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Commuting vs teleworking: How does it impact the relationship between commuting satisfaction and subjective well-being

Richa Maheshwari [a, b, *], Veronique Van Acker [a], Philippe Gerber [a]

[a] Luxembourg Institute of Socio-Economic Research (LISER), 11, Porte des Sciences, 4366, Esch-sur-Alzette, Luxembourg
[b] University of Liege, Urban and Environmental Engineering Department, Local Environment Management and Analysis (LEMA), Allee de la Decouverte9, Quartier Polytech 1, Liege BE-4000, Belgium

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ABSTRACT

While the relationship between commuting satisfaction (CS) and subjective well-being (SWB) has been extensively studied, less attention is given to explaining how CS affects SWB via satisfaction with non-travel-related life domains. Failure to account for these spillover effects of life domains other than commuting has certainly led to an overestimation of the impact from CS to SWB. This study aims to address this gap and examine the recent changes in commuting practices/working conditions, particularly the increase in working from home (WFH) due to the pandemic. A structural equation model is employed to examine differences in WFH frequencies and their impact on the relationship between CS, satisfaction with other life domains and SWB. The results suggest that hybrid teleworkers exhibit highest SWB and occasional WFH individuals have the lowest levels of SWB. Moreover, the effect of CS on SWB is mediated first by time satisfaction (TUS) and then by other life domains, highlighting the dominance of TUS on the relationship between CS and SWB regardless of WFH frequency. These findings help to identify not only areas where employee SWB can be improved, but also how.

1. Introduction

Public policies aim to improve the well-being of their population. A crucial area influencing this well-being is transportation. Transportation significantly impacts various dimensions of well-being, including objective dimensions such as, job, income, commuting, health, social relationships – and subjective dimensions, including satisfaction levels related to these objective dimensions. The rising interest in the subjective aspect of well-being, particularly in travel satisfaction literature, is tied to the recognition that subjective well-being (SWB) is a holistic evaluation of an individual's overall life. According to Diener (1984), SWB is a multidimensional concept that shapes satisfaction across various life domains, encompassing both positive and negative emotional experiences. This understanding underscores the interplay of different life domains and their influence on individuals' overall well-being. Numerous studies have highlighted how policy interventions can lead to an increase in commuter satisfaction, consequently improving their subjective well-being. For instance, the effect of soft transport policy measures aiming at making motorized transport users switch to active and public transport use led to an increase in commuter satisfaction, thereby increasing their SWB (De Vos et al., 2019).

* Corresponding author.
E-mail addresses: richa.maheshwari@uliege.be (R. Maheshwari), Veronique.vanacker@liser.lu (V. Van Acker), Philippe.gerber@liser.lu (P. Gerber).

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Commuting to work, has a significant impact on our SWB because the time spent on commuting represents a significant portion of our daily routines. Over the past years, research on commuting satisfaction (CS) has gained increasing attention (De Vos et al., 2013; Ettema et al., 2010; Mokhtarian & Pendyala, 2018). Several empirical studies have shown how CS is influenced by commuting time, travel mode and travel distance (De Vos et al., 2019; Jang & Ko, 2019; Rau et al., 2019), built environment and subjective characteristics (Ewing & Cervero, 2010; Handy & Thigpen, 2018; Schwanen, 2002; Ye & Titheridge, 2017). As commuting is an important daily activity and often a source of stress (Stutzer & Frey, 2008), dissatisfaction with commuting can result in lower levels of SWB as highlighted in a few studies (Bergstad et al., 2011; Ettema et al., 2011). While there is a growing interest in examining how (dis) satisfaction with commuting contributes to SWB, only a limited number of studies have explored the broader impact of CS on satisfaction with various life domains and, subsequently on SWB (Maheshwari et al., 2022a, 2022b; Mouratidis, 2020). Neglecting the impact of satisfaction with other life domains (i.e. satisfaction with non-travel-related life domains), in explaining the impact of CS on SWB has led to biased results in travel satisfaction literature and certainly to an overestimation of the impact of CS on SWB (Maheshwari et al., 2022b). For example, someone who is able to run errands on the way home after work will have affective response, be satisfied with the activities and expect higher SWB as they are able to achieve their goals than someone who is unable to do so due to limited travel capacity or lack of time. Being able to participate in other life activities immediately before or after work, which are often spatially separated, such as meeting friends and family after work, engaging in leisure activities or picking up the children on the way home, and being satisfied with them, makes commuting more fulfilling and contributes to the individual's SWB (Babb et al., 2017). It is therefore important to analyze the impact of CS on SWB, taking into account satisfaction with life domains such as time use, leisure, health, etc.

Furthermore, owing to recent changes in working conditions, particularly the surge in working from home (WFH) post-pandemic, people are commuting less. Consequently, the role of commuting to work versus working from home needs to be re-analysed, considering its implication for individuals' SWB. The WFH practices have evolved overtime and now occur in different forms. While some people WFH full-time, others prefer to divide their time between WFH and working in the office (Pulido-Martos et al., 2021). This means that a person who engages in WFH one day per week is likely to experience commuting differently from a person who engages in WFH four or more days per week (Allen et al., 2015). Having said that, this study supports the idea that changes in commuting practices linked to WFH may affect the relationship between CS, satisfaction with life domains and SWB. This paper will therefore examine differences in workers' WFH frequencies and its implications on their satisfaction with different life aspects, including commuting, and SWB.

The remaining paper is structured in the following manner. Section 2 offers insight into the relationships between the fundamental components of the study. Section 3 elaborates on the data obtained from a Luxembourg-based travel satisfaction and quality of life survey and employs a multiple group Structural Equation Modelling (SEM) methodology to explore the data set. Section 4 presents the results on the differences in the relationship between CS, satisfaction with non-travel related life domains and SWB for different WFH frequencies. Section 5 discusses the key findings and concludes the paper with recommendations for policymakers who seek to enhance the SWB of their populace.

2. Literature review

The body of literature on travel satisfaction and SWB is growing considerably. This literature review section is therefore restricted to those studies that have specifically addressed (i) the relationship between CS and SWB; (ii) how commuting time affects satisfaction with other life domains and SWB; (iii) how changes in WFH practices challenge the well-documented relationships between CS and SWB.

2.1. Satisfaction with commuting and subjective well-being

Commuting is one of the most important activities in a worker's life, yet if often brings about stress and frustration. Most studies consistently indicate that individuals enduring longer commute times, irrespective of the mode of transportation, tend to experience lower levels of SWB (Ettema et al., 2012, 2013; Manaugh & El-Geneidy, 2013; Mao et al., 2016; Nie & Sousa-Poza, 2018; St-Louis et al., 2014; Stutzer & Frey, 2008). The detrimental impact of commuting is even worse during peak hours, such as the rush hours from 5 pm. to 6 pm. on weekdays, leading to a less positive mood among drivers in major cities, primarily due to congestion (Morris & Hirsch, 2016). Conversely, studies highlight the positive influence of shorter commutes on SWB (Mouratidis et al., 2019). Furthermore, using active modes of transport, such as walking or cycling, during commutes has been associated with heightened enjoyment and happiness, contributing positively to individuals' SWB (De Vos et al., 2019; Páez & Whalen, 2010; Scheepers et al., 2014; Schneider & Willman, 2019; St-Louis et al., 2014). Moreover, the ability to choose one's mode of transport, reside in a preferred neighborhood, or control commuting schedules has been linked to higher satisfaction (De Vos, 2018; De Vos & Singleton, 2020; Ma et al., 2021; Mokhtarian, 2008). These elements, collectively, play a role in enhancing SWB by fostering a more satisfying commuting experience.

2.2. Satisfaction with commuting and other life domains

Studies that examine how domain satisfaction contributes to SWB use a bottom-up approach. These studies focus on the impact of satisfaction across various life domains, encompassing commuting, job, time-use, leisure, personal relationships, place of residence, and health (Diener, 1984; Heady et al., 1991). In essence, individuals aim to maximize happiness in each life domain to attain the overarching goal of elevated SWB. However, research has demonstrated that satisfaction across these diverse life domains also

interacts with one another (Heady et al., 1991). For instance, Lorenz (2018) used a panel data set (2007–2013) and found that longer commutes were negatively associated with satisfaction with leisure and family time. Stutzer and Frey (2008) used a panel data set (1985–2003) to report that commute times are negatively associated with job and health satisfaction. Künn-Nelen (2015) analyzed a panel data set (1991–2008) and found that longer commute times were associated with lower satisfaction with health. Maheshwari et al., (2022b) used data from 32 European countries and found that job and time-use satisfaction had the strongest influence on commuting (time) satisfaction compared to other life domains in all countries. In addition, satisfaction with recreational space was negatively associated with commuting (time) satisfaction in relatively less developed countries. Finally, Chatterjee et al. (2017) and Clark et al. (2020) found that longer commute duration have a significant negative impact on people's mental health, job satisfaction and leisure time satisfaction. Most research on travel satisfaction centers on the interaction between CS and satisfaction with other life domains, or between CS and SWB. However, the connection from CS to satisfaction with other life domains and subsequently to SWB is absent, with a few exceptions: Gao et al., 2017 and Kroesen, 2014 and Maheshwari et al., 2022a, 2022b. Failing to consider the indirect impact of CS on SWB through satisfaction with other life domains has led to an overestimation of the direct effect of CS on SWB. Therefore, addressing this limitation is crucial.

2.3. *Working from home and subjective well-being*

The research on WFH dates back to 1970s (Nilles, 1975), but has gained popularity due to technological advances (Allen et al., 2015) and more recently due to the COVID-19 pandemic, which has since changed individuals' working practices. Eurofound (2023) found that the pandemic accelerated WFH, with 2 out of 10 European employees teleworking in 2021. WFH has since evolved in various forms, including full-time WFH, hybrid WFH (where workers divide their time between WFH and working in the office), and occasional WFH (where workers engage in WFH as needed but commute to the office more frequently) (Pulido-Martos et al., 2021).

