ELSEVIER

Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.
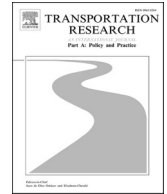
Will COVID-19 accelerate telecommuting? A cross-country evaluation for Israel and Czechia

Ayelet Kogus [a], Hana Brůhová Foltýnová [b,*], Ayelet Gal-Tzur [c], Yuval Shiftan [a], Eliška Vejchodská [d], Yoram Shiftan [a]

[a] *Faculty of Civil and Environmental Engineering, Technion–Israel Institute of Technology, Technion City, Haifa 32000, Israel*
[b] *Faculty of Social and Economic Studies, Jan Evangelista Purkyně University in Ústí nad Labem, Pasteurova 3544/1, 400 96 Ústí nad Labem, Czech Republic*
[c] *Department of Industrial Engineering and Management, Ruppin Academic Center, Emek Hefer, 4025000, Israel*
[d] *Faculty of Social Sciences, Charles University in Prague, Smetanovo nábřeží 6, 110 01 Prague 1, Czech Republic*

ARTICLE INFO

ABSTRACT

The COVID-19 crisis has forced many people to work from home, rather than at their regular workplace. This paper aims to assess the impact of the pandemic on telecommuting and commuting behavior after the end of the crisis: Will people embrace teleworking and reduce commuting, even to some extent, or will they resume their pre-pandemic work patterns?

This study, implementing a cross-country survey from Israel and Czechia, combines data regarding *revealed preferences* about work habits before and during the pandemic and *stated intentions* data regarding anticipated work patterns when life returns to "normal" after the pandemic. Two models were used for the data analysis, one addressing factors that affect the increased/decreased teleworking trend and the other addressing factors that affect the frequency of actual commutes.

The results reveal that most respondents (62% in Israel and 68% in Czechia) will maintain the same telecommuting/working from home balance. About 19% of respondents in both countries expressed their intention to reduce the number of commuting days, while 6% stated they would increase out-of-home days. However, these estimates rely only on workers' expectations not accounting for employers' point of view and other constraints they may have. Not accounting for potential bias, a moderate reduction of 6.5% and 8.7% (in Israel and in Czechia, respectively) in the number of commuting trips is expected in the post-pandemic era.

The anticipated decrease in commuting days is accompanied by an increase in teleworking: from 10% to 14% among those who work more than 20 h a week (in both countries) and a drop in the rate of those who telework five hours or less a week (down from 73% to 63% in Israel and from 76% to 70% in Czechia).

Self-employment, travel time to work, working solely on premise during the lockdown, and personal preferences regarding telework versus working away from home were found to significantly contribute to a decrease in the number of commuting days and to an increase in teleworking. An interesting finding is the high probability of increased teleworking among people who teleworked for the first time during the lockdown or who increased their teleworking time

* Corresponding author.
E-mail addresses: kogus@campus.technion.ac.il (A. Kogus), hana.bruhova@ujep.cz (H. Brůhová Foltýnová), ayeletg@ruppin.ac.il (A. Gal-Tzur), shiftan7@gmail.com (Y. Shiftan), Eliska.vejchodska@seznam.cz (E. Vejchodská), shiftan@technion.ac.il (Y. Shiftan).

during the lockdown. This indicates that the teleworking experience due to the pandemic has enabled some people to view working from home as viable.

Although, overall, the change in working habits does not seem dramatic, our results suggest that hybrid schemes for combining on premise and telework are expected to be adopted by some sectors.

1. Introduction

The COVID-19 pandemic began to spread worldwide during the first quarter of 2020, causing widespread illness, disruption, and even death (Hensher et al., 2021). Its substantial impact on society was especially felt in urban areas (United Nations, 2020). Countries have taken drastic measures to contain the outbreak, mainly through social distancing (Baert et al., 2020). As such, people have been forced to shift their activities, wherever possible, to the online environment. This global shock has had dramatic consequences on travel behavior, particularly causing a sudden downswing in commuting for work and travelling for various other activities.

The recent decrease in commuting (i.e., working away from home [WAFH]) is the outcome of the forced or voluntary increase in telecommuting (i.e., working from home [WFH]) due to the pandemic (Beck et al., 2020; Shamshiripour et al., 2020). Some studies indicate that although the share of WFH will decline after the pandemic, with forced WFH being replaced by voluntary WFH, it will remain higher than the pre-pandemic level (Currie et al., 2021; Shakibaei et al., 2021). The general concept of remote working, known as teleworking or telecommuting, has several definitions in the literature and covers various situations in terms of technology, location, contractual arrangements, and intensity (Aguilera et al., 2016).

Thanks to the rise of information and communication technologies (ICT), more people can substitute working at the workplace with teleworking. Dingel and Neiman (2020) estimated that 37% of job positions within the current US economy could be conducted entirely from home. This share, however, varies significantly across industries and income brackets, with lower-income countries having a lower share of such job positions. The COVID-19 outbreak has revealed the number of jobs that could be conducted from home if a "shelter in place" order is enforced. Bick et al. (2020) show that 35% of the US workforce have been working from home since the COVID-19 outbreak in May 2020, and 71.7% of workers who could effectively work from home did so[1]. Similar trends are presented by Deng et al. (2020) regarding Canada.

Prior to the COVID-19 pandemic, however, the rate of regular telecommuting was low, albeit slowly increasing (Shabanpour et al., 2018; Vilhelmson and Thulin, 2016). Over the past decade, the number of workers in Europe who state that they regularly work from home has increased from 4.6% to 5.2% (Eurostat, 2020). Considering only frequent telecommuters (i.e., people who work from home at least three times a week), de Abreu e Silva and Melo (2018) reported that in 2012 in the UK, only 0.7% of employed people work from home. In the US, one study found that the rate of employed people who worked from home increased from 1% in 1980 to 4.2% in 2019 (Delventhal et al., 2020), while the American Community Survey reported that WFH rates even reached 5.2% in 2019[2].

When investigating reasons for the limited effect of ICT on decreasing travelling (such as telecommuting), Mokhtarian (2009) found that ICT is often not an acceptable alternative, although feasible, or that it is a way to make commuting more appealing as it can be used for entertainment while travelling. Bloom et al. (2015) found that telecommuting is not everyone's "cup of tea", with some employees insisting on working at the workplace, even if their job is just as suitable or even more so when conducted through tele-working, with the most highly cited reason being possible loneliness.

The overall telecommuting snapshot might change, following the shock caused by the COVID-19 pandemic, with numerous employees and employers having experienced the benefits of WFH (Hensher et al., 2021). In other words, this crisis could serve as a catalyst for the beginning of a new era, not only in terms of the share of telework, but also in terms of travel patterns and the growing demand for new mobility services. Nevertheless, the possibility of people's behavior reverting to previous habits from the pre-crisis era should not be overlooked. Both researchers and practitioners should monitor telecommuting trends cautiously, as although a higher share of telecommuting may lead to changes in travel patterns, it may not necessarily lead to a decrease in the overall travel demand (de Abreu e Silva and Melo, 2018; Hu and He, 2016; Stiles and Smart, 2020; Zhu et al., 2018). Moreover, if the share of telecommuting increases significantly, cities might need to accommodate an increasing amount of travel to non-work destinations and provide appropriate sustainable transport services. Good accessibility of local schools, shopping centers, and leisure opportunities seems to be even more critical for WFH telecommuters than commuting workers (Budnitz et al., 2020). As emphasized by the OECD (2020), governments should promote investments in firms and workers' physical and managerial capacity of teleworking.

The aim of this paper is to assess the post-changes in telecommuting after the end of the COVID-19 crisis (or when "normal" living conditions are restored)[3] and its impact on the frequency of commute trips. Our main research questions include: Will the significant increase in people's work-from-home habits, that has been caused by the pandemic, be permanent? Or will the numbers revert to pre-pandemic behaviors, and perhaps even lead to a decrease in teleworking? Will workers embrace these newfound habits and find them

---

[1] However, other surveys provide even higher numbers; e.g. Brynjolfsson et al. (2020) who found that about half of American workers worked from home between February and May 2020, while the data from the Gallup online panel reported that as many as 62% of employed Americans worked from home in April 2020 (https://news.gallup.com/poll/306695/workers-discovering-affinity-remote-work.aspx, August 18th 2021).

[2] See https://www.census.gov/acs/www/about/why-we-ask-each-question/commuting/.

[3] It is important to note that this article was written during the pandemic, and it is still unclear when "returning to normal" can be expected.

beneficial? And are workers going to change the number of days that they commute to their workplace?

Since 2020, studies have focused on the impacts of the COVID-19 pandemic on commuting and teleworking; some have even tried to assess the post-impacts, once the pandemic is over. Currie et al. (2021), for example, focused on post-covid reduction in commute volumes in relation to WFH changes relating to Melbourne, Australia; Nayak and Pandit (2020) analyzed post-covid telecommuting in India, yet without representative sampling. The closest study to our approach was implemented by Beck et al. (2020), who surveyed the long-term impacts of COVID-19 pandemics on WFH in Australia, also using data based on participant preferences' data. As these authors focused solely on the employees' wishes for WFH, without considering the employers' point-of-view, their results (29% of workers wishing to work entirely from home) might be perceived as the upper estimate of full post-covid teleworking.

In our study, we asked people about their *stated intentions* (SI) regarding the shift to telecommuting and the number of commute days, while assessing the potential change in commuting trips in relation to various factors, including socio-demographic and employment characteristics. One of the interesting factors we also asked employees is about their estimation of the amount of post-pandemic telework they can conduct, while maintaining work efficacy (regardless of limits set by employers). Although this variable overlooks employers' constraints, we assumed that it could contribute to the understanding of the degree of long-term teleworking that can be maintained.

This paper offers a cross-country analysis of two developed industrial countries: Israel and Czechia. This allowed us to compare the impacts of the COVID-19 epidemic on commuting in two different regions, cultures, and behaviors (the Middle East and Eastern Europe), yet of similar size and having faced similar challenges regarding a continuous increase in traffic volumes and high motorization rates.

The following Literature Review in this article focuses on the known impacts of COVID-19 on commuting at present and on summarizing factors relating to the propensity for telecommuting. Next, the Methodology and Findings are presented. Finally, the Discussion section provides insights and analysis of the findings, while discussing research limitations and future research directions.

2. Literature review

The rich literature on telecommuting addresses its costs, benefits, and frequency (Mannering and Mokhtarian, 1995; Henderson and Mokhtarian, 1996; Nelson et al., 2007). Research has also attempted to understand why growth in telecommuting has been slow and explain the main forces and constraints behind the practice (Budnitz et al., 2020; Caulfield, 2015; He and Hu, 2015). Some researchers categorize and compare different types of telecommuters based on various characteristics, such as teleworking frequency, all day versus part of the day, and work location combinations (Crawford, 2020; Lachapelle et al., 2018) – and base their analysis on data sources such as existing statistical databases and dedicated surveys designed for a particular research study (Asgari and Jin, 2015).

