

COMMUTING SATISFACTION AND SUBJECTIVE WELL-BEING

Linking life domains, workplace relocation
and working from home practices

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LIST OF ABBREVIATIONS

ANOVA	Analysis of variance
COVID-19	SARS-CoV-2 (2019-nCoV) coronavirus
CTS	Commuting time satisfaction
CS	Commuting satisfaction
EU-SILC	European Union Statistics on Income and Living Conditions
IGSS	General Inspectorate for Social Security
P-SELL	Panel Socio-Economique Liewen on Lëtzebuerg 3
SEM	Structural equation modelling
SWB	Subjective well-being
WS	Work satisfaction
WPR	Workplace relocation

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CHAPTER 1. Introduction

1.1 Background

Commuting is an indispensable part of a worker's life. According to Eurostat, more than 60% of employed people in Europe commute to work in less than 30 minutes. In comparison, nearly 26% commute between 30 and 60 minutes, 8% commute more than 60 minutes and only 4% work from home (Eurostat, 2020). The share of those working from home more than doubled in 2021 (13.5%) due to COVID-19 pandemic (Eurostat, 2021b). Because commuting is an unavoidable activity for many, numerous studies have examined how time, mode, and distance affect individuals' satisfaction with commuting (or 'commute satisfaction', CS). For example, some studies found active mode users to be most satisfied with their commute, followed by car users and then public transport users (Friman et al., 2017; Olsson et al., 2013; St-Louis et al., 2014). Travel time also plays a significant role in individuals' CS (Olsson et al., 2013). While it is generally assumed that shorter travel times lead to higher CS, recent research has presented alternative perspectives. Theories of positive utility of travel time and worthwhileness of travel time counteract the linear relationship between travel time and CS, suggesting that people often prefer nonzero commute time to create a clear separation between their personal and work lives - emphasizing that travel time is not wasted time (Cornet et al., 2022; Mokhtarian & Salomon, 2001). As for the travel distance, shorter distance can lead to higher CS (Ettema et al., 2012, 2013; Manaugh & El-Geneidy, 2013). Other elements of commuting that may affect CS include traveling with someone (Mokhtarian et al., 2015), participating in activities during the travel (Jain & Lyons, 2008), external travel conditions such as temperature, precipitation, wind (Böcker et al., 2016), built environment (Hook et al., 2021; Mouratidis et al., 2019), subjective characteristics (Gao et al., 2017), attitudes towards travel (De Vos et al., 2016; Ye & Titheridge, 2017), and flexibility in commute mode, time or working hours (Handy & Thigpen, 2018). Thus, depending on individual perceptions and experiences, commuting can either be a stress-inducing activity or a valuable transition between the personal and professional lives (Jain & Lyons, 2008; Redmond & Mokhtarian, 2001).

All effects of commuting are noteworthy of attention owing to their implication on the subjective well-being. Subjective well-being (SWB) is a concept drawn from the literature on social science and psychology that refers to the overall evaluation of a person's life (Diener, 1984). There is a growing body of scientific literature examining the direct relationship between CS and SWB. For example, some studies found that longer commute times lead to lower SWB (Nie & Sousa-Poza, 2018; St-Louis et al., 2014), while others reported the opposite (Mouratidis et al., 2019) (elaborated further in section 1.2). Moreover, it seems that CS has an indirect influence on SWB as well through its interaction with other life domain satisfaction. For example, some studies have reported that longer commute duration is also associated with lower satisfaction with social relationships (Delmelle et al., 2013; Kroesen, 2014b) and higher job satisfaction (Abou-Zeid & Ben-Akiva, 2012), which could also contribute to SWB. However, examining the indirect influence of CS on SWB through the mediating role of life domain satisfaction has received little attention so far, with only a few exceptions (Gao et al., 2017; Kroesen, 2014a; Zarabi et al., 2019). Understanding this mediating effect is critical because commuting is often intertwined with these life domains, and satisfaction with commuting can affect satisfaction with other life domains (Heady et al., 1991;

Veenhoven, 2012). Failure to consider this has led to an incomplete conceptualization of the effects of CS on SWB and a lack of understanding of the broader effects of commuting on SWB. This is our **first research gap**, which we address in more detail in section 1.2.

Furthermore, most studies in travel satisfaction literature are based on cross-sectional datasets (Abou Zeid, 2009; De Vos et al., 2016; Ettema et al., 2011, 2012; Friman et al., 2013). Cross-sectional studies primarily focus on assessing the current state of travel satisfaction. However, to gain a better understanding of the causal relationships and temporal effects of CS, additional research using quasi-longitudinal or panel data sets is required to gain a comprehensive understanding of the dynamics in CS. Despite the significant role that life events play in our travel behaviour (Clark et al., 2014), there is not enough research examining these changes in CS. Some examples from the mobility biographies literature summarize how life events such as a change in residence or the purchase or sale of a car can change an individual's travel behaviour, encompassing changes in commuting mode, time, distance, habits and attitudes (Beige & Axhausen, 2017; De Vos et al., 2019; Lanzendorf, 2003; Monteiro et al., 2021). However, it is worth noting that these studies often overlook the crucial effects of changing workplaces on commuting behaviour, commuting satisfaction and subsequently SWB of individuals (some recent exceptions include (Schneider & Willman, 2019a; Sprumont & Viti, 2018; von Behren et al., 2018; Yang et al., 2017; Zarabi et al., 2019). The relationship from life event to CS can also be bi-directional. For instance, dissatisfaction with commuting can also influence life events such as a change of residence or workplace in response to dissatisfying commute patterns. The question of whether people change where they live, where they work, how they commute to cope with dissatisfying commuting patterns or whether they tolerate commute dissatisfaction remains unanswered. Neglecting to examine this retrospective (from life events to CS) and prospective (from CS to life events) approaches of CS using quasi-longitudinal or panel datasets marks notable knowledge gaps, thereby highlighting our **second research gap**, elaborated further in section 1.3.

As important as it is to understand changes in the workplace, it is also important to address recent changes in working conditions due to strict safety measures such as lockdown during the COVID-19 pandemic, which have led to an increase in working from home. The pandemic had a significant impact on various aspects of individuals' lives, including their activity patterns, travel patterns, and habits. As a result, researchers have shown massive interest in COVID-19-related studies that recognize the pandemic as a major life event (Domenico & Vanelli, 2020). Some studies have noted a shift from public transportation and shared mobility to private cars to reduce the risk of virus transmission, or a shift to walking and cycling, but mainly for shorter distances and to improve SWB (Abdullah et al., 2021; Luan et al., 2021; Shamshiripour et al., 2020). While commuting to work has traditionally been a large part of travel, during the pandemic the importance of other types of travel, such as shopping, leisure, and undirected travel, has increased (Hook et al., 2022; Parady et al., 2020). Numerous studies have already addressed changes in activity patterns, travel behaviours, and habits as a result of the COVID-19 pandemic (Anwari et al., 2021; Beck & Hensher, 2020; De Haas et al., 2020; König & Dreßler, 2021), and others have examined the "new normal" of telework (Atkinson, 2022; Bailey & Kurland, 2002; Blahopoulou et al., 2022; Mas & Pallais, 2020; Pan & Shaheen, 2022; Song & Gao, 2020). Recently, a few reviews/ discussions on the effects of COVID-19 on activity patterns and travel behaviour have also been published (Paul et al., 2022; Van Acker, 2022; van Wee & Witlox, 2021). There is mainly evidence about 'short' and 'medium-term' effects of

COVID-19, and some discussions about potential 'long-term' effects that COVID-19 has on individuals' commuting patterns and SWB. Nevertheless, there is no study comparing how differences in working from home (WFH) practices affect the relationship between CS and SWB. Accounting for flexibility in WFH is important because a person who engages in WFH one day per week is likely to experience commuting differently than a person who engages in WFH four or more days per week (Allen et al., 2015). This leads to a **third and final research gap**, which is discussed in more detail in section 1.4.

These three research gaps are worthy of attention owing to their implications for SWB and their potential to provide valuable insights for shaping future commuting practices and policies. Consequently, they are discussed in detail in sections 1.2 through 1.4.

1.2 Commuting satisfaction and satisfaction with life domains

Travel is an important part of our lives. While many studies have examined the objective aspects of travel, particularly in economics according to utility maximization theory, the subjective experiences of travel, including the contribution to SWB, have only gained increasing interest in the last decade. Consideration of both the objective and subjective components of travel (e.g., satisfaction with travel) is important for understanding how travel contributes to SWB, especially since improving health and well-being is one of the United Nations' key Sustainable Development Goals (i.e., Goal 3: Good health and well-being). Recently, many researchers have demonstrated the theoretical relationship between travel satisfaction and SWB (De Vos et al., 2013; Ettema et al., 2010; Mokhtarian, 2019; Mokhtarian & Pendyala, 2018). The subjective component of travel, i.e., travel satisfaction, among others, refers to the traveller's overall evaluation of the travel experience. To assess a person's travel satisfaction, several researchers have developed different scales based on various evaluation criteria. For instance, Ettema et al. (2011) developed a travel satisfaction scale that takes into account the cognitive and affective components (used in many commuting satisfaction studies). Some authors assessed travel satisfaction using only three items referring to the cognitive component of STS measurement scale (Susilo & Cats, 2014), while others used a single-item question related to the most recent commute trip (Mao et al., 2016) or a typical commute trip to measure CS (Olsson et al., 2013). Given the focus of this dissertation, we further explore the relationship between CS and SWB.

Subjective well-being (SWB) is a concept closely related to happiness and life satisfaction. It is an assessment of a person's cognitive and emotional evaluation of life, whether positive or negative, and it depends on the person's objective and subjective characteristics. Various researchers have derived different scales to assess individual well-being, mainly from the social and psychological perspectives, including the life satisfaction scale (Ettema et al., 2011), the positive and negative affect scale (Watson et al., 1988), the happiness scale (Diener et al., 2010), and the hedonic and eudaimonic well-being evaluations (Diener, 1984). Hedonic well-being refers to a bottom-up approach and is often defined as the maximisation of positive emotions and life satisfaction and the minimisation or absence of negative emotions. From this perspective, one would want to maximise satisfaction with various life domains, including CS, in order to achieve a high level of SWB. Eudaimonic wellbeing, on the other hand, refers to SWB as the ultimate goal in life and emphasizes the link between SWB and travel satisfaction (Diener, 1984; Heady et al., 1991; Ryan & Deci, 2001). Both hedonic and eudaimonic well-being are interrelated

constructs that represent higher levels of overall life satisfaction and are measured based on satisfaction with life domains. These life domains include satisfaction with, among others, job, family, work, home, personal relationships, social relationships, time use, leisure, residence, workplace, and health.

CS is also one of the life domains of SWB as commuting consumes a substantial part of a worker's life (Ettema et al., 2010). The relationship between CS and SWB has been well documented in various disciplines, including economics, psychology, social science, and health. Researchers are interested in it because daily commuting plays an important role in assessing individual SWB. For example, some studies found lower SWB among individuals with longer commutes (Nie & Sousa-Poza, 2018; St-Louis et al., 2014) and higher SWB among individuals with shorter commutes (Mouratidis et al., 2019). Some studies reported that commuting during peak hours results in lower SWB (Ettema et al., 2012; Morris & Hirsch, 2016), while other studies reported higher SWB when having a companion during the commute (Chatterjee et al., 2017). Some studies also reported that commuting using soft modes such as walking and bicycling resulted in higher SWB (Scheepers et al., 2014; Schneider & Willman, 2019a). However, a few empirical studies have also investigated how time spent on longer commutes affects satisfaction with other life domains, illustrating the spill over effect of CS on satisfaction with other life domains. For instance, three studies found profound negative effects of longer commute times on leisure satisfaction (Chatterjee et al., 2017; Clark et al., 2020; Lorsche, 2018), and others found that longer commute times were negatively associated with health and job satisfaction (Chatterjee et al., 2017; Clark et al., 2020; Künn-Nelen, 2015; Stutzer & Frey, 2008). Some studies also reported that longer commute duration is associated with lower satisfaction with social relationships (Delmelle et al., 2013; Kroesen, 2014b), and other studies reported that higher commute satisfaction is positively associated with job satisfaction (Abou-Zeid & Ben-Akiva, 2012). To provide deeper insights and a comprehensive conceptualization of how CS then influences SWB through domain satisfaction, three theoretical models have been developed that suggest that the relationship between travel and SWB is mediated by non-travel related life domains. For instance, Ettema et al. (2010) show that travel influences SWB in two different ways. First, travel invokes positive and negative emotions that are experienced during traveling as well as a cognitive evaluation of both instrumental factors like travel time and non-instrumental factors like interacting with other travellers, which then invokes SWB. De Vos et al. (2013) illustrate that activity participation during travel can increase both short- and long-term SWB. Chatterjee et al. (2020), however, specifically illustrate the relationship between commuting and SWB using three time horizons: during travel, after travel, and in the long term. The activities during travel influence the affective experiences of commuting. After travel horizon explores spill over effects on satisfaction with different life domains, and the long-term effects on SWB are examined.

These existing empirical and theoretical models provide valuable evidence on the importance of examining the full relationship between CS, satisfaction with non-travel related life domains and SWB. Given the lack of studies that provide this complete overview of the full interactions, this represents a notable knowledge gap in the travel satisfaction literature. Therefore, we highlight and elaborate on the **first research gap**.

1.3 Commuting satisfaction and life events

While numerous cross-sectional studies have examined how CS is associated with travel characteristics such as commuting mode, travel time, and travel distance, little attention has been paid to analysing how CS is influenced by a life event or how changes in CS influences life events. Despite the significant role that life events have on individual travel behaviour and thus on travel satisfaction (Clark et al., 2014), there are not enough quasi-longitudinal or panel-based studies. Longitudinal studies are better suited to explain the dynamics in CS and the causal relationships between the variables. Although there is limited evidence on the volatility of CS, there are some studies analysing the effect of a life event such as a residential relocation on changes in commuting behaviour and CS. For instance, De Vos et al. (2019) found that after a change of residence from a suburban to an urban neighbourhood in Ghent, Belgium, the distance and duration of trips decreased and the use of car alternatives increased. Using data from the United Kingdom, Aditjandra et al. (2016) reported that moving to a neighbourhood with more shopping and public transportation options could indirectly increase public transportation use mediated via a reduction in car ownership. Another study found that urban residents who come from less urbanized neighbourhoods are more likely to bike, walk, or use public transportation than to drive, while suburban residents who come from more urbanized neighbourhoods are more likely to drive (De Vos et al., 2018). Cross-border residential relocation from Luxembourg to one of its neighbouring countries showed an increase in car use for commuting, which subsequently lead to a decrease in travel satisfaction, but surprisingly to an increase in overall quality of life. This is due to the fact that the decrease in travel satisfaction is compensated by an increase in satisfaction with other life domains, in particular housing, which shows that satisfaction with housing is more important than spatial constraints related to the change of residence (Gerber et al., 2017).

