Case Studies on Transport Policy 10 (2022) 2175–2182

Contents lists available at ScienceDirect

Case Studies on Transport Policy

journal homepage: www.elsevier.com/locate/cstp

How the COVID-19 pandemic changes daily commuting routines – Insights from the German Mobility Panel

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ARTICLE INFO

Keywords:
German Mobility Panel
COVID-19
Commuting
Working-from-home
Travel behavior
Telework

ABSTRACT

The COVID-19 pandemic has had a major impact on everyday travel and, by extension, everyday commuting. During the pandemic, some people were able to work from home while others continued commuting. This study examines how commuting behavior changed between 2019 and 2020. In this study, we analyze panel data of the German Mobility Panel, a national household travel survey. We paint a broad picture of the characteristics and behavior of those who commuted during the pandemic. The analyses focus on the intra- and interpersonal differences and are presented in a mostly descriptive way. The results show that people with low income and a low level of education are primarily those who cannot work from home and do not have flexible working hours. The results further show that especially public transport has lost importance in daily commuting. However, those who commuted in 2019 and 2020 did not significantly change their commuting behavior regarding commuting time and commuting mode.

1. Introduction

The COVID-19 pandemic has had a significant impact on people's everyday lives. When vaccines were not yet available and the number of infections was high, many governments urged their citizens to practice social distancing. They mandated preventive measures such as stay-at-home requirements, social distancing, or workplace closing to limit the virus spread. These measures significantly impacted how people in Germany went about their daily lives. Especially everyday travel was affected by stay-at-home requirements.

The COVID-19-related changes in everyday travel have been investigated in various studies. De Haas et al. (2020) were one of the first, who found significant changes in mode choice and trip purposes. Similar results were found in many places worldwide, e.g. Pakistan (Abdullah et al., 2020), Turkey (Shakibaei et al., 2021), Switzerland (Molloy et al., 2021), Germany (Eisenmann et al., 2021) and the United States (Shamshiripour et al., 2020). In the surroundings of these changes, a massive reduction in public transport use is found by Abdullah et al. (2020), De Haas et al. (2020) and Kolarova et al. (2021). Some studies also doubt that public transport use is moving back to pre-COVID-19 levels (Coppola and de Fabiis, 2020). Reasons are uncertainties of measures to promote a new way of post-pandemic travel (Gkiotsalitis and Cats, 2021) due to, for example, structural changes in travel behavior in general (Coppola and de Fabiis, 2021) and social distancing measures (Tirachini and Cats, 2020). The car gains additional importance as a counterpoint of the public transport slump. Despite the general decrease in car-related travel volumes (Ecke et al., 2021), the car has relatively gained importance (Kolarova et al., 2021).

As an effective measure to contain the spread of COVID-19, working-from-home (WFH) was enforced in many companies. A study by the Hans-Böckler-Foundation in Germany shows that in June 2020 around 16 % of the employees surveyed worked mainly or exclusively from home. 17 % worked alternately at their workplace and from home. The proportion of employees working from home was significantly higher than before the pandemic. During the first lockdown in Germany in April 2020 the share was even higher (27 %) (Hans-Böckler-Stiftung, 2021).

As a consequence of WFH, besides minimizing physical proximity at the workplace, physical proximity to others on the way to the workplace was also limited. Reducing travel demand in the transport system and thus the physical proximity on the way to workplaces is essential for stopping the virus spread. However and as Hans-Böckler-Foundation's findings show, still more than every second employee could not WFH in 2020. With so many people still commuting to work, it is a social responsibility to ensure that the risk of infection during commuting is

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https://doi.org/10.1016/j.cstp.2022.10.001
Received 22 April 2022; Received in revised form 19 August 2022; Accepted 3 October 2022
Available online 7 October 2022

minimized. Therefore, it is of special interest to understand the daily travel routines and commuting behavior of people who do not WFH during the pandemic, in order to derive targeted measures to minimize the risk of infection for people using the transport system.

The presented study intends to better understand the everyday travel of those who commute to their workplaces during the COVID-19 pandemic. In particular, we focus on sociodemographic aspects of commuters, changes in mode choice and experiences with WFH. We use the unique data set of the German Mobility Panel (MOP) for the analysis. It is an annual survey collecting everyday travel data of the German population (Ecke et al., 2020). The MOP is a true panel survey, collecting data from the same individuals in three consecutive waves. Consequently, the survey provides data of individuals before and during the COVID-19 pandemic.

The paper is structured as follows: The next section summarizes commuting and WFH literature. Subsequently, a brief elaboration of the survey, the data approach and research framework is given. Exploratory data analysis comes next. Finally, we discuss potential policy implications and conclude the paper by suggesting further research.

2. Literature

The literature review reveals various studies about WFH and commuting routines before and during the COVID-19 pandemic. In the following, we give a brief overview of studies on WFH and how working environments have changed. Furthermore, we present an overview of the literature on commuting routines and how they changed.

