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THE DECLINE OF PUBLIC TRANSPORT DURING THE COVID-19 PANDEMIC AND THE IMPACT OF THE 9-EURO-TICKET IN THE SUMMER 2022 – RESULTS OF A MULTIPLE-WAVE STUDY IN GERMANY

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1. Introduction

Local public transport is suffering particularly from the consequences of COVID-19. No other everyday means of transport has experienced such a drastic decline in transport demand. Even before the Corona virus outbreak, the public transport situation was challenging given the increasing availability of cars combined with corresponding behavior. The sharp decline in public transportation during the pandemic has significantly exacerbated the situation. Recent developments in Germany give hope that the public transport situation can be significantly improved through low-cost public transport offers. In order to protect the population from increasing energy and fuel costs, the German government decided on a support package in spring 2022. One component of the package was the so-called 9-Euro-Ticket. During the three-month campaign period from June to August 2022, a monthly ticket for 9 euros allowed passengers to use all local buses and trains throughout Germany. This low-cost offer had a significant impact on demand for local public transport. Based on the situation before Corona and the sharp decline in demand for local public transport as a result of Corona, this article focuses in particular on the short-term changes in the summer of 2022.

The three core questions of the article are: How was public transport used before Corona? What changes did the pandemic cause? How did the introduction of the 9-Euro-Ticket affect mobility behavior? What can we learn from this for the future design of public transport.

2. STATE OF THE ART

The global Corona pandemic and the implemented measures to limit the spread of the virus has changed all areas of daily life including travel behaviour. For the first time, there is an opportunity to analyze the resilience of the transport system and the consequences of (potentially) reduced travel demand, e.g. due to increase share of teleworkers or reduce of leisure trips, for daily mobility. Consequentially, since the beginning of the pandemic, an increasing number of studies all around Europe and the world that are investigating the changes in travel patterns and their implications for the future transport system.

Despite different context-specific factors, a common alarming trend can be observed across Europe cities: public transport suffered from the Corona pandemic most and a shift towards individual (mostly motorized) transport can be observed. The magnitudes of changes differ across different regions, but a decline in public transport use has been reported in studies, among others, in: Budapest, Hungary (Bucsky, 2020);

Gdanks (Przybylowski et al., 2021) and Warshau (Kłos-Adamkiewicz & Gutowski, 2022) in Poland; Sicily, Italy (Campisi et al., 2020); cities in the Netherlands (Haas et al., 2020); Stockholm and Västra Götaland in Sweden (Jenelius & Cebecauer, 2020) and Zurich, Switzerland (Marra et al., 2022). For Germany, previous studies conducted by the authors, already showed first signs for decline in trips done by public transport during the early periods of the pandemic and the first lock-downs (Eisenmann et al., 2021, Kolarova et al., 2021). Similar results were found in several other studies for Germany (e.g., Fitbom et al., 2021, König & Dreßler, 2021).

Several research works were dedicated to the discussion of policy and practice implications for strengthening the position of public transport and increasing its attractiveness to transport users. Analyses suggest that higher investments are needed for improvements in public transport after the pandemic. Simultaneously, users seem to take them as granted and expect prices to remain the same (e.g., Awad-Núñez et al., 2021). Furthermore, risk perception plays an important role for the recovery time of public transport users after the pandemic. Hence, public transport operators have to minimize health-risk in their services and increase the understanding of the risk of infection in the services (Gutiérrez et al., 2020, Kopsidas et al., 2021, Fitbom et al., 2021). Returning to status quo after the pandemic won´t be sufficient to ensure resilience of the public transport – there is a need to rethink the whole public transport system (e.g., Vickerman, 2021, Tsvetkova et al., 2021).

Overall, there are early insights into changes of travel behavior due to the Corona pandemic that report especially changes in public transport use pattern. Also, there is a continuing discussion on potential measures to prevent long term negative effect of the pandemic on the public transport use. However, these studies vary in methodology, sample size and composition, as well as time period where the travel behavior changes were tracked. With only few exceptions, they cover one single time point of the pandemic and do not track continuing changes. The discussed implications for policy and practice are derived mostly from the observed changes in travel pattern and user statements. They do not evaluate concrete implemented measures that aim recovering the (regular) use of public transport and increasing its attractiveness.
Against this background, this study aims to provide insights on changes during different phases of Corona pandemic, including the changes due to the implemented 9-Euro-Ticket.

3. METHODS

The results presented are based on two data sources:

(1) For the period prior to Corona pandemic, the analyses are based on data from the National household travel survey "Mobility in Germany 2017" (MiD). In the MiD, the travel behaviour of more than 316,000 people was surveyed. The sample was selected to be representative for Germany with regard of selected socio-economic characteristics. Based on almost one million reported trips, everyday behaviour and the group specific use of public transportation can be described in detail.