2.1. Data and methodologies

A range of data sources have been utilized and described regarding teleworking research. Many studies use either preference data (e.g., Mokhtarian and Salomon, 1997) or revealed preference (RP, or choice) data (Hamer et al., 1991; Nurul Habib et al., 2012; Pendyala et al., 1991; Pratt, 1991), while others combine between the two (Shamshiripour et al., 2020). However, SP data tends to overestimate the telecommuting market (Asgari and Jin, 2015) – a finding that is also consistent with the SP/RP ratio in additional fields. An additional methodological caveat had been addressed by Bethlehem (2010) and Currie et al. (2021), who point out that online surveys have a notable and significant "under-representation bias" for lower income and older age groups.

With respect to data sources, databases with various complexity have been analyzed. Although studies often conduct small surveys or analyze case studies, there are more sophisticated surveys that utilize travel diaries for any number of days (often seven-day diaries that reflect variability during the week), are combined with interviews – often repeated over a longer time span (Crawford, 2020; de Abreu e Silva and Melo, 2018), panel data (de Vos et al., 2018), or large nationwide data (such as censuses or national travel surveys) – which may also cover repeated datasets over a longer time period (Asgari et al., 2016; Budnitz et al., 2020; Caulfield, 2015; Elldér, 2017).

During the COVID-19 epidemic, researchers have analyzed different data sets from nationwide surveys[4] (including panels), and web-based surveys designed for this purpose using social networks or instant messaging services, etc. (Baert et al., 2020; Beck and Hensher, 2020; de Haas et al., 2020; Echaniz et al., 2021; Riggs, 2020; Shamshiripour et al., 2020). Some studies have focused on the impact of the COVID-19 epidemic on travel behavior using repeated data collection to create panel data (Beck and Hensher, 2020; Beck et al., 2020; Brynjolfsson et al., 2020; Chauhan et al., 2021; Kim and Kwan, 2021; Nayak and Pandit, 2021; Shamshiripour et al., 2020).

A variety of data analysis techniques and methods have been employed. The level of sophistication ranges from simple descriptive statistics and pairwise *t*-test comparisons (Aguilera et al., 2016; Asgari and Jin, 2018; de Haas et al., 2020; Mokhtarian et al., 1998) to regression models (Chakrabarti, 2018; Elldér, 2017; Kim, 2017; Lachapelle et al., 2018) and the Poisson regression model used by He and Hu (2015) as a means for modelling the effects of telecommuting on the number of daily trips. Various forms of discrete choice models, especially binary or multinomial ones, are the most common techniques. The frequent use of this family of models stems from the nature of the independent variables, which often have multiple and discrete outcomes (Budnitz et al., 2020; Mokhtarian and Salomon, 1997; O'Keefe et al., 2016; Scott et al., 2012; Shabanpour et al., 2018). Brewer and Hensher (2000) proposed and

---

[4] Bick et al. (2020) analysed data from the Real-Time Population Survey, while Budnitz et al. (2020) from the National Travel Survey.

implemented an interactive agency choice experiment (IACE), where employees and employers revealed their joint preferences regarding telecommuting.

Some researchers have used methods of higher complexity. For example, Ettema (2010) used latent class discrete choice models for examining intended relocation and intended residential area type choices, and de Abreu e Silva and Melo (2018) and Asgari et al. (2016) estimated structural equation models (SEM)[5]. Singh et al. (2013) formulated and estimated a multivariate choice model that imbeds a hurdle count model for analyzing the precise counts of telecommuting days per month. Their multivariate equation system thus jointly models all three dimensions of telecommuting – the option of telecommuting, the choice of telecommuting, and the frequency of telecommuting – and accounts for individual-specific unobserved factors that impact the three decisions.

2.2. Factors influencing telecommuting

There is a range of factors that influence telecommuting. The primary factors, which make telecommuting possible and are the most influential for adopting it (Vilhelmson and Thulin, 2016) are *work-related* and *ICT factors*. In the past, ICT was analyzed as a factor that would boost the development of telework (Belzunegui-Eraso and Erro-Garcés, 2020); however, with today's widespread use of ICT both at work and at home, ICT no longer acts as a barrier to teleworking. Aguilera et al. (2016) stress that the lack of appropriate tools as an obstacle to WFH was only mentioned by 2% of the participants in their study. Together with Clear and Dickson (2005), they agree that organizational factors are more critical to the rate of telecommuting than technological provisions.

Most studies on the factors that influence telecommuting include analysis of both personal and socio-demographic factors. Prior to the outbreak of the COVID-19 pandemic, there was a consensus in the literature that WFH is positively associated with higher levels of education and with higher income, being male and having children (He and Hu, 2015; Nayak and Pandit, 2021; Turcotte, 2010). Sarbu (2015) found that having children under the age of six positively impacts WFH, with women being more likely to work from home in an intensive manner. She further reveals that telecommuters work more overtime compared to non-telecommuters. O'Keefe et al. (2016) also identified being married and having a car in the household as associated with a higher probability of telecommuting.

There is, however, no consensus regarding the role of age. For example, Shabanpour et al. (2018) found that middle-aged employees (aged 35–55) have the highest rates of telecommuting (about 13%); Singh et al. (2013), however, achieved the opposite results for the age group. Regarding qualification, skilled and autonomous workers and workers in professional and managerial roles are more likely to telecommute, as Budnitz et al. (2020) described using pre-pandemic data. Furthermore, job suitability for WFH, perceived personal benefits of WFH, stress connected to commuting or working at the workplace (Mokhtarian and Salomon, 1997), and not having a driving license and having knowledge of someone teleworking (Scott et al., 2012) were all found to play an important role in telecommuting as well. These results are in line with those obtained by initial studies during the COVID-19 epidemic: Brough et al. (2020) found a lower propensity for WFH during the outbreak among lower-income and less educated people; Bick et al. (2020) concluded that switching to remote work was much more prevalent among highly educated, high-income, and white workers. Beck and Hensher (2020) showed that WFH is more readily available to middle and high-income groups and men. Finally, Balbontin et al. (2021) showed that the role of socioeconomic characteristics varies between countries. For example, age and gender were found to be statistically significant in South America, while income was statistically significant in Australia and Chile.

Another important group of factors includes *spatial factors* and the role of travel characteristics such as flexible starting time at work (Mannering and Mokhtarian, 1995; Singh et al., 2013). Many studies found a relationship between the commuting distance and telework (as summarized by Melo and de Abreu e Silva, 2017) and commute time (Mokhtarian and Salomon, 1997; Nurul Habib et al., 2012). Research in this area is concerned with the direction of causality, i.e., whether longer commute trips lead to a higher propensity for telework, or whether the possibility of teleworking leads to a change in living location preferences (Ory and Mokhtarian, 2006). Most studies indicate that on average, teleworkers have longer commutes than people who work from their workplace (Peters et al., 2004; Turcotte, 2010) and that there is no clear-cut evidence that telecommuters move to live in more distant areas (Ory and Mokhtarian, 2006). However, Nurul Habib et al. (2012) presented different results, arguing that this may reflect sorting effects, whereby people who are open to environment-friendly modes, such as telecommuting, usually choose a home location closer to the workplace, in order to reduce travel time.

Some researchers also found an association between telecommuting and living in cities with poor transport conditions, including public transport access such as the availability of bus stops and rail in the vicinity of residence (Caulfield, 2015; Lister and Harnish, 2011; O'Keefe et al., 2016). Less dense urban forms were also identified as a factor that enhances telecommuting (Shabanpour et al., 2018), some studies also showed a higher propensity for teleworking where employment density is high (e.g., Caulfield, 2015; O'Keefe et al., 2016; Shabanpour et al., 2018), which could mean that companies located within central business districts offer greater opportunities for telecommuting, as a means for saving space and reducing energy consumption.

The economic sector has also been found to influence the potential of telecommuting (Caulfield, 2015; Nayak and Pandit, 2021; OECD, 2020), combined with employers' willingness to permit this (Varma et al., 1998). According to the OECD (2020), the extent of telework seems to be highest in knowledge-intensive services (such as professional and ICT services) and lowest in manufacturing and less knowledge-intensive market services (including wholesale, retail, and transportation). Turcotte (2010) reported the highest levels

---

[5] SEMs are multivariate (i.e., multi-equation) regression structures. In contrast to the multivariate linear model, the response variables in one regression equation in an SEM may also appear as predictors in another equation; variables in an SEM may influence one another reciprocally, either directly or through other variables as intermediaries. This aspect of SEMs allows them to capture relationships between different endogenous variables.

Table 1

Comparison between Israel and Czechia – Economic and transport characteristics.

Characteristics	Israel	Czechia
Number of inhabitants	9,246,000 (2020)	10,710,995 (2020)
Average population density	400 per km^2 (2020)	139 per km^2 (2020)
Share of urban population	93.2%	73.5%
GDP per capita	42,823 USD (2019)	23,079 USD (2018)
Unemployment rate	3.3 % (Feb 2020)	2.0 % (March 2020)
Number of registered motor vehicles	3.5 million (2017)	7.4 million (2018)
Individuals' Internet use (% of population)	87% (2019)	81% (2019)
Percentage of workers' routinely WFH (% of all workers)	4.1% (2018)	4% (2018)

Sources: https://www.itf-oecd.org/sites/default/files/israel-road-safety.pdf; https://www.itf-oecd.org/sites/default/files/czech-republic-road-safety.pdf; https://data.worldbank.org/indicator/IT.NET.USER.ZS?contextual=default&end=2019&locations=IL-CZ&start=2010&view=chart); EU data (Eurostat, 2020).

of WFH among self-employed workers with a university degree. Research conducted during the COVID-19 pandemic can better reveal the potential of various sectors for WFH. According to Deng et al. (2020), about 38.9% of Canadian employees work in jobs that can plausibly be carried out from home: most jobs in finance and insurance (85%), educational services (85%), and professional, scientific, and technical services (84%). On the other hand, those in accommodation and food services (6%) and agriculture, forestry, fishing, and hunting (4%) have almost no telework capacity.

The extraordinary situation that has emerged due to the COVID-19 pandemic has shown that additional factors such as housing situation, equipment, and quality (including room size, lighting, temperature, and furniture, among others) also play a significant role in the acceptance of WFH (Cuerdo-Vilches et al., 2021).