A considerable number of studies have thus examined the effects of a residential relocation on travel characteristics and, to some extent, CS (Cao & Ermagun, 2017; Cao et al., 2009; Clark et al., 2016; Krizek, 2003; Mokhtarian, 2008; Monteiro et al., 2021; Scheiner & Holz-Rau, 2013). However, studies focusing on the effect of a workplace relocation on CS remain scarce. This is rather surprising given that the workplace, like the place of residence, is an important anchor point for commuting trips. It has the potential to change individuals' commuting behaviour, CS, satisfaction with life domains other than commuting, and SWB (a few exceptions that analysed some of these relationships (Dargay & Hanly, 2007; Rau et al., 2019; Sprumont et al., 2014, 2020; Vale, 2013; Walker et al., 2015; Zarabi et al., 2019)). In addition, CS could differ depending on whether a workplace relocation (WPR) is voluntary or involuntary i.e. whether one changes job willingly or is forced to move along with the employer. While there are some empirical studies on the effects of an involuntary WPR on travel choices and satisfaction (Cervero & Landis, 1992; Hanssen, 1995; Pritchard & Froyen, 2019; St-Louis et al., 2014; Ye & Titheridge, 2017), no study has compared a voluntary and an involuntary WPR. We argue that such a distinction is important because voluntary commuters may end up with better commute circumstances and CS than involuntary commuters, where workers have less control pertaining to their commute due to the forced nature of their WPR.

Moving on, the relationship from life event to CS can also be bi-directional. For instance, dissatisfaction with commuting can also influence life events such as a change of residence or workplace in response to dissatisfying commute patterns. Surprisingly, almost no study examines this prospective approach of CS

or emphasizes on eliciting which responses are more common to dissatisfying commute patterns. Do people change where they live, where they work, how they commute to cope with dissatisfying commuting patterns or do they tolerate commute dissatisfaction? As explained above, the limited literature on travel and life events is dominated by cross-sectional studies that are focusing on the current state of travel satisfaction (exceptions are [De Vos et al. \(2019\)](#); [Monteiro et al. \(2021\)](#); [Wang et al. \(2020\)](#) for a longitudinal analysis of the impact of a residential relocation on commuting satisfaction). In absence of quasi-longitudinal studies that examines how dissatisfaction with commuting could trigger a change of residence or workplace in subsequent years marks notable knowledge gaps in the literature on CS. Hence, elaborating on the **second research gap**, which is the lack of longitudinal studies of CS either to examine the effects of a workplace relocation on the dynamics of CS or eliciting responses to how commuters cope with dissatisfaction in subsequent years. By overcoming this gap through a retrospective and prospective approach, this dissertation will contribute to a longitudinal perspective on CS.

1.4 Commuting satisfaction and COVID-19 pandemic

Another major yet unusual life event that has unquestionably disrupted individuals' travel behaviour is the COVID-19 pandemic. The implementation of safety measures such as a lockdown and the widespread adoption of remote working arrangements gave rise to working from home (WFH). Since the act of commuting was restricted in many countries as a result of a lockdown, it is crucial to re-examine the well-documented relationship between CS and SWB.

While there is ample evidence on the increase in WFH since the pandemic, the literature on how this increase has affected the relationship between CS, domain satisfaction and SWB is limited. Previous studies have reported that WFH can have positive effects on workers' SWB, including work productivity, job satisfaction, and leisure satisfaction, by providing greater flexibility in daily work schedules and allowing for shared production activities such as caring for children while at work ([Allen et al., 2015](#); [Blahopoulou et al., 2022](#); [Clark et al., 2020](#); [Pabilonia & Vernon, 2021](#)). Nonetheless, some studies have also found that WFH is associated with an increase in loneliness, stress (especially among male workers), work-family conflict, feelings of isolation, and lack of work productivity due to multitasking during the day ([Hamermesh, 2020](#); [Mas & Pallais, 2020](#); [Solís, 2017](#); [Song & Gao, 2020](#)). Since work-life balance and work-family conflict are part of the larger underlying concept of SWB, it seems important to understand how differences in WFH practices affect the relationship between various satisfaction variables and SWB. This closes our **final research gap**. Distinguishing between WFH frequencies is important because a person who engages in full-time WFH/telework is likely to experience satisfaction with different domains of life and SWB differently than a person who engages in occasional WFH. In this way, we will contribute to research on telework, travel satisfaction, and SWB by providing valuable insights for shaping future commuting practices and policies.

1.5 Aim and research questions

To overcome the research gaps on how commute satisfaction (CS) is related to satisfaction with life domains and subjective well-being (SWB) on the one hand, and changes in work location and working conditions (i.e., working from home) on the other hand, the general aim and subsequent research questions are as follows:

Exploring how CS affects SWB via satisfaction with other life domains, while taken into account changes in workplace location and changes in working conditions (i.e., WFH).

1. What are the important knowledge gaps in the well-documented literature on commuting satisfaction and subjective well-being from a workplace relocation perspective?
2. What is the interaction between commuting satisfaction, satisfaction with non-travel related life domains and subjective well-being, controlling for covariates and contextual differences?
3. How do commuters respond to dissatisfaction with commuting and work in subsequent years? Does dissatisfaction with commuting outweigh dissatisfaction with work or vice versa?
4. What is the effect of workplace relocation on commuting satisfaction? Are voluntary commuters more satisfied with their commuting than involuntary commuters after the relocation? Are static commuting variables still important in explaining satisfaction with commuting?
5. How do differences in working from home frequency affect the relationships between commuting satisfaction and subjective well-being while accounting for satisfaction with non-travel related life domains?

All research questions are interlinked. Q1 is based on a conceptual work and questions 2-5 are empirical work. The links between these empirical papers can be visualised by a conceptual model of commuting satisfaction, as shown in Figure 1.1. The model highlights important links between the key concepts of this dissertation, and is.

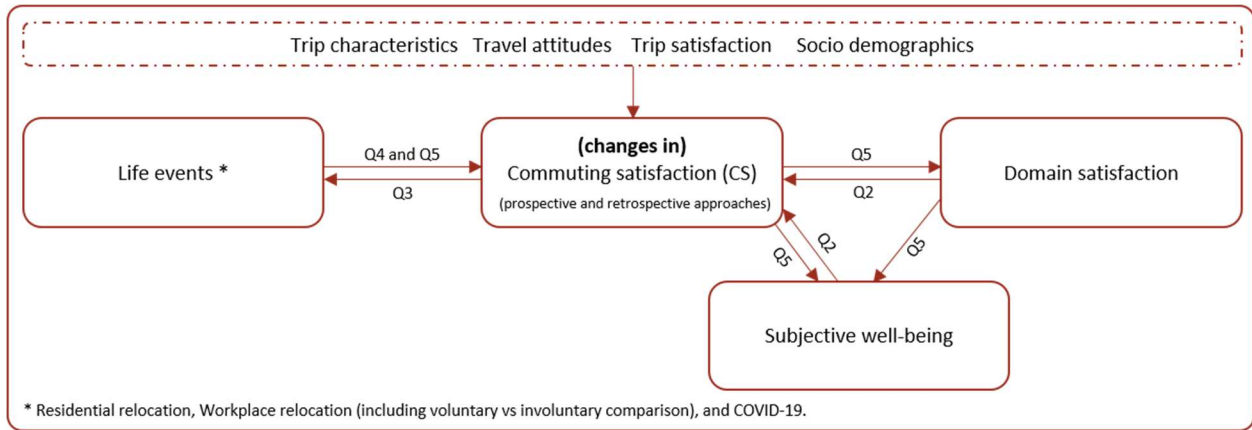


Figure 1.1: Conceptual model describing the main links of the dissertation

The model begins by emphasizing the significance of various travel components, such as objective trip characteristics (commute mode, time and distance) and subjective aspects (emotions, personality, travel attitudes), and trip satisfaction (positive (de)activation, negative (de)activation and cognitive evaluation). These travel components, along with socio-demographic factors (age, gender, marital status, education, income, having children, living situation, etc.) influence CS. Past studies have shown that these components can individually affect CS, but they can also interact with each other. Next, CS in retrospection can be influenced by life events such as changing residence, changing workplace or major events like the COVID-19 pandemic. These life events have the potential to change individuals' CS, highlighting the dynamics in CS. Next, the relationship between CS and SWB can be both direct and indirect, with CS

potentially influencing SWB through satisfaction with non-travel-related life domains. It is important to note that this direct relationship can also be bi-directional, indicating that SWB can influence CS, satisfaction with life domains can influence CS or SWB can influence domain satisfaction (not the focus of this dissertation). Furthermore, the model acknowledges that life events can also be a consequence of commute dissatisfaction, underscoring a prospective approach to understanding CS. Basing on this model, the outline of this dissertation is established.

1.6 Research strategy: datasets and methodologies

This dissertation is based on empirical research using secondary data sources as well as self-collected data through a large-scale online survey. Secondary data sources used in this dissertation include the European Union Statistics on Income and Living Conditions (EU-SILC) and the Panel Socio-Economique Liewen on Lëtzebuerg 3 (P-SELL III). Both datasets are coordinated by [Eurostat \(2018\)](#). The self-organized online survey is administered in Luxembourg and encompasses the working population of Luxembourg, including cross-border commuters from France, Belgium and Germany.

Before these datasets are used, **Chapter 2** of this dissertation introduces a comprehensive conceptual model by reviewing 35 empirical studies out of a total 143 studies. These academic papers were identified using three electronic databases (Web of Science, SCOPUS and Google Scholar). Employing a PRISMA methodology, a structured literature review was conducted to analyse these studies. Through this systematic review, a conceptual model for workplace relocation was developed. This model investigates the impact of a workplace relocation on commuting behaviour, commuting satisfaction and subjective well-being, identifying important knowledge gaps from four dominating perspectives (i.e., Sustainability, Mobility biographies, Household interaction and Social-psychology).

From **Chapter 3** onwards, the empirical part of this dissertation is developed. It is based on the EU-SILC dataset. EU-SILC is a European panel-based survey on income and living conditions. In addition to longitudinal data, the survey also offers cross-sectional data on selected topics. For example, in 2013 a module on SWB and life satisfaction was organized. Data of this 2013 module are used in this chapter. In total, more than 600,000 respondents from 32 European countries took part in this survey. However, as we are only interested in respondents who commute to work, only employed people from these 32 countries were included in the analysis ($n = 117,041$). The sample is representative of the European population, regardless of their country of origin. The cross-country comparison allows us to examine how satisfaction with commuting may differ across countries due to contextual differences (e.g. depending on income level, as commuting may allow people in some 'rich' countries to earn higher wages than in other countries). We use an ordered logistic regression model to analyse the effects of satisfaction with life domains and SWB on CS, controlling for covariates and contextual differences. For the latter, we ran three separate models: one for the whole sample, one for the less developed countries and one for the well-developed countries.

Next, **Chapter 4** uses the P-SELL III dataset to analyse how commuters react to dissatisfied commuting patterns in subsequent years. This is a Luxembourg panel dataset that is representative of Luxembourg's population. This longitudinal dataset offers information on satisfaction with commuting and work in year 2013, and life events such as changing residence and/or workplace and buying or selling a car in three

consecutive years (2013, 2014, and 2015). A total of 16,319 individuals in 6,619 households participated in this survey. However, as we are only interested in respondents who commute to work, only employed people were included in this analysis ($n = 3,029$). Using a cluster analysis, we first identify different satisfaction profiles of individuals based on their commuting and work satisfaction. We then use these profiles as independent variables in a logistic regression to examine how workers overcome their dissatisfaction in subsequent years. Although this dataset is somewhat older, its longitudinal nature allows us to capture the prospective approach of CS.

Chapters 5 and 6 are based on self-organized data collected through an online survey that focused on travel satisfaction and SWB and its relationship to changes in workplace location and working conditions. The organization, administration and implementation of the survey was made possible through the invaluable support of several organizations. We first approached the Inspectorate General of Social Security (IGSS) for the initial sample selection. The IGSS keeps an annual register of all individuals working in Luxembourg. We drew a stratified random sample from the 2018 to 2021 datasets. In total, 10,000 individuals working in Luxembourg were identified to participate in the survey. Next, we contacted the Ministry of Mobility and Public Works for their support and the Ministry of Digitalization for their consent to conduct this large-scale survey by selecting respondents from the IGSS data. Together with IGSS, we then contacted the IT authority (CTIE) to send invitation letters to the target population, while maintaining the anonymity of the participants. Subsequently, preparing the survey was a major challenge as we tried to find a balance between the length of the questionnaire and capturing all relevant questions. We also conducted pilot studies at LISER to ensure correct understanding of the survey questions by the respondents' and that the questionnaire could be completed within 15 minutes. The survey received ethical approval/clearance from the LISER ethics committee. It was then translated from English into Luxembourgish, French and German by a translation agency and cross-checked by colleagues at LISER and my supervisors. The survey was launched in July 2022 using the Lime Survey access from Ghent University, and reminders were sent again by CTIE in October 2022. After collecting the responses, we took additional measures to preserve the anonymity of the participants. To this end, LISER's data centre was contacted to separate the respondents' email addresses from the responses. Overall, the response rate was 10%, with complete responses corresponding to 852 respondents. With the help of several authorities and our funders, we were able to identify a sample that is representative of the working population in Luxembourg.

The survey comprised four modules: Employment characteristics, daily mobility characteristics, a satisfaction module and socio-demographic data. The first module asked questions about the type of employment, employment contract, place of work and frequency of WFH. The second module looked at commuting characteristics such as commute mode, travel distance and travel time, as well as satisfaction with the last commute and commuting in general - before and after the workplace relocation. The third module built on the satisfaction questions and asked respondents to self-report their satisfaction with different areas of life such as work, place of work, use of time, leisure, health, personal relationships, accommodation and overall life. In the last module, we asked all socio-demographic questions about age, gender, education, income and place of residence.

Chapter 5 uses a one-way ANOVA and post-hoc comparison tests to examine the differences in commuter satisfaction as a function of the static variables referring to current commuting behaviour (e.g., current commuting time, commuting mode) and dynamic variables referring to changes in commuting behaviour (e.g., changing from previously using public transport to commute to work to now using a car). Using this input, we run an ordinal logistic regression to examine the impact of dynamics on commuting satisfaction among those who have recently changed their place of work, either voluntarily or involuntarily. In doing so, we develop three regression models: one that measures the effect of static variables, one that measures the effect of dynamic variables, and one that combines the effect of both static and dynamic variables on CS.

In **Chapter 6**, we use a structural equation model (SEM) for multiple groups to examine the effect of the WFH frequency on the relationship between CS, domain satisfaction and SWB. WFH frequency is categorised as Never WFH, Occasional WFH, Hybrid WFH and Full-time WFH. Since we are interested in whether and how the relationship between CS, satisfaction with life domains and SWB differs between the different WFH frequencies, we conduct a multi-group path analysis instead of conducting separate analyses for each WFH frequency. The advantage of this method is that all relationships between the endogenous and exogenous variables are estimated in a single analysis for different WFH frequencies on the same paths. In doing so, the WFH variables are not included as explanatory variables, but are used as grouping variables.

1.7 Structure of the dissertation

This section enables the reader to navigate the remaining six chapters, including the conclusion chapter. The motivation for the five academic papers/chapters is based on three research gaps, so the reader can expect some overlap between the chapters, particularly in the literature review in chapters 2, 3 and 6 and the research design in chapters 5 and 6. The overlap in the chapters is important in disseminating standalone academic research papers that have then been submitted to peer-reviewed journals (some have been published and others are under review). Although these papers are included in the dissertation as my own work, including conceptualization, data collection, research design, data analysis, writing of the original drafts, they are multi-authored papers with co-authors reviewing the drafts and contributing valuable insights to their completion. The variations in the terminologies and sometimes spellings are indicative of the specific journal's preferences. To help organise the dissertation, Figure 1.2 shows the links between each chapter and their contribution to the existing literature.