(2) Right at the beginning of the pandemic, the DLR Institute of Transportation Research designed a panel study to examine the impact of the COVID-19 containment measures. To examine pandemic-related changes in mobility behaviour, the same individuals were surveyed at intervals of several months. In order to obtain representative results at each survey time, the loss of repeatedly interviewed persons is compensated by the inclusion of new test persons. Six waves of the survey have been conducted so far. The first survey was carried out at the beginning of April 2020, in the phase with the lowest traffic volume during the first lockdown in Germany. This was followed by two further surveys in summer and fall 2020 and two surveys in spring and fall 2021. The last survey was conducted in late June/early July. The field phase originally scheduled for spring was postponed in order to survey the effects of the 9-Euro-Ticket.

In the first four online surveys, 1,000 people aged 18 and over were interviewed via the Access Panel of the survey institute Kantar GmbH. In the fifth and sixth survey, the sample was increased to 2,500 people in order to achieve a sufficient number of cases even for relevant subgroups. The survey covers the use of transport before and during the crisis, mobility in connection with shopping, work and leisure, private and business travel, as well as attitudes and personal strategies for dealing with the crisis. Over a period of 2.5 years, a long-term study has been carried out, showing the different phases since the outbreak of the Corona virus with more or less far-reaching measures and, most recently, the offer of the 9-euro ticket.

4. RESULTS AND DISCUSSION

The following results cover three time periods: before Corona, since the outbreak of the Corona virus and during the campaign period of the 9-Euro-Ticket.

4.1 Public transport use before Corona

The National Travel household survey MiD provides an overview of the use of public transport in the time period before the Corona pandemic, in particular the travel behaviour in Germany in 2017. The share of public transport in transport volume and transport performance was at that time 10%. Almost a quarter of all people aged 14 and above used public transport on regular basis: 13% of respondents reported using it almost every day, and further 10% once to three times a week. The public transport use depends strongly on city size: In cities with 500,000 inhabitants and more, almost half of the respondents said they used public transport at least once a week. In small cities with fewer than 20,000 people, the proportion was 12%. Also, in large cities public transport is used for a wide range of purposes, while in small cities it is mainly used for commuting to work or to educational institutions.

The evaluation of public transport was less positive than for other modes of transport: only 34% of respondents aged 16 and older reported that they enjoy using public transport. In contrast to this, 60% reported this for bicycles, 77% for cars and even 83% for walking. The appreciation for one mode of transport increases with the frequency of use. For instance, 78% of the frequent public transportation users reported that they enjoy using it.

Before the Corona pandemic, the general trend in public transport demand was stagnation. In contrast to this, the passenger car fleet in Germany increased by 6 million vehicles from 2010 to 2020 resulting in total 48 million vehicles in Germany in total (cf. KBA) with clear consequences: from 2002 to 2017, the average daily distance travelled by car increased significantly (Nobis & Kuhnimhof, 2018, Nobis et al. 2019, Nobis & Eisenmann, 2021). Against this background, the stagnation of public transport can definitely be seen as positive, even if public transport had already failed to fulfil its role as the backbone of the mobility transition before Corona.

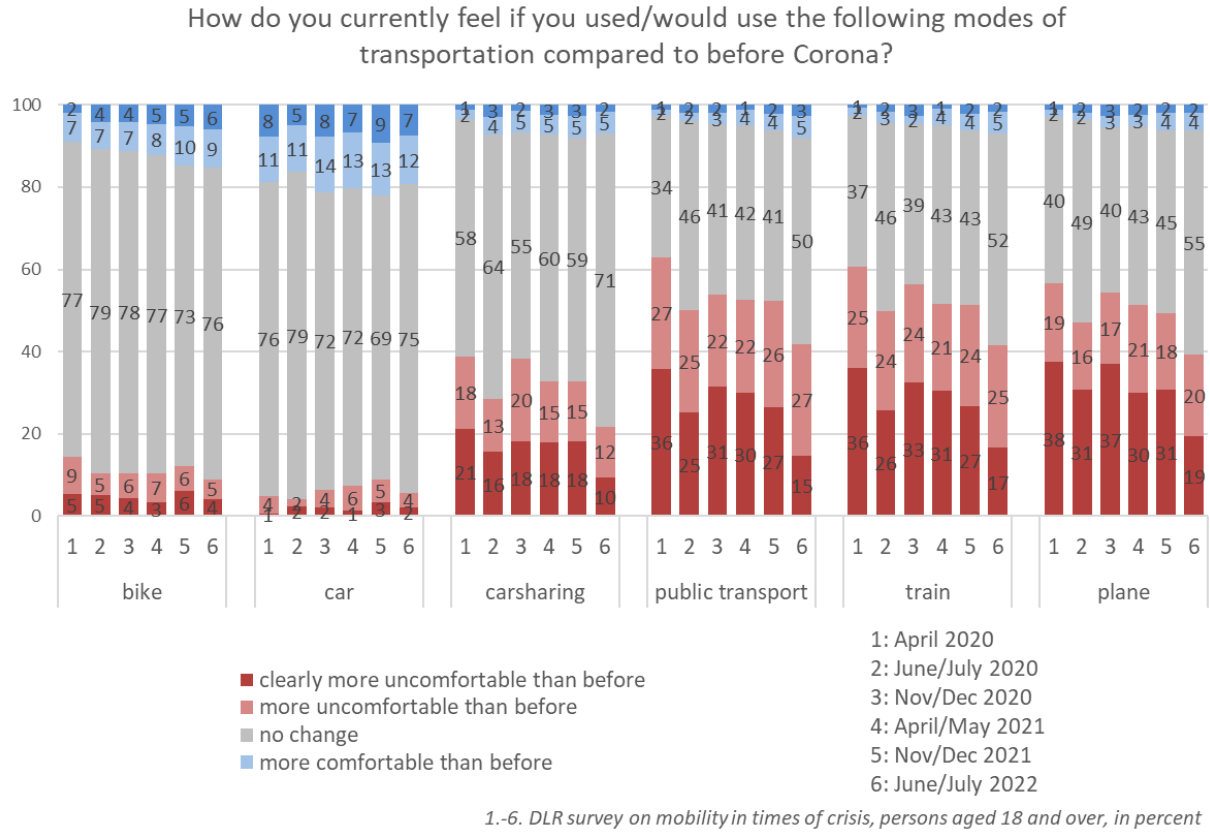
4.2 Public transport use since the outbreak of the Corona virus

