COMMUTING TO WORK VERSUS E-COMMUTING: DATA FROM AN AUSTRIAN COMPANY IN PRE-COVID-19 ERA, DURING 1ST LOCKDOWN, AFTER EASING AND DURING 2ND LOCKDOWN

[a]MICHAL BEŇO

Institute of Technology and Business in České Budějovice, 370 01 České Budějovice, Czech Republic
email: [a]beno@mail.vstecb.cz

Abstract: As a result of restrictions introduced to slow the spread of Covid-19, the number of commuters has significantly decreased and e-commuters increased. This analysis is based on Austrians who had a job prior to the pandemic and who were still working during the survey (whether they worked from home or commuted). Using data from the survey, this article examines changes in the mode of workplace of those who switched to e-commuting. Additionally, the authors were interested in finding out to what extent the e-commuting agreement reduces commuting. The following were done: a systematic review of e-commuting literature, a cross-tabulation of data to examine relationships within data, a McNemar test for workplace examination and a Friedman test with pairwise comparisons for commuting analysis. The data show that the number of e-commuters increased in almost all the surveyed periods except between the pre-Covid time and the easing of the lockdown. The e-working proportion increased on average by 59.74%. Results suggest that the frequency of commutes by cubicles differs significantly in all periods except between the first and second lockdowns, and by e-workers between February and the first lockdown and the easing and the second lockdown. If we look at the average rankings, we see that during the second lockdown, the frequency of cubicle commutes decreased significantly and that of e-workers increased.

Keywords: commuting, e-commuting, pre- and post-Covid-19, Austria.

1 Introduction

During the entire history of humankind, location dependency was the key for getting a job. This means that a lack of technological advancement prevented the work environment from being flexible. Humans moved from the Stone Age (hunting, gathering, preparing food, constructing human artefacts) to social groups, through agriculture (farming) and different industrial revolutions (physical power) to the modern information and communication technology (ICT) age (Beno, 2018). Before the 19th century, most workers lived less than a one-hour's walk from their workplace (Mauss et al., 2016). The industrial revolution, and the industrious revolution (De Vries, 1994), moved people from their home to workplaces, now people are able to move back to their homes (Simitis, 1986).

When traffic congestion, rail fare increases, the cost of petrol, air pollution, commuting time increases and many other factors are taken into consideration, commuting seems to be a far from stress-free experience. Commuting (travelling to work in general) places a disproportionate burden on the transport network, physical (Künn-Nelen, 2016; Sugiyama et al., 2016; Tsuji and Shiojima, 2015) and mental health (Hilbrecht et al., 2014; Sugiyama et al., 2016; Wener and Evans, 2011), work performance (Grinza and Rycx, 2020; Künn-Nelen, 2016; Nomoto et al., 2015; Steinmetz et al., 2014) and social participation (Delmelle et al., 2013; Mattison et al., 2015; Newman et al., 2014; Sandow, 2011).

Commuter behaviour is undergoing a change with regard to modes of commuting, increases in commuting distance and duration, time of day for commuting and increased congestion. Commuting time from the home to the workplace has been increasing (Lorenz and Goerke, 2015; Roberts and Taylor, 2017). In 2018, more than one in five European workers spent 90 minutes or more of their time travelling to and from work. On average, European workers spend 1 hour and 24 minutes a day commuting, travelling 28.56 km in total (SD Worx, 2018). But 70% of Europeans think their commute has a good ecological footprint, despite cars being the kings of the commute (SD Worx, 2019). Many Austrians are struggling to find work in the rural heartland and are being forced to commute long distances. Most employers say this is not their problem (Cermak, 2014). The number of commuters in Austria made up 2.2 million of the roughly 4 million employed people, i.e. more than a half (Statistik, 2020). Furthermore, 220 000 Austrians commute 40 km per day and almost 60 000 of them 100 km or more every day (Wolf-Eberl and Posch, 2018). Such long commutes and the high number of weekly working hours raise questions about safety, health, productivity and a good work-life balance.

E-commuting has the potential to address problems of congestion, pollution, work-life-balance, productivity and lack of housing affordability. It reduces the need to travel to cubicles primarily through the utilisation of modern ICT. Simply, it is working from different places on a full (hybrid) or part-time basis. But Covid-19 has had a dramatic impact on how people and businesses operate day-to-day, not least in how they approach travelling to and from places of work. Different efforts to contain the disease have had an instant and unprecedented effect on working patterns all over the world, with the lockdown restrictions and increased e-commuting reducing the use of car journeys and the demand for public transport.

Looking back, the Covid-19 pandemic, and the measures designed to tackle it, have had a dramatic effect on workplace activities. As Covid-19 spread, increased social distancing, higher uncertainty and the lockdowns reduced outside activities. The focus of this project was to explore employees' cubicle and e-commuting workplace activities in a surveyed country in the pre-Covid-19 time, during the first lockdown, the easing of the lockdown and during the second lockdown. Additionally, we were interested in finding out to what extent the e-commuting agreement reduces commuting. One of the reasons for many companies to implement e-commuting is to exercise corporate social responsibility, but also because it reduces the overall transmission of the disease.

The following section provides an account of the e-commuting concept. The third section briefly outlines the methodology used in this research. The fourth section gives a short overview of the results and closes with a discussion. The last section gives the conclusions.