3. Methodology

In this research, we applied a cross-country analysis for evaluating the potential changes in commuting and telecommuting patterns following the COVID-19 pandemic, while considering the role of current attitudes and preferences – thereby enabling a broad, cross-sectional and quasi-longitudinal study. Similar questionnaires were distributed in both Israel and Czechia, asking respondents about their work habits regarding telecommuting (defined as the number of weekly WFH hours) versus commuting (defined as the number of WAFH days each week) – prior to and during the pandemic (i.e., their RP). The questionnaires also addressed the participants' SI, i.e., their expected commuting habits (WFH and/or WAFH) after the pandemic. For the latter, we asked the respondents how many hours they intend (expect) to spend on telecommute and how many days a week they expect to commute after the pandemic (to the best of their estimation at the time of the survey). The format of the possible responses regarding RP and SI were identical. Following a descriptive statistics analysis, the data were used to estimate a multinomial logit model estimating the likelihood of increasing, decreasing, or maintaining the current amount of telework after the pandemic, as well as an ordered logit to estimate the number of days a week the respondents are expected to commute to their workplace after the pandemic.

3.1. Case study countries

The similarities between Israel and Czechia in their main characteristics, as well as the preventive measures taken during the COVID-19 crisis, provided a sound basis for a comparative study. Table 1 compares the main features of both countries. In general, the overall population of both countries is similar, although Israel is denser. The unemployment rate before COVID-19 was relatively low in both countries. Israel's urbanization characteristics are somewhat higher than those of Czechia, and its gross domestic product (GDP) is considerably higher. Both countries face the challenge of a rapidly growing motorization rate. In Israel, this rate increased from about 210 vehicles per 1,000 inhabitants in 1998 to about 320 in 2017; in Czechia, it rose from about 295 in 1995 to about 524 in 2017. Moreover, there has been a positive evolution of Internet users (in millions) in Israel and in Czechia. Although this development occurred slightly faster in Israel, similar trends can be seen in both countries, with more than 80% of both populations using the Internet by 2019.

In addition, both countries have experienced somewhat similar main milestones during the pandemic. The main restrictions during the first peak period (mid-March to mid-April 2020) in both countries included social isolation and distancing, restricted free movement, compulsory face masks, and (social) regulations for businesses such as restaurants, accommodation services, and retail services. Both countries also experienced similar levels of deaths during the first wave, although the official number of people who tested coronavirus was higher in Israel. Appendix A (Table A1) provides a comparison of the main developments and restrictions during the first peak of the pandemic.

3.2. Survey structure and data collection

3.2.1. Data collection

In both countries, the data were collected via an online questionnaire that was distributed to a panel of respondents through professional survey agencies. In Israel, this took place between 22 April and 2 May 2020; in Czechia this was conducted between 8 June
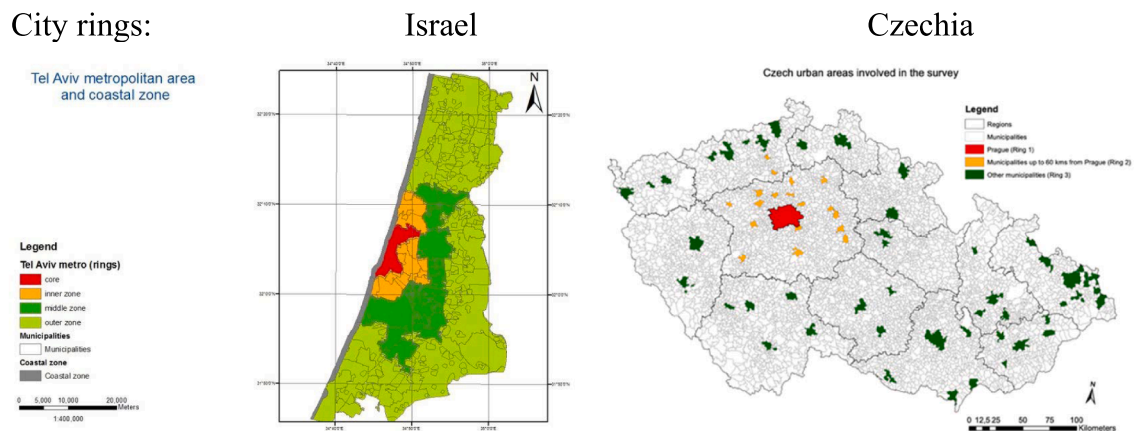
Fig. 1. City rings: Israel and Czechia.

and 14 June 2020. A total of 2,412 respondents answered the questionnaire in Israel, with 2,105 (87%) of them providing valid and complete responses and indicating their agreement to participate in our follow-up survey. The Czech sample consisted of 1,103 (75%) valid and full responses out of the 1,467 original respondents.

Our survey employed a quota sampling strategy to ensure that enough respondents were included by region (rings and districts) and pre-crisis employment (employees, self-employed persons, and students). As 90% of COVID-19 cases have occurred in cities (United Nations, 2020), this study focused on residents from urban areas. To ensure sufficient relevant respondents in both countries, the Israeli participants were from Tel Aviv (i.e., the core ring) and adjacent metropolitan areas (inner/outer rings) in Israel. Similarly, the Czech participants were from Prague (i.e., the core ring) and large cities with more than 20,000 residents. This also helped overcome differences in country geography, as Czechia is more decentralized than Israel and Prague is smaller than Tel Aviv (as seen in Fig. 1). The sample was also well represented by gender, age, income, education, employment status, and region of residence. Regarding employment status, about 70–80% of respondents in both countries were employees, and there was an equal distribution between students and self-employed (approximately 10% each).

The target population was defined as being economically active and residing in the metropolitan areas. The participants received payment (points or money) for their participation according to the survey agencies' policy. We had no access to participants' personal information who answer the questionnaire via a panel company. The average completion time of the questionnaire was about 20 min for both countries. As the data was collected in both countries during lockdown, online data collection was the chosen method, as physical contact was extremely limited. Moreover, the online panel allowed us to collect data relatively quickly while effectively ensuring control of the representativeness and size of the sample. A clear limitation was set whereby only respondents who were able to complete the questionnaire online were included in the study. However, as both countries are developed, most of the population are equipped with Internet access. In Czechia, for example, the agency stated that based on previous surveys that they conducted, only 7.7% of the economically active population lack access to the Internet. Our groups of participants may be somewhat oversampled, as participants who solely WFH before the pandemic accounted for 7% and 10% in Israel and Czechia respectively, compared to the general 4% for both countries (Table 1). Yet, as their proportion out of the entire sample is still small, this difference is not substantial.

3.2.2. Questionnaire structure

The questionnaire consisted of two main sections. Part A asked about socio-economic and demographic factors, including work status, travel-related characteristics, and attitude-related statements for identifying latent variables/factors. This section also evaluated the number of days the respondents think they can telework without compromising their efficiency/productivity – regardless of the pandemic. Finally, this section included personal characteristics. We used the Hebrew version of the big five-factor inventory (BFI) questionnaire (Etzion and Laski, 1998). As *agreeableness* and *emotional stability* have been found to be related to telecommuting attitudes (Clark et al., 2012), and a positive association between *openness* and *telecommuting* has also been seen (Gainey and Clenney, 2006), we only incorporated three out of five factors from the original BFI (John and Srivastava, 1999) in our questionnaire. This enabled us to provide the participants with a shorter questionnaire that still relates to openness, extroversion, and emotional stability. Five self-description statements were associated with each of these three factors, and an exploratory factor analysis was conducted with varimax rotation (with Kaiser normalization) to assess the structure of the BFI.

Part B contained a diary/log through which the respondents were asked to reveal their travel patterns (activity) with respect to two "existing" time periods (before and during the COVID-19 crisis), as well as their SI (i.e., their intended patterns) with respect to a third and later period ("after" the pandemic).

We asked about the total amount of hours spent on WFH in the ascending order of seven categories, from zero to more than 40 weekly hours. At the same time, we asked about the number of days (de facto number of trips) of WAFH in the ascending order of eight categories, from zero to seven working days per week. Doing so allowed us to calculate both changes in WFH hours and in the number of commuting trips.

Table 2
Descriptive statistics (in %) of socio-demographic traits.

Variable/Categories	Israel (N = 1723)	Czechia (N = 926)
Gender		
female	57.1	45.4
male	42.9	54.6
Age (years)		
under 29	18.4	11.7
30–49	49.1	60.9
50–69	32.5	27.4
Education (level)		
elementary; high school (without diploma)	3.7	28.4
high school graduate (with diploma)	16.1	40.3
tertiary education/profession	19.8	4.1
academic education	60.4	27.2
Family status		
Single	23.4	30.5
married/in a relationship	66.1	50.6
divorced/separated/widowed	10.5	18.9
Household size		
1	12.1	21.2
2	27.1	37.4
3	20.3	21.0
4	21.0	16.8
5+	19.6	3.7
Children living at home		
Yes	56.4	40.0
No	43.6	60.0
Monthly wage		
(well) above average	32.2	19.9
Average	25.2	18.3
(well) below average	34.0	60.3
refused to respond	8.6	1.6
City ring		
Ring 1 (core)	31.8	27.9
Ring 2 (inner)	34.4	30.6
Ring 3 (outer)	33.8	41.6
Vehicle in household		
0	13.2	24.0
1	47.9	47.6
2	34.2	22.2
3+	4.7	6.2
Car availability		
always	69.8	65.3
often/sometimes	13.4	11.6
rarely/never	16.6	22.9
missing	0.2	0.2

Subsequently, respondents were asked to rate their activity mode of performance preferences – WFH versus WAFH – regardless of the pandemic, on a Likert scale ranging from a strong preference for the former to a strong preference for the latter. The last segment of Part B included questions relating to the pandemic's timeline (i.e., before, during, and after) about the participants' primary mode of travel for three main purposes (i.e., work, shop, and leisure).

The questionnaire was initially designed in Hebrew and then translated into Czech using a back-and-forth translation technique to ensure accuracy and consistency.

3.3. Sample

As we were mainly interested in the impact of the pandemic on work related behavior and on commute trips, we defined sub-samples[6] for both countries that only included employed and self-employed people[7], not students, with 1,723 Israeli respondents and 926 Czech respondents. While reviewing these statistics, one should remember the potential bias resulting from internet-based survey methods as described in Section 3.2.1.

As seen in Table 2, the samples in both countries are relatively balanced regarding gender, age (about half the respondents were

---

[6] For the full sample description, please see Section 3.2.1.

[7] Employees who were fired during COVID-19 were not included in the sub-sample (since we could not conclude if and when they will return to work); However, we did include self-employed people who could not conduct business during the crisis due to government restrictions.

Table 3
Descriptive statistics (in %) of the pre-COVID-19 work characteristics.