Research on WFH and SWB is limited, but suggests that WFH can have positive effects on workers' SWB, including work productivity, job satisfaction and leisure satisfaction (Clark et al., 2020). WFH also offers greater flexibility in daily work schedules and allows for shared production activities such as caring for children while at work (Pabilonia & Vernon, 2021). WFH also has the potential to improve people's work-life balance and SWB (Allen et al., 2015; Blahopoulou et al., 2022; Pabilonia & Vernon, 2021). While WFH can have several benefits, it can also lead to negative impacts. For instance, Clark et al. (2020) found lower life satisfaction among individuals who engage in WFH. However, the reason for this is unclear and may not be captured by the covariates in this study. Some researchers also found that WFH is linked to an increase in loneliness, stress (especially among male workers), work-family conflicts, feelings of isolation and lack of work productivity due to multitasking during the day (Hamermesh, 2020; Mas & Pallais, 2020; Mokhtarian, 1991; Solís, 2017; Song & Gao, 2020). However, for individuals who choose WFH, it does not necessarily have a negative impact on them because they considered this of their free will when opting for WFH. These individuals value the improved flexibility and work-life balance, which is why they prefer WFH even after the pandemic (Šmite et al., 2023).

Nevertheless, a person with full-time telework is likely to have a different experience of home working than a person who occasionally works from home. It seems that the relationship between WFH and SWB is not straightforward but complex and may depend on individual socio-demographic characteristics, work characteristics and contextual circumstances. Not taking into account the extent of WFH and the impact of individual (e.g., age, gender), attitudes, and trip characteristics (e.g., transport mode and travel time) on the relationship between CS, domain satisfaction and SWB could lead to inconclusive and conflictual results.

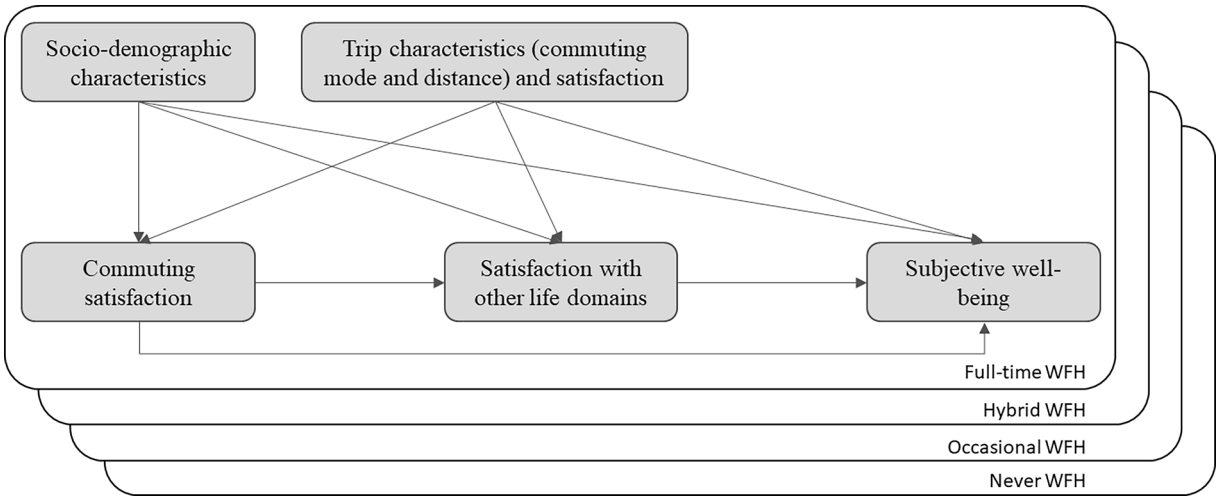


Fig. 1. Conceptual model.

2.4. WFH, CS and SWB: a conceptual model

On the one hand, the WFH literature identifies merits and demerits of WFH, such as increased flexibility and autonomy for workers through reduced commuting time and costs, or increased loneliness and work-life conflicts. On the other hand, the literature on CS and SWB is not adequate because it does not consider the interaction with domain satisfaction variables other than commuting. Hence, our study explores whether the effect of CS on SWB is overestimated, and whether interactions with satisfaction with different life domains contribute to a better understanding of the effect of CS on SWB while controlling for covariates. In doing so, this study aims at understanding how differences in WFH frequencies impact on the relationships between CS and SWB while simultaneously accounting for satisfaction with non-travel-related life domains. As seen in Fig. 1, each layer symbolizes the different WFH frequency, while controlling for those who never WFH.

3. Research design

This paper explores the impact of commuting satisfaction (CS) on satisfaction with non-travel-related life domains and subjective well-being (SWB) for different WFH frequencies using data administered in the Grand Duchy of Luxembourg through an online large-scale survey. The data collection took place after the COVID 19 pandemic, which gave us a better understanding of the relationship between CS and SWB linked to changes in WFH practices.

3.1. Study setting

The Grand Duchy of Luxembourg, a small Western European country, features a high-income economy and a compact yet growing population. Luxembourg shares its border with neighboring countries (i.e. Belgium, France and Germany). Public transportation, mainly buses and trains, serves this network of settlements. Despite public transport's increasing importance, the nation faces a challenge with its high motorization rate, the EU's highest at 682 cars per 1000 inhabitants. Car-oriented mobility culture is evident, with 73 % of commuting trips made by car, 19 % by PT and 8 % by active transport (Bausch, 2017). In an effort to mitigate the high dependency of cars and increase social cohesive the government introduced free public transport in Luxembourg in 2020.

3.2. Sampling

For the sampling, we used the 2020–21 repositories of the General Inspectorate for Social Security (IGSS) data to identify 10,000 (employed) people who are working in Luxembourg. The identification of the sample was done using a stratified random sample and controlled for gender and cross-border workers (living in one of the three neighboring countries (Belgium, France and Germany), but working in Luxembourg). Then invitation letters were sent to these 10,000 people to participate in an online survey. The survey was launched in July 2022 in four languages: Luxembourgish, French, German and English. Then reminder letters were sent in October 2022, which eventually led to a response rate of 10 %, with complete responses translating to 852 respondents. Table 1 compares the descriptive statistics of the sample of IGSS against the respondents of this study and the employed population in Luxembourg (STATEC, 2022) to highlight the representativeness of our sample.

3.3. Key variables

The survey comprised four modules: Employment Characteristics, Daily Mobility Characteristics, Satisfaction Module and Personal Characteristics. In the first module, we asked questions about the type of job, work contract, place of work and WFH frequency. The second module dealt with the characteristics of the commute, such as distance, travel time and travel mode, as well as satisfaction with the recent commute trip and commuting in general. The third module built on the satisfaction questions and asked respondents to self-report their satisfaction with different life domains such as job, place of work, time-use, leisure time, health, personal relationships, place of residence and overall life. In the last module, we put all socio-demographic questions related to age, gender, education, income, and residence place. The completeness in the responses on satisfaction variables and the WFH frequency made this dataset uniquely appropriate to investigate how WFH practices influence the relationship between CS and all other aspects linked to it,

Table 1
Descriptive statistics.

	IGSS	Survey	STATEC
	Sample (10,000) (In %)	Respondents (n = 852) (In %)	(Employed) population of Luxembourg (in % as of 2020)
Age (Less than 29 years)	8.5	13.4	–
Age (Between 30 and 49 years)	56.4	59.9	–
Age (50 years and above)	35.1	26.6	–
Female	40.7	43.4	33.8
Male	59.3	56.5	66.2
Resident commuters	61.0	56.8	54.0
Cross-border commuters	39.0	43.2	46.0

including SWB.

As seen in Fig. 1, the endogenous variable in our conceptual model refers to **subjective well-being** (SWB). Respondents were asked to self-report their satisfaction with life on a single-item question: "*How satisfied are you currently with your overall life (taking into account all aspects of your life)*?" where answers were given on a 5-point Likert scale ranging from 0 (very dissatisfied) to 5 (very satisfied). This approach to measure SWB is supported by the methodologies used in past well-being research (Cheung & Lucas, 2014; Diener et al., 2013; Eurostat, 2021; Maheshwari et al., 2022a). Respondents were also asked about their **satisfaction with commuting** on a 5-point Likert scale ranging from 0 (very dissatisfied) to 5 (very satisfied) using a single-item question: "*Overall, how satisfied are you with your current daily commute to work?*". Measuring CS based on one question has been a common approach in travel satisfaction literature (Maheshwari et al., 2022a; Mao et al., 2016; Milakis et al., 2015). The survey also consisted of single-item questions related to measuring individual's satisfaction with other life domains such as satisfaction with job, location of the job, time-use, leisure time, personal relationship, accommodation, residential place and health on a 5-point Likert scale in the same way as for measuring CS and SWB. These questions were inspired by other existing surveys, like the European Union Statistics on Income and Living Conditions (EU-SILC) survey, which was administered in 32 European countries (Eurostat, 2018). However, due to the relatively high correlation between satisfaction with the house and residential neighbourhood satisfaction variables ($r < 0.5$), a new variable "**satisfaction with place of residence**" was created by averaging the two items, which was then used in the further analysis. In the questionnaire, respondents were also asked to rate their **satisfaction with their recent commute trip** using the Satisfaction with Travel Scale (STS). This scale assesses the emotions people have experienced during their recent commute and how well they evaluate it. As such, the STS assess the affective and cognitive components of trip satisfaction. The validity of this scale is well documented in the literature (Ettema et al., 2011; Friman et al., 2013) and has been widely used in travel satisfaction studies (e.g. (Mokhtarian & Pendyala, 2018)). The scale consists of 9 items with each item ranging from −3 to +3. With a Cronbach's alpha of 0.9, a new variable called "trip satisfaction" was formed by averaging the scores on the 9 items. Table 2 provides details of the satisfaction variables and their mean values. Across all the life domains including CS, highest level of satisfaction among the respondents is for satisfaction with the place of residence whereas the lowest level is for CS.

In the analysis, we also controlled for trip characteristics variables, including travel mode (public transport, active modes and cars) and commuting time (less than 30 min one-way, between 30 and 60 min one-way and more than 60 min one-way) as well as socio-demographic variables such as gender (male, female) and children (yes, no). Lastly, respondents were asked about their WFH frequency: "*How many days per week do you currently work from home?*" and could choose one of the following options (i) never, (ii) less than once a week, (iii) once a week, (iv) twice a week, (v) 2–3 times a week, or (vi) 4 or more times a week. Based on the WFH categories as shown in Fig. 1, and considering employment status (full-time or part-time), four new variables were created: Never WFH, Occasional WFH, Hybrid WFH and Full-time WFH. Respondents who indicated 'never' were labeled as 'Never WFH' (52 %). Full-time workers indicating 'less than once a week' or 'once a week,' and part-time workers indicating 'less than once a week,' were categorized as 'Occasional WFH' (30 %). 'Hybrid WFH' included full-time workers selecting 'twice a week' or '2–3 times a week,' and part-time workers selecting 'once a week' (12 %). 'Full-time WFH' choosing '4 or more times a week' and part-time workers choosing '2–3 times a week' (6 %).