2 E-commuting

The idea of working at a distance arose in the 1970s (Nilles et al., 1976) during the oil crises (Scholefield and Peel, 2009). Since then, the term varies within the existing literature. "Since the idea of telecommuting has been around for decades now, it makes sense that new words and phrases would come to replace what is, in theory, a not-so-new workplace concept" (Parris, 2018). Over the years, researchers used different terms to indicate e-commuting, such as teleworking, remote working, nomadic working, mobile working and e-working. These terms do not always have the same meaning of the concept of e-commuting. Fonner and Roloff (2010) state that employees work principally from home, but teleworking is not limited to home-based work and includes working from a variety of other locations, such as telecentres and call centres. Basically, e-commuting means the utilisation of ICT rather than commuting to work (Beňo and Ferenčíková, 2019). It has become apparent that there are many ways in which teleworking can be practised, and so a more detailed breakdown of the term is needed. The definition varies from country to country, industry sector, time and place, but includes three common principles. Telecommuting involves (1) members of an organisation, (2) performing their regular work away from the central workplace at a remote location, (3) while using technology to complete the work (Pinsonneault and Boisvert, 2001).

E-commuting, formerly e-working, has increased over the last years, enabled by modern technology. Telework increased slowly in the 11 years before the appearance of Covid-19 (Eurostat, 2021a). E-commuting has been connected with staying at home to work on major projects/tasks for the company. With the arrival of Industry 4.0 and advanced ICT it became increasingly possible to meet the work requirements without needing to spend so much time in traffic, and it allowed more work flexibility. There are two types of e-commuters: those who commute to

cubicles once or twice a week or fully e-workers who do not commute at all.

In choosing the type of commuting model, commuters are assumed to evaluate the attributes of the different transport options available to them and to choose the type of transport mode that will provide them with maximum utility (Ortúzar and Willumsen, 2011). However, it has also been posited that commuting behaviour is habitual and that changes of the type of commuting is more likely at the time of major life events, such as moving house, changing jobs, relationship breakdowns or the birth of a child (Clark et al., 2016). Recent data show that the effect of teleworking on commuting is driven by occupations in which teleworking has grown. Therefore, policymakers should be aware that the effects differ between intellectual and manual occupations (De Vos et al., 2019).

E-commuting is seen as a tool for reducing the environmental and socio-economic impact of transport and mobility patterns on society (Beňo, 2021; Cerquiera et al., 2020; Hynes, 2014; Kitou and Horwath, 2006; Van Lier et al., 2014) and reducing distances and number of trips (Balepur et al., 1998; Choo et al., 2005; Ravalet and Rérat, 2019). Previously, e-commuters made significantly fewer and shorter trips than non-teleworkers (Elldér, 2020).

3 Material and Methods

3.1 Procedure

The authors of the paper regard the literature review as a critical, analytical account of the existing research on a particular topic. Firstly, the authors present their own discussion of the existing literature on e-commuting. Secondly, a descriptive empirical analysis is used. Data analysis consists of descriptive statistics and other quantitative measures in analysing particular issues and questions.

3.2 Participants

Research was performed following a quantitative approach, drawing from a sample of 154 individual employees in Austria. Our survey started at the end of February 2020; 154 employees were selected, made up of 34 e-workers (20 male and 14 female) and 120 cubicle workers (68 male and 52 female). In Table 1, we provide further socio-demographic data.

Table 1: Socio-demographic characteristics, N = 154

Variable		Cubicles	E-workers
		N=120	N=34
Sex	Male	68	20
	Female	52	14
Age	20-29	28	3
	30-44	38	12
	45-59	37	19
Marital status	Single (divorced, separated)	67	22
	Married/partnership	53	12
Parity	Children in household	99	29
	Childless	21	8

This work was developed to provide a better understanding of workplace changes and employees' commuting before Covid-19 (28.02.2020), during the first lockdown (31.03.2020), after the easing of the lockdown (29.05.2020) and during the second lockdown (30.11.2020) in relation to the future impact on the face-to-display workplace in an Austrian company. In the first stage of our survey, we identified cubicle workers and e-workers. Secondly, we examined the commuting trend and time saved by not commuting. As this data collection was done solely for this international company, ethics approval was not required.

The e-mail questionnaire contained several types of questions (in English) for respondents to answer. The following variables were used: cubicles, e-commuting in the pre-Covid era, during the first lockdown, after the easing of the first lockdown, second lockdown. The study was conducted regardless of gender, however both genders participated in our research. The participants came from Austria, from towns and cities, from suburbs and the countryside. Respondents' ages ranged from 20 to 59 (see Table 1).

The sample was a heterogeneous group of professionals working in several areas, including the following: customer services, accounting, electronic data processing, research and development, marketing and logistics. Responses to the questionnaires were anonymous.

There is a reliability risk with e-mail questionnaires. It is more difficult to guarantee their anonymity. The respondents might be concerned about the information they have provided being misused. To assure them that this would not happen, the authors of the paper proceeded as follows. First, the confidential nature of their responses was emphasised in the questionnaire invitation. This also contained a description of the mechanism which was then executed. We used trusted software which did not allow linking identifiers with their responses. Their ID and responses were stored in different files. Then, the authors made certain that all IP addresses, e-mail data, and other person-related data were not archived.

3.3 Data Collection and Analysis

In the first stage, we used a cross-tabulation of the data to examine relationships within the data. In the second stage of our analysis, we used the McNemar test to determine the consistency in the responses across two variables. We tested two workplace changes to determine whether there is a significant difference between the proportion of workers working from home and those working from cubicles in all four examined periods. In the next step, we examined commuting. We used the Friedman test with a pairwise comparison to determine whether there is a difference between the commuting of workers and e-workers during the examined periods.