Variable/Categories	Israel (N = 1723)	Czechia (N = 926)
Employment		
employed	83.7	89.7
self-employed	16.3	10.3
Job type		
office	60.3	59.6
Field	17.0	12.9
non-office	9.5	5.8
high mobility	9.3	8.3
factory	2.3	12.8
Travel time to work (in minutes)		
less than 15 mins.	26.8	42.0
15–30 mins.	31.0	32.9
30–60 mins.	32.6	19.1
more than 60 mins.	9.6	5.9
Travel mode to work		
car (private/company), motorcycle, carpool (driver)	60.6	44.2
public transport, carpool (passenger)	29.3	37.8
bicycle, walking, scooter	7.3	16.3
works (mostly) from home	1.8	1.5
missing	1	0.2
COVID-19 (during lockdown) work-status		
full time/part time WAFH	21.2	46.0
full time/part time WFH	33.8	19.4
full time/part time WAFH & WFH	14.6	19.7
forced/unpaid vacation; self-unemployed	28.9	8.4
missing	1.5	6.5

Table 4
Descriptive statistics (in %) of WFH preferences.

Variables/Categories	Israel (N = 1723)	Czechia (N = 926)
WFH perceived efficiency (days)		
0	21.6	44.5
1–2	24.0	20.3
3–4	24.0	14.8
5+	30.3	20.4
Mode-of-work preferences		
preferred WAFH	56	37.0
preferred WFH	36.8	30.9
neutral	3.8	21.6
missing	3.3	10.5

aged 30–49) and status (about half were married or in a relationship). However, the Israeli sample has a higher proportion of respondents with academic education and a larger average household size (i.e., more children); these differences are in line with the characteristics of the two countries. The proportion of respondents with below-average wage in the Czech sample is nearly twice that of the Israeli sample. Moreover, almost all respondents in both countries held a driver's license, with a car being readily available for more than 65% of respondents.

Regarding work-related characteristics (Table 3), more than 80% of the respondents were salaried employees and about 60% worked in an office. In both countries, the proportion of those whose travel time to work was over an hour was relatively low. While 42% of the Czech respondents reported that they commute to work less than 15 min, less than 30% of the Israeli respondence reported such low travel times. In terms of employment during lockdown, the proportion of Israelis who did not work was twice that of the Czechs (30% and 15% respectively), while about 70% of the Israeli respondents who maintained some level of employment experienced teleworking compared to only about 46% of the Czech respondents.

As for telework efficiency evaluation and mode-of-work preferences (Table 4), the proportion of Czech respondents who believed they could not telework effectively was double the proportion of the Israelis (44% and 22%, respectively). However, when personal preference was reported, the proportions are similar (31% of the Czech respondents and 37% of the Israeli ones).

Table 5a shows the descriptive statistics of the BFI statements used in our questionnaire. Based on factor eigenvalues and parallel analysis criteria, we extracted three factors (neuroticism, extroversion, and openness to experience) from the BFI that explain almost 60% of the total variance. The factor analysis (indicating the loadings of each item on a given factor) is described in Table 5b. The two statements that we adjusted (7 and 10) were omitted from the final analysis, as they did not fit any of the factors. The remaining 13 items were loaded substantially on their respective scales (mean loading = 0.62). Cronbach's alpha for the three scales were as follows: Neuroticism = 0.74, Extroversion = 0.71, Openness = 0.84.

Table 5a
Descriptive statistics of the BFI.

Item[1]	Definition (question)	Israel (N = 1723)		Czechia (N = 926)	
		Mean	Std. Deviation	Mean	Std. Deviation
BIG1	*Original, comes up with new ideas*	4.2	0.8	2.6	0.9
BIG2	*Reserved*	3.3	1.2	3.2	1.0
BIG3	*relaxed, Handles stress well*	3.9	1.0	2.7	1.0
BIG4	*Curious*	4.4	0.7	2.2	0.9
BIG5	*Full of energy*	3.8	1.0	2.8	0.9
BIG6	*Can be tense*	3.5	1.0	2.6	0.9
BIG8	*Tends to be quiet*	3.2	1.2	3.0	1.1
BIG9	*Is emotionally stable, not easily upset*	3.7	1.1	2.7	1.0
BIG11	*Is sometimes shy, inhibited*	2.9	1.2	3.0	1.0
BIG12	*Remains calm in tense situations*	3.6	1.1	2.7	0.9
BIG13	*Likes to try new technologies*	4.0	1.0	2.5	1.0
BIG14	*Is outgoing, sociable*	4.2	0.9	2.5	1.0
BIG15	*Worries a lot*	3.1	1.2	3.1	1.0

Scale: 1 = strongly disagree; 5 = strongly agree.
[1] According to the order of the items in the questionnaire.

Table 5b
Factor Loading Matrix (Component Matrix).

Factor	Item (BIG)	Definition (question)	Sample (N = 2649)		
			Neuroticism	Openness	Extraversion
Neuroticism	**12r**	*Remains calm in tense situations*	0.84		
	3r	*relaxed, Handles stress well*	0.84		
	9r	*Is emotionally stable, not easily upset*	0.80		
	15	*Worries a lot*	0.63		
	6	*Can be tense*	0.30		
Openness	**4**	*Curious*		0.90	
	1	*Original, comes up with new ideas*		0.87	
	13	*Likes to try new technologies*		0.84	
Extraversion	**8r**	*Tends to be quiet*			0.72
	11r	*Is sometimes shy, inhibited*			0.75
	2r	*Reserved*			0.65
	14	*Is outgoing, sociable*			0.63
	5	*Full of energy*			0.66

"r" denotes reversed item.

Table 6
Changes (in %) in WAFH (days) before and after the COVID-19 crisis.

WAFH (days per week)	Israel (N = 1723)				Czechia (N = 926)			
	Before (%)	After (%)	Percentage changes (%)	Percentage point change (%)	Before (%)	After (%)	Percentage changes (%)	Percentage point change (%)
0	7	8	14	1	10	13	30	3
1	3	4	33	1	4	6	50	2
2	3	5	67	2	3	5	67	2
3	4	9	125	5	4	8	100	4
4	8	10	25	2	10	10	0	0
5	63	53	−16	−10	63	53	−16	−10
6	9	8	−11	−1	4	3	−25	−1
7	3	3	0	0	2	2	0	0

4. Results

4.1. Descriptive statistics

In this chapter, we compare the respondents' pre-pandemic RP commuting patterns (WFH and WAFH) with their post-pandemic SI regarding these patterns. As noted in Section 3, when reviewing these statistics, one should remember the potential bias resulting from the internet-based survey methods. As described in Section 3.2.1, however this bias does not appear to be substantial.

Table 6 compares the numbers of WAFH days before and after the pandemic, while Table 7 compares the numbers of weekly WFH

Table 7
Changes (in %) in WFH (hours) before and after the COVID-19 crisis.

WFH (hours per week)	Israel (N = 1723)				Czechia (N = 926)			
	Before (%)	After (%)	Percentage changes (%)	Percentage point change (%)	Before (%)	After (%)	Percentage changes (%)	Percentage point change (%)
<5	73	63	−14	−10	76	70	−8	−6
5–10	11	13	18	2	10	10	0	0
10–20	6	10	67	4	4	6	50	2
>20	10	14	40	4	10	14	40	4

Note: we defined the first category as "<5" (including 0) and the last category as ">20" (from 20 to over 40 h) given the small amount of WFH activity in each separate category.

Table 8
Trends of change (in %) in WAFH (days) relative to WFH (hours).

%			WFH (hours per week)			
			Increase (%)	Same (%)	Decrease (%)	TOTAL (%)
WAFH (days per week)	Increase (%)	Israel (1723)	2	3	1	6
		Czechia (926)	3	3	1	6
	Same (%)	Israel (1723)	10	62	3	75
		Czechia (926)	4	68	2	74
	Decrease (%)	Israel (1723)	11	6	3	19
		Czechia (926)	8	9	3	19
	TOTAL (%)	Israel (1723)	23	70	7	100
		Czechia (926)	15	79	6	100

hours.

According to Table 6, while the proportion of respondents who worked entirely away from home in the pre-pandemic era (i.e., 5 + days a week) was smaller in Czechia than in Israel (69% and 75% respectively), the drop in this percentage after the pandemic was prominent in both countries (with a similar cumulative percentage point change of 11% in both countries). For the rest of the categories, the most noticeable change (since the pandemic outbreak) in Czechia was the 30% increase in the proportion of respondents who did not perform WAFH (from 10% to 13%); in Israel, on the other hand, the decrease in full WAFH was complemented by a moderate increase in the various categories of the partial WAFH. These results have direct implications regarding the number of commuting days.

Assuming the sample is representative, a comparison of the pre-pandemic and post-pandemic WAFH shows an expected 6.5% decrease in commuting days in Israel and an 8.7% drop in Czechia after the pandemic. It should be noted that the predicted post-crisis WAFH trend in the joint model dropped by 7% in WAFH (835 days). As WAFH is expected to drop, WFH is expected to increase. As shown in Table 7, the percentage distribution of respondents, over all the four WFH *duration* categories, was relatively similar for the two countries before the pandemic. Given the difference between the countries in full-time WAFH, it can be assumed that Israelis practice more hybrid working habits (both WFH and WAFH) compared to Czechs. In both countries, the percentage of those teleworking up to 5 h a week decreases. In Czechia, there is a minor decrease in the rate of those expecting to telework less than five hours a week and an increase of about 40–50% in the categories of 10–20 and over 20 weekly hours. In Israel, all categories over 5 h shown rise in the proportion of expected telework, with an increase of 67 in percentage change of respondents expecting to telework 10–20 h per week (from 6% to 10%).

Table 8 provides further insights regarding the expected trends in work patterns after the crisis (compared to before the pandemic), showing the joint trends in WAFH and WFH. A small proportion of the respondents (about 2% in both countries) expect to increase both WAFH and WFH. And 3% expect to decrease both WAFH and WFH in both countries. The vast majority (about 62% in Israel and 68% in Czechia) will maintain the same WFH-WAFH balance. In other words, only a small minority of participants would choose to make a radical change (by increasing or decreasing both their WAFH and their WFH), while the majority would prefer to revert to their pre-crisis routine. A substantial proportion of respondents reported an expected change in their WAFH-WFH ratio, with the balance favoring WFH over WAFH (rather than the opposite trend). In Israel and Czechia, 23% and 15% respectively would like to increase their WFH, while only 6% (in both countries) would like to increase their WAFH. In other words, the pandemic is expected to somewhat increase teleworking even after the crisis is over.

As for commuting travel modes (TM), Table 9 presents the modal split among the respondents in Israel and Czechia before and after the pandemic. Czechia is more public transport (PT) oriented than Israel to begin with (given the relative advantage of 8% in favor of the PT users from the Czech sample), but the use of PT (in both countries) is expected to drop by about 5 percentage points in both countries (a reduction of 19% in Israel and 14% in Czechia) in the post-crisis era. The expected shift in Czechia is towards non-motorized and other transport modes, while in Israel the share of car travel increases (by 3%) alongside the share of non-

Table 9
Changes (in %) in the main travel mode to work pre- and post-COVID19 in each country.