3.4. Methodology: a multigroup SEM

All the relationships discussed in the section 2 will be estimated using a Structural Equation Model (SEM). A SEM is an appropriate methodology to test the relationships between the variables as it can estimate all the regression equations simultaneously as opposed to a traditional regression model. This means that a variable can be an explanatory variable in one equation but a predicted variable for another equation. For example, Fig. 1 shows how CS is influenced by sociodemographic and trip characteristics on one hand, but it also shows how CS is then influencing satisfaction with other life domains Therefore, in SEM, instead of labelling variables as 'dependent' or 'independent', we label them as 'endogenous' and 'exogenous' variables. The former are those that are influenced by other variables, whereas the latter are those that are not influenced by other variables. In doing so, we form a path model which illustrates all the

Table 2
Key variables and their mean values.

Variables	Mean	SD	Min	Max
Subjective well-being	3.64	0.85	1	5
Commuting satisfaction	2.92	1.26	1	5
Job satisfaction (feeling fulfilled or enjoying work)	3.61	1.04	1	5
Workplace location satisfaction (workplace environment, such as access to public transport, parking, distance between work and home, etc.)	3.30	1.17	1	5
Time use satisfaction (amount of time available to do things one needs/wants to do)	2.97	1.12	1	5
Leisure time satisfaction (amount of time spent running, cycling, exercising, going out with family or friends, going to the cinema, etc.)	3.16	1.08	1	5
Personal relationship satisfaction (propensity to meet relatives, friends, work colleagues, etc.)	3.75	0.90	1	5
Place of residence (the area of the house, the presence of a balcony, the energy efficiency of the house, etc. + accessibility of the neighborhood such as access to shops, public transport, school, proximity to a park, etc.)	4.07	0.86	1	5
Health satisfaction (in general, including both mental and physical health).	3.53	0.95	1	5
Trip satisfaction (emotions experienced during your recent commute to work trip)	−0.13	1.49	−3	3

Note: Min = Minimum value, Max = Maximum value, SD = Standard Deviation.

relationships between the exogenous and endogenous variables. Path models are increasingly used in travel behavior research to investigate complex relationships (Van Acker et al., 2007). When path models are combined with confirmatory factor analysis (a measurement model that defines relationships between observed and latent variables), a full SEM model is created. However, since there are no latent or indirectly observed variables in this analysis, we only use the part of SEM that estimates structural relationships. In other words, a path model.

Path models are estimated using a covariance-variance matrix, which is inputted in the IBM SPSS AMOS program to estimate the structural relationships between the variables with the help of a standard maximum likelihood (ML) estimation technique. However, ML estimation assumes a multivariate normal distribution of all the endogenous variables. Since all endogenous variables are not normally distributed, we combined the ML technique with bootstrapping to overcome this problem (Byrne, 2016). Bootstrapping is a statistical resampling technique that uses random sampling with replacement from the original sample to obtain robust p-values (Fang & Ma, 2017).

Finally, in one single step, we drew relationships between the variables of interest i.e. from (i) trip satisfaction on CS, satisfaction with other life domains and SWB; (ii) CS on satisfaction with life domains and SWB and; (iii) satisfaction with life domains other than CS on SWB, while also controlling for socio-demographic and trip characteristics as shown in Fig. 2. However, at this stage, we did not draw any relationship between the seven domain satisfaction variables, because from past literature we know that each life domain is connected and integrated in people's life in a specific way and that satisfaction with each life domain is somehow affected by travel (Veenhoven, 2012; Zarabi et al., 2019). Then we estimated all the relationships described in this model at once and then deleted all insignificant relationships one by one until we found a solution with only significant relationships at $p < 0.1$. This is a restrictive backward selection technique in which all insignificant relationships are deleted to achieve an improved model fit. Meanwhile, we also added covariance between all exogenous variables (i.e. socio-demographic and trip characteristics), which improved the model fit without any changes in the estimated path coefficients. Lastly, we examined the modification indices (MI), a technique to determine how the chi-square value can be improved by adding a relationship between the variables. In doing so, we carefully added meaningful relationships between the domain satisfaction variables by looking at the highest MI from the output table. If the relationships between the domain variables were supported by past evidence, then we included these interactions. For instance, time-use satisfaction is directly impacting on the domain satisfaction variables and leisure-time satisfaction is also directly impacting on personal relationships and health satisfaction (see Fig. 2).

Nevertheless, we are also interested in whether and how the relationships as depicted in Fig. 2 differ between different WFH frequencies. Therefore, instead of conducting a separate analysis for each WFH frequency, we advance a multiple group path analysis. The advantage of this method is that all relationships between the variables are estimated using the same paths in a single analysis for different WFH frequencies. As shown in Fig. 2, WFH variables are not included as explanatory variables but instead as a grouping

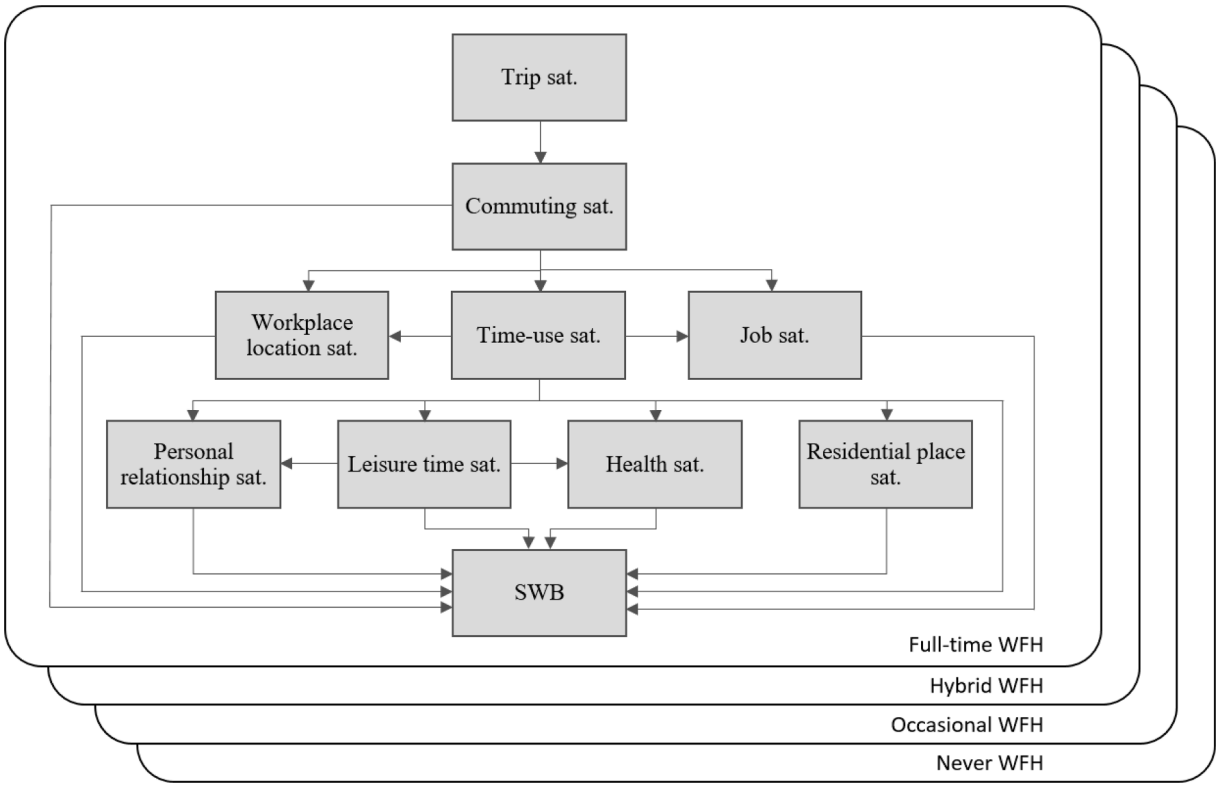


Fig. 2. Multiple group path model for different WFH frequencies.

variable.

To advance a multiple group path analysis, we need to compare a model with cross-group equality constrains (restricted model – with full sample) against another model without such constrains. A significantly worse fit of the constrained model would mean that the model has significantly deteriorated and that we reject the null hypothesis that the parameters are equal between the groups (Kline, 2015). In this analysis, we first constrain the relationships between the exogenous and the endogenous variables to be equal across never WFH, occasional WFH, hybrid WFH and full-time WFH and then we unconstrained these relationships across the four groups and allow them to be estimated freely.

4. Results

4.1. Descriptive results

To confirm whether the satisfaction variables differ between WFH frequencies, we conducted the analysis of variance (ANOVA) test. To respect the length of the paper, we only describe the differences for CS and SWB for each WFH frequency, as these are the main components of the conceptual model. The ANOVA test confirmed that the mean value of CS ($F = 7.26$ with $p < 0.1$) and SWB ($F = 2.00$ with $p < 0.1$) differed significantly between WFH frequencies. Post-hoc Tukey tests confirmed that CS significantly differs between never and occasional WFH, occasional and hybrid WFH, and occasional and full-time WFH. The mean CS value is higher for full-time WFH than for other WFH frequencies. Likewise, SWB differs significantly between hybrid and occasional WFH, with the former group experiencing higher levels of SWB compared to the latter. Table 3 presents the results of socio-demographic and trip characteristics for different WFH groups, with those who commute to their office daily accounting for almost 50 % of our sample size.

4.2. Multiple group path analysis

Post-hoc tests confirmed that significant differences exist between WFH frequency groups. Thus, we now advance a multiple group path analysis to identify how the relationship between CS, domain satisfaction and SWB might differ for different types of WFH frequencies. The first step is to compare the results of a constrained model (full sample) with the unconstrained model (four sub-samples). This yielded a chi square difference test (CMIN = 231.67, DF = 189, P = 0.02) that indicated a significant decrease in the model fit when structural parameters are constrained across WFH frequencies. Therefore, we further our analyses with the unconstrained model, where structural parameters differ across WFH frequencies, while comparing the results with the constrained model to understand the consequences of neglecting differences across WFH frequencies. As presented in Table 4, the magnitude of the relationship between the endogenous variables and SWB is consistent in both the constrained and unconstrained models. However, it is worth noting that job, workplace location, and personal relationship satisfaction show a negative relationship with SWB, although these associations are not statistically significant. The findings suggest that neglecting WFH differences would lead to an overestimation of the influence of life domain satisfaction (including commuting) on SWB for the groups with hybrid and full-time WFH, and to an underestimation for the groups with never and occasional WFH. This is because the coefficients are (in most cases) generally lower for hybrid and full-time WFH models than for the constrained model, and higher for occasional and never WFH models than for the constrained model. These results lend support to the differential impact of life domain satisfaction on SWB when the frequency of WFH is taken into account and highlight the usefulness of examining the four sub-models in more detail.