4 Commuting versus e-commuting: Looking Back and Looking Forward, Survey Results

Austria is widely recognised among EU and OECD countries (EFI, 2020) as having highly flexible labour markets. Additionally, Austria is rated as having the 29th most efficient labour market in the world (Schwab, 2019). In general, flexible labour markets tend to have higher employment rates and more skilled employees, and consequently lower unemployment. But working from home is suddenly the new normal as many employers and employees try to keep operating under the social distancing restrictions. Austria has, like many other countries, effectively closed down entire sectors of its economy and severely limited activity in many other sectors. The following paragraphs provide an overview of the findings from the quantitative component of the research study.

4.1 Workplace Formation

The Covid-19 pandemic has changed the ways and the places where people work. The number of people choosing to work remotely is increasing slowly in the European Union (Eurostat, 2021b). How many employees were working from home in the pre-Covid period? Before the lockdown, work carried out in cubicles (77.92%) exceeded the rate of e-workers (22.08%). During the first lockdown there were 92.21% e-workers, after the easing of the first lockdown (cubicles – 42.86% to e-workers – 57.14%) and in the second lockdown (cubicles – 32.47% to e-workers – 67.53%) the employed population was exclusively working at home (see Table 2).

Table 2: Socio-demographic characteristics, N = 154

Variable	Before Covid-19	1st lockdown	Easing of restrictions	2nd lockdown
	%	%	%	%
Cubicle-centred workers	77.92	7.79	42.86	32.47
E-workers	22.08	92.21	57.14	67.53

Based on the study data, the lockdown restrictions by the government of Austria show a high growth of e-working (shift to working from home). This confirms the statement that greater technological connectivity facilitates this process by enabling work to be carried out wherever workers happen to be and whatever the time of day (Messenger and Gschwind, 2016). Research carried out before the lockdown shows that e-working was more prevalent as a special privilege among male employees, but during and after the lockdown it was a necessity for everybody. This confirms Beno's survey data that telework is a male-dominated working method (Beno, 2019). Nearly four in 10 people in the EU began working from home as a result of the Covid-19 pandemic (Eurofound, 2020).

Our evidence, using the McNemar test, shows that there is a significant difference in the distribution of jobs (Chi-Square tests marked in bold), except in the pre-Covid and the easing of the lockdown periods (see Table 3a-f).

Table 3a-f: Workplace* period cross-tabulation and Chi-Square tests.

a) Workplace* period cross-tabulation

Count		Period		
		February	During 1st lockdown	Total
Workplace	Cubicles	120	12	132
	E-workers	34	142	176
	Total	154	154	308

		Value	Exact Sig. (2-sided)
Chi-Square tests	McNemar test		**0.002**[a]
	N of valid cases	308	

b) W2* Period Cross-tabulation

Count		Period		
		February	Easing lockdown	Total
Workplace	Cubicles	120	66	186
	E-workers	34	88	122
	Total	154	154	308

		Value	Exact Sig. (2-sided)
Chi-Square tests	McNemar test		**0.002**[a]
	N of valid cases	308	

c) W2* period cross-tabulation

Count		Period		
		February	During 2nd lockdown	Total
Workplace	Cubicles	120	50	170
	E-workers	34	104	138
	Total	154	154	308

		Value	Exact Sig. (2-sided)
Chi-Square tests	McNemar test		0.101[a]
	N of valid cases	308	

d) Workplace* period cross-tabulation

Count		Period		
		During 1st lockdown	Easing lockdown	Total
Workplace	Cubicles	12	66	78
	E-workers	142	68	230
	Total	154	154	308

		Value	Exact Sig. (2-sided)
Chi-Square tests	McNemar test		**0.000**[a]
	N of valid cases	308	

e) Workplace* period cross-tabulation

Count		Period		
		During 1st lockdown	During 2nd lockdown	Total
Workplace	Cubicles	12	50	62
	E-workers	142	104	246
	Total	154	154	308

		Value	Exact Sig. (2-sided)
Chi-Square tests	McNemar test		**0.000**[a]
	N of valid cases	308	

f) Workplace* period cross-tabulation

Count		Period		
		Easing lockdown	During 2nd lockdown	Total
Workplace	Cubicles	66	50	116
	E-workers	88	104	192
	Total	154	154	308

		Value	Exact Sig. (2-sided)
Chi-Square tests	McNemar test		**0.002**[a]
	N of valid cases	308	

According to the data, there are significant differences in the proportion of workers in the office and at home during all four periods. Over the course of the surveyed periods, the e-working proportion increased on average by 59.74%. Briefly, this surge in e-working occurred during the 1st lockdown (92.21%) and 2nd lockdown (67.53%).

4.2 Commuting versus e-commuting

Given its importance, commuting to/from work plays a central role in daily mobility planning, and thus the analysis of commuting behaviour is important for the correct design of mobility policy. Commuting time has been extensively studied in the past, and some level of consensus has been achieved in different settings (Giménez-Nadal et al., 2020). In 2019, more than half (61.3%) of employed people in the EU travelled less than 30 minutes from home to work, i.e. commuted one-way and without any detours. Employed people in Austria averaged 25 minutes of commuting time (Eurostat, 2020). Undoubtedly, one of the greatest conveniences of not working in cubicles is the absence of a daily commute (Beno, 2018b; Chatterjee et al., 2017; Gajedran and Harrison, 2007; Nilles et al., 1976; Nilles, 1997; Raišienė et al., 2020).