Travel Mode to Work	*Israel* (N = 1723)				*Czechia* (N = 926)			
	Before (%)	After (%)	percentage changes (%)	percentage point change (%)	Before (%)	After (%)	percentage changes (%)	percentage point change (%)
Car	61	63	3	2	44	43	−2	−1
PT	27	22	−19	−5	35	30	−14	−5
Non-motorized	7	8	14	1	16	19	19	3
Other	4	6	50	2	5	8	60	3

Table 10
Trends of changes (in %) in WFH for the main mode used for commuting to work before the COVID-19 crisis in both countries.

Trend of Change in WFH	Main Travel Mode to Work			
	Car	PT	Non-motorized	Other
Increase (%)	21	22	15	17
Same (%)	72	72	80	74
Decrease (%)	7	6	5	9

motorized and other modes.

Table 10 presents the crosstabulation analysis results of the trends in telecommuting by TM (before the COVID-19 crisis) in both countries. Car and PT users showed a greater tendency to increase telecommuting compared to the other modes, which makes sense as these tend to be longer trips. Given that car and PT are the frequent modes used both in Czechia (79%) and in Israel (88%), as seen in Table 9.

4.2. Modelling – Expected impact of COVID-19 on teleworking

4.2.1. Modelling approach

We propose two models as a framework for inferring about the potential commute and telework patterns in the post-COVID-19 era. The first model, the **WFH Model**, outlines the trends of changes in WFH. This trend-oriented model can provide us with insights regarding the perceived willingness of people to adopt or reduce teleworking, which is the less conventional and traditional work pattern. To do so, we estimated a multinomial logit model for exploring the impact of the various variables on telecommuting trends. The model includes three alternatives regarding our main research question, i.e., WFH trends (in hours per week): an increase, no change, or a decrease in the number of weekly hours of WFH. The no change status serves as the baseline reference alternative. It should be noted that both a positive coefficient in the "increase" and a negative coefficient in the "decrease" indicate a shift towards more teleworking. Moreover, when both are significant, the variable can be considered a prominent factor in enhancing telecommuting.

The second model, the **WAFH Model**, estimates the number of weekly WAFH days after COVID-19, specified as an ordered logit model. This model provides a straightforward prediction regarding the number of commuting days per week, and as such can be directly associated with the number of commuting trips. As its main explanatory variables, the model includes the frequency of commuting days before the pandemic, and other explanatory variables.

These two models are not mathematically additive, i.e., the sum of the pre-crisis WAFH and WFH RPs will not necessarily result in the same figure as the sum of the post-crisis WAFH and WFH SIs. Nevertheless, comparing the WAFH-WFH balance before and after the COVID-19 crisis could reveal new forms of hybrid work (i.e., combining both telework and WAFH). Moreover, to test differences in behaviour between Israel and Czechia, we ran market segmentation models, where we estimated variable coefficients for each country separately.

4.2.2. Result of the models

Table 11 depicts the variables included in both models for the two countries (with a total of 2,649 respondents) and portrays segmentation according to countries as a means for testing differences in behavior (with 1,723 Israeli respondents and 926 Czech participants). Coefficients are presented for the joint model for both countries and for the segmented model for each discrete country (where we estimated two coefficients for each variable: one for Israel and one for Czechia); the significance level (p-value) is indicated (adjacent to each coefficient) by * and ** for significance levels of 10% and 5%, respectively. The last rows present the log-likelihood values. The log-likelihood ratio test show that we reject the hypothesis that the parameters between the segmented models are equal, as there are significant differences in the impact of various variables on telecommuting and commuting patterns between both countries.

The following description combines findings of both models followed by the segmented comparison of both countries. In addition, we added supportive orientation to variables that were not found to be significant.

Socio-demographic variables. Five socio-demographic traits were identified as having a significant impact on telework in the WFH model, and one characteristic was found to affect post-Covid19 commuting trips in the WAFH model. The negative and significant coefficient of the core city dummy ring in Israel and in the joint WAFH model indicate that post-pandemic, they are likely to commute less than suburban residents. This may be the result of longer commuting times and is in line with the effect of average travel time to work on WAFH (as shown in the section addressing employment characteristics prior to COVID-19). The results from the WFH model indicate that age is negatively related to an increase in telecommuting, which might be explained by a poorer technology orientation among the senior population as well as their lower tendency to introducing behavioral changes. In addition, as education increases, so does the tendency to increase telework. In contrast, as wages increase, the tendency to reduce telecommuting decreases. These findings are in line with previous studies.

The findings regarding household size and the presence of young children at home should be examined together, especially subject to the unique circumstances of the COVID-19 crisis. During the lockdown period, families have faced the unprecedented need for the entire family to work and study from home. Although the survey participants were not explicitly asked about domestic conditions in terms of the size of their residence and the number of devices that enable remote working/studying, it is reasonable to assume that the need for separated spaces and communication devices for family members as a means for working and studying posed a great challenge for many. This could also explain the findings whereby the greater the number of members in a household, the lower the probability of their enhancing teleworking. This variable has not been found in previous literature as having an impact on teleworking in general, potentially due to its novel emergence in terms of multiple teleworking adults (and/or studying children) in one household. On the other hand, having younger children in the household increases the probability of more WFH, a phenomenon that is in line with findings by Turcotte (2010) and He and Hu (2015). It might be that the flexibility of teleworking has a greater added value when caring for younger children.

Four socio-demographic variables (gender, family-status, vehicles in household, and car availability) were not found to significantly explain the change in teleworking. As for gender, previous studies revealed contradictory findings: While Turcotte (2010) and He and Hu (2015) found that men are more inclined to telework, O'Keefe et al. (2016) found the opposite. O'Keefe et al. (2016) also found that being married and possessing at least one car in the household is positively associated with teleworking. In our study, neither the number of vehicles in the household nor car availability were found to be significant. This could be explained by the high correlation between car ownership and income. As for family status, while we expected to find that unmarried people, and particularly those living in a single-person household, would tend to decrease teleworking, especially given the possible feelings of loneliness associated with the lockdown period, this hypothesis was not confirmed in our study.

Furthermore, in a comparative interpretation of the segmented model results, we found that all the exploratory variables that were found to have a significant impact in both joint models (excluding age) were also found to significantly explain the same change (increase/decrease) in teleworking in Israel but not in Czechia. This could be explained by the smaller sample for Czechia.

Variables related to pre-crisis (COVID-19) employment. The most insightful set of parameters that explains the number of post-crisis WAFH days is the number of pre-crisis WAFH, with all these parameters being highly significant in both models (i.e., the joint model and the model for each of the two countries). The self-employment category in both models was found to decrease WAFH and increase the likelihood of increasing WFH, a phenomenon that was also identified by Turcotte (2010). The relatively high autonomy of self-employed people to choose their work environment compared to salaried workers probably contributed to this result, in conjunction with the COVID-19 experience and restrictions.

The position parameter included five categories: office work; industrial production facility; fieldwork; working from home; and high-mobility occupations that require intense travelling (such as deliveries). The "work-from-home" category was included in the WAFH model, while "office-work" and "high-mobility occupations" were included in the WFH model. As expected, both "office-work" and "work-from-home" were found to positively contribute to the probability of increasing teleworking after the pandemic, or at least maintain the status quo (for those respondents that had already been working from home prior to the crisis), compared to field/factory-work, which are not flexible. Nonetheless, the "high-mobility" category was found to explain both the increasing and the decreasing of telecommuting. However, as the estimated parameters for both directions were not statistically different, one single parameter was estimated for both directions. This finding could be explained by the relatively high flexibility of such positions and their potential for enabling hybrid working.

A directly travel-related outcome that was found to be significant in both models reveals that as the average travel time increases, so does the probability of enhancing teleworking and reducing commute trips. This finding is in line with previous works (Melo and de Abreu e Silva, 2017; Nurul Habib et al., 2012). Moreover, average travel time to work was found to have a negative significance for both countries in the WAFH model (whereby WAFH reduces as average travel time increases, a fact that also strengthens the probability for increasing telework); however, in the WFH model the average travel time was found to be significant only for Czechia as a predictor of the increase in telework, which might be associated with the higher level of PT use in Czechia.

The questionnaire also included a question addressing the industry sector to which the respondent belongs. Although twelve sectors were included in this parameter, none were significant in explaining working habits, neither individually nor when grouped into various categories. This finding differs from previous studies that did reveal an influence of the *industry sector* on teleworking (Caulfield, 2015; Turcotte, 2010). This difference might be the result of the industry sector serving as a very broad category, with a range of definitions and with large variability within each sector. In our study, job type was found to be more significant than the industry in which people work.

Moreover, when comparing the behavior of each country separately, we see that self-employment, jobs that require frequent

travelling (i.e., high mobility), and jobs conducted from home (i.e., no-office) were also found to significantly explain the increase in teleworking in Israel, but not in Czechia; with regards to jobs that require an office to work in (i.e., office work), we found significance only in Czechia. These findings are difficult to explain and as such, need further investigation.

Employment during the lockdown period. Six variables were found to be significant in relation to employment during lockdown: Four variables reflect the actual work status during the lockdown (full/part-time and a mix of WFH and WAFH, and no active employment) and two reflect the change in WFH behavior during lockdown compared to before lockdown.

One variable of the actual work status that was related to working entirely away from home during the lockdown, either full-time or part-time ("Covid19WS_out"), was found to have a significant impact on increasing post-crisis WAFH. It was also found to significantly reduce the likelihood of increasing telecommuting in the post-crisis era, in the joint and segmented models. This is most likely a reflection of certain essential position-related characteristics. Therefore, these individuals are less likely to increase teleworking in the post-crisis era (compared to employees who performed some WFH during lockdown or were unemployed). The remainder of the variables (solely teleworking during lockdown, non-active work during lockdown, and enhanced teleworking during lockdown) were found to only be significant in the WFH joint model and for Israel. This finding could be explained by the flexibility of the amount of work conducted from home, not only in the number of hours, but also as a means for completing work tasks on a day in which a person also traveled to work.

The Covid19WS_ftH variable shows that full time work that combines full or partial WFH during the crisis are also less likely to increase WFH in the post-Covid period. This finding is more difficult to explain. It might be the "stress impact" that is associated with full-time working during such challenging circumstances (e.g., lockdown) and during global pandemics, but further investigation into this finding is needed.

The variable "TW_FT" reflects the "first-time effect" of new teleworking experiences during lockdown. The results indicate that this involvement increases the probability of enhancing telecommuting in the post-crisis era. For those who had already experienced teleworking prior to the pandemic but enhanced it during the crisis ("TW_Change"), the results show that they are more likely to increase telecommuting than decrease it. These findings are interesting in the context of this study and will be further discussed in the Discussion section.