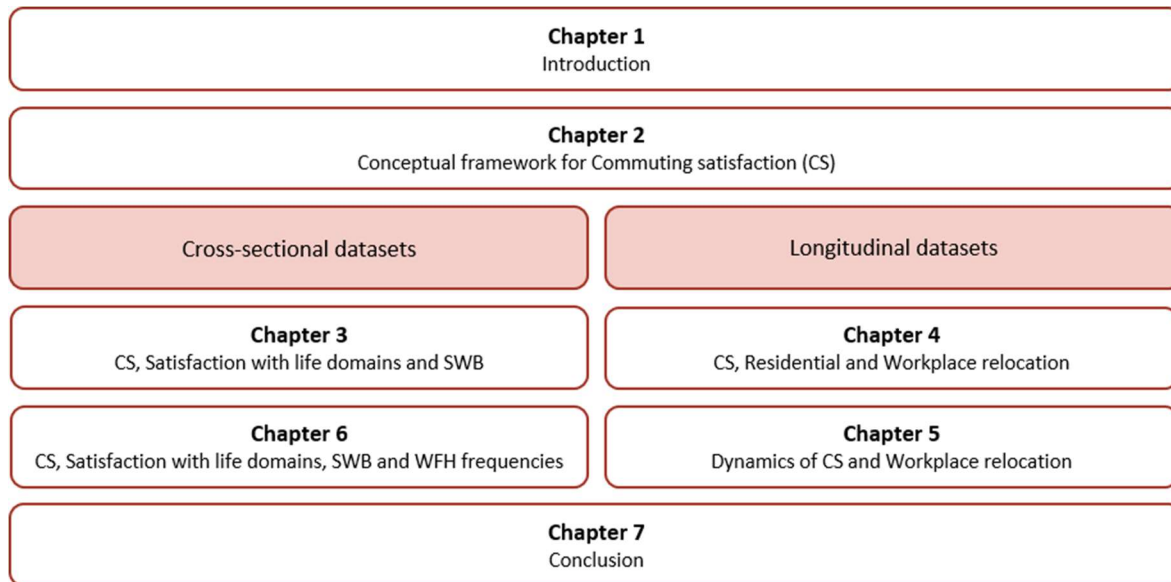


Figure 1.2: Dissertation outline

Chapter 2 lays the foundation for the dissertation by providing a comprehensive systematic review of the existing literature on commuting behaviour, satisfaction with commuting and SWB from a workplace relocation perspective. In doing so, the literature review is based on studies that analyse the temporal effect of commuting satisfaction. This chapter contributes to the development of the conceptual framework for this dissertation, which identifies important knowledge gaps in the literature on commuting satisfaction and is therefore explored in subsequent chapters of this dissertation. Chapter 2 has been published as (Maheshwari et al., 2022a) in *Transport Reviews*. The findings of this chapter contribute to answering the first research question.

The remaining chapters are empirical works based on secondary data or self-collected data. Chapter 3 contributes to answering research question 2 by using the EU-SILC dataset to examine the relationship between CS, SWB and satisfaction with different life domains. This is one of the first few studies to examine the interaction with different satisfaction variables such as satisfaction with job, financial situation, accommodation, living environment, recreational space, personal relationships, leisure time and time use. In addition, due to the richness of the EU-SILC dataset, which is available for 32 European countries, this study also, makes a cross-country comparison. By revealing these two advantages of the dataset, the results help to identify other innovative ways of achieving high levels of CS, rather than just looking at interactions with travel characteristics, for well and less developed European countries. Chapter 3 is published as Maheshwari et al. (2022b) in *Journal of Transport and Land Use*.

Chapter 4 analyses research question 3 using the P-SELL III dataset. It sheds light on how commuters overcome dissatisfying commute patterns in the subsequent years and becomes the first study to address this gap. This chapter enriches research on commuting satisfaction by going beyond the effects of trip characteristics, subjective characteristics and built environment characteristics on commuting satisfaction and contributes to a prospective approach by opening new avenues for exploring the effects of

commuting dissatisfaction on life changes in subsequent years. Chapter 4 is submitted to *Travel Behaviour and Society* and is currently under review.

While chapters 3 and 4 are based on secondary datasets, chapters 5 and 6 use self-collected data from a bespoke survey organized in Luxembourg through a retrospective online survey. Chapter 5 contributes to answering research question 4 and analyses the dynamics of CS among people who have recently changed their workplace, voluntarily or involuntarily. Voluntary switchers are those who change jobs willingly, while involuntary switchers are those who are forced to move with their employer in order to keep their job. In this study, we argue that such a comparison between voluntary and involuntary moves is of particular interest because the characteristics of commuting may be part of a voluntary move, as opposed to an involuntary move, where workers have less control over their commute due to the forced nature of that move. The findings of this study are not only the first to highlight the differences in satisfaction between voluntary and involuntary commuters, but they also contribute to the existing literature on travel satisfaction by improving our understanding of the volatility of satisfaction. Chapter 5 is ready to submit.

Chapter 6 analyses research question 5 and to some extent research question 2. The analysis focuses on examining the direct and indirect effect of CS on SWB in the post-pandemic period. This study takes into account the significant changes in working conditions and commuting patterns that have resulted from the increase in working from home (WFH). The study controls for the mediated effect of satisfaction with other life domains to better understand the impact on SWB of the group that never WFH, occasionally WFH, hybrid WFH or full-time WFH. The results shed light on which WFH group predicts the highest level of satisfaction and which life domains have the greatest impact on SWB and how they are linked from a travel satisfaction perspective. These results are important for policy makers as they indicate not only in which areas employee wellbeing can be improved, but also how. Chapter 6 has been submitted to *Transportation Research Part A: Policy and Practice* and is currently under review.

CHAPTER 2. Multi-perspective review

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>

Recently, a growing body of literature has focused on the role of daily mobility on subjective well-being (SWB). What is less well understood is the temporal effect of commuting on SWB/life satisfaction. To date, most studies addressing this temporal effect consider the impact of a residential relocation and not many studies reflect on the impact of a workplace relocation (WPR) on commuting behaviour, commuting satisfaction, and SWB. This is surprising considering that changes at the destination of a commuting trip (i.e. relocation of the workplace) could be as important as changes at the origin of a commuting trip (i.e. relocation of the place of residence). This paper therefore aims to provide a systematic review of the impact of a WPR on commuting behaviour, commuting satisfaction and SWB. Using the PRISMA method, we identified 35 papers and developed a conceptual model summarizing the main relationships between workplace relocation, commuting behaviour, commuting satisfaction and SWB. This conceptual model also reflects four disciplinary perspectives dominating research on the impacts of a workplace relocation.

2.1 Introduction

There is a growing body of literature on Subjective Well-Being (SWB), a concept closely related to life satisfaction and happiness. Since the beginning of 2010s, the role of (satisfaction with) daily mobility on SWB has gained attention. However, most studies are based on cross-sectional data and only a limited number of studies are longitudinal (Abou-Zeid et al., 2012; Stutzer & Frey, 2008). Some of these longitudinal studies are panel-based (i.e. they study the same person over several time periods), while others are based on retrospective surveys (i.e. changes before/after a specific life event). Compared to cross-sectional studies, longitudinal studies are much better suited to answer questions about causality and control for possible confounding factors. Nevertheless, only a few longitudinal studies of travel satisfaction exist and majority of them are restricted to analysing the impact of a residential relocation (De Vos, 2018; De Vos et al., 2019; Monteiro et al., 2021; Wang et al., 2020) as this is an important origin to many trips. Only one study to date has examined the impact of changes at the destination-side of trips, especially in the context of commuting behaviour by focusing on the impact of a workplace relocation (hereafter referred to as WPR) on (satisfaction with) daily commuting and SWB (e.g., Zarabi et al., 2019). This is rather surprising given that commuting behaviour does not only depend on residential location choices but also workplace location choices. Therefore, the purpose of this literature review is to focus on the impacts of a WPR (be it voluntary or involuntary) on commuting behaviour, commuting satisfaction and SWB.

A WPR usually leads to a 'window of opportunity' for changes in an individual's commuting behaviour (Rau et al., 2019; Walker et al., 2015), commuting satisfaction (Gerber et al., 2020) and SWB (Zarabi et al., 2019). A WPR can either be the result of a decision made by an employer who wants to expand their company, increase accessibility and/or achieve societal goals (e.g., reducing pressure on central business districts) (Sprumont et al., 2020), or it is often the responsibility of individual employees who want to improve their SWB. According to the Bureau of Labour Statistics (BLS) survey in the US, an individual changes jobs an average of 12 times over the course of their lifetime (Doyle, 2020). This number varies slightly between men (12.5 jobs) and women (12.1 jobs). According to a survey in the UK, people change jobs an average of 17 times during their career (HR News, 2019). Most of these changes seem to be made to advance professionally, earn a higher salary, and receive better benefits and rewards. According to a recent Prudential report on 31 countries, about 26% of workers plan to change jobs voluntarily, and more than 40% of workers consider leaving their employer voluntarily because they feel stuck at work (Castrillion, 2021). A preliminary analysis of Luxembourg's social security data found that the majority of the people changed jobs voluntarily (23.8%), 2% moved from unemployment to employment and only 0.6% of people changed jobs involuntarily between 2018 and 2019 (based on the authors' own calculations using the General Inspectorate for Social Security (IGSS) dataset of Luxembourg). The proportion of people who chose to change jobs themselves (i.e. voluntary workplace relocation) seems to be substantially higher than the proportion of those who moved with their employer (i.e. involuntary workplace relocation).

Given the high frequency of workplace location changes over someone's life course, it is important to know the impact of WPR on people's daily commuting behaviour, their satisfaction with commuting, and their SWB. However, there is a knowledge gap about the impact of a WPR on these three key concepts

and especially the complex interactions between commuting behaviour, commuting satisfaction, and SWB. There are several studies on the impact of involuntary WPR on commuting behaviour in terms of commuting mode, commuting distance and travel time (Cervero & Landis, 1992; Hanssen, 1995; Pritchard & Froyen, 2019; Rau et al., 2019; St-Louis et al., 2014; Ye & Titheridge, 2017). There are other studies that analyse the interaction between workplace relocation, commuting behaviour and commuting satisfaction (Schneider & Willman, 2019a; Ye & Titheridge, 2017), but only a few studies examine how changing workplace leads to changes in SWB (Fordham et al., 2018). Evidence on the impact of WPR on these three key concepts is thus scattered and almost no studies provide an overview of the entire interaction between workplace relocation, (changes in) commuting behaviour, (changes in) commuting satisfaction and (changes in) SWB (one exception is Zarabi et al., 2019). Therefore, this paper aims to provide a systematic review of the literature to present a complete overview of the interaction between WPR and these three key aspects (i.e., commuting behaviour, commuting satisfaction, SWB). Although there are already a few reviews on WPR (Budiman, 2018; Christersson & Rothe, 2012; Munton & Forster, 1990; Zarabi & Lord, 2019), none of these consider the broader interaction with commuting behaviour, commuting satisfaction and SWB altogether.

Thus, our review will start with a conceptualization of the impact of WPR on commuting behaviour, commuting satisfaction and SWB. Section 2.3 describes the PRISMA methodology we used to systematically identify the relevant literature that examines the relationship between WPR and changes in commuting behaviour and/ or changes in commuting satisfaction and/ or changes in SWB. In Section 2.4, we classify the literature on WPR and describe key relationships according to four dominating perspectives, which we identified during the literature review process. We combine main findings of these four perspectives, and present a more elaborated version of our conceptual model in Section 2.5. In Section 2.6, we conclude the paper with key policy recommendations.

2.2 How a workplace relocation impacts CB, CS and SWB

As understood from the previous section, a WPR is a frequent life event for many people, which could have important impacts on their SWB through changes in their commuting behaviour and their commuting satisfaction. De Vos et al. (2013) and more recently Chatterjee et al. (2020) provided a theoretical conceptualization of the relationships between commuting behaviour, commuting satisfaction and SWB. We will build further on this work by putting WPR at centre stage (see Figure 2.1). This is important given that evidence to date on the impacts of a WPR is not conclusive and stronger evidence for causal inferences is needed.

Firstly, WPR could invoke a change in transport mode, commute route, travel distance and travel time (Lanzendorf, 2003; Zarabi & Lord, 2019). Changes in these aspects of commuting behaviour may also lead to changes in commuting satisfaction (De Vos et al., 2019; Ye & Titheridge, 2017) (see arrow 1 in Figure 2.1).

Second, WPR not only has an impact on commuting behaviour but also on activities other than commuting and satisfaction with these activities/ other life domains (see arrow 2 in Figure 2.1). For instance, Rau et al. (2019) found that a short-distance WPR in Munich disrupted worker's daily routine and mobility practices, as the new workplace offered fewer opportunities for trip chaining. Many authors speak about

the ‘bundles of interacting practices’ which means that changes in one activity location could often leads to changes in other activities/ life-domains (von Behren et al., 2018; Zax & Kain, 1991).

Finally, a WPR also impact individuals’ SWB either through changes in commuting behaviour and commuting satisfaction or through changes in other activities and satisfaction with these activities (see arrow 3 in Figure 2.1) (Chatterjee et al., 2020; Fordham et al., 2018; Heady et al., 1991). Our conceptualization of the relationships between workplace relocation, commuting behaviour, commuting satisfaction and SWB is shown in Figure 2.1.

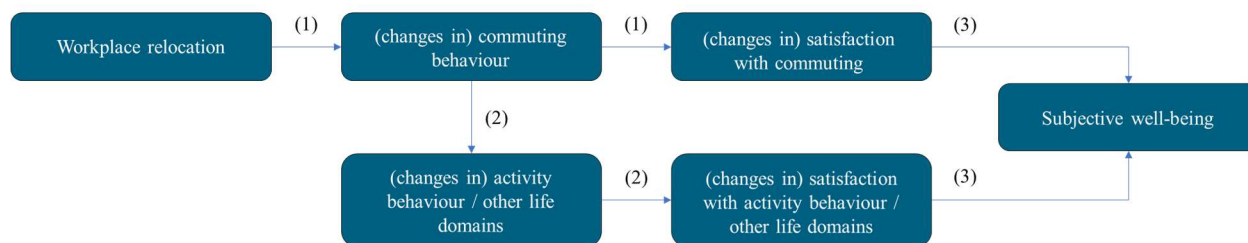


Figure 2.1: Conceptualization of the impacts of a workplace relocation

2.3 Methodology

2.3.1 Search strategy

Three electronic databases (Web of Science, SCOPUS and Google Scholar) were searched for studies that investigated the influence of a WPR on commuting behaviour, commuting satisfaction and SWB. However, Google Scholar did not yield a substantial improvement, so we included only peer-reviewed publications with Web of Science and Scopus. We then used the PRISMA methodology (Moher et al., 2009) to select relevant studies for our literature review (Figure 2.2). First, we identified articles based on our search syntax¹. We specifically did not include a start date because WPR has been a recent topic of discussion in the existing literature on travel (commute) satisfaction and SWB. We searched for articles published until July 2020. This resulted in 143 research papers. Next, duplicates were removed. Second, we screened the articles based on a first reading of the title, keywords and abstract. Only articles published in English were included. We excluded articles that examined (i) predictors of workplace relocation; (ii) factors affecting the willingness to relocate; (iii) relocation mobility readiness; (iv) a workplace change due to change in residential location; (v) workplace design; and (vi) review papers. These articles were excluded because they focused on the relocation process instead of the impacts of workplace relocation. The full articles were then retrieved/downloaded and the full text was read. Some articles were eventually judged to be irrelevant after reading the full text. This resulted in a final list of relevant papers (N = 35).