In accordance with the obtained survey data of all periods, all commuters prefer cars over public transport because the public transport network tends to be inefficient, and in the Covid-19 period the risk of infection makes employees avoid public transport. The exodus from public transport to private cars and to some extent bicycles is in line with existing evidence (Molloy et al., 2020). International comparisons of the impact of Covid-19 on mobility have so far been based on data from mobility service providers such as Google Maps, Apple Plans, Citymapper, Waze and Moovit. However, our analysis is based on commuters' data. In the pre-Covid-19 period, those who covered relatively longer distances (average one-way distances of 20 km by rail and 50 km by car) were given the flexibility to work remotely. During other periods, commuting decreased rapidly and e-commuting increased.

4.2.1 Cubicles

The P-value of the test is lower than the chosen level of significance, so we reject the null hypothesis of frequency difference in commuting in the given four periods. This confirms that there is a significant difference in the frequency of commuting between at least one pair of given periods (see Table 4).

Table 4: Hypothesis test summary

Null hypothesis	Test	Sig.	Decision
The distributions of February, 1st, easing and 2nd are the same.	Related-samples Friedman's two-way analysis of variance by ranks	0.000	Reject the null hypothesis.
	Asymptotic significances are displayed. The significance level is 0.05.		

The following graph describes the distribution of the data and their average order (nonparametric tests are based on the order of the value and not on the values themselves). The table shows the test results (see Figure 1 and Table 5).

Figure 1. Related-samples Friedman's two-way analysis of variance by ranks

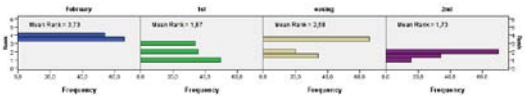


Table 5: Test results

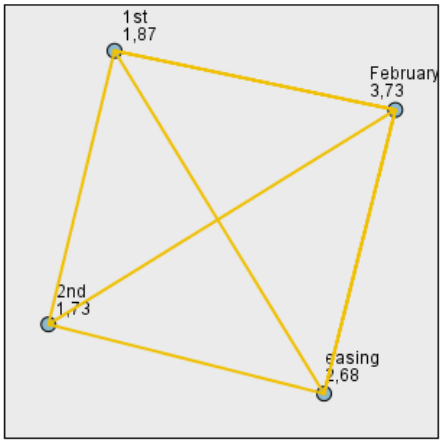
Total N	120
Test statistic	214.812
Degrees of freedom	3
Asymptotic Sig. (2-sided test)	0.000

Significantly different periods are marked in bold (see Table 6). We see, for example, that the frequency of commutes differs especially between February and the first and second lockdowns. If we look at the average rankings, we see that during the second lockdown, the frequency of commutes decreased significantly (see Figure 2).

Table 6: Pairwise comparisons

Sample1-Sample2	Test statistic	Std. error	Std. test statistic	Sig.	Adj. Sig
2^{nd}-1^{st}	0.142	0.167	0.850	0.395	1.000
2^{nd} - easing	0.958	0.167	5.750	0.000	**0.000**
2^{nd} – February	2.000	0.167	12.000	0.000	**0.000**
1^{st} – easing	-0.817	0.167	-4.900	0.000	**0.000**
1^{st} - February	1.858	0.167	11.150	0.000	**0.000**
Easing - February	1.042	0.167	6.250	0.000	**0.000**

Figure 2. Pairwise comparisons



4.2.2. E-workers

The P-value of the test is lower than the chosen level of significance, so we reject the null hypothesis of frequency difference in commuting in the given four periods. This confirms that there is a significant difference in the frequency of commuting between at least one pair of given periods (see Table 7).

Table 7: Hypothesis test summary

Null hypothesis	Test	Sig.	Decision
The distributions of February, 1st, easing and 2nd are the same.	Related-samples Friedman's two-way analysis of variance by ranks	0.000	Reject the null hypothesis.
	Asymptotic significances are displayed. The significance level is 0.05.		

The following graph describes the distribution of the data and their average order (nonparametric tests are based on the order of the value and not on the values themselves). The table shows the test results (see Figure 3 and Table 8).

Figure 3. Related-samples Friedman's two-way analysis of variance by ranks

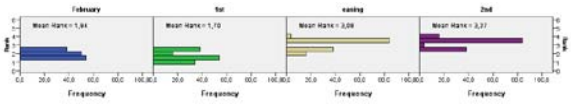


Table 8: Test results

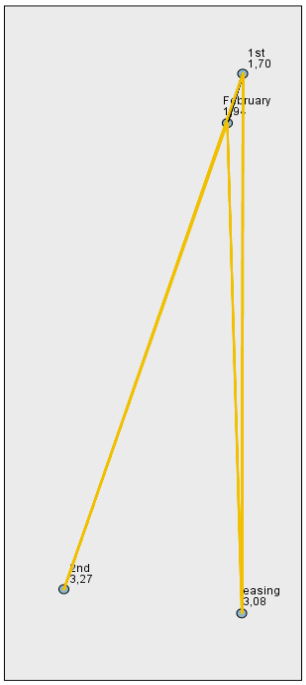
Total N	142
Test statistic	270.888
Degrees of freedom	3
Asymptotic Sig. (2-sided test)	0.000

Significantly different periods are marked in bold (see Table 9). We see, for example, that the frequency of commutes differs especially between the first and second lockdowns, the first lockdown and the easing and between February and the second lockdown. If we look at the average rankings, we see that during the second lockdown, the frequency of commutes increased (see Figure 4). E-workers typically commute longer than average commutes of cubicles but this does not necessarily mean that e-commuting encourages more remote living.