With the outbreak of the Corona pandemic, the situation of public transport has worsened considerably. After the first Corona cases appeared in Germany in February 2020, various measures were taken by the federal and state governments starting in March 2020 to slow down the spread of the Corona virus. These included the closure of schools, stores, restaurants, theatres, discotheques and other places of public life. Businesses were encouraged to have their employees work at home as much as possible. These measures had a major impact on daily life and led to a rapid decline in traffic in a very short time.

The lowest level of transport volume was reached in early April 2020, when the number of trips was 40% lower than in the previous year (Schlosser et al. 2020). All modes of transportation were affected by this drastic decline. Individually used modes, such as bicycles, but especially cars, gained importance at this low level of travel activities. The number of passengers using local and long-distance public transport, on the other hand, declined sharply not only in absolute terms, but also in relation to the total volume of transportation. To some extent, this situation has continued to the present day. While demand for transportation rose rapidly to normal levels during phases of easing measures, public transport recovered only to a limited extent.

One reason for the persistently low usage is discomfort with collectively used modes of transportation such as bus and rail or car sharing (see Figure 1). In all DLR surveys, participants were asked how comfortable or uncomfortable they felt using the various modes of transportation compared to the time before Corona. The results show: While respondents feel mostly the same or more comfortable using individual modes of transportation, such as bicycles or their own cars, the opposite is true for public transportation. In April 2020, 63% of respondents said they now feel less comfortable using public transportation. Although there has been a clear downward trend in recent surveys, which is also reflected in a shift in proportions from the "significantly more uncomfortable" category to the weaker "more uncomfortable than before" category, the proportion of people who feel uncomfortable on public transport is still at a high level. As an overall conclusion, therefore, it can be said that discomfort has become deeply embedded in people's minds and is only slowly decreasing. In contrast, a constant 20% of respondents now feel more comfortable in their cars.

Figure 1: Subjective perception when using transportation compared to the pre-Corona pandemic period

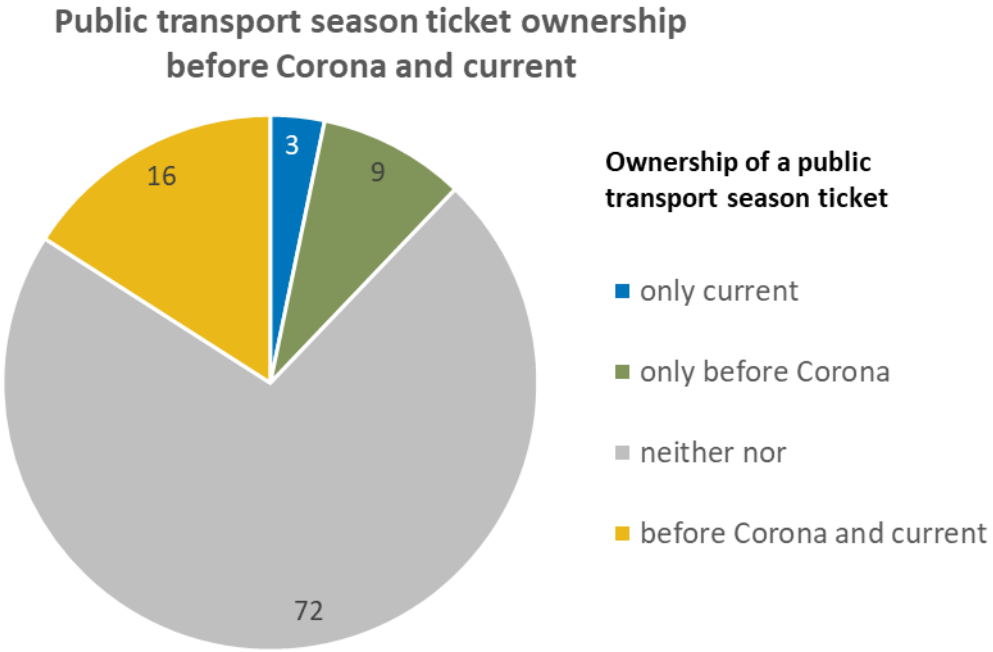


1.-6. DLR survey on mobility in times of crisis, persons aged 18 and over, in percent