2.1. Working-from-home in times of COVID-19

Routines and mandatory activities such as commuting to work shape the activity patterns of individuals and significantly influence travel demand (Hilgert et al., 2018). Due to technological advances, WFH is theoretically possible for most employees, specifically in sectors, where the work is not tied to a specific location, for example, because it is performed exclusively on the computer. The COVID-19 pandemic has obliged employers and employees to facilitate or practice WFH, whether they like it or not, because social interactions during the commute and at the workplace have become associated with the risk of infection. WFH during the COVID-19 pandemic was, however, mostly a privilege of higher-income jobs (Tanguay and Lachapelle, 2020). The resulting changes in working and commuting behavior have been reported in several studies (De Haas et al., 2020; Harrington and Hadjiconstantinou, 2022; Reiffer et al., 2022; Shamshiripour et al., 2020; Shibayama et al., 2021). COVID-19 has been a turning point in the high number of people who have started to WFH. For example, Reiffer et al. (2022) found that people with children in the household are more likely to choose WFH, while people living alone are less likely to choose to WFH. However, Reiffer et al. concluded that this was reduced due to the pandemic.

Shamshiripour et al. (2020) reported that 71 % of the Chicago metropolitan area survey respondents had never WFH before the COVID-19 pandemic. De Haas et al. (2020) present similar findings: Analyses of the Netherlands Mobility Panel indicate that 44 % of employed respondents have started WFH regularly during the first lockdown and 58 % attested that WFH is a new experience for them. A study by Shibayama et al. (2021) shows that WFH was conducted by between 40 % and 60 % of working respondents in countries around the world (primarily in the global north) after the start of the COVID-19 pandemic. Nonetheless, there are still drawbacks and limiting factors regarding the implementation of WFH. The most limiting factor of WFH is that not everybody can work remotely due to the nature of the job (Mokhtarian and Salomon, 1996a; Mokhtarian and Salomon, 1996b).

As a positive effect of increasing WFH during the COVID-19 pandemic, commuting time was minimized for those who started WFH, which resulted in more time available for personal disposition. Rubin et al. (2020) show that WFH has positive effects by reducing commuting trips. However, while WFH may be linked to a better work-life balance and higher productivity because of work-related trip reductions, some employees like going to work on-site for social interaction. WFH thus influences their satisfaction, also due to the need to separate their workplace from their personal space (Fonner and Roloff, 2010; Vilhelmson and Thulin, 2016). Consequently, WFH harms their well-being and satisfaction.

2.2. Commuting in times of COVID-19

Typically, travel styles resist changes under non-pandemic conditions (Gärling and Axhausen, 2003; Schönfelder and Axhausen, 2016). For those who work, (daily) commuting is an essential part of their weekly trips and the overall distances travelled. Generally, commuting is a crucial segment of travel demand. The consideration of this segment is highly relevant for transport planning because the travel demand reacts inelastically compared with other travel purposes. If the job characteristics do not allow WFH (e.g. nurses), one must travel to work. Even with a significant increase in mobility costs, work commutes must be undertaken when WFH is impossible. Even events such as strikes or cars in need of repair rarely seem to deter employees from getting to their place of work. Moreover, a study of Papaioannou et al. (2020) shows that adaptations in commuting behavior are not straightforward. This means, for example, choosing a low-cost alternative is not always the best choice for a person, because there are other choice criteria that vary from person to person (e.g., perception of safety, choice of residence, attitudes).

Daily travel varies within the week. Hilgert et al. (2016) found that commuting mode choice and variation are generally determined by sociodemographic factors as well as the availability of transport options and subsequent activities under non-pandemic conditions. Furthermore, commuting to and from workplaces serves other lifestyle purposes, such as dropping children off at school or grocery shopping (Kitamura, 1984). Furthermore, the commuting mode is intraindividually very stable, and changes in commuting mode choice are related to sociodemographic factors, partner interactions, spatio-temporal circumstances, household attributes and working hour preferences (Chidambaram and Scheiner, 2021).

Analyses by Shibayama et al. (2021) show that most of those who continued commuting during the COVID-19 pandemic switched commuting transport modes. During the pandemic, some who had to stop commuting miss it, especially those who commute on foot or by bike (Rubin et al., 2020). Analyses by Harrington and Hadjiconstantinou (2022) show that barriers and motivators play a role for car and public transport commuters when thinking of or even changing commuting modes.

Molloy et al. (2021) found that public transport was affected by a decline in riders. With the use of public transport, a great risk of becoming infected with COVID-19 was associated (Hu and Chen, 2021; Shamshiripour et al., 2020). While the overall decline in riders is based on a shift to WFH, there is also a significant shift to less environmentally friendly modes of transportation, such as the car, which in particular appears problematic. Some of these shifts can however be expected to return to the pre-pandemic state. The results of Molloy et al. (2021) indicate that mode choice changes regress with increased relaxation of lockdown measures. Another study by Harrington and Hadjiconstantinou (2022) found that car and public transport commuters in the UK are considering a switch of transport mode once COVID-19 restrictions lift. The study shows that some will switch to bicycling or walking due to basically changes in the current lifestyle demands, but some bus/train users will also change to cars for safety reasons.