Table 9: Pairwise comparisons

Sample1-Sample2	Test statistic	Std. error	Std. test statistic	Sig.	Adj. Sig
1st – February	0.239	0.153	1.563	0.118	0.709
1st – easing	-1.373	0.153	-8.963	0.000	**0.000**
2nd-1st	-1.570	0.153	-10.250	0.000	**0.000**
Easing - February	-1.134	0.153	-7.400	0.000	**0.000**
2nd – February	-1.131	0.153	-8.687	0.000	**0.000**
2nd - easing	-0.197	0.153	-1.287	0.198	1.000

Figure 4. Pairwise comparisons



5 Discussion

Reducing the frequency of commuting will reduce vehicle miles travelled, lowering emissions, but also reducing population centralisation as people move out to the suburbs (Bento et al., 2005). Another convenience for the employee of working from home is saving time in commuting to the office, avoiding rush-hour traffic and stress. Ford and Butts (1991) claim that eliminating the stresses of driving in rush hour traffic may represent the most important advantage for many employees. Wienclaw (2019) indicates that by not commuting, employees will have more free-time to spend with their families. A recent Upwork survey reveals that since the pandemic started US workers have saved more than $90 billion from not commuting (UpWork, 2020).

According to our data, the increase in e-commuting means fewer workers commuting to work. Prior to the pandemic, the car (60%) was the most common mode of transportation to work, followed by public transport (22.5%) and active transportation (walking or cycling) (17.5%). Many Austrian employees were still working from home during the easing of the lockdown (57.14%) and in the 2nd lockdown (67.53%), and this mostly explains why fewer workers were using cars instead of public transport. Additionally, people turn to cars because of fears of coronavirus infection on public transport. Will the daily commute be the same? Will the coronavirus reverse healthier commuting? Will working from home be here to stay forever? Guyot and Sawhill (2020) emphasise that e-commuting was usually rare in the past, but is now a necessity. The authors further believe that e-commuting will probably continue long after the pandemic. Our findings confirm that hybrid working might be the future of work. E-commuting two days a week will be optimal for balancing collaborative and quiet work, while benefiting from the reduced stress of less commuting. The e-commuting proportion increased on average by 59.74%.

6 Conclusion

This pandemic has had a remarkable impact on how employees and employers operate regularly, not least in how they approach travelling to and from places of work. Covid-19 has had an immediate and unprecedented effect on working patterns, with the lockdown restrictions, social distancing and increased working from home significantly reducing commuting to/from work.

According to our data, the crisis has demonstrated that employers and employees in an Austrian company adapted quickly to change. In this paper, we examined commuter types, the degree to which they worked in different workplaces and how they cope with working remotely. Furthermore, the commuting variability of individuals (by car, by rail, by foot and by bicycle) was studied during four periods. Our analysis used a systematic literature review for e-commuting, a cross-tabulation of data to examine relationships within the data, the McNemar test for workplace examination and the Friedman test with pairwise comparisons for commuting analysis.

The results indicate the direct implications of e-commuting and commuting. Some of the commuting changes will be temporary, reflecting the pandemic situation. But others will be more permanent, and they will reflect an acceleration of workplace transformation and changes to the way we work. It appeared that there was a decline in the number of trips to/from work, but the average distance travelled has increased, and it is likely that the trip lengths for e-workers are longer than the average. These trips are car-dependent, and the travel frequency to/from work is increasing. The importance of e-commuting for business is becoming more apparent. Results indicate that the frequency of commutes by cubicles differs significantly in all periods, except between the first and second lockdowns, and by e-workers between February and the first lockdown and the easing and the second lockdown. If we look at the average rankings, we see that during the second lockdown, the frequency of cubicle commutes significantly decreased and that of e-workers increased. Those who worked remotely in the pre-Covid-19 period were male. The potential for increase is substantial, on average by 59.74%.

As lockdown restrictions ease and more areas of economy restart or expand, new challenges will arise in relation to the increasing number of trips. An increase in non-work related trips, car-dependency, e-commuters' consumption and occupations may negate any benefits (Büttner and Breitkreuz, 2020; Cerqueira et al., 2020; De Vos et al., 2019; Elldér, 2020; He and Hu, 2015; Stiles and Smart, 2020; Zhu and Mason, 2014). In future research, answers should be sought to the question of whether additional trips that are undertaken as a result of e-commuting should be included as this is a form of induced travel that is common in transport. This additional travel takes place because the car is now needed at the home for other uses.

As this paper argues, we have a unique opportunity to bring about change in relation to commuting and e-commuting, and this should not be squandered.

The results of this research are limited by several factors: first, data collection took place through e-mail questionnaire because of distance, financial aspects and Covid-19. There is no guarantee that the researchers drew all possible information from the participants that could be used in the analysis of the data and the results. Secondly, the sample does not reflect the population by sectoral structure. Furthermore, the researchers have no way of knowing whether the respondent is being truthful, and the quality of the data depends upon the quality of the questions asked. It should be stated that the results from this study do not necessarily reflect how commuting patterns and the modes of transportation for going to work will evolve in the post-pandemic period.