In all surveys, respondents were asked to rate on a five-point scale to which extend they agree or disagree different statements. With regard to public transportation, the following picture emerges: Many respondents stated to perceive having a risk of infection when using public transportation. Also, they criticized that other passengers do not wear masks or do not wear them properly and that the obligation to wear masks, which still exists in Germany, is not adequately monitored. The hygiene measures of the public transport companies are judged by many as being inadequate. This is accompanied by the statement of many people that buses and trains are currently too crowded for them and that they consciously avoid using public transport.

This leads to a significant change in the ownership of season tickets for public transport (see Figure 2). Before Corona, a quarter of respondents owned a public transport season ticket. In the last survey, their share was just under one-fifth. This represents a decrease of about 20%. Compared to the time before Corona, the number of regular public transport customers with a classic monthly travel pass has decreased significantly.

Figure 2: Changes in the ownership of public transport season tickets



6. DLR survey on mobility in times of crisis, persons aged 18 and over, in percent

If we consider only those people who had a monthly pass for public transport before Corona, only two-thirds of them currently have a monthly pass. There are many different reasons for abolishing a monthly pass. For example, the Fall 2021 survey had shown that Corona plays an important role in cancelling season tickets, but less than half are directly attributed to it. What turns out to be problematic is that the number of cancelled season tickets is not countered by an equally large - or, as in the years before Corona, often larger - group of people purchasing new season tickets. While the market for public transport season tickets was stable to growing in the period before Corona, it is now declining.

The described trends are associated with a significant change in people's mobility habits. Mobility behavior is characterized by routines that generally lead to stable transport preferences over long periods of time (Banister 1978, Bargh 1996, Gorr 1997, Betsch et al. 1998). This can be mapped quite well by so-called modal groups. The basis of the classification are the three means of transportation: car, bicycle and public transport. The group membership results from the use of one (monomodal behavior) or more of the means of transportation in the course of a week (multimodal behavior). Since many of people's activities are repeated in a weekly rhythm, the week is a good time unit for mapping mobility. In this way, the crucial means of transportation for daily life are captured for most people.

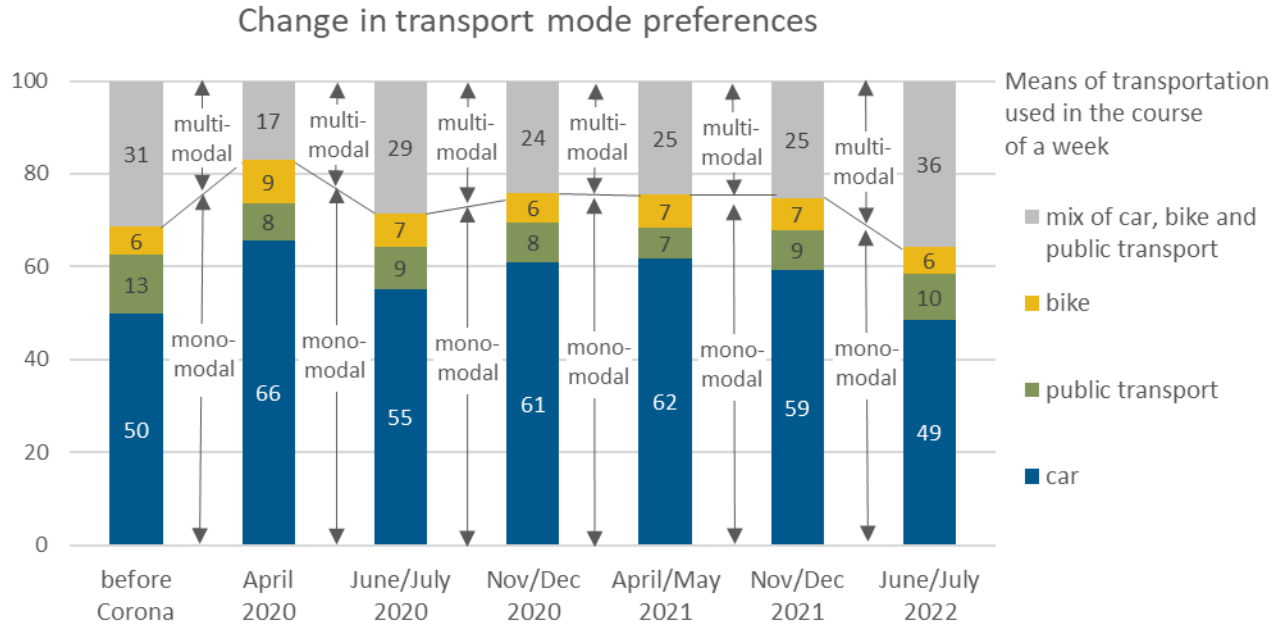
Before the Corona virus outbreak, it was common practice for half of the respondents to use only their car and not once the bicycle or public transportation during the course of a week (see Figure 3). This monomodal use of the car received a significant boost