4.3. Direct, indirect and total effects on SWB for different WFH frequencies

The central paths of the conceptual model i.e. the relationship between CS and SWB, while taking into account satisfaction with other life domains, are shown in Fig. 3(a – d). CS has a direct effect on SWB. CS also influences SWB in many indirect ways. First, it has an influence on time-use satisfaction (TUS), which in turn influences people's SWB. Second, CS has a direct influence on satisfaction with workplace location (WPLS), which in turn influences people's SWB. Third, CS has a direct effect on job satisfaction (JS), which carries on this effect on people's SWB. Fourth, CS has an effect on TUS, and from TUS this effect goes to all other life domains such as satisfaction with personal relationships (PRS), satisfaction with leisure (LTS), satisfaction with health (HS) and satisfaction with place of residence (RPS), including JS and WPLS, and each of these life domains then has an influence on SWB. Finally, there are two possible interactions within the life domains: LTS on PRS on SWB and LTS on HS on SWB. These possible paths exemplify associations between CS and SWB, taking into account satisfaction with the life domains. Based on the model in Fig. 3, we can argue that not all the life domains are at the same level. The indirect effect of CS on SWB is first mediated by the life domain of time use, workplace location and job and then by other life domains such as personal relationship, leisure-time, health and residential place.

A detailed overview of the direct, indirect and total effects of CS on life domain satisfaction and SWB for different WFH frequencies is described in Table 5. The results for the group that never WFH seems to be consistent with previous research on the relationship between CS and SWB. This is also logical because these individuals still commute to work and therefore we find a significant direct effect of CS on SWB at $p < 0.001$. For occasional and hybrid WFH groups, however, CS no longer has a significant direct effect on SWB, but only indirectly. For full-time WFH group, CS has neither direct nor indirect effect on SWB. This makes sense since people who telework for four or more times a week have to commute to a limited extent and we therefore do not see a connection between CS and SWB.

Job satisfaction (JS), i.e. feeling fulfilled or happy at work, has a positive but only direct influence on SWB. This means that people who are satisfied with their work tend to report higher levels of SWB. However, this is only true for people who never or only

Table 3
Descriptive statistics across the WFH groups and all respondents.

	Never WFH (n = 443)		Occasional WFH (n = 256)		Hybrid WFH (n = 106)		Full-time WFH (n = 47)		All respondents (n = 836)	
	Total	%	Total	%	Total	%	Total	%	Total	%
Socio-demographic characteristics										
Female	191	55.36	99	28.70	36	10.43	19	5.51	345	100
Male	224	49.45	138	30.46	66	14.57	25	5.52	453	100
Have children	179	50.71	121	34.28	38	10.76	15	4.25	353	100
No children	71	46.71	40	26.32	27	17.76	14	9.21	152	100
Trip characteristics (travel time and commute mode)										
Less than 30 min	211	60.11	66	18.80	55	15.67	19	5.41	351	100
Between 30 and 60 min	145	46.62	107	34.41	37	11.90	22	7.07	311	100
More than 60 min	79	45.40	78	44.83	13	7.47	4	2.30	174	100
Car use	333	57.71	168	29.12	49	8.49	27	4.68	577	100
Public transport	81	40.30	70	34.83	39	19.40	11	5.47	201	100
Active mode	20	40.82	10	20.41	16	32.65	3	6.12	49	100

Table 4
Model estimation results for SWB (unstandardized total effect).

	Constrained model	Unconstrained model			
		Never WFH	Occasional WFH	Hybrid WFH	Full-time WFH
Trip satisfaction	0.12 ***	0.09 ***	0.17 ***	0.09 ***	0.08
Commute satisfaction	0.10 ***	0.11 ***	0.08 *	0.07 *	0.13
Job satisfaction	0.12 ***	0.15 ***	0.10 **	0.06	−0.02
Workplace location satisfaction	−0.00	0.01	−0.01	0.07	−0.07
Time use satisfaction	0.35 ***	0.33 ***	0.36 ***	0.36 ***	0.41 **
Leisure time satisfaction	0.26 ***	0.25 **	0.28 **	0.22 **	0.31 *
Health satisfaction	0.30 ***	0.27 ***	0.36 ***	0.17 *	0.48 *
Personal relationship satisfaction	0.11 **	0.11 **	0.14 **	0.15	−0.01
Residential place satisfaction	0.15 **	0.14 **	0.11 **	0.24 ***	0.18

*** < 0.01; ** < 0.05; * < 0.10.

occasionally engage in WFH, and not for groups who engage in hybrid or full-time telework. Furthermore, to our surprise, satisfaction with the location of the workplace (WPLS), i.e. proximity to public transport, parking, etc., has no significant effect on SWB in all models. Either the effect of WPLS on SWB is picked up by CS ($r = 0.40$) or by TUS ($r = 0.31$), as there is a high correlation with WPLS. The positive (but not significant) correlation between WPLS and SWB is understandable, in contrast to the negative (but not significant) correlation for the occasional and full-time WFH groups.

Time-use satisfaction (TUS) has no direct effect on SWB, but only an indirect positive effect via satisfaction with life domains. This is true for all the models. The models also indicate that TUS has the strongest total effect on SWB compared to other life domains (see standardized coefficient). This lend to support that TUS is probably the most important life domain. In other words: When people are satisfied with their time use, they are also satisfied with their other life domains, which in turn has a positive effect on their SWB. Although the standardized coefficients for the impact of TUS on SWB differ slightly across the models, the magnitude of the coefficients suggests that those who telework may report higher SWB probably than those who never WFH, possibly due to the flexibility and autonomy linked to WFH. Leisure time satisfaction (LTS) refers to time spent on leisure activities such as running, cycling, playing sports, going out with family or friends, going to the cinema, etc. Like TUS, leisure is another time variable that has a significant impact on SWB. However, unlike TUS, LTS has a direct influence on SWB even among those who never or only occasionally work from home. This could suggest that workers who commute to the office more often than others have more opportunity to have drinks after work or participate in social activities outside work, which could improve their LTS and thus their SWB. Overall, LTS has a significant effect on SWB in all models ($p < 0.05$) and a higher p-value ($p < 0.1$) for the full-time teleworkers. The difference in p-value may indicate that the relationship between LTS and SWB is likely to be ambiguous for full-time teleworkers.

Satisfaction with health (HS) refers to a person perception of overall health, including mental and physical health. The results suggest that HS has a direct significant effect on SWB in all the models; however, the effect is stronger at $p < 0.01$ for the groups with never and occasional WFH than for the groups with hybrid and full WFH, where it is significant at a higher p-value ($p < 0.1$). The different p-values could indicate that the relationship between HS and SWB is not necessarily positive, especially for those who frequently engage in WFH. The impact of personal relationship satisfaction (PRS) on SWB differs significantly between those who engage in less WFH (never and occasional WFH) and those who engage in more WFH (hybrid and full-time WFH). For the former groups, the impact on SWB is direct and significant, whereas for the latter groups, the impact on SWB is insignificant (and even negative for full-time WFH). This implies that individuals who commute to the office more often are more likely to meet work colleagues and family members away from home, which could increase their PRS and thus their SWB. Nevertheless, due to the