Literature:

1. Balepur, P. N., Varma, K. V., & Mokhtarian, P. L.: Transportation impacts of center-based telecommuting: Interim findings from the Neighborhood Telecenters project. *Transportation*, vol. 25, 1998, pp. 287-306. https://doi.org/10.1023/A:1005048329523
2. Beno, M.: Transformation of Human Labour from Stone Age to Information Age. In: Younas M., Awan I., Ghinea G., & Catalan Cid M. (eds) *Mobile Web and Intelligent Information Systems*. MobiWIS 2018. Lecture Notes in Computer Science, vol. 10995, 2018a, pp. 206-216. https://doi.org/10.1007/978-3-319-97163-6_17
3. Beno, M.: WORKING IN THE VIRTUAL WORLD – AN APPROACH TO THE "HOME OFFICE" BUSINESS MODEL ANALYSIS. *Ad Alta*, vol. 8, no. 1/2018b, pp. 25-36.
4. Beno, M. *Home-based Telework and the Role of Gender – Results of a Study in Austria*. CONF-IRM 2019 Proceedings; 2019, 12 p.
5. Beňo, M.: Face-to-Display Working: Decarbonisation Potential of not Commuting to Work before Covid-19 and during and after Lockdowns. *Academic Journal of Interdisciplinary Studies*, vol. 10, no. 3/2021, 17-24.
6. Beňo, M., & Ferenčíková, S.: The Future of Work is e-Work. *14th IWKM 2019, 7 – 8 November 2019, Bratislava - Trenčín*, Slovakia, pp. 6-20.
7. Bento, A. M., Cropper, M. L., Mobarak, A. M., & Vinha, K.: The Impact of Urban Spatial Structure on Travel Demand in the United States. *The Review of Economics and Statistics*, vol. 87, no. 3/2005, pp. 466-478.
8. Büttner, L., & Breitkreuz, A.: How COVID-19 working routines can save emissions in a post-COVID-19 world, 2020. Available at: https://www.greenpeace.de/sites/www.greenpeace.de/files/2020-08-19_gpd_homeofficestudy_english.pdf
9. Cermak, Ch.: In Austria, Bus Nomads Battle Daily Rural Commuter Gauntlet to Vienna, 2014. Available at: https://app.handelsblatt.com/english/labor-mobility-in-austria-bus-nomads-battle-daily-rural-commuter-gauntlet-to-vienna/23612302.html?ticket=ST-7402534-9JDJEqj0LOzXCO55eb2A-ap1
10. Cerqueira, E. D. V., Motte-Baumvol, B., Chevallier, L. B., & Bonin, O.: Does working from home reduce CO2 emissions? An analysis of travel patterns as dictated by workplaces. *Transportation Research Part D: Transport and Environment*, vol. 83, no. 102338/2020. ISSN: 1361-9209. DOI: 10.1016/j.trd.2020.102338
11. Chatterjee, K., Clark, B., Martin, A., & Davis, A.: The Commuting and Wellbeing Study: Understanding the Impact of Commuting on People's Lives, 2017. Available at: https://uwe-repository.worktribe.com/output/880203/the-commuting-and-wellbeing-study-understanding-the-impact-of-commuting-on-peoples-lives
12. Choo, S., Mokhtarian, P. L., & Salomon, I.: Does telecommuting reduce vehicle-miles traveled? An aggregate time series analysis for the U.S. *Transportation*, vol. 32, no. 1/2005, pp. 37-64.
13. Clark, B., Chatterjee, K., & Melia, S.: Changes to commute mode: The role of life events, spatial context and environmental attitude. *Transportation Research Part A: Policy and Practice*, vol. 89, 2016, pp. 89-105.
14. Delmelle, E. C., Haslauer, E., & Prinz, T.: Social satisfaction, commuting and neighborhoods. *Journal of Transport Geography*, vol. 30, 2013, pp. 110-116. https://doi.org/10.1016/j.jtrangeo.2013.03.006
15. De Vos, D., Van Ham, M., & Meijers, E.: Working from Home and Commuting: Heterogeneity over Time, Space, and Occupations. IZA DP No. 12578, 2019. Available at: http://ftp.iza.org/dp12578.pdf
16. De Vries, J. The Industrial Revolution and the Industrious Revolution. *The Journal of Economic History*, vol. 54, no. 2/1994, pp. 249-270. ISSN 0022-0507.
17. Elldér, E. Telework and daily travel: New evidence from Sweden. *Journal of Transport Geography*, 86, 2020. https://doi.org/10.1016/j.jtrangeo.2020.102777
18. EFI: Employment Flexibility Index 2020, 2020. Available at: https://www.llri.lt/wp-content/uploads/2019/12/Employment-flexibility-index2020.pdf
19. Eurofound: Living, working and COVID-19, 2020. Available at: https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef20059en.pdf
20. Eurostat: Majority commuted less than 30 minutes in 2019, 2020. Available at: https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20201021-2
21. Eurostat: Employed persons working from home as a percentage of the total employment, by sex, age and professional status (%), 2021a. Available at: http://appsso.eurostat.ec.europa.eu/nui/show.do?query=BOOKMARK_DS-052914_QID_6E0BB9BE_UID_-3F171EB0&layout=TIME,C,X,0;GEO,L,Y,0;SEX,L,Z,0;FREQUENC,L,Z,1;AGE,L,Z,2;WSTATUS,L,Z,3;UNIT,L,Z,4;INDICATORS,C,Z,5;&zSelection=DS-052914WSTATUS,EMP;DS-052914FREQUENC,USU;DS-052914INDICATORS,OBS_FLAG;DS-052914AGE,Y15-64;DS-052914SEX,T;DS-052914UNIT,PC;&rankName1=WSTATUS_1_2_-1_2&rankName2=TIME_1_0_0_0&rankName3=UNIT_1_2_-1_2&rankName4=GEO_1_2_0_1&rankName5=AGE_1_2_-1_2&rankName6=FREQUENC_1_2_-1_2&rankName7=INDICATORS_1_2_-1_2&rankName8=SEX_1_2_-1_2&sortC= ASC_-1_FIRST&rStp=&cStp=&rDCh=&cDCh=&rDM=true&cDM=true&footnes=false&empty=false&wai=false&time_mode=ROLLING&time_most_recent=false&lang=EN&cfo=%23%23%23%2C%23%23%23.%23%23%23
22. Eurostat: Employed persons working from home as a percentage of the total employment, by sex, age and professional status (%), 2021b. Available at: https://ec.europa.eu/eurostat/databrowser/view/lfsa_ehomp/default/table?lang=en
23. Fonner, K. L., & Roloff, M. E.: Why teleworkers are more satisfied with their jobs than are office-based workers: When less contact is beneficial. *Journal of Applied Communication Research*, vol. 38, no. 4/2010, pp. 336-361. https://doi.org/10.1080/00909882.2010.513998
24. Ford, R. C., & Butts, M. A.: Is Your Organization Ready for Telecommuting? *SAM Advanced Management Journal*, vol. 56, no. 4/1991, pp. 19+.
25. Gajedran, R. S., & Harrison, D. A.: The Good, the Bad, and the Unknown About Telecommuting: Meta-Analysis of Psychological Mediators and Individual Consequences. *Journal of Applied Psychology*, vol. 92, no. 6/2007, pp. 1524-1541. DOI: 10.1037/0021-9010.92.6.1524
26. Giménez-Nadal, J. I., Molina, J. A., & Velilla, J.: Trends in Commuting of European Workers: A Cross-Country Analysis, 2020. *IZA DP* 2020, 12916. Available at: http://ftp.iza.org/dp12916.pdf
27. Grinza, E., & Rycx, F.: The Impact of Sickness Absenteeism on Productivity: New Evidence from Belgian Matched Panel Data. *Journal of Economy and Society*, vol. 59, no. 1/2020, pp. 150-194. https://doi.org/10.1111/irel.12252
28. Guyot, K., & Sawhill, I. S.: Telecommuting will likely continue long after the pandemic, 2020. Available at: https://www.brookings.edu/blog/up-front/2020/04/06/telecommuting-will-likely-continue-long-after-the-pandemic/
29. He, S. Y., & Hu, L.: Telecommuting, income, and out-of-home activities. *Travel Behaviour and Society*, vol. 2, no.3/2015, pp. 131-147. https://doi.org/10.1016/j.tbs.2014.12.003
30. Hilbrecht, M., Smale, B., & Mock, S. E.: Highway to health? Commute time and well-being among Canadian adults. *World*