The prominent phenomenon is that the variables that reflect the essence of the survey (i.e., the impact of the COVID-19 pandemic on the expected working habits) are significant for both countries. More specifically, those who teleworked during the lockdown period for the first time (TW_FT) and those who teleworked more intensively during the lockdown period (TW_Change) have a higher probability of increasing their teleworking, based on the results from the WFH model. Moreover, as the personal preference towards telecommuting grows and as the perceived amount of effective telework increases, respondents expect to enhance telecommuting.

Preferences and personality characteristics. Respondents were asked about their personal preferences regarding WAFH compared to WFH, regardless of any job-related constraints ("TW_Pref"), and about their perceptions of the amount of telework they can conduct while maintaining work efficacy ("TW_Eff"). In the WFH models, personal preference was found to be significant in both the joint model and in the segmented models. In the WAFH model, this was not significant for Czechia in the segmented model – but was significant in the joint model as well as in the segmented model for Israel. This finding enhances the meaning of personal preferences when explaining behavioral changes. In addition, telework efficacy was found to be significant only in the WFH model, but its significance is consistent in the joint model as well as in the segmented ones. This might be explained by the hybrid working schemes offered through part-time teleworking.

Lastly, of the three factors of personal traits investigated – extroversion, neuroticism, and openness to experience – only extroversion was found to be significant in the joint WFH model (and for Israel), contributing to a decrease in teleworking. This result is in line with the expected behavior of outgoing people, who would prefer to work in an environment with other people than alone at home.

5. Discussion and conclusions

The unique and rare circumstances dictated by the COVID-19 crisis pose extreme challenges that are reflected in all domains of life, while at the same time opening new windows of opportunity. Our research aimed to assess the impact of the imposed changes in people's routines on both teleworking and commuting trips in the post-crisis era. Most previous telecommuting-related literature was conducted prior to the outbreak of the pandemic, and more recent research on the impact of the pandemic on telecommuting is quite limited, focusing mainly on trends during the pandemic. Our study, therefore, focused on the impact of the pandemic on post-pandemic trends, and on factors associated with the frequency of commuting and the intensity of teleworking. Our study included two models, one that addressed the factors that affect the teleworking trend (WFH) and the other that addressed factors that impact the frequency of commuting trips (WAFH) in the post-pandemic era. Examining the expected post-pandemic working habits from these two angles simultaneously provided grounds for better understanding the expected habits. Moreover, the comparison between Czechia and Israel, characterized by similar demographics and COVID-19 related situations, added an insightful dimension to the research.

As can be expected, after the pandemic, most respondents (62% in Israel and 68% in Czechia, Table 8) will maintain the same balance between telecommuting and WAFH. About 19% of the respondents in both countries intend on reducing the number of WAFH days, while 6% intend on increasing them. Consequently, a reduction of 6.5% and 8.7% in the number of commuting trips is expected in Israel and Czechia respectively in the post-pandemic era.

At the same time, an increase in teleworking is expected. Although it was more difficult to obtain the foreseen number of WFH hours, due to flexibility and possible discontinuity of teleworking, the most prominent change in teleworking habits was reported by those who had already teleworked for five hours or less in the pre-pandemic era (10% in Israel and 6% in Czechia, Table 7). In addition, a greater percentage of respondents reported their intention to increase teleworking (23% and 15% in Israel and in Czechia respectively, Table 8) compared to those who stated their intention to decrease this mode of work (7% and 6% in Israel and in Czechia respectively, Table 8). These results, in conjunction with the decrease in commuting days, highlight new opportunities for working people by experiencing teleworking during lockdown. This provides the basis for assuming that new hybrid working schemes will be adopted by some sectors of the population.

The two models that we developed help explain the factors that affect behavioral commuting and telecommuting changes. As expected, the most prominent predictor of the post-crisis numbers of WAFH days is this number during the pre-crisis era. However, the contribution of additional variables that were found significant in the WAFH model is valuable.

Four variables were found to be significant in both the WFH and WAFH models: Self- employment, travel time to work, working solely away from home during lockdown, and personal preference regarding WAFH versus WFH (regardless of job-related constraints should they exist).

The results of the segmented models for each country show significant differences in the factors affecting the behavior change between Israel and Czechia. Some of the variables included in the joint models were not significant in the Israeli model and were even less so for the Czech model. The proportion of Israeli respondents in the total sample (65%) is probably a primary reason for more significant variables in Israel.

Results of the joint models, as well as the Israeli segmented one, indicate that self-employed people are more likely to increase telecommuting and reduce the number of WAFH days. This finding is expected due to the flexibility usually associated with self-employment. Interestingly, people with high mobility jobs are also expected to change their telecommuting habits in both directions.

In all models, those who only worked away from home during lockdown are less likely to increase WFH and are more likely to increase their WAFH days. This finding is probably related to the rigid nature of the job these people hold, yet may also be connected to a deeper understanding of the importance of on premise work that were revealed in light of the imposed constraints during lockdown.

Another interesting finding in the joint WFH model and accordingly in the segmented Israeli one is that people who only WFH during lockdown are more likely to decrease their teleworking – a finding that probably conveys their negative experience and/or desire for social interactions while working.

Travel time to work was found to significantly increase the intensity of teleworking in the joint model and in the segmented model for Czechia (excluding the Israeli model) while decreasing the number of WAFH days in both the joint model and the segmented one for both countries. These findings, and especially the latter, might have important transport-related implications. In addition to the expected absolute reduction in travelling days to work – especially by people who live farther away from their workplace – this finding, in conjunction with the flexibility of teleworking, might indicate a change in the time of day that they choose to WAFH, in order to avoid traveling during rush hour.

Personal preference regarding WAFH versus WFH was found to significantly explain the likelihood of increasing telework (in both the joint and the segmented models) and the reduction of expected number of WAFH days (excluding the segmented model for Czech). This finding should be addressed in conjunction with the positive correlation between the degree of perceived efficacy of teleworking and the increased likelihood of enhancing telework in the post-crisis era (significant in the WFH model for both countries as well as for each country separately). These findings have important policy implications: If governments and employers wish to encourage telecommuting, they need to provide people with good conditions for doing so while increasing its efficiency.

Two other variables that significantly explain the expected increase in future WFH in both the joint and segmented models support this insight: for those who did not telework before the pandemic but did so during lockdown and for those who already WFH before the pandemic. Apparently, the restriction on working at the workplace has turned into an opportunity for people to realize that working from home can be both practical and have some added value, making it a viable option. These results align with behavioral economic principles that support encouragement and incentives to try out new behavior to make a permanent shift to such behavior.

5.1. Research limitations and future research

Our paper poses a very challenging question: Will the COVID-19 pandemic, which has forced many people to telework from home during the pandemic, have a post-impact after resuming normal pre-pandemic life? To answer this question, we relied on the participants' stated intentions, which may have various biases and could reflect people's wishes and desires rather than their what they will eventually do after COVID-19. We are not counting for the employers' point of view or other potential constraints that these employees may face in the future, we are only asking for the peoples' intentions. Conducting the surveys solely through online recruitment raised the issue of sampling bias and over-sampling, particularly with regards to the ratio of full-time teleworking in the pre-pandemic era. Yet, we did not find this issue to be sufficiently significant to create a bias that could impair the reliability of the sample and its results. However, these results should be considered in light of this potential bias.

Other bias may result from possible changes in workplace/employer or even positions held by the respondents in the post-COVID-19 era compared to before the pandemic. Specifically, some respondents who intend to (semi-)retire, and hence decrease commuting are potentially included in the sample while those who intend to join the workforce after the crisis are not represented in the sample. Another potential bias is in that those who are able to work from home may be less likely to retire or be unemployed post-COVID-19, which may explain some of the anticipated decreases in commuting days begin accompanied by an increase in teleworking.

Moreover, the Israeli survey was conducted during the country's peak lockdown, and in Czechia it was conducted shortly after the

Table 11

Results of the WFH and WAFH models[1].

Variable name	Variable description	WFH (Multinomial logit model)						WAFH (Ordinal logit model)		
		Increased WFH (coefficient + indication of significance level)			Decreased WFH (coefficient + indication of significance level)			Post-Covid19 WAFH (coefficient + indication of significance level)		
		Both countries	Israel	Czechia	Both countries	Israel	Czechia	Both countries	Israel	Czechia
ASC (multinomial)										
ASC_H	Alternative-specific constant (increase)	−3.00**	−2.28**	−4.54**						
ASC_O	Alternative-specific constant (decrease)				−1.46**	−1.55**	−1.36*			
Threshold (ordinal)										
WAFH3_0	WAFH after Covid19 = 0 days							0.60**	−0.10	1.54**
WAFH3_1	WAFH after Covid19 = 1 days							1.40**	0.69**	2.36**
WAFH3_2	WAFH after Covid19 = 2 days							2.10**	1.49**	2.96**
WAFH3_3	WAFH after Covid19 = 3 days							3.01**	2.45**	3.79**
WAFH3_4	WAFH after Covid19 = 4 days							3.88**	3.35**	4.61**
WAFH3_5	WAFH after Covid19 = 5 days							8.41**	7.91**	9.24**
WAFH3_6	WAFH after Covid19 = 6 days							10.88**	10.99**	10.74**
Socio-demographic traits										
CityRing1	Core ring: Tel-Aviv/Prague (bin.)							−0.18**	−0.30**	0.09
AgeAv	Average Age (cont.)	−0.008*	−0.008	−0.003						
Education	Education level (cont.)	0.12**	0.08*	0.07						
Wage	Wage (cont.)				−0.19**	−0.17**	−0.21			
HouseSize	Household size (cont.)	−0.09*	−0.14**	0.12						
Kids_at_Home	Children of age 0–8 at home (bin.)	0.38**	0.41**	0.15						
Characteristics of pre-crisis (Covid19) work										
WAFH1_0	WAFH before Covid19 = 0 days							0[1]		
WAFH1_1	WAFH before Covid19 = 1 days							1.82**	1.44**	2.51**
WAFH1_2	WAFH before Covid19 = 2 days							2.35**	2.02**	2.89**
WAFH1_3	WAFH before Covid19 = 3 days							2.97**	2.83**	3.12**
WAFH1_4	WAFH before Covid19 = 4 days							3.44**	3.28**	3.55**
WAFH1_5	WAFH before Covid19 = 5 days							5.46**	5.25**	5.53**
WAFH1_6	WAFH before Covid19 = 6 days							9.04**	9.003**	8.65**
WAFH1_7	WAFH before Covid19 = 7 days							11.47**	12.77**	7.58**
Self_emp	Self-employed (bin.)	0.51**	0.58**	0.12				−0.24**	−0.33**	−0.24
JobOffice	Occupation in an office (bin.)	0.22*	0.17	0.51**						
JobHiMobi	Occupation involving high mobility (marketing, deliveries etc.) (bin.)	0.58**	0.61**	0.48	0.58**	0.61**	0.48			
JobNOffice	Occupation from home (not office) (bin.)							−0.35**	−0.33**	−0.29
TrTimeAv_W	Average Travel time to work (cont.)	0.006**	0.003	0.01**				−0.006**	−0.007**	−0.008**
Covid19 Work Status during the lockdown										
Covid19WS _out	WAFH only (bin.)	−0.87**	−0.57**	−1.49**				0.54**	0.5**	0.82**
Covid19WS_ftH	Full-time work with full/partial WFH (bin.)	−0.53**	−0.58**	−0.39						
Covid19WS_H	WFH only (bin.)				0.59**	0.66**	0.35			
Covid19WS_ue	No active employment (bin.)				−0.56**	−0.63*	−0.008			
TW_FT	WFH for new teleworkers (0 if telecommute before the pandemic; cardinal variable)	0.26**	0.27**	0.24**						
TW_Change	Change in WFH compared to pre-crisis (0 if new teleworker; cardinal variable)	0.35**	0.36**	0.35**	−0.43**	−0.42**	−0.45			