¹ "Workplace relocation" OR "Organi* relocation" OR "Job* relocation" OR "Relocat* employees" OR "Voluntary workplace relocation" OR "Involuntary workplace relocation" OR "Staff relocation" OR "Office relocation" AND "Travel satisfaction" OR "Commute* satisfaction" OR "Travel behavio*" OR "Commute* behavio*" OR "Behavio* change" OR "Daily travel" OR "Transport*" OR "Mobilit*" OR "Subjective wellbeing" OR "Subjective well-being" OR "Overall life satisfaction" OR "Overall-life satisfaction" OR "Life satisfaction" OR "Wellbeing" OR "Well-being" OR "Quality of life" OR "Happiness" OR "Satisfaction".

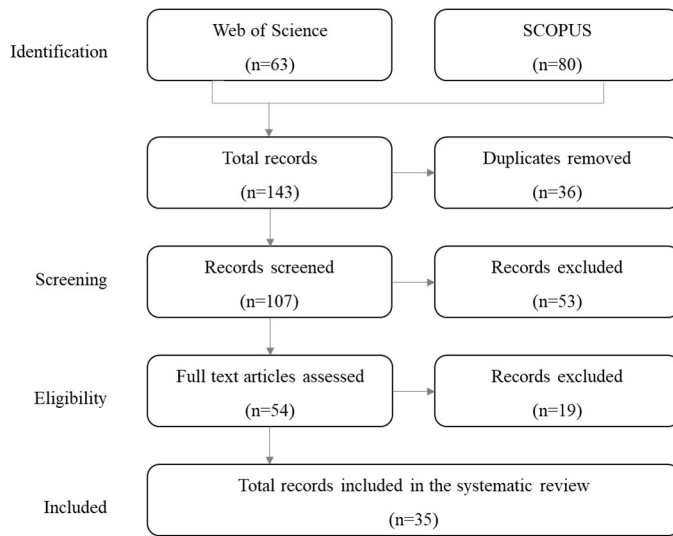


Figure 2.2: PRISMA methodology

2.3.2 Data extraction strategy

Following this PRISMA methodology, we identified 35 empirical studies for our literature review, but we do not claim that this is an exhaustive list. After an initial review of these studies, some overlap was identified in terms of the impact/outcomes of workplace relocation. In order to understand the different outcomes of WPR from different disciplines, we classified papers with similarities under one perspective and papers with differences under other perspectives. In doing so, four dominating disciplines/perspectives became apparent. Studies that analyse modal shift and whether people shift to a more sustainable urban transport mode after a WPR are classified under the **Sustainability** perspective (N = 10). Studies that explain the changes in individual’s commuting behaviour following a life event (i.e. workplace relocation) are classified under the **Mobility biographies** perspective (N = 7). Studies that explain reorganization of household activities in response to a WPR are classified under the **Household interaction** perspective (N = 6). Finally, studies of individuals’ well-being post-relocation are classified under the **Social-Psychology** perspective (N = 12).

Most of these studies are from Europe, although some are based on data from other regions, such as the U.S., Canada, and Australia. For each study, we have summarized relevant information such as author’s name, year of publication, spatial context, sample size, data collection method, methodology, and key impacts in a matrix format (see Table 2.1 – Table 2.4 in the following section). These matrices provide detailed information about the studies reported in this review and allow the reader to make comparisons between the variables included in each study, under each perspective.

2.4 Results

In what follows, we summarize the key impacts of a WPR under each of the four perspectives. These impacts are in line with the basic conceptual model demonstrated in Figure 2.1, which first looks at the impact on commuting behaviour followed by commuting satisfaction, then the impact on activities other than commuting and satisfaction with these activities and then finally the link to SWB.

2.4.1 Sustainability

Studies under the Sustainability perspective focus on the first relationship highlighted in Figure 2.1, which is the impact of a WPR on commuting behaviour, in particular on changes in terms of modal shift. Even if WPR is a consequence of national policies aimed at decentralizing central business districts or developing transit-oriented cities, the impact on individual's commuting behaviour is significant. This is because after workplace relocation, people may be forced to change their travel mode (e.g., if the distance to the new job increases significantly) and reconsider their travel behaviour. Ten studies were ranked under this perspective that focuses on factors responsible for stimulating more sustainable and less sustainable commuting after the move (see Table 2.1). These studies focused on three types of relocation: (i) city centre to the suburb relocation (N=4), (ii) suburb to city centre relocation (N=5), and (iii) interurban relocation (N=1).

Relocation from the suburb to the city centre

All four studies reported a decrease in car use and an increase in walking, cycling, public transport use, and carpooling after the move. Factors that influenced this modal shift included higher car parking pricing in city centres, shorter commute distances/times, and higher traffic congestion (Frater et al., 2019). Other factors included availability of car parking, incentives to carpooling, encouraging the use of public transport and active transport, and educating employees regarding carbon footprint (Cumming et al., 2019). Another study with data from Rome found an increase in the use of active and public transport and a decrease in car use as a result of restricting city centre areas for cars. Such an intervention not only resulted in a modal shift, but also promoted the use of car-sharing, carpooling, park and ride, and broke car-dependent habits. Traditional factors of travel behaviour studies such as change in travel time, distance and route also lead to changes in commuting decisions (Pritchard & Froyen, 2019). Altogether, the four studies reported different techniques to encourage the use of sustainable transport modes and reduce car dependence after moving the workplace from the suburb to the inner city.

Relocation from the city centre to the suburb

Studies related to employment decentralization (i.e., a WPR from city centre to the suburbs) provide strong evidence of a shift from sustainable modes to motorized vehicles (Cervero & Landis, 1992; Cervero & Wu, 1998). We identified five empirical studies with similar conclusions. Yang et al. (2017) pointed out how this modal shift to motorized vehicles is influenced by changes in aspects of commuting behaviour (e.g., longer commuting distance and an increase in commuting time), and the built environment of the new workplace (e.g., low public transport accessibility in the suburbs). Sprumont et al. (2014) found an increase in travel time, travel distance, a lack of public transport accessibility, and a lack of safe infrastructure for walking and cycling in the suburbs. Other studies reached similar conclusions (Aarhus, 2000; Vale, 2013). Hanssen (1995) reported more than one transfer on the journey to work by public transport as a barrier to the use of public transport. In sum, all five studies reported a shift from sustainable transport modes to commuting by car.

Inter-urban relocation

Only one study considered inter-urban relocation. [Walker et al. \(2015\)](#) noted an increase in the use of sustainable travel modes and a decrease in reliance on private vehicles. The main reason for this change in travel mode was attributed to people’s travel habits and attitudes. As a pro-environment group of employees were relocated, regardless of the type of relocation, these people would use active and public transport instead of private cars because of their attitudes towards travel.

In conclusion, the underlying principle of the Sustainability perspective is to study the factors that encourage and discourage sustainable commuting mode choices. To foster a shift towards sustainable modes of commuting, strategies such as increase in car pricing, increase in the use of carpooling, restricting city centre area to cars, etc. are widely encouraged. The evidence from these ten studies are conclusive and mainly focuses on company moves (i.e., involuntary workplace relocation) and the direction of the move (from city centre to suburbs indicates a shift from sustainable modes to car, whereas, the reverse encourages sustainable transport options).

Table 2.1: Comparison of studies linked with sustainability perspective

Study characteristics				Key impacts
Publications	Spatial context	Sample size and Data collection method	Methodology	
Cumming et al. (2019)	British Columbia (BC), Canada	N = 464 (Survey)	Discrete Choice Modelling	Commuting behaviour (mode)
Frater et al. (2019)	Christchurch, New Zealand	N = 834, 1234 and 624 (pre-move survey, interviews and post-move survey respectively)	One-way ANOVA	Commuting behaviour (mode, travel habits)
Pritchard and Froyen (2019)	Trondheim and Oslo, Norway	N = 195 (Survey)	Multinomial regression	Commuting behaviour (time, distance, mode and route)
Patella et al. (2019)	Rome, Italy	N = 296 (Survey and Focus group discussion)	Discrete Choice Modelling Multinomial regression	Commuting behaviour (mode)
Yang et al. (2017)	Kunming, China	N = 172 and 192 (Survey)	Descriptive statistics and Multinomial regression	Commuting behaviour (mode, distance and time); Socio-demographic factors
Walker et al. (2015)	Woking, UK	N = 70 (Survey)	Descriptive statistics and Logistic regression	Commuting behaviour (mode, travel habits)
Sprumont et al. (2014)	Luxembourg	N = 329 (Travel diary)	Multinomial regression	Commuting behaviour (mode, time and distance)
Vale (2013)	Lisbon, Portugal	N = 285 (Survey)	Binary and Multinomial logistic regressions	Commuting behaviour (mode, distance); Attitude
Aarhus (2000)	Norway	N = 9400 (Survey, interview and review of public document)	Descriptive analysis	Commuting behaviour (mode, distance); Attitude
Hanssen (1995)	Oslo, Norway	N = 851 and 691 (Travel diary)	Descriptive analysis	Commuting behaviour (mode, time)

2.4.2 Mobility biographies

The Mobility Biographies perspective goes one step further compared to the sustainability perspective and focuses on other aspects of commuting behaviour such as commuting distance and travel time and not only on the commuting mode. In addition, these studies also examine the impact on satisfaction with commuting (first relationship in Figure 2.1). Based on the conceptual framework of [Salomon and Ben-Akiva's \(1983\)](#) who positioned daily travel behaviour within long-term lifestyle decisions, [Lanzendorf \(2003\)](#) formulated the mobility biographies framework. This framework connects three domains in which life events may occur that impact daily travel behaviour: (i) lifestyle domain including changes in demographics, education, profession and leisure, (ii) accessibility domain including changes in residential location, workplace and ownership of mobility tools, and (iii) mobility domain including changes in activity and travel behaviour. Given the focus of this paper on workplace relocation, we found seven studies in this perspective that examine the effect of a WPR on changes in commuting behaviour and commuting satisfaction (see Table 2.2: Comparison of studies linked with mobility biographies perspective).

Most studies found that a WPR has an indirect effect on commuting satisfaction, mediated via (changes in) commuting behaviour. Some studies reported the effect of changes in commuting time on commuting satisfaction ([Bell, 1991](#); [Carrese et al., 2019](#); [Gerber et al., 2020](#); [von Behren et al., 2018](#)), while other studies reported the effect of a change in commuting mode on commuting satisfaction after the move ([Bell, 1991](#); [Carrese et al., 2019](#); [von Behren et al., 2018](#); [Zarabi et al., 2019](#)). [Gerber et al. \(2020\)](#) observed an increase in commuting satisfaction due to a reduction in the daily commute time of hospital workers following the relocation of a hospital in Montreal, Canada. [von Behren et al. \(2018\)](#) also pointed out a similar relationship, where employees began using public transport instead of cars to reduce their average commuting time and distance after an involuntary WPR from suburbs to the inner city in Karlsruhe, Germany. This was because public transport was much faster and congestion-free compared to car use. However, some studies found the opposite - where employees shifted from public transport to cars, with the same goal of reducing their travel time ([Bell, 1991](#); [Carrese et al., 2019](#)). In contrast, [Sprumont and Viti \(2018\)](#) witnessed an increase in commuting distance among employees of the University of Luxembourg after the University moved from a location in the city of Luxembourg to a location in the south of the country.

Compared to previous studies focusing on the impact of a WPR on commuting behaviour and commuter satisfaction, [Zarabi et al. \(2019\)](#) nuanced these findings by examining the issue of consonance. They found that people did not necessarily use their preferred mode of transport after a WPR and even then, most of these dissonant commuters were satisfied with their commute because they were satisfied with other domains of their life such as general health, residential location, saving/spending money, etc. This made travel dissatisfaction bearable (or even beneficial). In other words, they found that travel mode consonance (or dissonance) and commuting satisfaction (or dissatisfaction) are not necessarily positively related.

Like the earlier study by [Zarabi et al. \(2019\)](#), a limited number of studies from the mobility biographies perspective also scratch the surface of changes in activities/ life-domains other than commuting. For instance, [Gerber et al. \(2020\)](#) found that employees with greater attachment to their new workplace indicated higher satisfaction with their commuting. [Sprumont and Viti \(2018\)](#) found that the large distance

relocation of the University campus from the city centre to the suburb not only affected individuals' commuting behaviour, but also led to a complete modification in their daily activities, such as shopping, lunch, and other non-work related activities. [von Behren et al. \(2018\)](#) reported changes in the daily routine of other household members and their daily travel chain after one of the household members changed their workplace. [Rau et al. \(2019\)](#) reported a decline in employees' satisfaction with commuting after relocating their workplace, due to factors such as fewer opportunities for trip chaining, a longer duration of commuting and a decline in the frequency of after-work drinks with colleagues.

In summary, studies using the mobility biography perspective usually focus on the impact of WPR on commuting behaviour and satisfaction with commuting. Only a few studies stretch a bit to analyse the effect on satisfaction with life domains other than commuting. As a result, we have only a partial understanding of the relationship between WPR and change in activity behaviour/ life domains other than commuting.

Table 2.2: Comparison of studies linked with mobility biographies perspective

Study characteristics					Key impacts
Publications	Type of relocation	Spatial context	Sample size and Data collection method	Methodology	
Carrese et al. (2019)	Involuntary relocation within the city centre	Luxembourg	N = 717 (temporal data collection and two weeks travel diary)	Travel demand modelling (within day dynamics)	Commuting behaviour (mode and time); Commuting satisfaction
Gerber et al. (2020)	Involuntary relocation from the city centre to a TOD location south-west of the city centre	Montreal, Canada	N = 1977 (Cross-sectional retrospective survey)	Multinomial logistic model	Commuting behaviour (time); Commuting satisfaction; Other life domain (workplace attachment)
Rau et al. (2019)	Involuntary relocation within the city (short distance approx. 20 km) between the old and new site	Munich, Germany	N = 121 (Quasi-longitudinal retrospective survey)	Descriptive analysis and statistical tests	Commuting behaviour (mode, number of trips); Commuting satisfaction; Other life domain (social relationship satisfaction)
Zarabi et al. (2019)	Involuntary relocation from the city centre core to the south-west of the city centre	Montreal, Canada	N = 1005 survey and 19 interviews (Cross-sectional retrospective survey and interviews)	Descriptive analysis, statistical tests and weighted decision making	Commuting behaviour (mode, habit); Attitudes; Commuting satisfaction; Other life domain (health, residential location, financial well-being)
von Behren et al. (2018)	Involuntary relocation from a peripheral location in the north to the inner city	Karlsruhe, Germany	N = 120 (Longitudinal pseudo panel survey)	Descriptive analysis and statistical tests	Commuting behaviour (time, mode and distance); Commuting satisfaction
Sprumont and Viti (2018)	Involuntary relocation from the north of the country to the south of the country	Luxembourg	N: 43 (Travel diary and Survey)	Descriptive statistics, standard deviational ellipses and multivariate outlier analysis	Commuting behaviour (activity pattern, mode, time and distance); Other life domain (non-work activity)
Bell (1991)	Involuntary relocation from the central	Melbourne, Australia	N = 843 and 1071 (Survey)	Descriptive analysis	Commuting behaviour (mode and time)

	business district to the suburb				
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2.4.3 Household interaction

While the mobility biographies perspective pays limited attention to the impact of WPR on household interactions or changes in other life domains, the household interaction perspective elaborates on these changes in life domains/activities other than commuting (second relationship in Figure 2.1). [Schönfelder and Axhausen \(2010\)](#) reported that WPR impacts the reorganization of household tasks. To take a step back and understand these household interactions, [Olson et al. \(1983\)](#) introduced the theoretical model of Family Functioning. Studies based on this theoretical model examined the relationship between a major life event (e.g. a workplace change or a change of residence) and the reorganisation of household tasks. They focused on how changes in one person's commute affect the lives of other household members. We identified six studies that provide insights into this relationship and shed light on adaptation strategies following a workplace change of a household member (see Table 2.3).