3. Data and methods

3.1. German Mobility Panel

The analyses are based on the German Mobility Panel (MOP) data. The MOP is a multi-day and multi-period survey that has been conducted since 1994. It collects travel data of the German population. The annual sample size of the survey is about 1800–2000 households with 3000–3400 respondents aged ten years and older.

The yearly survey period is during fall and excludes any holidays to best capture everyday travel. Information about trips taken within seven consecutive days is reported in a trip diary, including distances, means of transport, trip purposes and start and arrival times. Furthermore, sociodemographic information about the participants (e.g. employment status, gender, age), the availability of cars, bicycles and public transport passes as well as specific characteristics of the transportation system facilities (e.g. public transport service quality for commuting) are captured. In addition, the participants report illness, vacation or days their car was in the shop and other abnormalities within the survey period. A broad picture of everyday life and travel is drawn based on this information. For our analysis, we rely on two years of data. 2019 serves as a pre-Covid-19 reference because the 2019 MOP survey data was collected before the declaration of the pandemic. The survey in the fall of 2020 (Sep./Oct.) was conducted during the pandemic, a period in which infections enormously increased (RKI, 2021). However, it must be mentioned that people already had their first experience with the COVID-19 pandemic during the first wave of the pandemic.

We use a subsample to focus on employed people (full-time and part-time) who reported in 2019 and 2020. We regard only respondents aged 18 and older and who did not report any particularity (i.e. illness or vacation) or a relocation or job change during the survey. The data we use contains information from 623 full-time and part-time employees.

Table 1 displays the sample structure of employees who reported in 2019 and 2020 in the MOP survey compared to the employed population in Germany in 2019. Some variables of the official statistics for employed people, such as occupation status, have been affected by the COVID-19 pandemic. The MOP subsample differs from the 2019 statistics because each cohort is recruited to be individually representative for the population. Only those who participate for the second or third time (repeaters) are presented in the subsample. Young people are underrepresented in the subsample, whereas older people are overrepresented. In addition, the share of people with a high level of education is considerable. Only the share of employees between 35 and 50 years might be a reasonably representative subset. Summing up, the presented study is exploratory, meaning that, given the present sample size, this study has no ambition to represent the whole employed population in Germany. Nevertheless, the authors assume that this sample can map the structural changes.

Table 1
Sample structure of employees who reported in 2019 and 2020 in the MOP, employed population statistics in Germany 2019 (Destatis, 2019), including those who cannot WFH in 2020 based on the MOP data 2020.

Variable	Level	Sample [%]	No WFH in 2020 [%]	Employed population in Germany [%]
Gender	Male	48.7	50.4	53.3
	Female	51.3	61.3	46.7
Age (years)	< 25	0.8	100.0	9.6
	25–35	9.3	57.1	20.0
	35–50	29.9	50.6	32.2
	50–60	39.3	57.9	26.9
	> 60	20.7	58.8	11.3
Employment status	Full-time	68.4	54.3	70.8
	Part-time	31.6	61.0	29.2
Level of education	Low	9.8	81.0	
	Medium	28.8	57.5	
	High	61.5	36.1	
Economic status	Low	14.8	80.0	
	Medium	19.9	61.3	
	High	66.7	50.1	

3.2. Research framework

Given the need for insights on the impacts of the COVID-19 pandemic on commuting during the pandemic in Germany, this work presents descriptive analysis. Where relevant, indicators, e.g. the calculated kilometers per week for commuting, are broken down by sociodemographic characteristics. The research uses the longitudinal structure of the data to enable a direct comparison between behavior measured before the outbreak and during the first year of the COVID-19 pandemic. The multifaceted analyses are structured as follows:

First, it is investigated how people experienced WFH in 2020. In the MOP, the participants were asked how they evaluate WFH and if flexible working hours are possible in their job.

Next, commuting during the peak hours in the morning is analyzed. Because the study focuses on commuting, we use the data of people who reported commuting trips for this analysis. In the analysis, people who reported in 2019 and 2020 are included. A chi-square test is used to check the presence or absence of a relationship between time of day and commuting activity.

Moreover, sankey plots are calculated to study changes in commuting modes and if people switched to WFH. Furthermore, inter- and intraindividual changes in distances travelled are examined. For this, paired t-tests are performed to check whether the values differ significantly between the years. Furthermore, relative changes in work-related travel are displayed and analyzed.

The last analyses focus on changes in tour characteristics throughout the pandemic. For this purpose, trips are combined into tours. A tour starts and ends at (second) home or hotel and includes at least two trips (outward/return). The only exception are loop trips with only one trip, which starts and ends at the same place. These loop trips usually have a recreational character (e.g. walking the dog). Only tours that lead at least once to the place of work are examined. We only consider individuals who cannot WFH in 2019 and 2020 in this analysis. This group is of particular interest for studying commuting under pandemic conditions because it is the most vulnerable to contracting the virus both on the way to work and at work itself. Again, t-tests are performed to check for significant changes between 2019 and 2020.