Leisure Journal, vol. 52, no. 2/2014, pp. 151-163. https://doi.org/10.1080/16078055.2014.903723
31. Hynes, M.: Telework Isn't Working: A Policy Review. *Economic and Social Review*, vol. 45, no. 4/2014, pp. 579-602.
32. Kitou, E., & Horwath, A.: Transportation Choices and Air Pollution Effects of Telework. *Journal of Infrastructure Systems*, vol. 12, no. 2/2006, pp. 121-134. https://doi.org/10.1061/(ASCE)1076-0342(2006)12:2(121)
33. Künn-Nelen, A.: Does Commuting Affect Health? *Health Economics*, vol. 25, no. 8/2016, pp. 984-1004. https://doi.org/10.1002/hec.3199
34. Lorenz, O., & Goerke, L.: Commuting and Sickness Absence. *Jahrestagung des Vereins für Socialpolitik 2015: Ökonomische Entwicklung – Theorie und Politik –Session: Empirical Studies*, vol. 5, no. G16-V4/2015.
35. Mattison, K., Hakansson, C., & Jakobsson, K.: Relationships Between Commuting and Social Capital Among Men and Women in Southern Sweden. *Environment and Behaviour*, vol. 47, no. 7/2015, pp. 734-753. https://doi.org/10.1177/0013916514529969
36. Mauss, D., Jarzcok, M. N., & Fischer, J. E.: Daily commuting to work is not associated with variables of health. *Journal of Occupational Medicine and Toxicology*, vol. 11, no. 12/2016, pp. 1-5. https://doi.org/10.1186/s12995-016-0103-z
37. Messenger, J., & Gschwind, *L.:* Three Generations of Telework: New ICT and the (R)Evolution From Home Office to Virtual Office. New Technology, Work and Employment, vol. 31, no. 3/2016, pp. 195-208. https://doi.org/10.1111/ntwe.12073
38. Molloy, J., Tchervenkov, Ch., Schatzmann, T., Schoeman, B., Hintermann, B., & Axhausen, K. W: MOBIS-COVID19/08: Results as of 25/05/2020 (Post-lockdown). Available at: https://doi.org/10.3929/ethz-b-000416869
39. Newman, B. J., Johnson, J., & Lown, P. L.: The "Daily Grind": Work, Commuting, and Their Impact on Political Participation. *American Politics Research*, vol. 42, no. 1/2014, pp. 141-170. https://doi.org/10.1177/1532673X13498265
40. Nilles, J. M.: Telework: Enabling Distributed Organizations. *Information Systems Management*, vol. 14, no. 4/1997, pp. 7-14. https://doi.org/10.1080/10580539708907069
41. Nilles, J. M., Carlson, R. F., Gay, P., & Hanneman, G. J.: *The Telecommunications-Transportation Tradeoff. Options for Tomorrow*; Wiley: New York, USA, 1976.
42. Nomoto, M., Hara, A., & Kikuchi, K.: EFFECTS OF LONG-TIME COMMUTING AND LONG-HOUR WORKING ON LIFESTYLE AND MENTAL HEALTH AMONG SCHOOL TEACHERS IN TOKYO, JAPAN. *Journal of Human Ergology*, vol. 44, no. 1/2015, pp. 1-9. https://doi.org/10.11183/jhe.44.1_1
43. Ortúzar, J. d. D., & Willumsen, L. G.: *Modelling Transport*, 4th ed. John Wiley & Sons, Ltd.: USA, 2011, 607 p.
44. Parris, J.: Remote Work or Telecommute: What's the Difference, 2018. Available at: https://www.workflexibility.org/remote-work-vs-telecommute-whats-the-difference/
45. Pinsonneault, A., & Boisvert, M.: The impacts of telecommuting on organizations and individuals: A review of the literature. *Telecommuting and virtual offices: Issues and opportunities*, 2001, pp. 163-185.
46. Raišienė, A. G, Rapuano, V., Varkulevičiūtė, K., & Stachová, K.: Working from Home - Who Is Happy? A Survey of Lithuania's Employees during the COVID-19 Quarantine Period. *Sustainability*, 12, no. 13/2020, 5332. https://doi.org/10.3390/su12135332
47. Ravalet, E., & Rérat, P.: Teleworking: decreasing mobility or increasing tolerance of commuting distances? *Built Environment*, vol. 45, no. 4/2019, pp. 582-602. DOI: 10.2148/benv.45.4.582
48. Roberts, J., & Taylor, K.: Intra-Household Commuting Choices and Local Labour Markets. *Oxford Economic Papers*, vol. 69, no. 3/2017, pp. 734-757. https://doi.org/10.1093/oep/gpw037