Most studies have observed residential relocation of the entire household as an adaptation strategy following a WPR of one household member ([Burke & Miller, 2017](#); [Lawson & Angle, 1994](#); [Munton & Reynolds, 1995](#); [Rives & West, 1993](#)). The main determinants leading to a change of residence are related to gender roles and the extent of the other person's attachment to their employment. For instance, [Rives and West \(1993\)](#) found that wife's employment and her attachment to the workplace were strong barrier to changing residence. In contrast, [Lawson and Angle \(1994\)](#) found that the spouse's employment was not an important factor in the decision to change residence. [Burke and Miller \(2017\)](#) reported that families who chose to relocate observed significant effects on spouse employment and their financial well-being.

Other factors, such as family size, attachment to the community, employees' tenure with their company, presence of children in the household and experience with residential relocation also influenced the decision to relocate. For instance, two studies found that families who began making small changes in response to their change of residence adapted more easily to the new location than families who had no previous experience with relocation ([Lawson & Angle, 1994](#); [Munton & Reynolds, 1995](#)).

Some studies also examined the impact of a WPR on household interaction factors such as stress, conflict between spouses, distribution of household chores and maintenance of social relationships ([Munton, 1990](#); [Wiersma, 1994](#)). Stress factors include being away from family and friends, establishing new relationships at work, spouse employment, property issues related to buying and selling a house, finding a new home, children's education and changes in living standards. [Munton and Forster \(1990\)](#) reached similar findings in their review.

Overall, the household interaction perspective focuses on the interaction with other activities, especially moving residence, but often neglects the preceding steps of the impact of a WPR on the individual's commuting behaviour and commuting satisfaction. Nevertheless, it is important to understand this perspective, as it sheds light on how a change in one person's workplace can have cascading effects on the different spheres of life of the other household members. As little attention has been paid to the

interaction between household members and their satisfaction with life domains other than commuting, future studies should take this into account when deciphering the impact of workplace relocation.

Table 2.3: Comparison of studies linked with household interaction perspective

Study characteristics				Key impacts
Publications	Spatial context	Sample size and Data collection method	Methodology	
Burke and Miller (2017)	Military move in the U.S.A.	N = 900000 (Longitudinal study – 12 years)	Descriptive analysis and Regression models	Other life domain (residential relocation, spouse employment, financial well-being)
Munton and Reynolds (1995)	Twenty-two organisations in United Kingdom	N = 200, 149, 127 (Longitudinal study with questionnaires)	Descriptive analysis, Multivariate analysis of variance	Other life domain (residential relocation, work-home relationship, family adaptation)
Lawson and Angle (1994)	Northern United States	N = 202 (Survey and interviews)	Descriptive statistics and Multiple regression analysis	Other life domain (residential relocation, work-home relationship, spouse employment; presence of children)
Wiersma (1994)	North-western United States	N = 24 (Interviews)	Content analysis	Other life domain (work-home relationship)
Rives and West (1993)	-	N = 224 (Survey of moved and non-moved workers)	Logit analysis	Other life domain (residential relocation, spousal employment; workplace attachment)
Munton (1990)	United Kingdom	N = 111 (Survey)	Descriptive analysis, Principal component analysis and correlation analysis	Other life domain (spouse employment, work characteristics, work-home relationship, stress)

2.4.4 Social-Psychology

Studies from a household interaction perspective have already touched upon the social-psychology perspective by focusing on the stress induced by a household member workplace relocation. This perspective takes it a step further by linking it to SWB and social psychological well-being (last relationship in Figure 2.1). As moving to another workplace is a complex event from a social-psychological perspective (Zarabi & Lord, 2019), it can induce a lot of stress for people, impact on their mental health and affect their social-psychological well-being (Martin, 1996). Therefore, it seems essential to analyse this perspective from the point of view of workplace relocation. With this in mind, we have identified twelve case studies that show the impact of workplace change on workers' social-psychological well-being (see Table 2.4).

Several studies in social-psychology analysed the influence of a WPR on an individual's relocation-related stress based on a comparison between a group of relocated employees and another group of non-relocated employees. Martin (1996) found that for male employees, relocation-related stress significantly decreased after their workplace relocation, while for female employees, stress remained the same before and after the relocation. In another study, Martin (1999) found that employees who reported greater preparation for the relocation had better mental health and higher job satisfaction after the relocation

compared to employees who did not mentally prepare for the relocation of their workplace. In a subsequent study, [Martin et al. \(2000\)](#) reported that people who perceived/ expected many relocation-related problems (e.g. disruption to children’s education, household members losing social ties, disruption of family life, and employment-related problems) experienced poor mental health, stress and job dissatisfaction. This was also true for those who were pessimistic and had a negative psychological outlook. In similar lines, other studies reported an increase in psychosocial stress, disruption with work-related adjustments, poor mental health, and lower subjective well-being for those who relocated compared to the control group ([Anderzén & Arnetz, 1997, 1999](#); [Zeng et al., 2015](#)).

Table 2.4: Comparison of studies linked with social-psychology perspective

Study characteristics				Key impacts
Publications	Spatial context	Sample size and Data collection method	Methodology	
Christersson et al. (2017)	Medium-sized city in Finland	N = 9 (Longitudinal study – three waves)	Thematic coding	SWB (Stress and fear); Other life domain (social well-being)
Brandis et al. (2016)	Hospital move to a greenfield site in Australia	N = 316 (Survey)	Regression analysis	Other life domain (job satisfaction)
Bellagamba et al. (2016)	South of France	N = 180 relocated and 272 controlled (Cross-sectional survey)	Linear and Logistic regression	SWB (mental and physical health); Other life domain (work-life factors, job satisfaction)
Zeng et al. (2015)	Central China	N = 613 and 507 (Survey)	Probit least squares models	SWB (mental health); Other life domain (social relationship satisfaction)
Joslin et al. (2010)	Australia	N = 80 relocated and 170 non-relocated employees (Survey)	Multiple-group Structural Equation Model	SWB; Other life domain (work characteristics, attitudes and behaviour)
Eilam and Shamir (2005)	Jerusalem, Israel	N = 178 and 32 workshops (Survey and Interviews)	Semantic differential scale and Descriptive test	SWB
Martin et al. (2000)	South Wales	N = 93 (Cross sectional survey)	Attributional analysis	SWB (mental health, stress); Other life domain (Job satisfaction)
Anderzén and Arnetz (1999)	From Sweden to a foreign country	N = 47 relocated and 35 not relocated (Survey)	Stepwise linear regression models	SWB; Other life domain (work characteristics)
Martin (1999)	Cardiff, Wales	N = 54 (Longitudinal study - Survey)	Regression	SWB (mental health); Other life domain (Job satisfaction)
Anderzén and Arnetz (1997)	From Sweden to all over the world with the exception of the Scandinavian countries	N = 69 relocated and 39 non-movers (Survey)	Stepwise linear regression models	SWB (mental health); Other life domain (Job satisfaction)

Martin (1996)	Britain, United Kingdom	N = 51 employees, 31 partners and 58 controlled group (Longitudinal study - Survey)	Descriptive analysis and Factor analysis	SWB (mental health, stress)
Munton and West (1995)	United Kingdom	N = 121 (Longitudinal survey)	Structural equation modelling	SWB (mental health, stress, psychological well-being)

Since a WPR involves a change in the work characteristics, the effects may include disruption of the work-life factors. The work-life factors includes organizational constraints, sense of uncertainty and isolation, increase in job insecurity (Bellagamba et al., 2016). Nevertheless, Joslin et al. (2010) found that employees with positive relations at work were more likely to change their attitude and behaviour towards work in order to be accepted by their colleagues at the new workplace, thereby reducing their work-life conflicts at home. They further pointed out that mood, behaviour and attitude experienced at work have a direct effect on psychological distress.

Christersson et al. (2017) identified psychological factors that are influenced by a workplace relocation. This includes resistance to change, feelings of fear and stress, new ways of working, and associated behavioural change, as well as shifts in organizational dynamics. Eilam and Shamir (2005) suggested that employees are resistant to change. They support it only when it is in line with their self-concepts otherwise they experience the change as stressful. Brandis et al. (2016) found that if employees' efforts at work are recognised, their job satisfaction increases. Munton and West (1995) found that employees with positive self-esteem were likely to report innovating at work in response to workplace relocation. These workers also reported better mental health and were able to handle stress during the relocation. In other words, role innovation may be an important strategy for dealing with negative well-being effects of a job relocation. Alternatively, they also found that people with low self-esteem were more likely to report changes in their values, attitudes, career goals, and personality in response to a job relocation.

In summary, the social-psychological perspective includes studies that link the impacts of WPR to people's SWB. The evidence for the social-psychological consequences is conclusive. The most common and widely discussed outcome is an increase in stress and poor mental health. Thus, the body of evidence reviewed in this study suggests a variety of main and secondary outcomes of a workplace relocation. These outcomes are synthesized into four perspectives, as illustrated in Figure 2.3.

2.5 Conceptual model for workplace relocation

Based on our understanding of the four perspectives, we have gained better insights into the complex interaction between workplace relocation, commuting behaviour, commuting satisfaction and SWB. Based on these insights, we have elaborated the basic conceptual model.

The elaborated conceptual model, illustrated in Figure 2.4, describes the relationship between WPR and its key aspects in a person's life course at both individual and household level. A WPR could affect four relationships, namely (a) a person's commuting behaviour, followed by (b) their satisfaction with commuting, (c) their activity behaviour/life domains other than commuting, followed by their satisfaction with these life domains, and (d) their social psychological characteristics. The activity behaviour or changes in areas of life other than commuting also depend on how the individual interacts with other

household members (c). Relationship a, b, c, and d correspond to the insights gained from Sustainability, Mobility biographies, Household interaction and the Social-psychological perspective, respectively.

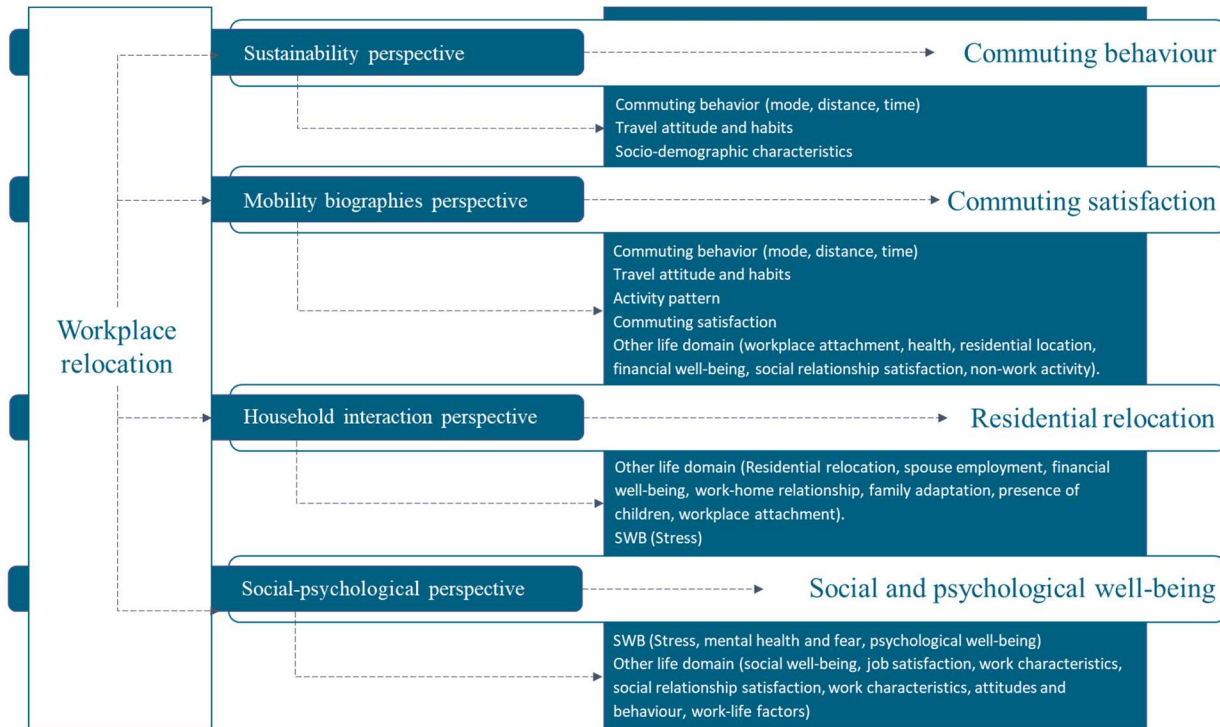


Figure 2.3: Summary of the multi-perspective review

Nevertheless, there might be other possible effects of WPR that we know from existing studies but are not covered by these four perspectives (see red dashed lines in Figure 2.4). For instance, previous studies have often indicated that satisfaction with commuting influences SWB (De Vos et al., 2013; Friman et al., 2017; Zarabi et al., 2019). Satisfaction with life domains other than commuting also influences SWB (Diener, 1984; Veenhoven, 2012). Chatterjee et al. (2017) suggested an indirect impact of satisfaction with commuting on SWB through its impact on satisfaction with life domain other than commuting. The impact of WPR on satisfaction with life domains other than commuting and SWB has not been adequately studied. Potential life domains include satisfaction with job, accommodation, salary, living environment, leisure, social relationships and recreational space. It is important to examine satisfaction with life and life domains as there is evidence that time spent commuting affects time spent on other activities and thus SWB (Christian, 2012; Hilbrecht et al., 2014; Nie & Sousa-Poza, 2018). Because interaction with other life domains is neglected, especially through a WPR lens, studies cannot examine how individuals cope with travel dissatisfaction in their personal lives. Previous studies are largely based on cross-sectional data and we cannot be sure of causal conclusions.

Furthermore, there is evidence that WPR of one of the household members affects the organization of activities of other household members; however, the impact of WPR on household member's satisfaction with different life domains is often overlooked. Mao and Wang (2020) used data from Beijing to investigate the effects of a residential relocation on household couples' SWB. Data collection in two waves showed significant improvements in SWB for both household heads. The increase in SWB for male

household heads was due to improvements in social relationships and the physical environment, while SWB for female household heads improved due to better transport links. However, future research is required to understand the impact of a WPR of one household member on satisfaction with life domains of other household members and vice versa.

There are also some feedback effects that we know from other empirical studies that are not about the impact of a WPR (see red dashed lines in Figure 2.4). For instance, previous studies, have often pointed out that satisfaction with life domains such as job, leisure, physical and social time influences satisfaction with commuting (Abou-Zeid & Ben-Akiva, 2012; Hilbrecht et al., 2014; Maheshwari et al., 2022b; Wheatley, 2014). SWB also influences individuals' satisfaction with commuting (De Vos, 2019; Gao et al., 2017; Maheshwari et al., 2022b) and satisfaction with life domains other than commuting (Heady et al., 1991). As these relationships are relevant to a WPR but less researched, they mark important knowledge gaps in the current state-of-the-art on workplace relocation.