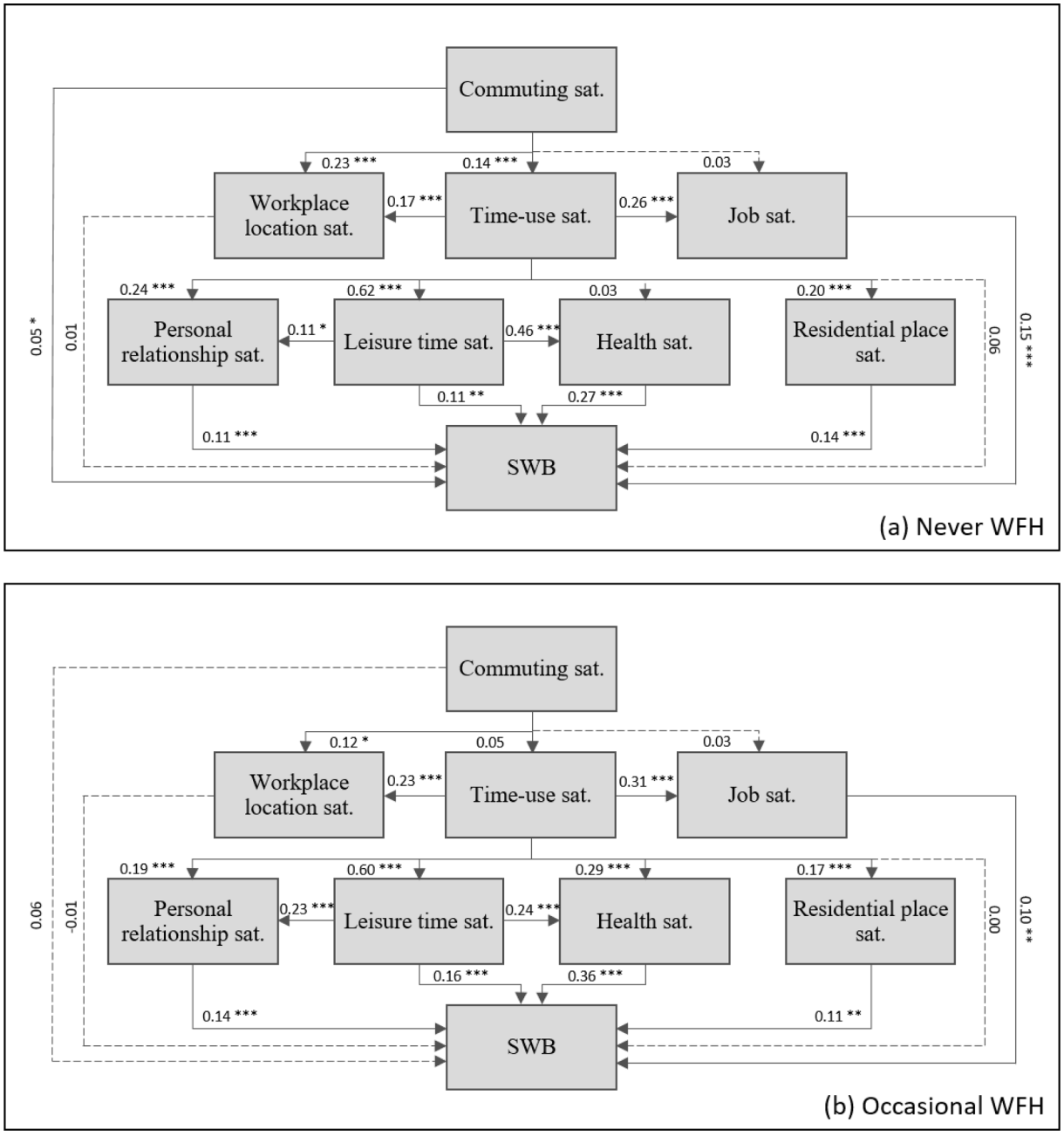
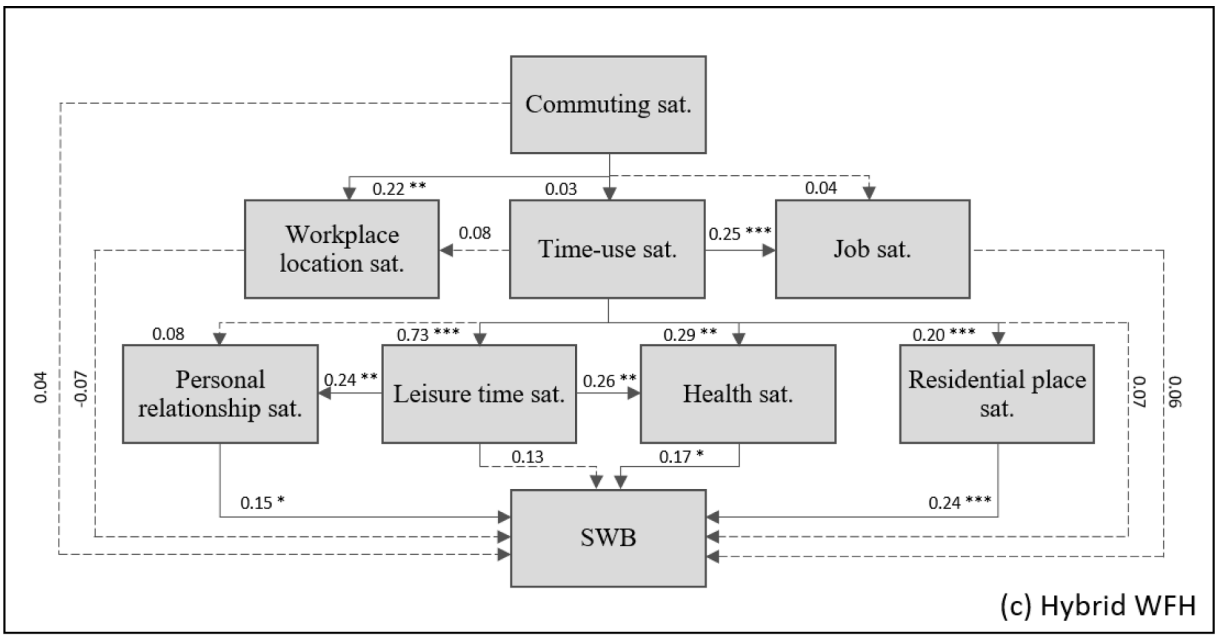


Fig. 3. (a-d): Model estimates for four WFH frequencies.

insignificant effect of PRS on SWB among frequent teleworkers, we cannot say whether WFH limits opportunities for social interactions due to fewer ties with colleagues or whether WFH hinders personal relationships due to an unclear work-family balance. For satisfaction with place of residence (RPS), i.e. satisfaction with the home and neighborhood environment, the results indicate a significant direct effect on SWB for all groups except full-time teleworkers. This is somewhat surprising as full-time teleworkers spend most of their time either working or doing other activities from home and therefore RPS should have contributed to SWB. Lastly, trip satisfaction has no direct effect on SWB, but has an indirect effect through satisfaction with life domains, including CS. The positive association between trip satisfaction and SWB is also discussed in the past literature (De Vos, 2019; Mokhtarian & Pendyala, 2018). Overall, the results suggest that hybrid teleworkers tend to report the highest levels of SWB, while individuals who occasionally WFH have the lowest levels of SWB.

Table 6 shows the effect of socio-demographic variables on SWB. Female respondents who never or occasionally engage in WFH



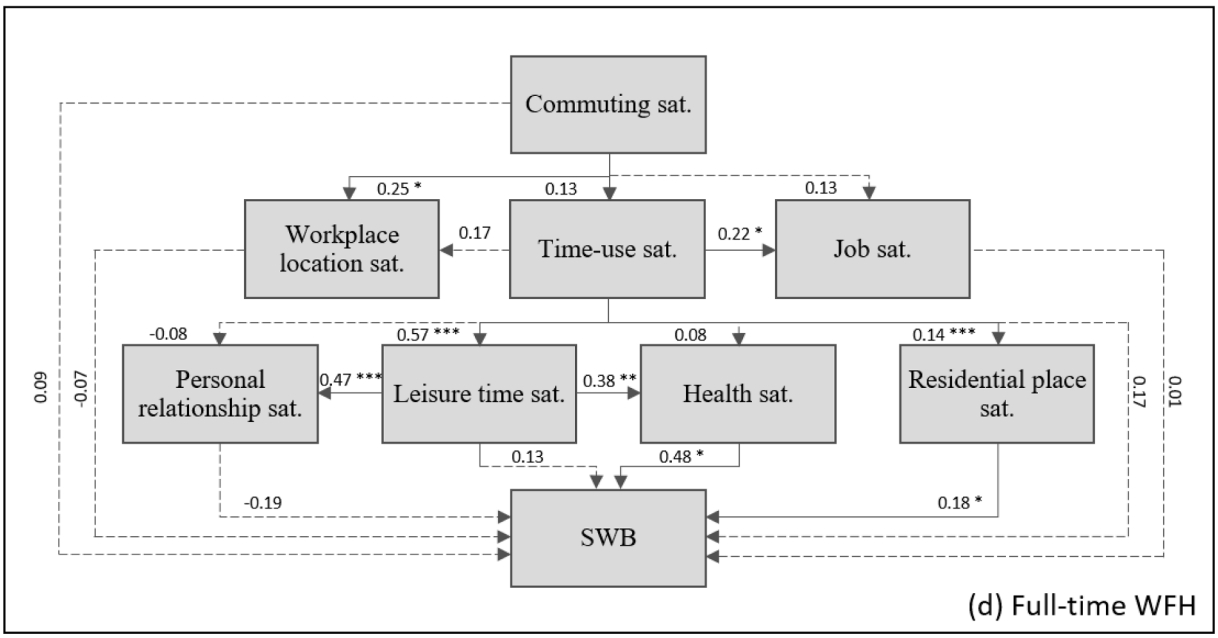


Fig. 3. (*continued*).

had lower levels of SWB than male respondents. The indirect effect of gender on SWB is via satisfaction with trip and commuting satisfaction. In other models, gender has no effect on SWB. Our results on the impact of gender on SWB are in contrast to the reports of Schwanen and Wang (2014). Surprisingly, presence of children in the household has no significant effect on individuals' SWB, which contrasts the results of previous studies (e.g. Pataki-Bittó and Kun (2022)). In terms of travel characteristics, public transport users have a significantly higher SWB (indirectly) compared to car users. For active transport users, there is no significant difference compared to car users. The influence of the mode of transport on SWB is through trip satisfaction, CS and WPLS. It is worth noting that this effect is observed only within the groups who never and occasional WFH. Conversely, for other groups that do not commute to work as frequently, no statistically significant impact of the mode of transport on SWB is observed. Public transport users scoring higher levels of SWB than car users might be because public transport in Luxembourg is free. Even though public transport users complain about operational aspects such as travel time, reliability, etc., loyal public transport users are satisfied with several service attributes (Maciejewska et al., 2023). Moreover, those commuting by car are often stuck in traffic jams and pay for parking fees,

Table 5
Direct, indirect and total effect of endogenous variables on SWB (unstandardized and standardized coefficients).

	Never WFH			Occasional WFH			Hybrid WFH			Full-time WFH		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Commuting satisfaction	0.05 *	0.05 ***	0.11 ***	0.06	0.02	0.08 *	0.04	0.03	0.07 *	0.09	0.03	0.13
	0.09	*0.07*	*0.18*	*0.09*	*0.02*	*0.12*	*0.07*	*0.05*	*0.12*	*0.13*	*0.05*	*0.19*
Job satisfaction	0.15 ***	0.00	0.15 ***	0.10 **	0.00	0.10 ***	0.06	0.00	0.06	0.01	0.00	0.01
	0.20	*0.00*	*0.20*	*0.13*	*0.00*	*0.13*	*0.08*	*0.00*	*0.08*	*0.01*	*0.00*	*0.01*
Workplace location satisfaction	0.13	0.00	0.01	−0.01	0.00	−0.01	0.07	0.00	0.07	−0.07	0.00	−0.07
	0.01	*0.00*	*0.01*	*−0.02*	*0.00*	*−0.02*	*0.11*	*0.00*	*0.11*	*−0.09*	*0.00*	*−0.09*
Time use satisfaction	0.06	0.27 **	0.33 ***	0.00	0.36 **	0.36 **	0.07	0.29 ***	0.36 ***	0.17	0.24 **	0.41 **
	0.08	*0.40*	*0.45*	*0.10*	*0.49*	*0.50*	*0.10*	*0.40*	*0.50*	*0.20*	*0.29*	*0.50*
Leisure time satisfaction	0.11 **	0.14 ***	0.25 **	0.16 **	0.12 ***	0.28 **	0.13	0.08 **	0.22 **	0.13	0.17	0.31 *
	0.15	*0.18*	*0.34*	*0.20*	*0.16*	*0.36*	*0.19*	*0.11*	*0.31*	*0.15*	*0.20*	*0.35*
Health satisfaction	0.27 ***	0.00	0.27 ***	0.36 ***	0.00	0.36 ***	0.17 *	0.00	0.17 *	0.48 *	0.00	0.48 *
	0.33	*0.00*	*0.33*	*0.42*	*0.00*	*0.42*	*0.21*	*0.00*	*0.21*	*0.48*	*0.00*	*0.48*
Personal relationship satisfaction	0.14 **	0.00	0.16 **	0.14 **	0.00	0.14 **	0.15	0.00	0.15	−0.01	0.00	−0.01
	0.13	*0.00*	*0.13*	*0.15*	*0.00*	*0.15*	*0.17*	*0.00*	*0.17*	*−0.02*	*0.00*	*−0.02*
Residential place satisfaction	0.14 **	0.00	0.14 **	0.11 **	0.00	0.11 **	0.24 ***	0.00	0.24 ***	0.18	0.00	0.18
	0.16	*0.00*	*0.16*	*0.11*	*0.00*	*0.11*	*0.27*	*0.00*	*0.27*	*0.17*	*0.00*	*0.17*
Trip satisfaction	0.00	0.09 ***	0.09 ***	0.00	0.17 ***	0.17 ***	0.00	0.09 ***	0.09 ***	0.00	0.08	0.08
	0.00	*0.22*	*0.17*	*0.00*	*0.30*	*0.30*	*0.00*	*0.17*	*0.17*	*0.00*	*0.14*	*0.01*

Standardized coefficients in italics.
*** < 0.01; ** < 0.05; * < 0.10.