4. Results

The focus of our study lies on full-time and part-time employees who reported in 2019 and 2020. This section analyses structural changes of commuting during the COVID-19 pandemic.

First, we analyze the opportunity to WFH and how it is related to sociodemographic characteristics. Interestingly, most of the employees in our sample cannot WFH (Table 1). A chi-square test was used to check the presence or absence of a relationship between sociodemographic

Table 2
Characteristics of work-related tours in 2019 and 2020 of employees who cannot WFH (n = 290), 95 % significance level of *t*-test.

Variable	2019	2020	Difference	*t*-value	p-value
# trips per work-related tour	2.6	2.5	0.1	1.8	0.072
tour length [km]	42	34	7	1.91	0.058
tour duration [min]	64	56	7	2.75	0.006

factors and the opportunity to WFH. Chi-square test results show that there are significant relationships of the level of education (p=.001), the economic status (p=.001) and gender (p=.008) with the opportunity of WFH. No significant relationship was found for age (p=.129) or employment status (p=.135) with the opportunity of WFH. The results indicate that those with a higher level of education preliminary WFH. Only 36.1 % of people with a high level of education cannot WFH, whereas this applies to 81.0 % of people with a low level of education. Furthermore, the higher the economic status, the more likely it is that people will have the opportunity to WFH.

4.1. Experiences with WFH

A relevant finding is that people with a low economic status or a low level of education are more likely to evaluate WFH more negatively than those with a high economic status or high level of education (Fig. 1). We see that people with a negative evaluation of WFH are also those who cannot WFH. It is not surprising that the share of people who are more likely not to WFH is highest for the group with a negative attitude towards WFH.

When WFH is not possible and people need to commute to get to their workplace, flexible working hours are one measure that can reduce the risk of close contact with others – at work and on the commute (e.g. in public transport). The results indicate however that those who are more likely not to WFH also do not have flexible working hours. It should be noted that there are many jobs without flexible arrangements for working hours because of work shifts (e.g. doctor, nurse, factory worker).

4.2. Commuting during peak hours in the morning

As most people commute to work in the morning, it is interesting to identify changes in the commute in terms of transport volumes and mode choice to see how the morning peak hours have changed during the pandemic. Fig. 2 displays the commuting mode on trips to work between Monday and Friday (working days) for the peak hours in the morning. It can be seen that car and public transport were used by fewer people in 2020.

Nonetheless, the peak hour did not change between 2019 and 2020. Most people still commute between 7 a.m. and 8 a.m. in 2020. The results indicate that people who commute to work during the pandemic have no opportunities or do not feel the need to commute at other times. As a result, the daily commuting routines have not visibly changed in terms of the time of the day. This may be because shift work or core work hours were not changed during the pandemic. A chi-square test also failed to demonstrate a significant relationship between time of day and commuting activity (p = 0.921) between the years.

4.3. Mode choice on the commute

Based on the previous analysis, we can conclude that little has changed in the temporal commuting routines. However, commuting behavior might have been affected by a change of the transport mode. Thus, the next step is to examine how mode choice for commuting has changed between 2019 and 2020. Changes in transport mode are expected for those who cannot WFH. For the analysis, we also consider that people no longer commuted but switched to WFH in 2020.

The Sankey diagrams of Fig. 3 (full-time employees) and Fig. 4 (part-time employees) show the change in the main transport mode on trips to work before and during the COVID-19 pandemic as volume flows. The car includes the response options car as a driver, passenger and motorcycle. “Other” contains e-scooters, airplanes, boats, etc. If a person travels more than every second trip by a certain transport mode within the reporting week, we define this as the main transport mode.

The analysis is based on employees employed in 2019 and 2020 and who reported WFH options or trips to work in both years. People who said that they often WFH are defined as WFH employees. The figures show that there were only minor shifts between the transport modes. Most commuters were not in a position to change their commuting mode. The most significant change is described by people commuting by car in 2019 and changed to WFH in 2020. Also, many part-time employees commuted by public transport (PT) in 2019 and switched to the car in 2020. However, more people have changed from PT to WFH than from PT to the car as individual transport.

Interestingly, we find differences between part-time and full-time employees. Within the part-time employees, higher shares of people changed from car to bicycle and from PT to car. This might also be due to differences in the mean distances from home to the workplace. In our study, full-time employees tend to travel longer distances to get to work than part-time employees.

4.4. Changes in distances travelled

Work-related mobility generates a significant contribution to transport demand. Thus the question arises to what extent the travel demand changes if fewer occasions for trips arise during a pandemic. With the pandemic’s start, many employees started to WFH. Consequently, the distances travelled to work decreased between 2019 and 2020 (Fig. 5). Also, distances travelled for other purposes decreased due to limited opportunities during the pandemic (e.g., closure of recreational sites). However, the decrease is more recognizable among employees who WFH than those who cannot WFH. The results of a *t*-test show that employees who can WFH in 2019 and 2020 generally travel significantly fewer kilometers in 2020 (p =.001).