The elaborated conceptual model also includes a feedback loop (black dashed line). The literature review started with the question of the impact of WPR on commuting behaviour, commuting satisfaction, and SWB of people. However, we can also reverse this and ask whether people who are dissatisfied with their commuting are also more likely to change their commuting behaviour by changing workplaces in the subsequent year. Using longitudinal data for workers in England, Chatterjee et al. (2017) found that workers with longer commutes of over 45 min one way tended to have lower SWB than other workers and were more likely to change jobs in the following year. Therefore, to provide more insights into the feedback loop, a longitudinal perspective is needed that looks at the level of commuting satisfaction in year t and the likelihood to changing workplaces in the subsequent year ($t+1$). Nevertheless, future research should be devoted to understanding the direction of causality. Supplementing the available quantitative research with qualitative analysis can also help to gain better insights into the causal relationship (Clifton & Handy, 2003).

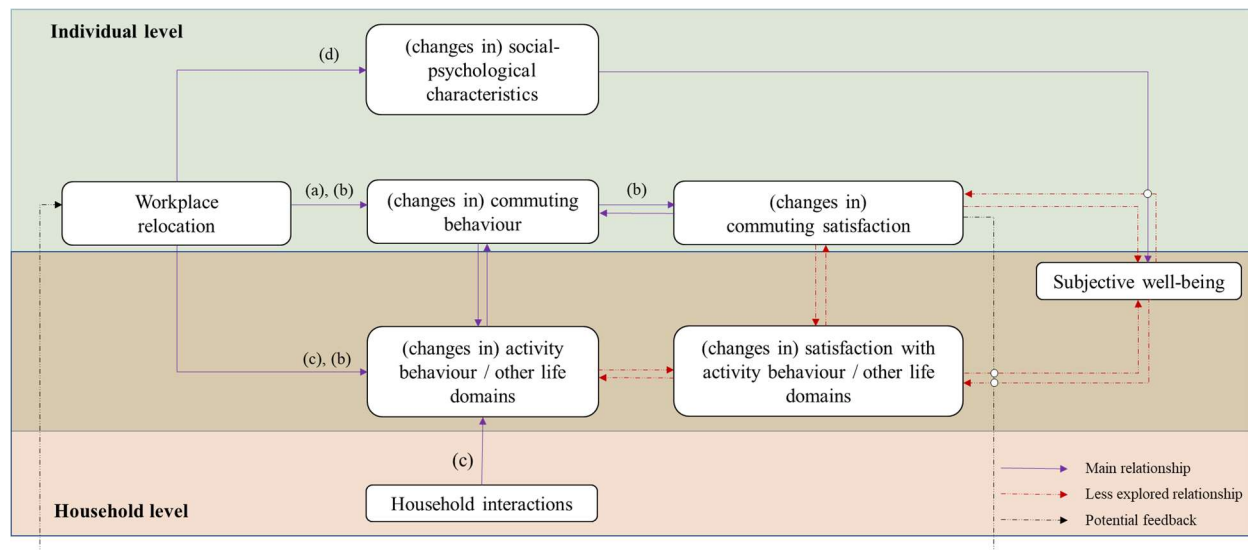


Figure 2.4: Conceptual model of the impacts of a workplace relocation

Finally, most of the studies included in this review focus on involuntary moves. The effects of a voluntary move on commuting behaviour, commuting satisfaction, and satisfaction in other life domains are poorly understood. We believe that satisfaction with life and life domains, including commuting, is affected differently in voluntary and involuntary moves. Future research should be devoted to understanding differences in these effects. It is important to analyse these relationships because the workplace is not an isolated aspect, but may encompass changes in many other life domains. Future research on WPR should examine these perspectives together to gain a better understanding of the wider impacts of a workplace relocation, particularly by examining a more longitudinal analysis.

In summary, the data presented in this paper merely touch upon the red and black dashed relationships. Therefore, these relationships are open for future research. Since the evidence is limited, we do not have a complete picture of the impacts of a WPR on commuting behaviour, commuting satisfaction, satisfaction with life domains other than commuting, and life satisfaction.

2.6 Conclusion and Policy recommendations

This comprehensive literature review provides an overview of factors/ outcomes of a WPR from each of the four perspectives and the knowledge gap in the literature on commuting and SWB. Key concepts from these four perspectives have been integrated into the conceptual model to provide a robust understanding of the impacts of a WPR on commuting behaviour, commuting satisfaction and SWB. The insights gained from this review will help policymakers and practitioners identify areas of life where tailored interventions are needed to increase people's SWB. Based on the conceptual model created in this study, we finally give an overview of policy recommendations, which have been proposed in existing studies and are in line with our model.

Recommendations linked to a WPR

WPR is a consequence of national policies aimed at decentralising central business districts or developing transit-oriented cities. We recommend that future companies keep in mind the direction of the relocation to mitigate any potential modal shift towards car. Other factors such as ease of access to the new workplace, connectivity to public transport, availability of paid parking and the presence of a mixed-use development also matter (Cervero & Landis, 1992).

Recommendations linked to (satisfaction with) commuting behaviour

Ettema et al. (2010) suggest that the goal of policy makers should be to increase commuter satisfaction. This could mean investing in soft modes, as the use of soft modes is associated with higher SWB (Ettema et al., 2016). This could also be done by making public transport infrastructure efficient as delays, overcrowding and strikes can affect commuter satisfaction more than high ticket costs (Sprumont, 2017). Another strategy is to relax working from home policies at the workplace, as a poor commute can become more acceptable if it only has to be done once or twice a week. Results have shown that working from home reduces work-home conflicts and increase satisfaction with work, family and life (Beutell, 2010). Another study observed a decrease in work-home conflicts when employees were offered flexible work arrangements (Anderson et al., 2002). Lastly, efforts should be made to study/ evaluate individuals' daily

trips, as the end of a journey (the destination) plays an important role in how people evaluate their travel experience.

Recommendations linked to (satisfaction with) other life domains/activities

A recent study by [Spumont and Viti \(2018\)](#) illustrates how relocating a workplace to a monofunctional area negatively impacts employees' activity patterns. In contrast, relocating workplaces to a mixed-use area can help workers run errands on their way home and reduce the need for multiple long trips, which significantly increases workers' overall well-being. Policy makers and practitioners are recommended to pay attention to the analysis of the daily activity chain of individuals to understand their commuting behaviour and allow multiple transport options within the city so that individuals and their household members can run their daily errands with satisfaction.

Recommendations linked to SWB

Changes in WPR are associated with changes in individuals' SWB. The results suggest that employees are less stressed and worried about the move if the employer informs its employees about the move early or increases awareness about the moving process by organising training for employees before the move. This is because it gives them time to make adjustments in their daily activities and the lives of their household members ([Munton & Forster, 1990](#)). Another way to increase employees' social-psychological and SWB is to pay attention to their satisfaction with commuting and satisfaction with life domains other than commuting.

CHAPTER 3. Commuting and Domain satisfaction

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>

Although the majority of literature explains travel satisfaction by examining trip determinants, the interaction between travel satisfaction and satisfaction with other life domains has been analysed less frequently. Accounting for satisfaction with other life domains is nevertheless important because the effect of trip characteristics on travel satisfaction may be overestimated without considering satisfaction with non-travel-related life domains. Hence, this paper examines the interaction between satisfaction with commuting time, satisfaction with other life domains and overall life satisfaction. An ordered logistic regression has been estimated using a large dataset comprising data from 32 European countries. Results indicate that satisfaction with specific life domains and overall life satisfaction have a significant association with commuting time satisfaction (CTS), while controlling for employment characteristics, and personality (i.e., trust). Of all life domains, job and time-use satisfaction have the strongest associations with CTS. Given the large dataset, we controlled for the contextual differences between the European countries by making a distinction between well- and less-developed countries. The result seems to suggest that all life domains and employment characteristics explain CTS in well-developed countries better compared to less-developed countries. This paper thus contributes to reporting other innovative ways to obtain high levels of commuting time satisfaction rather than only looking at the interactions with transport mode, travel distance and travel time.

3.1 Introduction

Since 2010, several studies have explained travel satisfaction by examining trip determinants like transport mode, travel distance, travel time (St-Louis *et al.*, 2014; De Vos *et al.*, 2016), the built environment (Mouratidis *et al.*, 2019), and subjective characteristics like attitudes and personality traits (Gao *et al.*, 2017; Ye & Titheridge, 2017). Very little attention is paid to the interactions between travel satisfaction and satisfaction with other life domains (a few exceptions can be found in Gao *et al.*, 2017; Kroesen, 2014). This is rather surprising since daily travel largely depends on the decisions we make regarding other life domains like where to live and work, how to commute, how to spend the leisure time, and how to distribute daily time-use. Accounting for satisfaction with other life domains is nevertheless important because it is not only the trip characteristics that explain travel satisfaction but also the interaction of satisfaction with other non-travel-related life domains that explain travel satisfaction. Not controlling for this association between travel satisfaction and other life domain satisfaction may have introduced important biases in the results of travel satisfaction.

Furthermore, there is extensive literature on how satisfied people are with their daily travel in general. However, what is less explored is the satisfaction with the time component of travel. It is nevertheless important to examine satisfaction with travel time due to the concept of travel as derived demand and positive utility of travel time. Although travel is generally considered a disutility that needs to be minimised, people still travel as it can provide certain physical and emotional benefits (Mokhtarian & Salomon, 2001). For example, the commute to work can act as a transition between personal and professional life (Redmond & Mokhtarian, 2001). This explains that travel time is not necessarily a source of disutility that needs to be minimised but should be studied in combination with satisfaction with other specific life domains.

To fill these two research gaps, this article analyses the interaction between commuting time satisfaction (CTS) and satisfaction with multiple life domains using data from the 2013 European Union Statistics on Income and Living Conditions (EU-SILC) survey. To our knowledge, this is one of the only dataset that includes not only the satisfaction with commuting time, but also the satisfaction with several other life domains. Moreover, this survey collected data from 32 European countries, allowing for a cross-sectional country comparison. Satisfaction with commuting may differ from country to country due to contextual differences (e.g. by income level, as commuting may allow people in some "rich" countries to earn higher wages than in other countries). This paper will therefore distinguish between well-developed and less-developed countries based on the Human Development Index (HDI).

In doing so, this paper will answer two research questions: (i) what is the interaction between CTS and satisfaction with other life domains, while controlling for covariates?; and (ii) how is this interaction influenced by contextual differences across EU32 countries? The remaining paper is organised as follows. Section 3.2 provides a review of the literature on commuting satisfaction. Section 3.3 describes the dataset and the methodology used. Results are presented and discussed in Section 3.4. Section 3.5 finally summarizes the main findings and provides avenues for future research.

3.2 Literature review

Over the past years, many studies have provided interesting insights into the relationship between travel satisfaction and its main determinants (for an overview, see [Ettema et al., 2016](#)). In this study, travel satisfaction is limited to commuting satisfaction. First, we describe the direct and indirect effects of some frequently researched determinants of commute satisfaction such as transport mode, travel distance and travel time. Next, we present the influence of some less frequently studied, but relevant, variables such as employment characteristics and personality.

3.2.1 Commuting satisfaction and its key determinants

Commuting is one of the least enjoyable activities ([Kahneman et al., 2004](#)) and is labelled “the stress that doesn’t pay” ([Stutzer & Frey, 2008](#)). Previous studies have indicated that this is due to (but not limited to) the influence of trip characteristics, built environment, subjective and socio-demographic characteristics. Amongst all determinants, **trip characteristics** (mode, distance and time) seem to have an important effect on commuting satisfaction. For instance, active modes of transport suggest higher satisfaction levels with commuting than motorised and public transport ([De Vos et al., 2016](#); [Legrain et al., 2015](#); [Mao et al., 2016](#); [Morris & Guerra, 2015](#); [Ye & Titheridge, 2017](#)), whereas train users present higher satisfaction with commuting than bus users ([Handy & Thigpen, 2018](#); [St-Louis et al., 2014](#)). [De Vos and Witlox \(2017\)](#) pointed out that the reason for these differences in the transport mode choice is still unclear and could partly be explained in the future by incorporating more qualitative research. From quantitative research, we understand that active travellers are most satisfied because they do not suffer from traffic congestion, whereas car users are mostly annoyed by travel elements like congestion, experienced traffic safety, parking availability ([Ettema et al., 2013](#); [Morris & Hirsch, 2016](#)). Likewise, public transport users associate their satisfaction with elements like comfort, cleanliness, safety and reliability of the system ([van Lierop & El-Geneidy, 2016](#)). Moreover, trip distance also has an important effect on satisfaction with daily travel (be it positive or negative), depends on the built environment characteristics, subjective characteristics and socio-demographics ([Handy & Thigpen, 2018](#); [Mokhtarian et al., 2015](#); [Ye & Titheridge, 2017](#)).

Another trip characteristic that has a direct impact on commuting satisfaction is travel time. There is extensive literature that longer commute time reduces commuting satisfaction and increases negative feelings such as stress, tiredness, worries ([Mokhtarian et al., 2015](#); [Morris & Guerra, 2015](#)). Since satisfaction could be an indicator of individual’s perceived utility, commuting time can be associated with both positive utility and disutility. Although [Redmond and Mokhtarian \(2001\)](#) pointed out the positive utility of time, most commuters aspire to a shorter commute time than the actual commute time. Several other studies analysed the ideal commute time (ICT) versus actual commute time (ACT) and found that on average ICT is usually less than ACT ([Milakis & van Wee, 2018](#); [Zhao et al., 2012](#)). Among them, many commuters have higher satisfaction with their commute time when the ACT is ± 5 minutes than their ICT. Nevertheless, [Humagain and Singleton \(2020\)](#) reported that a large proportion of their sample (80%) were dissatisfied with their commuting time because the difference between their ACT and ICT was much more than 5 minutes. On similar lines, [Ye et al. \(2020\)](#) found that respondents having a commute time close to (or below) their ICT (35.6% of the respondents) had significantly higher levels of commuting satisfaction compared to those travelling longer than ICT (64.4% of the respondents). [Higgins et al. \(2018\)](#) also obtained similar results. In general, these studies observed a negative association between longer

commute time and commuting satisfaction. Additional downsides of longer commute time are less time spent with family members (Christian, 2012), less time spent on leisure activities and physical activities (Hilbrecht et al., 2014; Lorenz, 2018), and less time spent on sleeping (Nie & Sousa-Poza, 2018). This explains that commute time can either be a source of disutility that people want to minimize or can be associated with positive benefits that people desire. Based on this, it seems imperative to explore **satisfaction with the time component of travel**, specifically commute time.

