combining GPS tracking data and survey information, covering almost 4 million routes and 3,000 participants across Germany between April and December 2023.

We find that modal split changes related to the introduction of the Deutschlandticket are small, but show considerable heterogeneity with respect to socio-economic characteristics and travel behaviour. Overall, the modal share of public transport is slightly higher after May 1st than before, but it is questionable whether this increase can be attributed to the Deutschland-ticket. Furthermore, we find that the public transport mode share for trips with a distance of less than 30km increases consistently after the introduction of the ticket. In addition, certain sub-groups reacted to the fare policy by increasing their public transport share, particularly partici-pants that are unoccupied, come from low-income households, or travel primarily in urban en-vironments. Overall, our analysis does not suggest that the Deutschlandticket reached the goal of a significant shift towards public transport. Instead, it serves mostly as a subsidy for previous season ticket holders and regular users of public transport.

Further conclusions can be drawn with respect to the data and methodology requirements of an analysis of the effects of the Deutschlandticket. Most existing studies focus on specific groups of trips. For example, the largest RP dataset collected (Koch et al., 2025) covers only trips with a distance over 30km. Our findings and further mobility data (e.g., MiD, 2025) sug-gest that these trips represent a rather small fraction of all trips and differ in multiple ways from shorter trips. Similarly, studies often focus on specific (metropolitan) regions that are not rep-resentative for other parts of the country (e.g., Loder et al., 2024). The heterogeneity we find in our data underlines that conclusions drawn from particular samples cannot be generalised and that an analysis of the nation-wide effects of the Deutschlandticket requires a corresponding dataset. In addition, our descriptive analysis cannot identify causal relationships, which is also true for most of the existing research on the Deutschlandticket. Consequently, it is important to discuss whether potential changes in travel behaviour can be attributed to the fare intervention. We conclude from our analysis that a large share of the modal split variation in our data stems from seasonal patterns rather than the Deutschlandticket.

Finally, our findings provide a starting point for further research in multiple directions. First, causal relationships could be identified with a respective methodological approach, such as a regression discontinuity in time (RDiT) design or a synthetic control group approach. Such an analysis allows differentiating between seasonal effects and general developments on the one hand and the immediate impact of the Deutschlandticket on the other hand, and is necessary for a reliable assessment of the costs and benefits of the ticket. Second, the administrative limitations of the Deutschlandticket could deter people from purchasing the ticket and using public transport. The two most important points in this context are that the ticket is only available as a monthly subscription and that it is distributed only on a chipcard or in a smartphone app, making it impossible to purchase the ticket spontaneously when starting a trip. Further research could focus on these aspects and aim at identifying the share of potential customers lost due to these limitations. Third, the data on the Deutschlandticket as well as a previous analysis on the 9-Euro ticket (Gaus et al., 2023) suggest that the reliability of public transport forms an obstacle for a comprehensive switch towards public transport in Germany. With half of our participants experiencing delays or cancellations on a regular basis, a detailed analysis of the impact of irregularities on mode choice can contribute an important aspect to the discussion about public transport strengthening policy measures.

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