during the April 2020 lockdown. The small group of monomodal bicyclists also increased by half during this time. Public transportation, on the other hand, lost significant importance. The share of monomodal public transit users dropped from 13% to 8%. Multimodal behavior, meaning the use of several modes of transport in the course of a week, also fell from 31% to 17%. Again, the reason was often the elimination of public transportation trips and the associated transition from multimodal to monomodal behavior.

After the strict rules were suspended in the summer of 2020, behavior and the shares of the modal groups had already largely return to its normal level. However, in the fall of 2020 and also in the two follow-up surveys in 2021, the share of monomodal car use stabilized at a level of around 60 %, which was about 10 percentage points higher. In contrast, multimodal behavior, switching between different modes of transportation, and exclusive use of public transportation had declined. General preferences in the choice of means of transportation thus shifted significantly in favor of the car over the course of the pandemic.

A clear change can be seen in the last survey, which is mainly due to the 9-Euro-Ticket described at the beginning. The shares of the modal groups largely correspond to the picture from before the Corona pandemic. The share of multimodal persons even turns out to be higher than before the pandemic. Analyses show that about a quarter of the trend is due to a higher share of bicycling, which is typical for the summer months. As a result, the proportion of people using cars exclusively decreases and the group using cars and bicycles increases. The other 75% of the change is mainly related to the offer of the 9-Euro-Ticket, as especially the multimodal groups, where public transport is one of the used means of transportation, have increased. This behavior, which is unusual for the summer, is mainly due to the low-priced special ticket valid during the promotional period of three months.

Figure 3: Proportion of modal groups before Corona and during the course of the pandemic:



1.-6. DLR survey on mobility in times of crisis, persons aged 18 and over, in percent

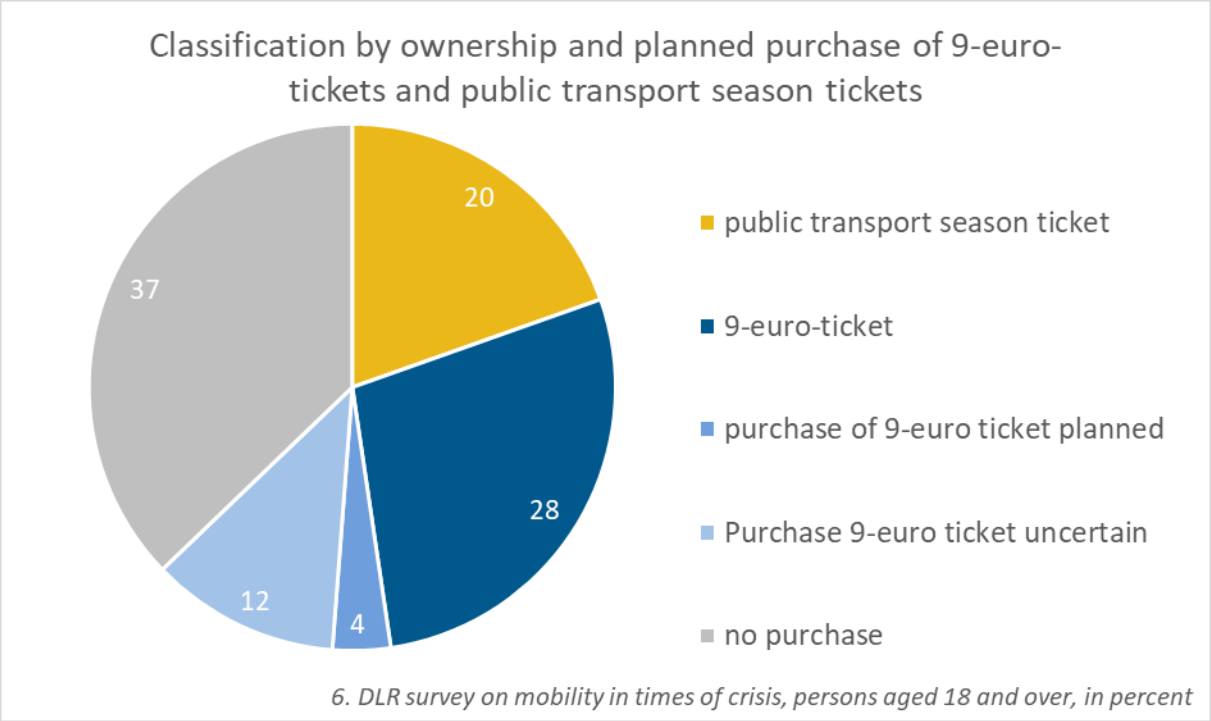
4.3 Public transport use during the campaign period of the 9-Euro-Ticket

This subsection will examine in more detail the behavioral change induced by the 9-Euro-Ticket. The key questions are: Who purchased the 9-ticket, how often and for what trip purpose was it used? Was it able to bring about fundamental changes in mobility behavior?