In addition to trip characteristics, the **built environment** also has an indirect influence on commuting satisfaction, mediated through trip characteristics, especially transport mode (Handy & Thigpen, 2018; Ye & Titheridge, 2017). For instance, Mao et al. (2016) found an indirect effect of urban density on commuting satisfaction through transport mode in Beijing. They reported that the use of active transport in denser areas are associated with higher satisfaction with commuting. Mouratidis et al. (2019) obtained similar results, noting higher travel satisfaction among commuters who travel shorter distances by active transport in dense urban areas. Hook et al. (2021) reported that built environment characteristics play an important role in determining travel satisfaction because trip characteristics and other travel-related elements are highly dependent on the characteristics of the residential built environment. A few studies have also suggested an influence of **subjective characteristics** like attitudes towards travel, personality and mood during travel on satisfaction with commuting (De Vos et al., 2019; Mokhtarian et al., 2015). For instance, travel attitudes have a direct effect on commuting satisfaction (Zeid, 2009; Abou-Zeid et al., 2012; Manaugh and El-Geneidy, 2013). The authors suggested that if people travel with their preferred mode of transport, they indicate a higher satisfaction level with their travel. Handy and Thigpen (2018) obtained similar results. Apart from travel attitudes, mood during travel also impacts commuting satisfaction. It is especially true for commuting trips where Zhu and Fan (2018) found commuting trips to be associated with negative feelings, in contrast to non-commuting trips, which seem to be more relaxed and enjoyable. Lancée et al. (2017) pointed out that a combination of commuting time and commuting mode increases negative feelings during the commute, whereas an increase in commuting time can even uplift the mood when commuting by active modes of transport. On the other hand, Mokhtarian et al. (2015) reported that only 8% of the total trips in France were tiring and less than 4% were unpleasant, suggesting that travel is not always obnoxious. In general, mood during travel has a short-term effect on commuting satisfaction. However, another important factor that has a long-term effect on commuting satisfaction is overall life satisfaction.

Life satisfaction or subjective well-being (SWB) is a concept closely related to happiness and, has been a topic of research in social and psychological science for decades (for an overview, see Diener et al., 1999). Several studies have pointed out the relationship between life satisfaction and travel satisfaction (Ettema et al., 2010; Bergstad et al., 2011; De Vos et al., 2013). However, less is known about the indirect effect of life satisfaction through domain-specific satisfaction on commute satisfaction (a few exceptions can be found in (Gao et al., 2017; Kroesen, 2014a; Mouratidis, 2020). Accounting for satisfaction with other life domains is nevertheless important because it might be an overestimation to conclude the effect of life satisfaction on travel satisfaction without considering the interactions of satisfaction with other daily non-travel-related life domains. Not doing so may have introduced important biases in the results on travel satisfaction so far.

3.2.2 Commuting satisfaction and some less frequently studied determinants

Apart from the main determinants of commuting satisfaction, there are some less frequently studied but relevant determinants that could also affect satisfaction with commuting. It is somewhat strange that not many studies pay attention to the **employment characteristics** of the individuals because people are mostly obliged to commute to work, and the activities at the destination may influence people's satisfaction with commuting time (Ettema et al., 2010; Bergstad et al., 2011; De Vos et al., 2013).

Past studies analysed the effect of employment characteristics on job satisfaction. For instance, some studies reported temporary employees to be less satisfied with their jobs compared to permanent employees (Bruno et al., 2013; Graaf-Zijl, 2005; Waaijer et al., 2016). Clark et al. (2020) pointed out that home-workers (or workers with zero commute) have higher job satisfaction in comparison to those who do not work from home. Some studies even analysed the impact of commuting behaviour or commuting satisfaction on job satisfaction (Amponsah-Tawiah, Annor and Arthur, 2016; Chatterjee et al., 2020; Mouratidis, 2020). For instance, Amponsah-Tawiah et al. (2016) observed an indirect and negative effect of commuting stress on job satisfaction, through burnout.

However, it also seems plausible that employment characteristics other than job satisfaction can have a spill over effect on satisfaction with the daily commute to work. After all, people who are satisfied with their work characteristics might also report higher levels of satisfaction with their daily commute to work. There are only two studies that analyse the effect of employment characteristics on commuting satisfaction. Lucas and Heady (2002) found no significant relationship between flexitime working environments and commuting satisfaction, whereas, Morris and Guerra (2015) found the total affect scores (positive and negative) of work-related travel to be lower than other non-work-related travel. Other studies also analysed the relationship between workplace satisfaction, workplace attachment, workplace environment and design, and satisfaction with the commute (Gerber et al., 2020; Haapakangas et al., 2018; Phillips et al., 2010; Spreckelmeyer, 1993; Wallmann-sperlich et al., 2019). However, workplace attachment and workplace satisfaction are not indicative of an individual's employment characteristics. These are rather a separate life domain. Therefore, we understand that not many studies have analysed the relationship between employment characteristics and commuting satisfaction, which is surprising because people commute to participate in their work activity and work activity can largely influence their satisfaction with commuting.

From this viewpoint, and for a holistic conceptualisation, this study attempts to understand the role of employment characteristics, multiple life domains and personality on CTS. These unusual variables could be a new addition to the commuting satisfaction literature. To the best of our knowledge, no study exists that demonstrates these relationships. Commuting satisfaction was always analysed using transport variables, built-environment and subjective characteristics. However, people have to commute because their place of residence and workplace are often spatially separated. Therefore, this paper aims to fill the current gap by analysing the interactions between commuting time satisfaction (CTS) on one hand and satisfaction with multiple life domains on the other hand, while also controlling for employment characteristics, personality and socio-demographics (see also the conceptual model in Figure 3.1).

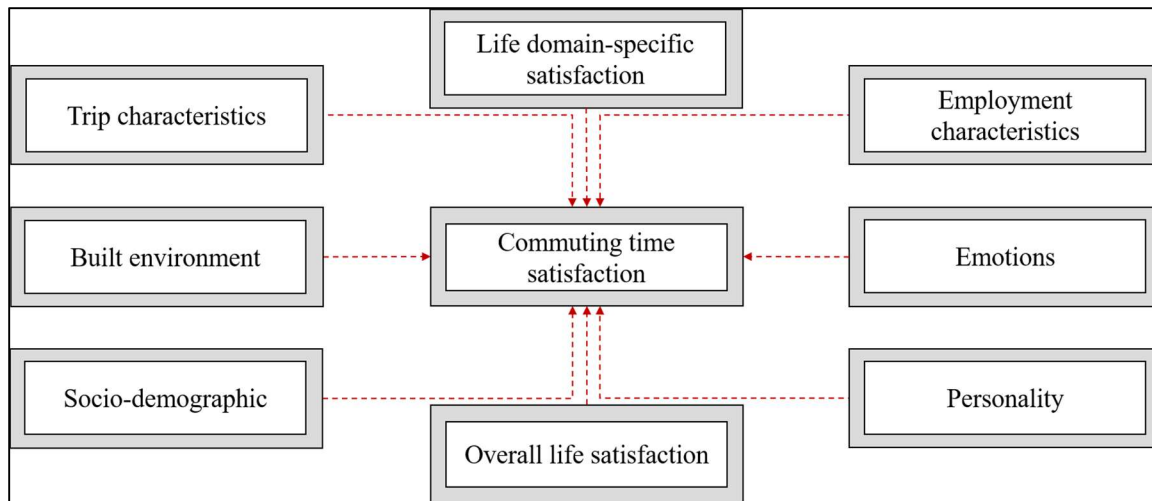


Figure 3.1: Conceptual model of commuting time satisfaction

3.3 Research design

3.3.1 Sample

The dataset used for this study is the 2013 module of the European Union Statistics on Income and Living Conditions (EU-SILC). In this module on “Well-being and Satisfaction”, respondents are asked about their quality of life and SWB, their satisfaction with multiple life domains (among others CTS) and their socio-demographics. In total, 600,000+ respondents from 32 European countries participated in this survey. The sample is representative of the European population, irrespective of their country of origin (Eurostat, 2018). For this paper, only employed people were included in the analysis (117,041 respondents). Respondents who are unemployed, unfit to work, retired or inactive were excluded from the analysis because these people do not commute to work, and therefore do not report a CTS score. Although this survey dates back to 2013, it still has multiple benefits. First, it allows us to study the interaction between CTS and domain-specific satisfaction. Second, this dataset allows for a cross-sectional countries’ comparison. The only disadvantage of this dataset is the absence of mainstream travel behaviour variables like mode, distance and time. We are aware that this is a limitation of this dataset, but at the same time, it provides ample opportunities to study the interactions between CTS and satisfaction with other life domains.

Our sample has an even distribution of males and females. The mean age of the respondents is 43.5 years which corresponds to the largest category of respondents being in the adult category (≤ 50 and ≥ 30 years) followed by older adults (> 50 years) and young adults (< 30 and > 15 years). The majority of our respondents are married (60%). Two-third of the respondents do not have a university degree. Around 85% of our sample owns a car. The survey did not ask about the commuting mode and, consequently, we do not know if respondents use their cars to commute to work. However, previous studies suggest that an increase in household car ownership triggers a change in individuals’ travel behaviour, which in turn leads to an increase in commuting by car (Clark, 2012; Clark et al., 2016; Dargay & Hanly, 2007). Therefore, we assumed that car ownership is a proxy for commuting mode. Furthermore, almost 40% of the respondents live in urban areas, whereas the remaining 60% is divided almost equally over suburban and

rural areas. Respondents were also asked to rate their general health. One fourth reported having bad health.

Since the EU-SILC survey is organised in 32 European countries, results can be impacted by contextual differences between these countries. We took that into account by making a distinction between well-developed and less-developed countries using the Human Development Index (HDI). Countries with an HDI score of ≥ 0.89 were classified as well-developed countries, whereas those with a score of < 0.89 were classified as less-developed countries. The cut-off point of 0.89 was determined using the median value of HDI. This classification was necessary because it might be an over-exaggeration to treat all 32 European countries in the same way as these countries have different socioeconomic and demographic contexts. These contextual differences are captured by the HDI as this index combines income, the standard of living, education, and health parameters.

3.3.2 Measurement of key variables

The dependent variable in this paper is commuting time satisfaction (CTS). Respondents were asked to rate their degree of satisfaction with their commuting time to work. CTS was measured on an 11-point Likert scale ranging from 0 - 'very dissatisfied' to 10 - 'very satisfied'. The average score on this scale is 7.46. It illustrates that majority of the respondents are satisfied with their commuting time. The independent variables in this study are (i) satisfaction with life in general and specific life domains, (ii) employment characteristics, and (iii) subjective characteristics like emotions and trust. The life domains included satisfaction with the job, financial situation, time-use, accommodation, personal relationship, recreational space, living environment, and overall life satisfaction. Respondents were asked to rate their satisfaction with overall life and specific life domains on an 11-point Likert scale ranging from 0 - 'very dissatisfied' to 10 - 'very satisfied'. On average, respondents were found to be least satisfied with their financial situation (6.3) and most satisfied with personal relationships (8.0), while life satisfaction had an average score of 7.3. A Spearman's correlation test indicated significant correlations ($p < 0.05$) between CTS, overall life satisfaction and satisfaction with specific life domains².

Employment characteristics were measured by three variables: (i) full-time (>30 h per week) vs part-time employees (<35 h per week)³, (ii) change in employment status from unemployment/inactivity/retirement to employment vs no change, and (iii) temporary vs permanent employee. Respondents were asked to indicate their current employment characteristics. The majority of respondents work as a full-time

² We performed Spearman's correlation analysis to measure the associations between CTS and the life domain variables. The analysis reveals $r=.20$ for overall-life satisfaction, $r=.21$ for satisfaction with the financial situation, $r=.18$ for accommodation satisfaction, $r=.27$ for job satisfaction, $r=.26$ for time-use satisfaction, $r=.16$ for personal relationship satisfaction, $r=.16$ for recreational space satisfaction and $r=.18$ for living environment satisfaction All values are at $p<.05$ level of significance.

³ There is an overlap between these two categories. It is impossible to establish an exact distinction between full-time and part-time work. This is due to the variations in the measurement across the EU32. Based on the spontaneous answers of the respondents, they were assigned to one of these two categories.

employee (84%) and has a permanent contract (89%). Only a small amount of respondents experienced a recent change in their employment status (5%)⁴.

Regarding emotions, respondents were asked to indicate their feelings in the last four weeks on a 5-point Likert scale (all/most/some of the time to a little/none of the time). Negative feelings included being nervous, feeling down and in the dump, and feeling downhearted or depressed, whereas positive feelings comprised feeling calm and peaceful, and being happy. Although it can be argued that happy and calm/peaceful are different types of positive feelings (i.e., positive activation versus positive deactivation (Mokhtarian, 2019)), due to their internal consistency (Cronbach alpha = 0.79), we combined them into a new variable “Positive feelings”. Similar results were observed with negative feelings (Cronbach alpha = 0.68) and a new variable “Negative feelings” was created.

Respondents were also asked to rank their trust on an 11-point Likert scale with 0 “no trust” and 10 “complete trust”. Trust included trust in the police, the political and legal system. Due to their internal consistency (Cronbach alpha value = 0.85), a new variable “Trust” was created. Since it is a personality trait (Deneve & Copper, 1998), we included it in our analysis. It is uncommon in the literature on commuting satisfaction but could also be relevant because people with a happy personality might evaluate their commuting more positively compared to those with a negative personality. We also controlled for socio-demographic variables like age, gender, education, and marital status.

3.3.3 Methodology

Commuting time satisfaction (CTS), the dependent variable in our analysis is ordinal. For that reason, we estimated an ordered logistic regression using the STATA ologit module. To control for the contextual differences, we estimated three logistic models using a maximum likelihood estimation technique. The first model is based on the entire sample (Model 1, n = 117,041). The second model only includes respondents from less-developed countries (Model 2, n = 55,494), whereas the third model only includes respondents from well-developed countries (Model 3, n = 61,547). Sample sizes of these three models are very large which may result in the “p-value problem” meaning that p-values quickly go to zero and might falsely indicate significant associations (Lin et al., 2013). One solution for this is to apply bootstrapping (Fang & Ma, 2017). Bootstrapping is a resampling method that uses random sampling with replacement from the original sample. In doing so, it provides more robust p-values. Since all the models consist of multiple covariates, we checked for multicollinearity by calculating the variance inflation factor (VIF). The VIF for all the predictors is < 10 (mean VIF = 1.39). Therefore, we do not foresee any problem of multicollinearity. We also reported the log-likelihood ratio and McFadden’s Pseudo R² values for analysing the goodness of fit. Furthermore, we conducted an independent validity check of the full model using the estimation sample and found an 80.99% average correctly predicted values in the model, thereby demonstrating a good model.

⁴ We performed three Mann-Whitney U tests to compare the mean CTS value between respectively, full-time and part-time workers, respondents with and without a change in employment status; and permanent and temporary employee. Each time there are significant differences (p < 0.01) between both groups.

3.4 Results and discussion

We first focus on the results of the entire sample (Model 1) and then discuss differences between less-developed and well-developed countries (Model 2 and Model 3). The results for the three models are demonstrated in Table 3.1. Out of these models, Model 2 obtains a slightly better model fit than Model 3 with McFadden's Pseudo R² improved from 0.044 to 0.069 with the same degree of freedom (24) and a log-likelihood ratio of < 0.0001. It implies that both models have comparable complexity and the increase in R² values in Model 2 is not due to adding more variables. Although the R²-value of all the models is less than 0.2, which is a minimum score representing good model fit (McFadden, 1999), we still consider that the model for less-developed countries explains the association between CTS and the other variables in a slightly better way.

3.4.1 CTS and satisfaction with life and life domains

Results from Model 1 indicate a significant association between CTS and satisfaction with other life domains like job, time-use, accommodation, personal relationship, living environment and recreational space. In exception, financial situation satisfaction (FSS) is insignificant. It might be that the effect of FSS is picked up by the overall life satisfaction due to their high correlation ($r=.61$, $p<.0.05$). Out of the other significant life domains, job and time-use satisfaction have by far the largest-magnitude coefficients among those for variables measured on the same scale. Moreover, we tested the relationship between the life domains and CTS for all European countries separately and found that these two life domains were significant in all the countries, further pointing to their importance.