In contrast, employees without the option to WFH in 2019 and 2020 show no significant change in kilometers travelled (p = 0.159 for tripsto

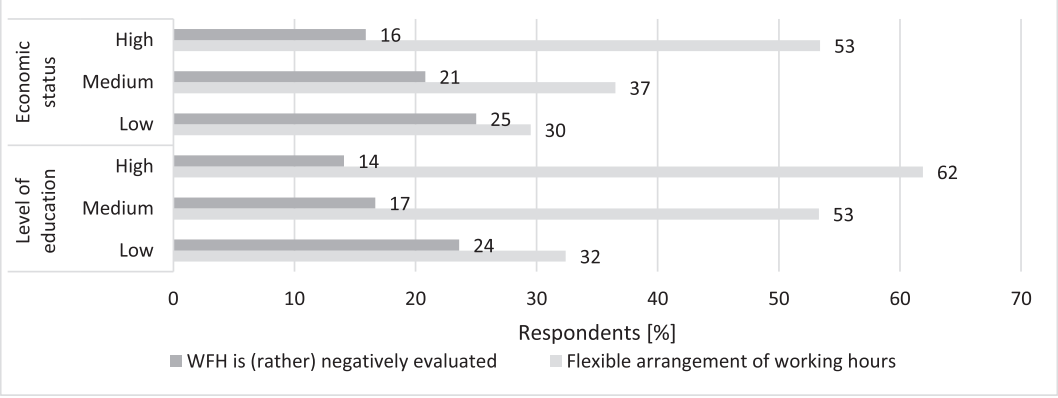

Fig. 1. Experiences with WFH and share of employees with flexible arrangements of working hours in 2020.

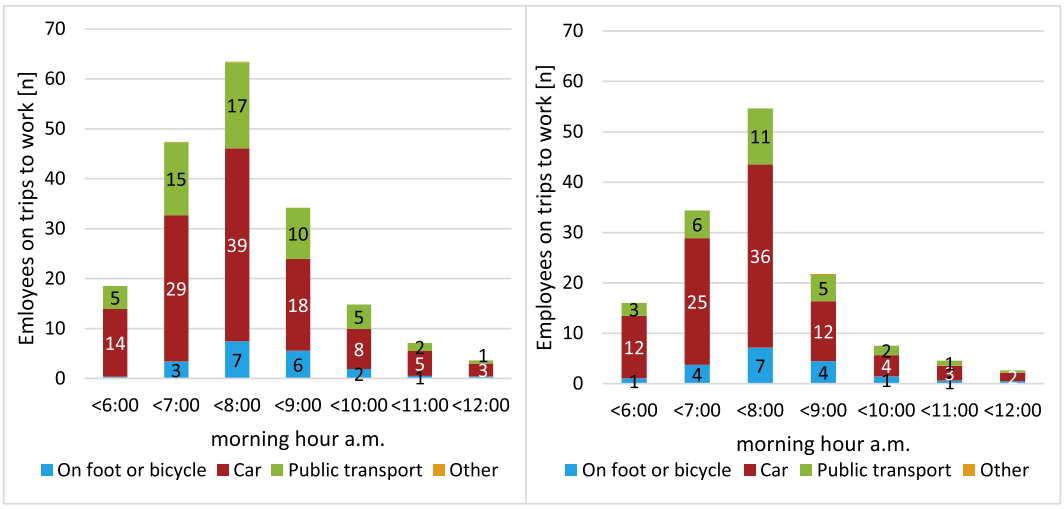

Fig. 2. Commuters mode choice for commuting trips during the peak period in the morning for 2019 (left) and 2020 (right) for identical employees.

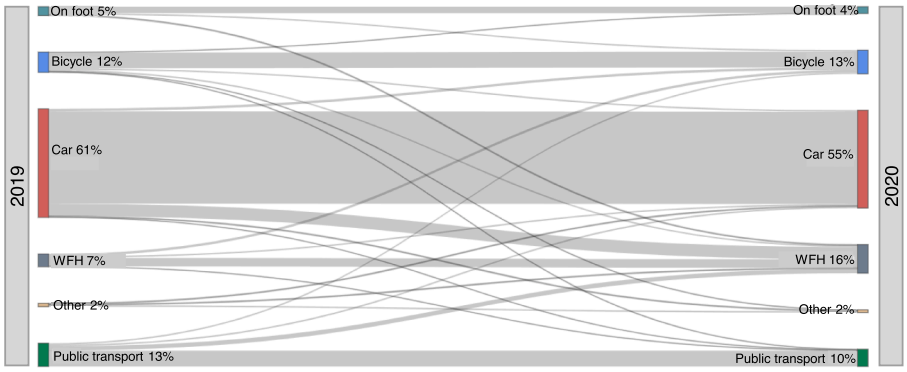

Fig. 3. Sankey diagram of changes in commuting mode choice between 2019 (before COVID-19) and 2020 (during COVID-19) for full-time employees (n = 359).