Table 11 (*continued*)

Variable name	Variable description	WFH (Multinomial logit model)						WAFH (Ordinal logit model)		
		Increased WFH (coefficient + indication of significance level)			Decreased WFH (coefficient + indication of significance level)			Post-Covid19 WAFH (coefficient + indication of significance level)		
		Both countries	Israel	Czechia	Both countries	Israel	Czechia	Both countries	Israel	Czechia
Preferences and Personality traits										
TW_Pref	Personal preference towards teleworking (cont.)	0.18**	0.15**	0.31**				−0.07**	−0.13**	0.05
TW_Eff	Perceived efficacy of telework (cont.)	0.14**	0.09**	0.22*	−0.11**	−0.1	−0.1*			
Extroversion	Extrovert personality (cont.)				0.08**	0.08*	0.07			
N		2649	1723	926				2649	1723	926
Init LL	constants-only	−2260.26	−1489.88	−770.39				−3265.14	−2174.89	−1222.63
Fin LL		−1461.18	−1058.88	−381.54				−2154.80	−1382.89	−879.63
Likelihood ratio test		1598.16	862.18	777.70				2220.67	1583.99	686.01
Rho-square		0.35	0.29	0.51				0.34	0.36	0.28
Adjusted rho-square		0.34	0.28	0.48				0.34	0.36	0.27

Note: * p-value $\leq$ 0.1 ** p-value $\leq$ 0.05.

[1] Set to zero because this parameter is redundant.

country's peak. As the participants were asked about their behavior during the peak, the input from the Czech respondents may have been less accurate. To ensure behavioral consistency (given data that rely on SI responses), we conducted an additional round of the survey from the same respondents after the restrictions were lessened, as a means for achieving further insight from the data analysis. These data are currently being analyzed and will appear in future research. This work will include additional models of the long-term shifts in WAFH and WFH, as well as consistency validation evaluation.

Asking respondents about both WFH and WAFH enabled us to conduct certain consistency checks. However, we were faced with the challenge of how to compare between the two, as it was easier for people to respond about WAFH in terms of days and about WFH in terms of hours. We therefore opted for the better questions on compatibility between the two.

We have asked the respondents to participate in a future survey in the post-pandemic era. We hope this future study will reveal the extent to which the measured intentions are realized.

Further future research could benefit from exploring additional countries, with different cultures and other characteristics, as well as differences in the intensity of the pandemic and the related restrictions. Moreover, examining the points-of-view of employers regarding telecommuting in general and during the pandemic in particular could add an additional facet to the study, in addition to the attitudes of employees and self-employed persons as analyzed in this study. Finally, it would also be interesting to investigate the impact of the pandemic on trade-offs between other at-home and away-from-home activities, such as shopping, education, and leisure which we also collected in these surveys.

CRediT authorship contribution statement

Ayelet Kogus: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Hana Brůhová Foltýnová:** Data curation, Writing – original draft, Writing – review & editing. **Ayelet Gal-Tzur:** Conceptualization, Methodology, Writing – original draft. **Yuval Shiftan:** Writing – original draft, Writing – review & editing. **Eliška Vejchodská:** Conceptualization, Data curation, Writing – original draft. **Yoram Shiftan:** Conceptualization, Data curation, Methodology, Supervision, Writing – original draft, Writing – review & editing.

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

Appendix A

See Table A1.

Table A1
Developments and restrictions during the first COVID-19 pandemic peak.

Parameters	Israel	Czechia
Restrictions during first COVID-19 peak (mid-March to mid-April) prior to data collection in both countries	**11 March:** Social distancing. **14 March:** Closure of all entertainment and recreation venues, including restaurants, cinemas, gyms, and shopping malls. **15 March:** Beginning of the government's tracking the mobile devices of positively tested individuals. **16 March:** All non-critical government and local authority workers are sent home on paid leave until the end of the Jewish Passover holiday. **16 March:** Firms in the private sector with more than ten employees are required to reduce staff presence in the workplace by 70%. **18 March:** learning becomes only online. **19 March:** National state of emergency is declared; free movement is prohibited; 38.5% reduction in public transportation. **25 March:** Wearing face masks outside the house is compulsory; people may only leave their homes for up to a hundred meters and only for a short time (except for	**12 March:** National state of emergency is declared; free movement is prohibited **12 March:** Wearing face masks outside the home is compulsory. **14 March:** Retail sales and sales of services on business premises (including restaurants) is forbidden. **16 March:** Free movement is limited except for travelling to and from work and essential trips for ensuring basic needs; closure of state borders. **24 March:** Gatherings of only up to two people in public. **26 April:** The prohibition of free movement is lifted; gatherings of up to ten people in public. **17 May:** The state of emergency is lifted; events for up to 100 people are permitted; theatres and cinemas are reopened. **5 July:** Complete reopening of retail sales and services; wearing face masks in public is no longer compulsory.

(continued on next page)

Table A1 (*continued*)

Parameters	Israel	Czechia
	critical work purposes); public transport activity is reduced to a quarter of its regular scope. **19 April**: Workplaces allowed to return to a workshop format of up to 30% of the workforce; exercise is permitted up to 500 m from home. **26 April**: Street shops reopen, including beauty salons, cosmetic clinics, and restaurant take-aways. **30 April**: The 500-meter restriction on sports activities is cancelled.	
Impact on transport during the first COVID-19 peak prior to data collection in both countries	All train operations were stopped between 26 March and 21 June 2020	PT – masks compulsory, mostly the same services as before epidemics; a few cities implemented weekend timetables for working days for city public transport during the COVID peak
Total no. of people who tested positive with the Coronavirus	85,056 (as of 13 Aug 2020)	17,529 (as of 6 Aug 2020)
Total no. of deaths	617 (as of 13 Aug 2020)	388 (as of 6 Aug 2020)

Sources: Czech and Israeli Government websites: https://www.mzcr.cz/category/uredni-deska/rozhodnuti-ministerstva-zdravotnictvi/aktualni-mimoradna-a-ochranna-opatreni-ke-covid-19/page/51/; https://govextra.gov.il/ministry-of-health/corona/corona-virus-en/; World Health Organization website https://covid19.who.int/region/emro/country/ps.

References

Asgari, H., Jin, X., 2015. Toward a comprehensive telecommuting analysis framework: Setting the conceptual outline. Transp. Res. Rec. 2496 (1), 1–9.

Asgari, H., Jin, X., Du, Y., 2016. Examination of the impacts of telecommuting on the time use of nonmandatory activities. Transp. Res. Rec. 2566 (1), 83–92.

Asgari, H., Jin, X., 2018. An evaluation of part-day telecommute impacts on work trip departure times. Travel Behav. Soc. 12, 84–92.

Aguilera, A., Lethiais, V., Rallet, A., Proulhac, L., 2016. Home-based telework in France: Characteristics, barriers and perspectives. Transport. Res. Part A: Policy Pract. 92, 1–11. https://doi.org/10.1016/j.tra.2016.06.021.

Baert, S., Lippens, L., Moens, E., Weytjens, J., Sterkens, P., 2020. The COVID-19 crisis and telework: A research survey on experiences, expectations and hopes. IZA Discussion Paper No. 13229. Institute of Labor Economics. http://ftp.iza.org/dp13229.pdf.

Balbontin, C., Hensher, D.A., Beck, M.J., Giesen, R., Basnak, P., Vallejo-Borda, J.A., Venter, C., 2021. Impact of COVID-19 on the number of days working from home and commuting travel: A cross-cultural comparison between Australia, South America and South Africa. J. Transp. Geogr. 96, 103188.

Beck, M.J., Hensher, D.A., 2020. Insights into the impact of COVID-19 on household travel and activities in Australia-The early days of easing restrictions. Transp. Policy 99, 95–119. https://doi.org/10.1016/j.tranpol.2020.07.001.

Beck, M.J., Hensher, D.A., Wei, E., 2020. Slowly coming out of COVID-19 restrictions in Australia: Implications for working from home and commuting trips by car and public transport. J. Transp. Geogr. 88, 102846.

Bethlehem, J., 2010. Selection Bias in Web Surveys. International Statistical Review 78 (2), 161–188.

Belzunegui-Eraso, A., Erro-Garcés, A., 2020. Teleworking in the Context of the Covid-19 Crisis. Sustainability 12 (9), 3662.

Bick, A., Blandin, A., Mertens, K., 2020. Work from home after the COVID-19 Outbreak. wp 2020 (2017). https://doi.org/10.24149/wp10.24149/wp2017r1.

Bloom, N., Liang, J., Roberts, J., Ying, Z.J., 2015. Does working from home work? Evidence from a Chinese experiment. Q. J. Econ. 130 (1), 165–218.

Brough, R., Freedman, M., Phillips, D., 2020. Department of Economics Working Paper Series. Understanding socioeconomic disparities in travel behavior during the COVID-19 pandemic. University of California, Irvine.

Budnitz, H., Tranos, E., Chapman, L., 2020. Telecommuting and other trips: an English case study. J. Transp. Geogr. 85, 102713. https://doi.org/10.1016/j.jtrangeo.2020.102713.

Brynjolfsson, E., Horton, J. J., Ozimek, A., Rock, D., Sharma, G., TuYe, H.Y., 2020. COVID-19 and remote work: an early look at US data (No. w27344). National Bureau of Economic Research. http://www.nber.org/papers/w27344.

Caulfield, B., 2015. Does it pay to work from home? Examining the factors influencing working from home in the Greater Dublin Area. Case Studies Transport Policy 3 (2), 206–214. https://doi.org/10.1016/j.cstp.2015.04.004.

Chakrabarti, S., 2018. Does telecommuting promote sustainable travel and physical activity? J. Transport Health 9, 19–33.