49. Sandow, E.: *On the road - Social aspects of commuting long distance to work*. Umeå: Kulturgeografiska institutionen, Umeå universitet, 2011, 55 pp.
50. Scholefield G., & Peel S.: Managers' attitudes to teleworking. *New Zealand Journal of Employment Relations*, vol. 34, no.3/2009, pp. 1-13. ISSN: 1176-4716.
51. Schwab, K.: The Global Competitiveness Report 2019, 2019. Available at: http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf
52. SD Worx: More than 20 % of Europeans Commute at Least 90 Minutes Daily, 2018. Available at: https://www.sdworx.com/en/press/2018/2018-09-20-more-than-20percent-of-europeans-commute-at-least-90-minutes-daily
53. SD Worx: Nearly three-quarters of European employees think their commute has a good ecological footprint, 2019. Available at: https://www.sdworx.com/en/press/2019/2019-09-10-nearly-three-quarters-of-european-employees-think-their-commute
54. Simitis, S.: The Juridification of Labour Relations. *Comparative Labor Law*, vol. 93, no. 2 1986, pp. 93-142.
55. Statistik: Erwerbstätige 2009 bis 2019 nach Entfernungskategorie, 2020. Available at: http://www.statistik.at/web_de/statistiken/menschen_und_gesellschaft/bevoelkerung/volkszaehlungen_registerzaehlungen_abgestimmte_erwerbsstatistik/pendlerinnen_und_pendler/078510.html
56. Steinmetz, S., De Vries, D. H, & Tijdens, K. G.: Should I stay or should I go? The impact of working time and wages on retention in the health workforce. *Human Resources for Health*, vol. 12, no. 23/2014. https://doi.org/10.1186/1478-4491-12-23
57. Stiles, J., & Smart, M. J.: Working at home and elsewhere: daily work location, telework, and travel among United States knowledge workers. *Transportation*, 2020. https://doi.org/10.1007/s11116-020-10136-6
58. Sugiyama, T., Wijndaele, K., Koohsari, M. J., Tanamas, S. K., Dunstan, D.W., & Owen, N.: Adverse associations of car time with markers of cardio-metabolic risk. *Preventive Medicine*, vol. 83, 2016, pp. 26-30. https://doi.org/10.1016/j.ypmed.2015.11.029
59. UpWork: Where Remote Work Saves Commuters Most, 2020. Available at: https://www.slideshare.net/upwork/where-remote-work-saves-commuters-most
60. Tsuji, H., & Shiojima, I.: Commuting by Public Transportation is Associated With Lower Prevalence of Excess Body Weight, Hypertension, and Diabetes. *AHA Journal*, vol. 132, no. 3/2015, A15214.
61. Van Lier, T., De Witte, A., & Macharis, A.: How worthwhile is teleworking from a sustainable mobility perspective? The case of Brussels Capital region. *European Journal of Transport and Infrastructure Research*, vol. 14, no. 3/2014. https://doi.org/10.18757/ejtir.2014.14.3.3033
62. Wener, R. E., & Evans, G. W.: Comparing stress of car and train commuters. *Transportation Research Part F: Traffic Psychology and Behaviour*, vol. 14, no.2/2011, pp. 111-116. https://doi.org/10.1016/j.trf.2010.11.008
63. Wienclaw, R. A.: Telecommuting. *Salem Press Encylopedia*, 2019. Available at: http://search.ebscohost.com/login.aspx?direct=true&site=eds-live&db=ers&AN=89163905
64. Wolf-Eberl, S.; & Posch, P.: Arbeitswege und Arbeitszeit-Zeit für mein Leben?, 2018. Available at: https://emedien.arbeiterkammer.at/viewer/ppnresolver?id=AC15225562
65. Zhu, P., & Mason, S. G.: The impact of telecommuting on personal vehicle usage and environmental sustainability. *International Journal of Environmental Science and Technology*, vol. 11, 2014, pp. 2185-2200. https://doi.org/10.1007/s13762-014-0556-5

Primary Paper Section: A

Secondary Paper Section: AE, AH, AP