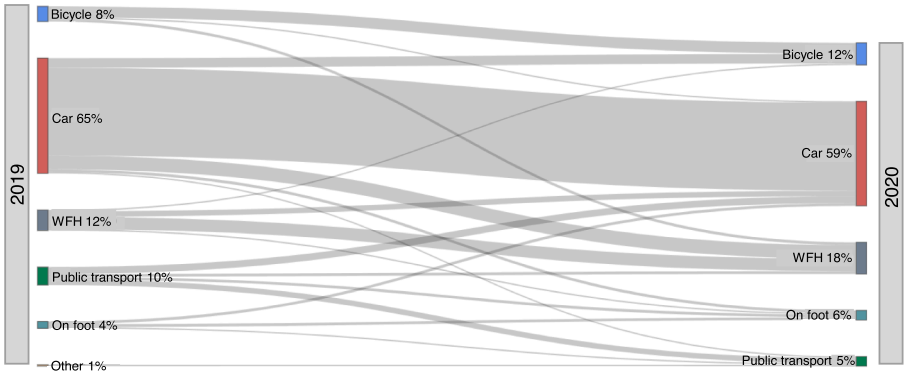

Fig. 4. Sankey diagram of changes in commuting mode choice between 2019 (before COVID-19) and 2020 (during COVID-19) for part-time employees (n = 129).

work). Based on this, it can be said that daily commuting remained almost the same (58 km per week in 2019 and 61 km per week in 2020). Fig. 5 also shows that people with no WFH option travelled less in their leisure time in 2019 than employees who WFH under non-pandemic conditions. However, based on this analysis, it is impossible to say how sustainable these changes will be.

Fig. 6 displays the relative changes between 2019 and 2020 in kilometers travelled within work-related trips, depending on the option to WFH. For this, business-related trips and trips to work are combined. All graphs are left skewed, meaning that more people have reduced their travel. 26 % of people who can WFH in 2019 and 2020 have reduced their travel by 100 %, i.e. they do not travel at all for working purposes in 2020. For those who can only WFH in 2020, it is 25 %. For people who cannot WFH, the proportion of people with no apparent change in distances travelled is the highest (18 %). People who cannot WFH significantly increased their travel distance in 2020 compared to the other groups. It must be mentioned that besides the COVID-19 effects, other reasons must be considered which explain the year-to-year intra-individual variability in travel. This is especially true for the share of people unable to WFH who reduced work-related travel by 100 %. This

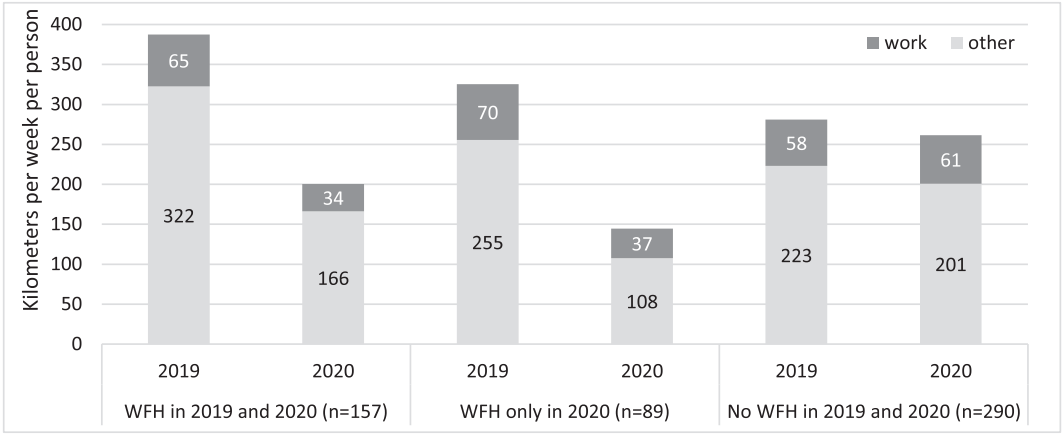

Fig. 5. Kilometers travelled, depending on the option to WFH in 2019 and 2020; trips back home from work are included in "other".