The 9-Euro-Ticket has turned out to be a real sales hit. By the end of June/beginning of July, the inexpensive and easy-to-understand offer had already reached a level of awareness of 98%. The ticket was thus known to virtually every adult in Germany. 60% said they were also familiar with the ticket in detail.

At the time of the survey - around one month after the start of the campaign period – 28% of all respondents had already purchased a 9-Euro-Ticket. In addition, 20% of respondents had a classic monthly pass. This allowed around half of the adult population to use all regional buses and trains throughout Germany. A further four percent were definitely planning to buy a 9-Euro-Ticket in the remaining campaign period. This means that the proportion of people with a public transport season ticket had more than doubled by the time of the survey.

Figure 4: Classification by ownership and planned purchase of 9-euro tickets and public transport season tickets



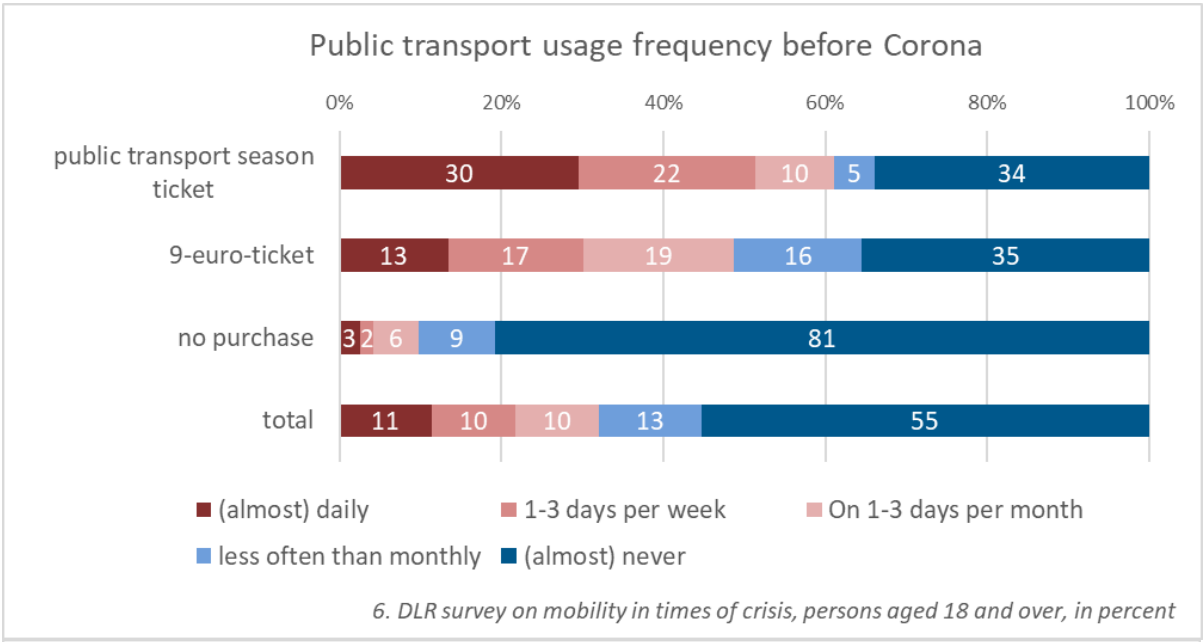
A look at the sociodemographic shows that the 9-Euro-Ticket has arrived in the middle of society. While customers with a classic public transport ticket have a very specific profile, the distribution of characteristics of 9-Euro Ticket holders largely corresponds to the overall distribution in the population. This applies to the distribution of age groups, gender, educational qualifications and occupations of the individuals. Classical public transport season tickets, on the other hand, are disproportionately owned by young, more highly educated and full-time employed people, as well as by schoolchildren and students. Those who do not want to buy a 9-euro ticket are disproportionately likely to belong to the group of elderly people and thus also to pensioners. Thus, only the clientele of the 9-Euro-Ticket represents the cross-section of the population.