Table 6
Direct, indirect and total effect of exogenous variables on SWB (unstandardized and standardized coefficients).

	Never WFH			Occasional WFH			Hybrid WFH			Full-time WFH		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
SED Female (ref: Male)	–	−0.04 ***	−0.04 ***	–	−0.10 ***	−0.10 ***	–	0.00	0.00	–	−0.06	−0.06
		−0.02	*−0.02*		*−0.06*	*−0.06*		*0.00*	*0.00*		*−0.03*	*−0.03*
Children (ref: No children)	–	−0.02	−0.02	–	0.00	0.00	–	0.08	0.08	–	0.27	0.27
		−0.01	*−0.01*		*0.00*	*0.00*		*0.05*	*0.05*		*0.15*	*0.15*
Use PT (ref: Use cars)	–	0.07 ***	0.07 ***	–	0.15 ***	0.15 ***	–	0.10	0.10	–	0.06	0.06
		0.03	*0.03*		*0.07*	*0.07*		*0.06*	*0.06*		*0.03*	*0.03*
Use soft modes (ref: Use cars)	–	0.03	0.03	–	0.19 **	0.19 **	–	0.09	0.09	–	0.13	0.13
		0.01	*0.01*		*0.04*	*0.04*		*0.04*	*0.04*		*0.03*	*0.03*
Between 30 and 60 min (ref: < 30 min)	0.13	−0.12	0.01	0.14	−0.22 **	−0.07	0.15	−0.08	0.07	−0.24	−0.08	−0.33
	0.08	*0.00*	*0.00*	*0.08*	*−0.12*	*−0.04*		*0.09*	*0.04*	*−0.13*	*−0.04*	*−0.17*
More than 60 min (ref: < 30 min)	0.23	−0.29	−0.05	−0.01	−0.38 ***	−0.40 ***	0.24	−0.41 **	−0.17	−0.09	−0.46	−0.55
	0.11	*−0.02*	*−0.02*	*−0.00*	*−0.20*	*−0.21*		*0.09*	*−0.07*	*−0.02*	*0.14*	*−0.17*

Standardized effect in italics.
- = no significant effect found and therefore relationship was deleted from the model.
*** < 0.01; ** < 0.05; * < 0.10.

whereas public transport users can make their commute more worthwhile by engaging in activities during their journey, such as working or reading (Cornet et al., 2022). Finally, workers with a commute time of less than 30 min each way are the most satisfied compared to their colleagues. The indirect effect of commute time on SWB comes from satisfaction with trip, satisfaction with life domains such as CS, TUS, WPLS and PRS. In other words: If people are satisfied with their commute time, then this is likely to be reflected in their satisfaction with life domains including commuting, which in turn increases their SWB.

5. Discussion and conclusion

In this study, we explore the impact of CS on SWB while considering satisfaction with other life domains and examine how the relationship between these variables differs for different WFH frequencies. In doing so, this study contributes to the existing research debate on the relationship between travel satisfaction and SWB and highlights nuances of how changes in work practices could potentially affect the relationship between CS and SWB. Overall, using an online survey and estimating a multiple group SEM, six key findings emerged.

First, hybrid teleworkers (who WFH 2–3 days per week and in the office the rest of the week) have the highest mean SWB (3.80), while individuals who engage in occasional WFH (who WFH less than one or one day per week and in the office most days) have the lowest mean SWB (3.55).[1] A possible argument for this could be that hybrid teleworkers do not need to commute to their workplace every day and can therefore use the time they spend on a long and stressful commute for other activities. The elimination of commuting time may in turn improve their SWB. This is consistent with previous (albeit limited) research that found that teleworkers have more control over their time use, which could lead to higher TUS and thus higher SWB (Golden et al., 2006). The fact that they go to the office almost half of the week could help them maintain their social ties in the office. Interaction with colleagues and a flexible work routine could thus contribute to improving the SWB of these hybrid teleworkers. In contrast, for occasional WFH group, commuting to work remains an important daily activity, and a long commute could increase negative emotions such as stress, frustration and anxiety, which could ultimately lower their SWB.

A comparison of the constrained model with the unconstrained model (see Table 4) points to our second finding that the constrained model over/underestimates the relationship between CS and SWB. For example, the effect of CS on SWB via satisfaction with life domains is overestimated for hybrid and full-time teleworkers and underestimated for the other groups. This could be because commuting is very limited for hybrid and full-time teleworkers and CS is therefore no longer relevant for explaining SWB. Nevertheless, for the never WFH group, CS has a significant effect on SWB, which is in line with previous studies (Chatterjee et al., 2020; Clark et al., 2020; Ettema et al., 2011; Kahneman et al., 1999; Stutzer & Frey, 2008). For hybrid teleworkers, the path from CS to SWB via RPS remains important, but the restricted model underestimates this effect. Even though the boundaries between work and

[1] 3.64 mean SWB for never WFH and 2.61 mean SWB for full-time WFH.

personal life is a bit blur for these teleworkers as they spend most of their time at home, the path from CS to SWB via JS is not significant. This result is at odds with previous findings (Blahopoulou et al., 2022; Cannas et al., 2019). The effect of CS on SWB via HS is less strong for teleworkers compared to the never and occasional WFH groups. A possible explanation could be that an increase in WFH provides fewer opportunities for physical activity or leads to a sedentary lifestyle, which in turn could affect the SWB of these teleworkers (de Oliveira da Silva Scaranni et al., 2023). Through these comparisons, this study supports the idea that WFH practices influence the relationship between CS, satisfaction with other life domains and SWB, and is therefore useful for policy makers and implementers to identify not only areas where employee SWB can be improved, but also how.

Third, our model (see Fig. 3) suggests that not all life domains are at the same level. CS first has a direct effect on TUS, WPLS and JS and then on SWB. For the other life domains (including WPLS and JS), the effect of CS is mediated through TUS and then on SWB. This suggests that satisfaction with the life domain variables is distributed across two levels, with TUS dominating in explaining the indirect effect of CS on SWB. This leads to our fourth finding that TUS is the most important life domain influencing SWB. Our findings are consistent with other studies on time use and SWB (Pabilonia & Vernon, 2021; Sharif et al., 2021). The indirect effects of TUS on SWB through satisfaction with other life domains opens an avenue for discussion and highlights how TUS could critically influence people's SWB through satisfaction with other life domains. Furthermore, the life domains of time use, leisure and health have significant effects on SWB in all groups, with the standardized coefficient of TUS being higher for all WFH frequencies.

Additionally, our model suggests that there are interactions within the life domains as highlighted in other, but very limited, studies (Gao et al., 2017; Kroesen, 2014; Maheshwari et al., 2022a, 2022b). Besides the direct effects of each life domains on SWB, domains such as CS, TUS and LTS also have an indirect effect on SWB. For CS, the indirect effect on SWB comes from TUS. For TUS, the indirect effect on SWB emanates from all possible life domains, while for LTS the indirect effect on SWB is either via PRS or HS. This leads to our next finding: although our model shows some interactions within life domains, there might be other interactions that were not captured from the travel perspective. However, from an economic, psychological and geographical perspective, other interactions within the satisfaction variables are possible. For example, from an economic perspective, there could be an interaction between JS and LTS. Studies have shown that time spent on work increases and consequently hours spent on leisure activities decrease (Yahyagil, 2015). This could lead to an increase in JS but a decrease in LTS and consequently affect individuals' SWB. Also, from a geographical perspective, working in an isolated location far from social amenities could lead to an increased sense of isolation or social seclusion, which could reduce people's satisfaction with PRS and LTS, which in turn could reduce SWB (Mouratidis, 2021). Future research is therefore needed to look at other potential interactions within these life domains.

Moreover, the inclusion of additional control variables, such as attitudes and socioeconomic and demographic, and work-related characteristics, might also be crucial in understanding the factors that affect the relationship between CS, satisfaction with life domains, and SWB across these four WFH practices. We also encourage future researchers to investigate the reverse directionality. For example, examining how individuals' overall SWB, whether positive or negative, may influence their satisfaction with different life domains and commuting satisfaction and how these relationships are influenced by different WFH practices. This bidirectional exploration holds significance in the context of eudaimonic well-being and calls for further investigation. Another avenue for future research could be to investigate how variations in WFH practices affect the relationship between CS and SWB. In order to test this effect, it is essential to incorporate WFH variable as a mediating variable inside the model, as opposed to treating it as a moderating variable outside the model. This avenue presents an interesting area for exploration in future research.

Finally, satisfaction with all life domains has a significant direct effect on SWB (except for workplace location satisfaction), suggesting that an increase in satisfaction with any of the life domains would increase individuals' SWB. For WPLS, the results are not significant, which is somewhat strange as previous findings show that the built environment of the workplace can contribute to people's SWB (Kent & Thompson, 2014; Tonne et al., 2021). This insignificant impact could be due to a misinterpretation of the question on WPLS in the survey. Respondents were asked to indicate their satisfaction with the location of their workplace; however, after the pandemic, the concept of workplace has changed. Depending on where people work, i.e. from home, in a remote location close to home or in a traditional office, WPLS may have a different meaning. Thus, it seems that respondents answered this question depending on where they spend most of their working time. Because of this ambiguity, further research on the impact of WPLS on SWB is recommended.