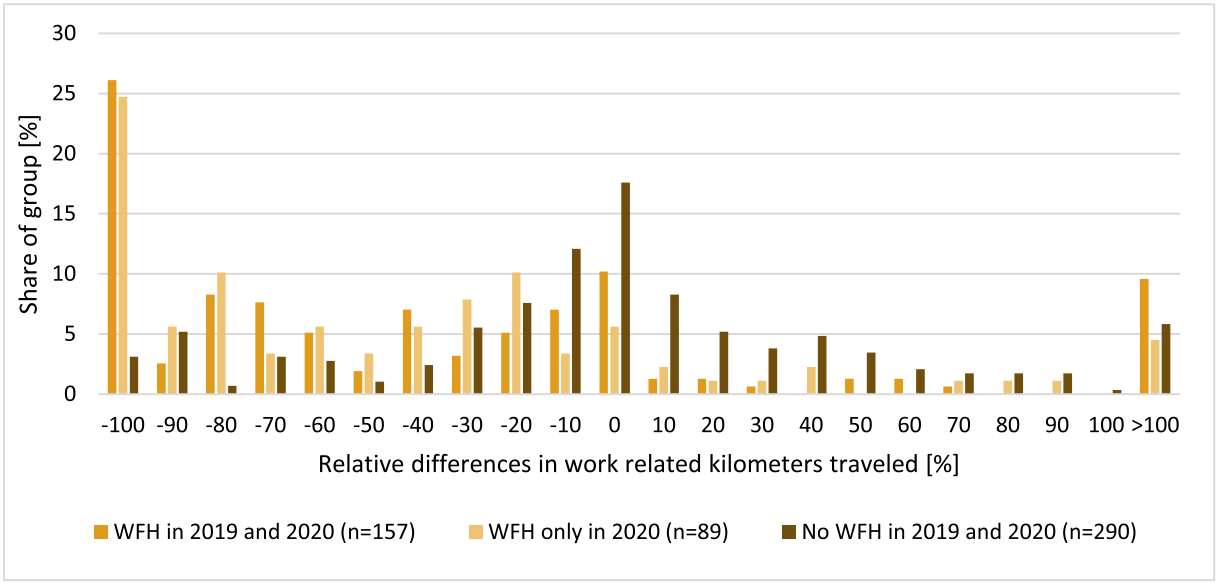

Fig. 6. Relative differences in work-related kilometers traveled (work and business purposes), differentiated by the possibility of working from home in 2019 and 2020.

applies, for example, to people who made business trips in 2019 but no work trips and made neither work nor business trips in 2020. Furthermore, we can also observe individuals who increase their work-related travel considerably for other reasons that occur in daily life.

4.5. Tour characteristics

Lastly, we examine the structure of commuting routines during the COVID-19 pandemic in 2020 and 2019. Fewer people are expected to combine work activities with other activities directly after/before work due to the lack of opportunities (e.g. closures of sports facilities) in 2020. People are also expected to increase travel straight to work or back. Working time takes up a large part of the time budget for workers. To this end and under non-pandemic conditions, commutes are often combined with other activities (e.g. picking up/dropping off children, shopping) to save time before and after work. From the analysis of tours, we find that 62 % in 2019 and 66 % in 2020 of all tours including a trip to work lead from home to work and directly back (home → work → home). The results indicate that people tend to engage in fewer activities before and after work under pandemic conditions compared to the pre-pandemic situation.

However, the analysis shows that the mean number of trips per work-related tour does not significantly decrease between 2019 and 2020 for those who cannot WFH in both years. Also no significant differences in the mean trip length per tour were found. The results suggest that these people do things before or after work that also respond inelastically (e.g., picking up/bringing children). During the data collection period, an increasing number of facilities for leisure activities had to close in Germany (Bauer and Weber, 2021). Consequently, most out-of-home leisure activities could no longer be attended. The results suggest that even under normal conditions, these people rarely attend leisure activities on work-related tours. One reason may be that working hours cannot be flexibly arranged (see also Fig. 1).

Significant differences can be seen in the tour duration. In 2019, the mean tour duration is 64 min; in 2020, it is 56 min. This change is also due to changes in transport mode (Fig. 3 and Fig. 4). On closer inspection, however, the results show that the change does not result from the mode shift, but mainly from the WFH. The fact that many people WFH leaves more space in the transport system (road and rail) for those who cannot WFH. When it is less crowded in the transport system, those who commute can save time because waiting times may be reduced. The time savings are achieved, for example, by reduced waiting times and an increased punctuality of trains or less congested roads. However, in our data, it can also be seen that speeds have actually decreased. This means

that those who are travelling need more time in relative terms, which is an effect of a change in the modal split – e.g., through more cycling or the use of other slower modes of transport.

5. Discussion

Using the German Mobility Panel (MOP) data, the presented work examines commuting routines during the COVID-19 pandemic. The MOP provides unique data of individuals who participated both before and during the COVID-19 pandemic in 2019 and 2020 and allows for identifying changes in travel behavior triggered by the pandemic. In the context of this work, it was thus possible to study changes at the interpersonal and intrapersonal levels.