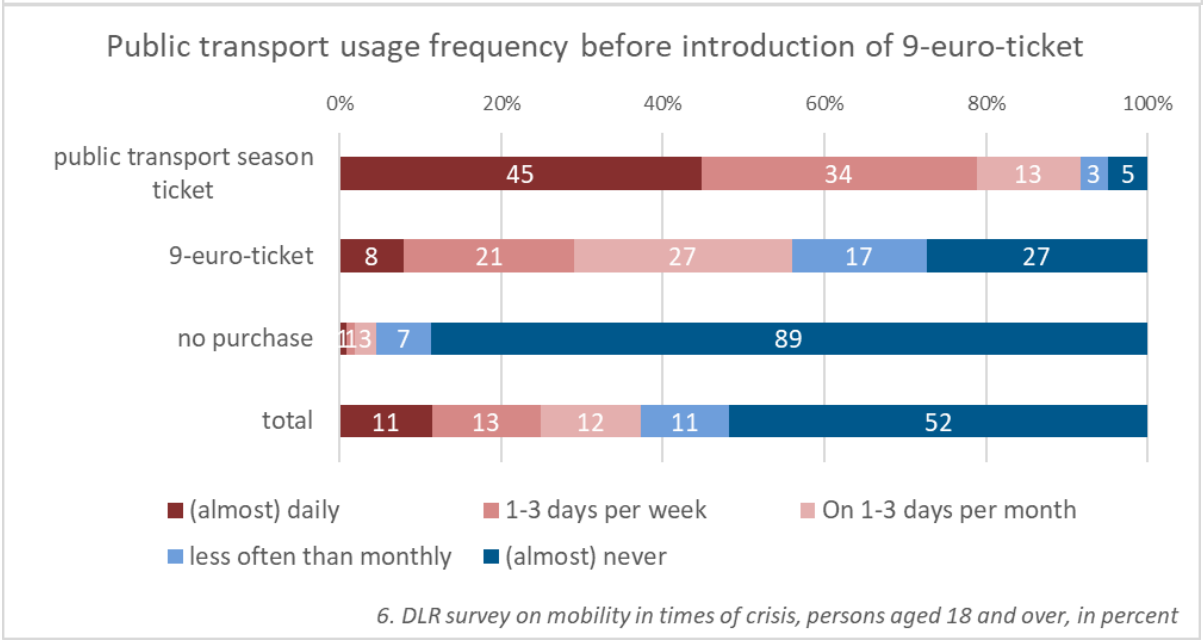
The situation is different when it comes to place of residence. Customers of the 9-Euro Ticket, and especially of the classic public transport season tickets, are more likely to live in large cities. In contrast, those who do not want to buy a 9-euro ticket during the campaign period are far more likely than average to live in small towns and rural areas and in a household with a car. In contrast, 30% of 9-Euro-Ticket customers live in a household without a car. This is 9 percentage points higher than the national average. Very clear differences are also observed in mobility behaviour (see figure 5). As expected, people with a public transport season ticket show the highest rates of public transport use both for the period before the pandemic and for the period before the introduction of the 9-Euro-Ticket. Among the 9-Euro-Ticket customers, the use of public transport was not quite as pronounced. But even for these, the following applies

to the six months before the campaign period: 56% used public transportation at least monthly, 29% at least once a week. For half of the 9-Euro-Ticket customers, public transportation was also part of their everyday transportation set before the Corona virus outbreak. At the same time, this means that for the other half of the 9-Euro-Ticket customers, traveling by public transportation was a rare event. The 9-Euro-Ticket thus appeals both to people who have previously used public transport and to people who have rarely used it.

In contrast to this, people who are not interested in buying a 9-EuroTicket used public transportation little or not at all both before the pandemic (96%) and in the six months before the campaign period (90%). While a low level of public transportn use encourages the purchase of a 9-Euro-Ticket, the barrier for people who never use public transport is very high.

Figure 5: Public transport use before Corona and in the six months before the introduction of the 9-euro-ticket