All in all, our findings linked to different WFH practices seem to be useful for policymakers who seek to increase the SWB of their population at large. For the group of never and occasional WFH users, policy makers can develop ideas to improve people's satisfaction with commuting, especially in an atypical case like Luxembourg where almost 45 % are cross-border workers. This could be achieved by making the public transport system more efficient and predictable, incentivizing companies to create a mobility plan for their employees to increase their satisfaction with commuting to work, and promoting sustainable alternatives to car use. For hybrid and full-time teleworkers, time use seems to be the most important life domain contributing to SWB. Therefore, policy makers can think about innovative solutions to improve people's satisfaction with their time use. This could be done by integrating public transport and land use (Hickman et al., 2013) so that workers have the possibility to combine several activities in a single trip, or by making office opening hours more flexible. In this context, policy makers can also think about creating flexible working conditions for employees. A flexible working environment would also act as a catalyst to encourage people to work more productively and efficiently in exchange for less commuting. To ensure the benefits of flexible working, policy makers should find creative labor market solutions to encourage WFH or working close to home. The establishment of co-working spaces could be an innovative solution to promote flexible working conditions (Howell, 2022).

CRediT authorship contribution statement

Richa Maheshwari: Writing – original draft, Visualization, Validation, Methodology, Formal analysis, Data curation, Conceptualization. **Veronique Van Acker:** Writing – review & editing, Supervision, Project administration, Funding acquisition. **Philippe Gerber:** Writing – review & editing, Supervision.

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.

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References

Allen, T.D., Golden, T.D., Shockley, K.M., 2015. How effective is telecommuting? assessing the status of our scientific findings. Psychological Science in the Public Interest 16 (2), 40–68. https://doi.org/10.1177/1529100615593273.

Babb, C., Olaru, D., Curtis, C., Robertson, D., 2017. Children's active travel, local activity spaces and wellbeing: a case study in Perth, WA. Travel Behaviour and Society 9, 81–94. https://doi.org/10.1016/j.tbs.2017.06.002.

Bausch F. (2017). *Enquête Luxmobil 2017. Ministry of Sustainable Development and Infrastructure*. Retrieved from http://www.developpement-durable-infrastructures.public.lu/fr/actualites/articles/2017/12/07-EnqueteMobilite/EnqueteMobilite-Presse-v2.pdf.

Bergstad, C.J., Gamble, A., Garling, T., Hagman, O., Polk, M., Ettema, D., Olsson, L.E., 2011. Subjective well-being related to satisfaction with daily travel. Transportation 38, 1–15. https://doi.org/10.1007/s11116-010-9283-z.

Blahopoulou, J., Ortiz-Bonnin, S., Montañez-Juan, M., Torrens Espinosa, G., García-Buades, M.E., 2022. Telework satisfaction, wellbeing and performance in the digital era. lessons learned during COVID-19 lockdown in Spain. Current Psychology 41 (5), 2507–2520. https://doi.org/10.1007/s12144-022-02873-x.

Byrne B.M. (2016). Structural Equation Modeling with Amos: Basic Concepts, Applications, and Programming, Third edition. Structural Equation Modeling with Amos: Basic Concepts, Applications, and Programming, Third edition. 10.4324/9781315757421.

Cannas, M., Sergi, B.S., Sironi, E., Mentel, U., 2019. Job satisfaction and subjective well-being in Europe. Economics and Sociology 12 (4), 183–196. https://doi.org/10.14254/2071-789X.2019/12-4/11.

Chatterjee, K., Chng, S., Clark, B., Davis, A., De Vos, J., Handy, S., Reardon, L., 2020. Commuting and wellbeing : a critical overview of the literature with implications for policy and future research. Transport Reviews 40 (1), 5–34. https://doi.org/10.1080/01441647.2019.1649317.

Chatterjee, K., Clark, B., Davis, A., & Toher, D. (2017). *The Commuting and Wellbeing Study*. Bristol. Retrieved from https://www.understandingsociety.ac.uk/research/publications/524474.

Cheung, F., Lucas, R.E., 2014. Assessing the validity of single-item life satisfaction measures: results from three large samples. Quality of Life Research 23 (10), 2809–2818. https://doi.org/10.1007/s11136-014-0726-4.

Clark, B., Chatterjee, K., Martin, A., Davis, A., 2020. How commuting affects subjective wellbeing. Transportation 47, 2777–2805. https://doi.org/10.1007/s11116-019-09983-9.

Cornet, Y., Lugano, G., Georgouli, C., Milakis, D., 2022. Worthwhile travel time: a conceptual framework of the perceived value of enjoyment, productivity and fitness while travelling. Transport Reviews 42 (5), 580–603. https://doi.org/10.1080/01441647.2021.1983067.

de Oliveira da Silva Scaranni, P., Griep, R.H., Pitanga, F.J.G., Barreto, S.M., Matos, S.M.A., de Jesus Mendes da Fonseca, M., 2023. Work from home and the association with sedentary behaviors, leisure-time and domestic physical activity in the ELSA-brasil study. BMC Public Health 23, 1–10. https://doi.org/10.1186/s12889-023-15167-z.

De Vos, J., 2018. Do people travel with their preferred travel mode? analysing the extent of travel mode dissonance and its effect on travel satisfaction. Transportation Research Part A 117, 261–274. https://doi.org/10.1016/j.tra.2018.08.034.

De Vos, J., 2019. Analysing the effect of trip satisfaction on satisfaction with the leisure activity at the destination of the trip, in relationship with life satisfaction. Transportation 46 (3), 623–645. https://doi.org/10.1007/s11116-017-9812-0.

De Vos, J., Schwanen, T., Van Acker, V., Witlox, F., 2013. Travel and subjective well-being: a focus on findings, methods and future research needs. Transport Reviews 33 (4), 421–442. https://doi.org/10.1080/01441647.2013.815665.

De Vos, J., Ettema, D., Witlox, F., 2019. Effects of changing travel patterns on travel satisfaction: a focus on recently relocated residents. Travel Behaviour and Society 16, 42–49. https://doi.org/10.1016/j.tbs.2019.04.001.

De Vos, J., Singleton, P.A., 2020. Travel and cognitive dissonance. Transportation Research Part A 138, 525–536. https://doi.org/10.1016/j.tra.2020.06.014.

Diener, E., 1984. Subjective well-being. Psychological Bulletin 95 (3), 545–575. https://doi.org/10.1037/0033-2909.95.3.542.

Diener, E., Inglehart, R., Tay, L., 2013. Theory and validity of life satisfaction scales. Social Indicators Research 112 (3), 497–527. https://doi.org/10.1007/s11205-012-0076-y.

Ettema, D., Gärling, T., Olsson, L.E., Friman, M., 2010. Out-of-home activities, daily travel, and subjective well-being. Transportation Research Part A 44 (9), 723–732. https://doi.org/10.1016/j.tra.2010.07.005.

Ettema, D., Gärling, T., Eriksson, L., Friman, M., Olsson, L.E., Fujii, S., 2011. Satisfaction with travel and subjective well-being: development and test of a measurement tool. Transportation Research Part F 14 (3), 167–175. https://doi.org/10.1016/j.trf.2010.11.002.

Ettema, D., Friman, M., Gärling, T., Olsson, L.E., Fujii, S., 2012. How in-vehicle activities affect work commuters ' satisfaction with public transport. Journal of Transport Geography 24, 215–222. https://doi.org/10.1016/j.jtrangeo.2012.02.007.

Ettema, D., Gärling, T., Olsson, L.E., Friman, M., Moerdijk, S., 2013. The road to happiness: measuring dutch car drivers' satisfaction with travel. Transport Policy 27, 171–178. https://doi.org/10.1016/j.tranpol.2012.12.006.

Eurofound. (2023). The rise in telework: Impact on working conditions and regulations. Retrieved from https://www.eurofound.europa.eu/en/publications/2021/rise-telework-impact-working-conditions-and-regulations.

Eurostat. (2018). Statistics on commuting patterns at regional level.

Eurostat. (2021). Quality of life indicators – overall experience of life – Statistics Explained. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Quality_of_life_indicators_-_overall_experience_of_life#Overall_life_satisfaction_in_the_context_of_quality_of_life.

Ewing, R., & Cervero, R. (2010). Travel and the built environment. *Journal of the American Planning Association*, (11). 10.1080/01944361003766766.

Fang, K., Ma, S., 2017. Analyzing large datasets with bootstrap penalization. Biometrical Journal 59 (2), 358–376. https://doi.org/10.1002/bimj.201600052.

Friman, M., Fujii, S., Ettema, D., Gärling, T., Olsson, L.E., 2013. Psychometric analysis of the satisfaction with travel scale. Transportation Research Part A 48, 132–145. https://doi.org/10.1016/j.tra.2012.10.012.