The results show that commuting to work generally decreased during the pandemic and many people started to WFH. A general finding in the MOP is that WFH is possible for about 45 % of workers, and in a higher percentage among office workers, who are more likely to have a higher educational status. Furthermore, it must be taken into account that at the time of the survey, no strict measures for virus containment had been enacted. It is likely that the WFH share may increase under stricter measures. However, most of our sample cannot WFH, which is in line with the findings of Kolarova et al. (2021). Further, the results align with De Haas et al. (2020), Harrington and Hadjiconstantinou (2022) and Shibayama et al. (2021). But compared to these studies, the level of WFH in our study differs regarding the observation period and local restrictions. No significant changes regarding the daily commute starting time or trip length were found for those who still commute. Based on the results, it can be stated that lower-income and less-educated people experienced minor behavioral changes regarding their commute. Furthermore, these people are more likely not to WFH. However, these people are underrepresented in our sample so no representative conclusion can be drawn. Our results indicate that people with high education and economic status are more likely to WFH, which is in line with Reiffer et al. (2022).

The results of our study that public transport has lost ground for the commute align with Hu and Chen (2021) and Tirachini and Cats (2021; 2020). It was shown how the mode choice of commuters affected by the COVID-19 threat has changed. A key finding is that commuting modes can change when measures are taken to contain the virus. Well-educated people and people with a high economic status are more likely to WFH and stop commuting. Generally, such employees are more likely to have jobs that allow them to do so. People with a lower economic status tend to have negative attitudes towards WFH which is also a barrier and makes it less likely that they will do it voluntarily.

After the start of the pandemic, some people changed their transport mode of commuting. People who commute by car continue to commute by car or switch to WFH. In particular, public transport has become less important and critical for commuting during the pandemic – many people, especially part-time employees, have used other means of transport, e.g., non-motorized modes, or switched to WFH. These results are in line with Osorio et al. (2022). Lastly, our study also showed that many changes occurred at inter- and intrapersonal levels, but the changes were broadly distributed. For example, at the interpersonal level, we see that full-time workers have changed more than part-time workers concerning WFH. However, at the intrapersonal level, we also see large differences within these groups, simply because the job conditions to WFH depend on the profile and not the work model (full-/part-time).

This study also captures several aspects of commuting behavior during the COVID-19 pandemic. However, there are shortcomings: Because the survey focuses on everyday travel, the survey is not explicitly designed to capture WFH and no details on the type of occupation (office, industry, etc.) are captured. Because not all jobs allow to WFH, a differentiated perspective is limited. Furthermore, highly educated people are overrepresented in the sample. Hence, it does not allow for an extrapolation to the population as a whole, but still provides indications on the effects of the Covid-19 pandemic on employed people and their commuting patterns in Germany.

The COVID-19 pandemic can be seen as an event that triggers employees to break their commuting habits. This also opens a window of opportunity to reflect on travel habits in general. In the future, increased importance must be paid to information and communications technologies (ICT) e.g. digital solutions for e-conferencing. Therefore, it is essential to address the apparent shortcomings of available ICT solutions to facilitate behavioral changes that rely on ICT. Policymakers must pay attention to the increased preference for individual travel modes such as walking or cycling as well as to negative attitudes towards public transport. Further, it should be considered how structural effects on travel may depend on accommodating policies by governments and employers, e.g., stimulating working from home and active modes. In the future, the changes in commuting will also be an issue for employers. It will become more difficult to retain employees because if WFH is allowed, it is also possible to work far from the company and communicate less directly with other employees.

6. Conclusion

This study presents a comprehensive overview of changing commuting patterns due to the COVID-19 pandemic in 2020. Measures to stop the virus spread have impacted travel patterns. The realted changes are investigated based on the unique dataset of the MOP.

The survey data used for the analysis contains one-week trip diaries to capture intra- and interpersonal facets of changes in everyday travel and trip purposes. The focus of the study was to describe the impacts of the COVID-19 pandemic on commuting routines and establish initial trends of changes and their potential to become a part of the new normality.

The results show that the COVID-19 pandemic significantly changed commuting travel. We see that 2020 differs substantially from 2019, especially for people who are able to WFH. The results indicate a “new normality” in which old patterns have been partially removed and new ones adopted. Also, our study shows that commuting seems comparatively stable compared to other types of travel. However, the results cannot draw a clear picture. Identifying statistically robust patterns during the pandemic is challenging because every-one was affected somehow. Future work will focus on the 2021 survey wave because it was conducted in a period with relatively low infection rates. In the following survey wave in 2021, it will be possible to evaluate how people who started WFH in 2020 adjusted their behavior in low-risk times.

While this study focuses on the employees’ side and how they adapted their travel behavior during the pandemic, there is still a lot to be discussed in the future on how the long-term effects of the pandemic can reshape commuting. In our study, people with a low economic status show a low level of WFH and thus did not change their commuting behavior. This leads to a discussion of (social) equity since a gap becomes prevalent.

Staying at home to work can reduce the risk of infection. In order to protect those who are not able to WFH, policymakers and employers should pay attention to protective measures against infection, e.g., larger capacity in public transportation or workplaces to minimize exposure during peak commuting. Furthermore, promoting active modes such as walking or cycling can also help minimize the risk of infection and improve individual health.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This paper presents analyses of the German Mobility Panel funded by the German Federal Ministry for Digital and Transport (grant number: 70.952/19).

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