Chauhan, R.S., Bhagat-Conway, M.W., Capasso da Silva, D., Salon, D., Shamshiripour, A., Rahimi, E., Khoeini, S., Mohammadian, A.K., Derrible, S., Pendyala, R., 2021. A database of travel-related behaviors and attitudes before, during, and after COVID-19 in the United States. Sci. Data 8, 245.

Clark, L.A., Karau, S.J., Michalisin, M.D., 2012. Telecommuting attitudes and the 'big five' personality dimensions. J. Manage. Policy Pract. 13 (3), 31–46.

Clear, F., Dickson, K., 2005. Teleworking practice in small and medium-sized firms: management style and worker autonomy. New Technology, Work and Employment 20 (3), 218–233.

Crawford, F., 2020. Segmenting travellers based on day-to-day variability in work-related travel behaviour. J. Transp. Geogr. 86, 102765. https://doi.org/10.1016/j.jtrangeo.2020.102765.

Cuerdo-Vilches, T., Navas-Martín, M.A., March, S., Oteiza, I., 2021. Adequacy of telework spaces in homes during the lockdown in Madrid, according to socioeconomic factors and home features. Sustainable Cities and Society 75, 103262.

Currie, G., Jain, T., Aston, L., 2021. Evidence of a post-COVID change in travel behaviour – Self-reported expectations of commuting in Melbourne. Transport. Res. Part A: Policy Pract. 153, 218–234.

de Abreu e Silva, J., Melo, P.C., 2018. Does home-based telework reduce household total travel? A path analysis using single and two worker British households. J. Transp. Geogr. 73, 148–162. https://doi.org/10.1016/j.jtrangeo.2018.10.009.

de Haas, M., Faber, R., Hamersma, M., 2020. How COVID-19 and the Dutch 'intelligent lockdown'change activities, work and travel behaviour: Evidence from longitudinal data in the Netherlands. Transport. Res. Interdisciplinary Perspect. 100150.

de Vos, D., Meijers, E., van Ham, M., 2018. Working from home and the willingness to accept a longer commute. Ann. Reg. Sci. 61 (2), 375–398.

Delventhal, M. J., Kwon, E., Parkhomenko, A., 2020. How do cities change when we work from home. Working Paper, Claremont McKenna College.

Deng, Z., Morissette, R., Messacar, D., 2020. Running the economy remotely: Potential for working from home during and after COVID-19. Statistics Canada Catalogue, (45280001).

Dingel, J. I., & Neiman, B. (2020). *How many jobs can be done at home?* (No. w26948). National Bureau of Economic Research.

Echaniz, E., Rodríguez, A., Cordera, R., Benavente, J., Alonso, B., Sañudo, R., 2021. Behavioural changes in transport and future repercussions of the COVID-19 outbreak in Spain. Transp. Policy 111, 38–52.

Elldér, E., 2017. Does telework weaken urban structure–travel relationships? J. Transport Land Use 10 (1), 187–210.

Ettema, D., 2010. The impact of telecommuting on residential relocation and residential preferences: A latent class modeling approach. J. Transport Land Use 3 (1), 7–24. https://doi.org/10.5198/jtlu.v3i1.61.

Etzion, D., Laski, S., 1998. The "Big Five" Inventory-Hebrew Version by Permission. Tel Aviv University, Faculty of management, The Institute of Business Research, Tel Aviv.

Eurostat. (2020). https://ec.europa.eu/eurostat/data/database.

Gainey, T.W., Clenney, B.F., 2006. Flextime and telecommuting: Examining individual perceptions. Southern Business Rev. 32 (1), 13–21.

Hamer, R., Kroes, E., Van Ooststroom, H., 1991. Teleworking in the Netherlands: an evaluation of changes in travel behaviour. Transportation 18 (4), 365–382. https://doi.org/10.1007/BF00186565.

He, S.Y., Hu, L., 2015. Telecommuting, income, and out-of-home activities. Travel Behav. Soc. 2 (3), 131–147.

Henderson, D.K., Mokhtarian, P.L., 1996. Impacts of center-based telecommuting on travel and emissions: analysis of the Puget Sound Demonstration Project. Transport. Res. Part D: Transport Environ. 1 (1), 29–45.

Hensher, D.A., Beck, M.J., Wei, E., 2021. Working from home and its implications for strategic transport modelling based on the early days of the COVID-19 pandemic. Transport. Res. Part A: Policy Pract. 148, 64–78.

Hu, L., He, S.Y., 2016. Association between telecommuting and household travel in the Chicago metropolitan area. J. Urban Plann. Dev. 142 (3), 04016005.

John, O.P., Srivastava, S., 1999. The Big Five trait taxonomy: History, measurement, and theoretical perspectives. Handbook of Personality: Theory Res. 2 (1999), 102–138.

Kim, S.-N., 2017. Is telecommuting sustainable? An alternative approach to estimating the impact of home-based telecommuting on household travel. Int. J. Sustainable Transport. 11 (2), 72–85.

Kim, J., Kwan, M., 2021. The impact of the COVID-19 pandemic on people's mobility: A longitudinal study of the U.S. from March to September of 2020. J. Transp. Geogr. 93 (103039).

Lachapelle, U., Tanguay, G.A., Neumark-Gaudet, L., 2018. Telecommuting and sustainable travel: Reduction of overall travel time, increases in non-motorised travel and congestion relief? Urban Studies 55 (10), 2226–2244.

Lister, K., Harnish, T., 2011. The state of telework in the US: How individuals, business, and government benefit. Telework Res. Network 1, 1–27.

Mannering, J.S., Mokhtarian, P.L., 1995. Modeling the choice of telecommuting frequency in California: an exploratory analysis. Technol. Forecast. Soc. Chang. 49 (1), 49–73.

Melo, P.C., de Abreu e Silva, J., 2017. Home telework and household commuting patterns in Great Britain. Transportation Research Part A: Policy and Practice, 103, 1-24.

Mokhtarian, P.L., Salomon, I., 1997. Modeling the desire to telecommute: The importance of attitudinal factors in behavioral models. Transport. Res. Part A: Policy Pract. 31 (1), 35–50.

Mokhtarian, P.L., Bagley, M.N., Salomon, I., 1998. The impact of gender, occupation, and presence of children on telecommuting motivations and constraints. J. Am. Soc. Inform. Sci. 49 (12), 1115–1134.

Mokhtarian, P., 2009. If telecommunication is such a good substitute for travel, why does congestion continue to get worse? Transportation Letters 1 (1), 1–17.

Nayak, S., Pandit, D., 2021. Potential of telecommuting for different employees in the Indian context beyond COVID-19 lockdown. Transp. Policy 111, 98–110.

Nelson, P., Safirova, E., Walls, M., 2007. Telecommuting and environmental policy: Lessons from the ecommute program. Transport. Res. Part D: Transport Environ. 12 (3), 195–207. https://doi.org/10.1016/j.trd.2007.01.011.

Nurul Habib, K.M., Sasic, A., Zaman, H., 2012. Investigating telecommuting considerations in the context of commuting mode choice. Int. J. Sustainable Transport. 6 (6), 362–383.

OECD, 2020. Productivity gains from teleworking in the post COVID-19 era: how can public policies make it happen?. http://www.oecd.org/coronavirus/policy-responses/productivity-gains-from-teleworking-in-the-post-covid-19-era-a5d52e99/.

O'Keefe, P., Caulfield, B., Brazil, W., White, P., 2016. The impacts of telecommuting in Dublin. Res. Transportation Economics 57, 13–20.

Ory, D.T., Mokhtarian, P.L., 2006. Which Came First, the Telecommuting or the Residential Relocation? An Empirical Analysis of Causality. Urban Geography 27 (7), 590–609. https://doi.org/10.2747/0272-3638.27.7.590.

Pendyala, R.M., Goulias, K.G., Kitamura, R., 1991. Impact of telecommuting on spatial and temporal patterns of household travel. Transportation 18, 383–409. https://doi.org/10.1007/BF00186566.

Peters, P., Tijdens, K.G., Wetzels, C., 2004. Employees' opportunities, preferences, and practices in telecommuting adoption. Information & Management 41 (4), 469–482. https://doi.org/10.1016/S0378-7206(03)00085-5.

Pratt, J.H., 1991. Travel behavior impact of telecommuting following the San Francisco earthquake: a case study. Transp. Research Record 1305, 282–290.

Riggs, W., 2020. Telework and Sustainable Travel During the COVID-19 Era. Available at SSRN 3638885. https://doi.org/10.2139/ssrn.3638885.

Sarbu, M., 2015. Determinants of work-at-home arrangements for German employees. Labour 29 (4), 444–469.

Scott, D.M., Dam, I., Páez, A., Wilton, R.D., 2012. Investigating the effects of social influence on the choice to telework. Environment and Planning A 44 (5), 1016–1031.

Shabanpour, R., Golshani, N., Tayarani, M., Auld, J., Mohammadian, A.K., 2018. Analysis of telecommuting behavior and impacts on travel demand and the environment. Transport. Res. Part D: Transport Environ. 62, 563–576. https://doi.org/10.1016/j.trd.2018.04.003.

Shakibaei, S., de Jong, G.C., Alpkökin, P., Rashidi, T.H., 2021. Impact of the COVID-19 pandemic on travel behavior in Istanbul: A panel data analysis. Sustainable Cities Soc. 65, 102619.

Shamshiripour, A., Rahimi, E., Shabanpour, R., Mohammadian, A.(., 2020. How is COVID-19 reshaping activity-travel behavior? Evidence from a comprehensive survey in Chicago. Transport. Res. Interdisciplinary Perspect. 7, 100216. https://doi.org/10.1016/j.trip.2020.100216.

Singh, P., Paleti, R., Jenkins, S., Bhat, C.R., 2013. On modeling telecommuting behavior: Option, choice, and frequency. Transportation 40 (2), 373–396.

Stiles, J., Smart, M.J., 2020. Working at home and elsewhere: daily work location, telework, and travel among United States knowledge workers. Transportation 48 (5), 2461–2491. https://doi.org/10.1007/s11116-020-10136-6.

Turcotte, M., 2010. Working at home: An update. Can. Social Trends 91, 3–11.

United Nations, 2020. Policy Brief: COVID-19 in an Urban World. https://go.nature.com/335VRRS.

Varma, K.V., Ho, C.-I., Stanek, D.M., Mokhtarian, P.L., 1998. Duration and Frequency of Telecenter Use: Once a Telecommuter, Always a Telecommuter? Transport. Res. C 6 (1-2), 47–68.

Vilhelmson, B., Thulin, E., 2016. Who and where are the flexible workers? Exploring the current diffusion of telework in Sweden. New Technology, Work and Employment 31 (1), 77–96. https://doi.org/10.1111/ntwe.12060.

Zhu, P., Wang, L., Jiang, Y., Zhou, J., 2018. Metropolitan size and the impacts of telecommuting on personal travel. Transportation 45 (2), 385–414.