Gao, Y., Rasouli, S., Timmermans, H., Wang, Y., 2017. Understanding the relationship between travel satisfaction and subjective well-being considering the role of personality traits : a structural equation model. Transportation Research Part F 49, 110–123. https://doi.org/10.1016/j.trf.2017.06.005.
Golden, T.D., Veiga, J.F., Simsek, Z., 2006. Telecommuting's differential impact on work-family conflict: is there no place like home? Journal of Applied Psychology 91 (6), 1340–1350. https://doi.org/10.1037/0021-9010.91.6.1340.
Hamermesh, D.S., 2020. Life satisfaction, loneliness and togetherness, with an application to Covid-19 lock-downs. Review of Economics of the Household 18 (4), 983–1000. https://doi.org/10.1007/s11150-020-09495-x.
Handy, S., Thigpen, C., 2018. Commute quality and its implications for commute satisfaction: exploring the role of mode, location, and other factors. Travel Behaviour and Society 16, 241–248. https://doi.org/10.1016/j.tbs.2018.03.001.
Heady, B., Veenhoven, R., Wearing, A., 1991. Top-down versus bottom-up theories of subjective well-being. Journal of Happiness Studies 24 (1), 81–100. https://doi.org/10.1007/BF00292652.
Hickman, R., Hall, P., Banister, D., 2013. Planning more for sustainable mobility. Journal of Transport Geography 33, 210–219. https://doi.org/10.1016/j.jtrangeo.2013.07.004.
Howell, T., 2022. Coworking spaces: an overview and research agenda. Research Policy 51 (2), 104447. https://doi.org/10.1016/j.respol.2021.104447.
Jang, J., Ko, J., 2019. Factors associated with commuter satisfaction across travel time ranges. Transportation Research Part f: Traffic Psychology and Behaviour 66, 393–405. https://doi.org/10.1016/j.trf.2019.09.019.
Kahneman D., Diener E., & Schwarz N. (1999). *Well-Being: Foundations of Hedonic Psychology*. *Russell Sage Foundation*. Russell Sage Foundation.
Kent, J.L., Thompson, S., 2014. The three domains of urban planning for health and well-being. Journal of Planning Literature 29 (3), 239–256. https://doi.org/10.1177/0885412214520712.
Kline, R.B., 2015. Principles and Practice of Structural Equation Modeling 1. https://doi.org/10.15353/cgjsc.v1i1.3787.
Kroesen, M., 2014. Assessing mediators in the relationship between commute time and subjective well-being: structural equation analysis. Transportation Research Record 2452, 114–123. https://doi.org/10.3141/2452-14.
Künn-Nelen, A., 2015. Does commuting affect health? Health Economics 25 (8), 984–1004. https://doi.org/10.1002/hec.
Lorenz, O. (2018). Does commuting matter to subjective well-being? *Journal of Transport Geography*, *66*(April 2017), 180–199. 10.1016/j.jtrangeo.2017.11.019.
Ma, T., Van Acker, V., Gerber, P., 2021. Dissonance and commute satisfaction: which reference point to use ? Transportation Research Part D 100 (September). https://doi.org/10.1016/j.trd.2021.103046.
Maciejewska, M., Boussauw, K., Kębłowski, W., Van Acker, V., 2023. Assessing public transport loyalty in a car-dominated society: the case of Luxembourg. *journal of public*. Transportation 25 (September). https://doi.org/10.1016/j.jpubtr.2023.100061.
Maheshwari, R., Van Acker, V., De Vos, J., Witlox, F., 2022a. A multi-perspective review of the impact of a workplace relocation on commuting behaviour, commuting satisfaction and subjective well-being. Transport Reviews 1–22. https://doi.org/10.1080/01441647.2022.2119296.
Maheshwari, R., Van Acker, V., De Vos, J., Witlox, F., 2022b. Analyzing the association between satisfaction with commuting time and satisfaction with life domains: a comparison of 32 european countries. Journal of Transport and Land Use 15 (1), 231–248. https://doi.org/10.5198/jtlu.2022.2121.
Manaugh, K., El-Geneidy, A.M., 2013. Does distance matter ? exploring the links among values, mot- ivations, home location, and satisfaction in walking trips. Transportation Research Part A 50, 198–208. https://doi.org/10.1016/j.tra.2013.01.044.
Mao, Z., Ettema, D., Dijst, M., 2016. Commuting trip satisfaction in Beijing: exploring the influence of multimodal behavior and modal flexibility. Transportation Research Part A 94, 592–603. https://doi.org/10.1016/j.tra.2016.10.017.
Mas, A., Pallais, A., 2020. Alternative work arrangements. Annual Review of Economics 12. https://doi.org/10.1146/annurev-economics-022020-032512.
Milakis, D., Cervero, R., van Wee, B., Maat, K., 2015. Do people consider an acceptable travel time? evidence from Berkeley, CA. Journal of Transport Geography 44, 76–86. https://doi.org/10.1016/j.jtrangeo.2015.03.008.
Mokhtarian, P.L., Pendyala, R.M., 2018. Travel satisfaction and well-being. In: Friman, M., Ettema, D., Olsson, L.E. (Eds.), Quality of Life and Daily Travel. Springer International Publishing, pp. 17–39. https://doi.org/10.1007/978-3-319-76623-2_2.
Mokhtarian, P. L. (1991). *Defining Telecommuting*. Retrieved from https://escholarship.org/uc/item/35c4q71r.
Mokhtarian P.L. (2008). Examining the impacts of residential self-selection on travel behavior : A focus on methodologies, *42*, 204–228. 10.1016/j.trb.2007.07.006.
Morris, E.A., Hirsch, J.A., 2016. Does rush hour see a rush of emotions? driver mood in conditions likely to exhibit congestion. Travel Behaviour and Society 5, 5–13. https://doi.org/10.1016/j.tbs.2015.07.002.
Mouratidis, K., 2020. Commute satisfaction, neighborhood satisfaction, and housing satisfaction as predictors of subjective well-being and indicators of urban livability. Travel Behaviour and Society 21, 265–278. https://doi.org/10.1016/j.tbs.2020.07.006.
Mouratidis, K., 2021. Urban planning and quality of life: a review of pathways linking the built environment to subjective well-being. Cities 115. https://doi.org/10.1016/j.cities.2021.103229.
Mouratidis, K., Ettema, D., Næss, P., 2019. Urban form, travel behavior, and travel satisfaction. Transportation Research Part A 129, 306–320. https://doi.org/10.1016/j.tra.2019.09.002.
Nie, P., Sousa-Poza, A., 2018. Commute time and subjective well-being in urban China. China Economic Review 48, 188–204.
Nilles, J.M., 1975. Telecommunications and organizational decentralization. IEEE Transactions on Communications 23 (10), 1142–1147. https://doi.org/10.1109/TCOM.1975.1092687.
Pabilonia, S. W., & Vernon, V. (2021). *Telework and Time Use. GLO Discussion Paper, No. 970, Global Labor Organization (GLO), Essen*. 10.2139/ssrn.4114366.
Páez, A., Whalen, K., 2010. Enjoyment of commute: a comparison of different transportation modes. Transportation Research Part A 44 (7), 537–549. https://doi.org/10.1016/j.tra.2010.04.003.
Pataki-Bittó, F., Kun, Á., 2022. Exploring differences in the subjective well-being of teleworkers prior to and during the pandemic. International Journal of Workplace Health Management 15 (3), 320–338. https://doi.org/10.1108/IJWHM-12-2020-0207.
Pulido-Martos, M., Cortés-Denia, D., Lopez-Zafra, E., 2021. Teleworking in times of COVID-19: effects on the Acquisition of Personal Resources. Frontiers in Psychology 12 (June). https://doi.org/10.3389/fpsyg.2021.685275.
Rau, H., Popp, M., Namberger, P., Mögele, M., 2019. Short distance, big impact: the effects of intra-city workplace relocation on staff mobility practices. Journal of Transport Geography 79 (August), 102483. https://doi.org/10.1016/j.jtrangeo.2019.102483.
Scheepers, C.E., Wendel-Vos, G.C.W., den Broeder, J.M., van Kempen, E.E.M.M., van Wesemael, P.J.V., Schuit, A.J., 2014. Shifting from car to active transport: a systematic review of the effectiveness of interventions. Transportation Research Part a: Policy and Practice 70, 264–280. https://doi.org/10.1016/j.tra.2014.10.015.
Schneider, R.J., Willman, J.L., 2019. Move closer and get active: how to make urban university commutes more satisfying. Transportation Research Part F 60, 462–473. https://doi.org/10.1016/j.trf.2018.11.001.
Schwanen, T., 2002. Urban form and commuting behaviour: a cross-european perspective. Tijdschrift Voor Economische En Sociale Geografie 93 (3), 336–343. https://doi.org/10.1111/1467-9663.00206.
Schwanen, T., Wang, D., 2014. Well-being, context, and everyday activities in space and time. Annals of the Association of American Geographers 104 (4), 833–851. https://doi.org/10.1080/00045608.2014.912549.
Sharif, M.A., Mogilner, C., Hershfield, H.E., 2021. Having too little or too much time is linked to lower subjective well-being. Journal of Personality and Social Psychology 121 (4), 933–947. https://doi.org/10.1037/pspp0000391.
Šmite, D., Moe, N.B., Klotins, E., Gonzalez-Huerta, J., 2023. From forced working-from-home to voluntary working-from-anywhere: two revolutions in telework. Journal of Systems and Software 195, 111509. https://doi.org/10.1016/j.jss.2022.111509.
Solís, M., 2017. Moderators of telework effects on the work-family conflict and on worker performance. European Journal of Management and Business Economics 26 (1), 21–34. https://doi.org/10.1108/EJMBE-07-2017-002.
Song, Y., Gao, J., 2020. Does telework stress employees out? a study on working at home and subjective well-being for wage/salary workers. Journal of Happiness Studies 21 (7), 2649–2668. https://doi.org/10.1007/s10902-019-00196-6.

STATEC. (2022). *Luxembourg in Figures*. Luxembourg.
St-Louis, E., Manaugh, K., van Lierop, D., El-Geneidy, A., 2014. The happy commuter : a comparison of commuter satisfaction across modes. Transportation Research Part F 26, 160–170. https://doi.org/10.1016/j.trf.2014.07.004.
Stutzer, A., Frey, B.S., 2008. Stress that doesn't pay: the commuting paradox. The Scandinavian Journal of Economics 110 (2), 339–366. https://doi.org/10.1111/j.1467-9442.2008.00542.x.
Tonne, C., Adair, L., Adlakha, D., Anguelovski, I., Belesova, K., Berger, M., Adli, M., 2021. Defining pathways to healthy sustainable urban development. Environment International 146. https://doi.org/10.1016/j.envint.2020.106236.
Van Acker, V., Witlox, F., Van Wee, B., 2007. The effects of the land use system on travel behavior: a structural equation modeling approach. Transportation Planning and Technology 30 (4), 331–353. https://doi.org/10.1080/03081060701461675.
Veenhoven, R., 2012. Evidence based pursuit of happiness: what should we know, do we know and can we get to know? MPRA paper, university library of Munich. Munich, Germany.
Yahyagil, M.Y., 2015. Values, feelings, job satisfaction and well-being: the turkish case. Management Decision 53 (10), 1–5. https://doi.org/10.1108/MD-10-2014-0609.
Ye, R., Titheridge, H., 2017. Satisfaction with the commute: the role of travel mode choice, built environment and attitudes. Transportation Research Part D 52, 535–547. https://doi.org/10.1016/j.trd.2016.06.011.
Zarabi, Z., Gerber, P., Lord, S., 2019. Travel satisfaction vs. life satisfaction: a weighted decision-making approach. Sustainability 11 (19), 1–28. https://doi.org/10.3390/su11195309.