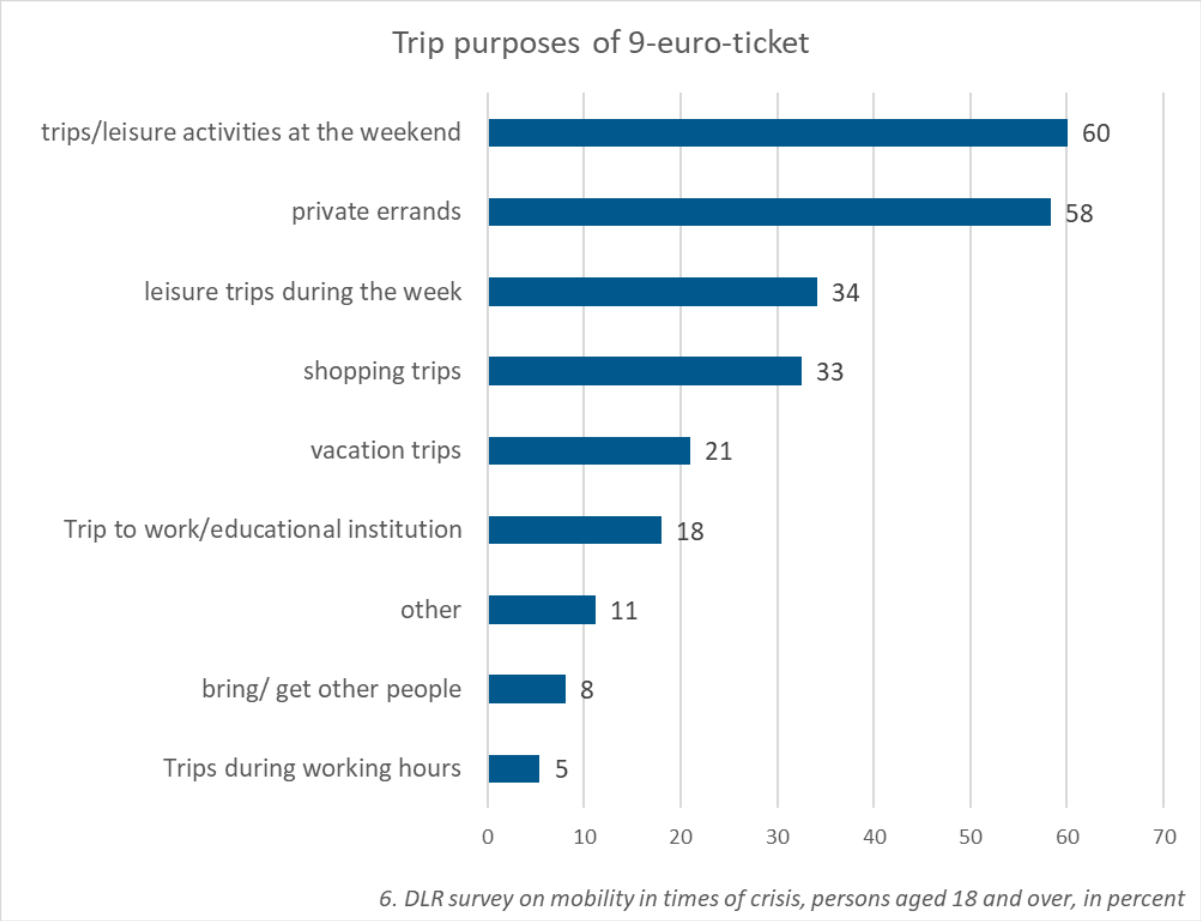




When looking at the different trip purposes, the 9-Euro-Ticket is very important for leisure trips. 60% of all respondents use the ticket for trips and leisure activities at the weekend, 34% for leisure trips during the week and 21% for vacations. But the ticket is also frequently used for private errands and shopping trips. The ticket plays a minor role for work-related trips: 18% use it for trips to work or to the educational institution. Only five percent of all people use it for business trips during work. If we consider only those in employment, the figures are 31% (work/ education trips) and 10% (for business trips). For a not inconsiderable proportion of working people, this means that

the federal government's declared goal of relieving commuters of high energy and fuel costs has been achieved. Nevertheless, the main focus of use of the 9-Euro-Ticket is in the leisure segment.

Figure 6: Trip purposes when using 9-euro-ticket



6. DLR survey on mobility in times of crisis, persons aged 18 and over, in percent

At the time of the survey, most respondents had already gained experience with the 9-Euro-Ticket: a good third had used the ticket for one to four trips, a fifth for five to nine, and another good third were intensive users of the ticket with 10 or more trips. Only eight percent had purchased the ticket but had not yet used it.

Considering that the average number of trips per day is 3.14 (Nobis, Kuhnimhof 2018), many people have very few daily trips that are covered by the 9-Euro-Ticket. For this group, no permanent change in mobility routines can be assumed after the end of the campaign period. The situation is different for the intensive users. Since most of them were already using public transport quite regularly before the introduction of the 9-Euro-Ticket, it is highly likely that public transport will continue to be part of their daily transport set.
The 9-Euro-Ticket is rated positively throughout by the respondents. It is described as a very attractive and easy-to-understand offer and is a good way to get to know public transport better. However, there is no willingness to buy a monthly ticket for public

transport at the regular price. And only nine percent of 9-Euro-Ticket holders expect to use public transport more often after the campaign period has ended than before.

5. CONCLUSION

The pandemic has led to a significant change in mobility behaviour. Public transport was the big loser in the process. Individual means of transportation such as the bicycle, but above all the car, have gained considerably in importance for everyday mobility. The already difficult situation of public transport has become even more difficult as a result of Corona.

With the 9-Euro-Ticket, public transport has regained considerable importance. The low price and the expansion of the range of regional transport services have led to a significant change in behaviour in a very short time. However, it cannot be expected that this has fundamentally changed the mobility habits of many people. Many have made only a few trips by public transport, but at least some of them have had some contact with public transport again after a long time. The results of the study suggest that many (potential) public transport customers can be reached with an attractive offer. The goal must be to create follow-up offers, to improve the public transport services and, above all, to build on the simplicity and clear comprehensibility of the ticket and to abolish the tariff jungle that prevails in many places in Germany.

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