Overall life satisfaction is also positively significant to CTS. It suggests that one unit increase in satisfaction with overall life leads to a 0.0139 increase in the log-ordered scale of CTS. Our finding is in line with past studies (Friman et al., 2017; De Vos, Ettema and Witlox, 2019).

3.4.2 CTS and other less frequently studied covariates

Furthermore, most of the employment variables also have a significant effect on CTS. Part-time workers are happier with their CTS compared to full-time workers. This might be because full-time workers tend to have longer commute times compared to part-time workers. Schwanen and Dijst (2002) came to similar conclusions, suggesting full-time workers have a lower commute/work and commute time ratio than part-time workers, thus indicating longer commute time for full-time workers (for an overview on travel-time ratio, see (Dijst & Vidakovic, 2000). They also found that part-time workers tend to live closer to their workplace, whereas full-time workers live relatively far. It could also mean that for part-time workers, one of the two daily commute trips is likely to be during off-peak hours. For all these reasons, it seems logical that part-time workers would not only spend less time commuting but would also have less burdensome commutes than full-time workers.

Likewise, our model indicates that temporary employees are less likely to be satisfied with their commuting time than permanent employees. It could exist because people who do not have a permanent job might always live under the pressure of finding another job, followed by a need to develop another commuting pattern. Other studies obtained similar results (Bruno et al., 2013; Graaf-Zijl, 2005; Waaijer et al., 2016). Moreover, we found that employees who did not experience any change in their employment

status are happier with their commuting time than those who experienced a change. This might be because people who experienced a change in their employment status need to adjust and get used to the new situation in which they have to commute now thereby rendering them to be less satisfied with their commute time. Gardner (2009) obtained a similar conclusion and labelled commuting as a ‘stable’ travel activity where commuters have a defined travel pattern.

Other uncommon variables are feelings and trust. Results indicate that when negative feelings increase with one unit, then also the log-odds of CTS decreases. Therefore, people who have more negative feelings are less satisfied with their commuting time. These results corroborate the findings from other studies (Stutzer and Frey, 2004; Bergstad et al., 2011; Morris and Guerra, 2015). The relationship between positive feelings and CTS is insignificant in Model 1. It is because the effect of positive feelings is picked up by negative feelings due to their high correlation. On the other hand, trust is positively significant to CTS. From the past study, we understand that trust is a personality trait (Denters & Klok, 2010), suggesting people who have trust in their political and legal system are happier with their life in general, thereby having higher CTS.

Many other covariates, like gender, health, age, income and level of urbanization also obtain significant results. Females have higher satisfaction with commuting time than males. People with bad health are more likely to report higher CTS compared to the reference group (good health). Adults have high levels of CTS compared to young adults. This might indicate that people between 30 to 50 years already have a defined commuting pattern and are used to that lifestyle compared to their cohorts who have just entered the workforce or are about to leave the workforce. This was pointed out by Gardner (2009). Employee’s income also has a positive effect on CTS, indicating as income increases by one unit, CTS increases by 0.801.

Moreover, respondents living in suburban areas are most satisfied with their commute time, followed by respondents living in urban and rural areas. This could indicate that suburban areas do not necessarily have issues of traffic congestion and unavailability of parking as seen in urban areas. However, when comparing urban and rural areas, the former offers better infrastructural facilities and better connectivity. These features of the built environment could indirectly help in making commuting less stressful and more satisfying. This finding corresponds with the findings of Ye and Titheridge (2017).

Lastly, to control for contextual differences, a dummy variable (HDI) was created. The association between HDI and CTS implies that respondents living in well-developed countries tend to be more satisfied with commuting time compared to those living in less-developed countries. Therefore, it makes sense to redo the ordered logistic regression for less-developed and well-developed countries separately.

Table 3.1: Results of an ordered logistic regression for commuting time satisfaction

Variable	Model 1 All countries	Model 2 Less-developed countries	Model 3 Well-developed countries
Satisfaction with sub-domains of life			
Financial satisfaction	0.000	-0.009	0.008*

Accommodation satisfaction	0.039***	0.045***	0.028***
Job satisfaction	0.249***	0.328***	0.187***
Time use satisfaction	0.147***	0.142***	0.149***
Personal relationship satisfaction	0.092***	0.106***	0.076***
Recreational space satisfaction	0.009**	-0.009*	0.028***
Living environment satisfaction	0.091***	0.110***	0.082***
Satisfaction with life	0.013***	0.011*	0.025***
Employment characteristics			
Part-time workers (ref: Full-time workers)	0.119***	0.109***	0.108***
Change in employment status to employed (ref: No change)	-0.095***	-0.045	-0.145***
Temporary employee (ref: Permanent employee)	-0.104***	-0.081***	-0.125***
Feelings			
Negative feelings	-0.059***	-0.094***	-0.024**
Positive feelings	-0.007	-0.042***	0.044***
Trust	0.016***	-0.014***	0.044***
Socioeconomic and demographic characteristics			
Female (ref: Male)	0.178***	0.167***	0.175***
Education level tertiary or higher than tertiary (ref: Lower than tertiary)	-0.035***	0.070***	-0.126***
Bad Health (ref: Good health)	0.060***	0.097***	0.011
Income of employees	0.801*	-4.846***	0.62
Age of Young Adults (ref: Adults)	-0.144***	-0.204***	-0.106***
Age of Older Adults (ref: Adults)	0.001	-0.013	0.007
Marital status Single/ Separated/ Widowed/ Divorced (ref: Married)	0.018	0.0006	0.033**
Car ownership (ref: Have a car)	0.009	-0.025	0.083***
Suburban (ref: Urban)	0.074***	0.148***	0.011
Rural (ref: Urban)	-0.027**	0.028	-0.074***
HDI – Less-developed countries (ref: Well-developed countries)	-0.237***		
Thresholds between categories of CTS			
Threshold 1 (0(very unsatisfied) 1)	-0.559***	-0.579***	-0.144
Threshold 2 (1 2)	0.067	0.135*	0.414***
Threshold 3 (2 3)	0.821***	0.965***	1.099***
Threshold 4 (3 4)	1.466***	1.689***	1.669***
Threshold 5 (4 5)	1.996***	2.267***	2.152***
Threshold 6 (5 6)	2.849***	3.216***	2.910***
Threshold 7 (6 7)	3.413***	3.863***	3.394***
Threshold 8 (7 8)	4.149***	4.662***	4.077***
Threshold 9 (8 9)	5.072***	5.700***	4.919***
Threshold 10 (9 10(very satisfied))	5.890***	6.595***	5.696***

n	117,041	55,494	61,547
Degrees of freedom	25	24	24
Log-Likelihood	-225,381	-107,830	-116,640
McFadden's Pseudo R ²	0.0581	0.0694	0.0444
Likelihood-ratio test (Prob > chi2)	<0.0001	<0.0001	<0.0001
*** p<0.01, ** p<0.05, * p<0.1			

3.4.3 Differences between less- and well-developed countries

There are considerable differences between the less-developed and well-developed countries. **Life satisfaction** is significant in both models, but it must be noted that for less-developed countries it is significant only at $p<0.100$ whereas for well-developed countries this is $p<0.001$. The higher p-value for less-developed countries might indicate that the relationship between life satisfaction and CTS is not that straightforward (see commuting paradox theory (Stutzer & Frey, 2008)). In reality, there might be two groups of respondents: some people are satisfied with their life even if they endure an unsatisfactory commute (because it still allows them to reach a well-paid job for example), and other people are satisfied with their lives and therefore also tend to report higher levels of satisfaction with other life domains such as commuting time. These two groups balance each other out, which might eventually explain why the association between life satisfaction and CTS in Model 2 is much weaker and only exists at a higher p-value.

Amongst all the **life domains**, the most striking finding is that all life domains are positively significant in Model 3 unlike Model 2 where there is no significant influence of satisfaction with the financial situation on CTS and the recreation space satisfaction is negatively significant to CTS. This is difficult to explain and is open for further research. Nevertheless, it suggests that people from well-developed countries are generally happy with their life domains, which is why they also report a higher degree of CTS.

All **employment variables** are significant in well-developed countries, unlike less-developed countries. The significance in Model 3 and insignificance in Model 2 might be because the percentage of people who moved from unemployment to employment are more in well-developed countries than in less-developed countries. Furthermore, in Model 2, **positive feelings** have a negative association with CTS unlike Model 3. This might indicate that as the presence of positive feelings increases by one unit, the log-odds of CTS decreases. Likewise, **trust** also has a negative relationship with CTS in Model 2, and the opposite relation in Model 3. The negative relationship might suggest that respondents in less-developed countries who have higher trust in police, politics, and the legal system have lower levels of CTS. In general, we can conclude that feelings and trust have a significant effect on CTS, but whether positive or negative depends on the context of the country. Although the pseudo-R² explains Model 2 better than Model 3, we believe our contextual differences support the argument that people in wealthier countries are happier with all the life domains than lower-income countries

3.5 Conclusion

In this study, we performed an ordered logistic regression to identify associations between commuting time satisfaction (CTS) and satisfaction with multiple life domains, while also controlling for other covariates. We used a large European dataset to analyse the interactions between these variables and to understand how this is influenced by contextual differences across EU32 countries. In general, we found a positive association between CTS, life satisfaction and satisfaction with multiple life domains. Of all these life domains, job and time-use satisfaction have the strongest associations. For less-developed countries, two life domains are negatively associated with CTS: satisfaction with the financial situation (although not significant) and recreational space satisfaction (although significant at a higher p-value compared to well-developed countries). More research is needed to explain why these two life domains obtain different results for less- and well-developed countries.

We, however, do acknowledge the limitations of this analysis. One important shortcoming is that this European dataset does not include any information about commuting characteristics (distance, time and mode). Furthermore, for a robust evaluation of the relationship between employment characteristics and CTS, more predictors like the location of the residence and workplace, workplace attachment, workplace characteristics, and stress related to the job would be useful ([Martin, 1999](#); [Stroh, 1999](#)).

In terms of policy implications, this study identifies two striking findings. First, even though life satisfaction has a positive effect on CTS in all models, this association is somewhat weaker for less-developed countries (given the higher p-value compared to well-developed countries). This suggests that CTS and life satisfaction do not always have a straightforward relationship (see commuting paradox theory for more explanation ([Stutzer & Frey, 2008](#))). For some people, the two measures may be positively correlated, while others endure an unsatisfactory commute to reach a job that contributes to higher satisfaction with life and thus, has a negative correlation. Both groups can balance each other, eventually resulting in a weaker association between CTS and life satisfaction as we have observed for less-developed countries. Furthermore, in order to be satisfied with commuting time, it is not only important to be satisfied with life but also with other life domains, more specifically with the job and time-use life domains. This leads to our second important takeaway that job and time-use satisfaction are the two most important life domains that are strongly associated with CTS. We suggest this because we tested the relationship between the life domains and CTS for all European countries separately and found that these life domains were significant in all the countries. Additionally, these two variables have by far the largest-magnitude coefficients among those for variables measured on the same scale, further pointing to their importance. Policymakers and practitioners should thus be aware that being happy with commuting is not always about transport mode, distance and time. There are also other ways to improve commuting satisfaction, especially when you think about the interactions with other life domains. Instead of only paying attention to lowering commuting time because then people are more satisfied with their commuting (as has been found in other studies), policymakers should pay attention to making sure that people are first of all satisfied with their job (and other employment-related characteristics) and second of all satisfied with their general time use like how people organize their daily lives, the timing of activities such as work in relation to school/dropping off, picking up of children/grocery shopping/leisure time/etc. Time use satisfaction can be addressed well in the context of interactions between land-use and transport.

Previous findings suggest an influence of the built environment on commuting satisfaction. [Mouratidis et al. \(2019\)](#) pointed out that compact and dense urban areas promote shorter trips and increase satisfaction with commuting. [Ewing et al. \(1994\)](#) and [Schwanen \(2002\)](#) indicated that higher built density leads to shorter commute time. The effects of land use diversity can also be compared to the effects of dense and compact urban areas. Greater diversity encourages the use of active and public transport modes over motorised use ([Cervero & Kockelman, 1997](#)). High diversity areas are also associated with lower trip chaining ([Ewing et al., 1994](#)). Thus, these findings suggest that policy makers should seek to develop neighbourhoods with a better mix of uses and high density development in order to have a population that is satisfied with their use of time.

This is important because from past studies we understand that each life domain is integrated with people's lives in a specific and connected way through travel and that satisfaction with each life domain and overall life satisfaction has an effect on travel and vice versa ([Veenhoven, 2012; Zarabi et al., 2019](#)). Thus, this study contributes to reporting other innovative ways to obtain high levels of commuting time satisfaction rather than only looking at the interactions with transport mode, travel distance and travel time.

There are also several avenues for further research. In this paper, we have analysed only the direct effect of life satisfaction (among others) on CTS. However, the effect of life satisfaction on CTS can also be indirectly through domain-specific satisfactions. Such indirect effects can be estimated using Structural Equation Modelling (SEM). Furthermore, we tried to account for contextual differences across countries by distinguishing less-developed from well-developed countries. However, a more advanced analysis could be the use of a multilevel regression analysis that accounts for the nested data structure of respondents being clustered in countries with different contexts. Finally, we only had cross-sectional data from 2013. Longitudinal data are needed to obtain better insights into the causality between CTS, life satisfaction and satisfaction with life domains. Only with longitudinal data, we will be able to analyse if changes in life satisfaction result in changes in CTS and if this effect is mediated by domain-specific satisfaction.

CHAPTER 4. Commuting satisfaction and Life events

Maheshwari, R., Van Acker, V., De Vos, J., & Witlox, F. Does dissatisfaction with commuting and work lead to changes in residence, workplace and/or car ownership in subsequent years? Submitted to and under review with *Travel Behaviour and Society*.

Despite extensive literature on commuting satisfaction, the question of how individuals adapt to commuting dissatisfaction has not been thoroughly analysed. In this study, a Luxembourgish panel-based survey from 2013 to 2015 is used to analyse whether individuals cope with commuting time and work dissatisfaction or continue to tolerate dissatisfaction in subsequent years. First, cluster analysis is used to identify different satisfaction profiles combining commuting time satisfaction (CTS) and work satisfaction (WS) in 2013. Then, cross-tabulations between these CTS-WS profiles and life events are created to highlight how dissatisfaction results into changing workplaces more frequently than changing residences and/ or car ownership. Next, a logistic regression is used to examine which CTS-WS combination has the strongest influence on the likelihood of changing workplaces. Not surprisingly, results indicate that the cluster with a combination of low CTS-low WS has a higher probability of changing workplaces in subsequent years than the cluster with a combination of high CTS-high WS. The cluster with high CTS-low WS has a stronger effect on changing workplaces than the cluster with the reverse combination, suggesting dissatisfaction with work might outweigh dissatisfaction with commuting time. Nonetheless, majority of dissatisfied individuals are unable to make a switch, and therefore tolerate commute and work dissatisfaction. Thus, this study is the first to report the consequences of commuting and work dissatisfaction. This not only enriches the research on commuting satisfaction by going beyond the effects of trip characteristics on CTS, but also contributes to a prospective approach of CS.

4.1 Introduction

Commuting to work can be regarded as an important activity that has the potential to impact individual's quality of life (Abou-Zeid & Ben-Akiva, 2012; Kahneman et al., 2004). Knowing whether individuals are satisfied with their commute and which factors contribute to that is therefore important to better enhance the well-being of the people. The traditional approach to understand satisfaction with commuting since the early 2010s has been to analyse travel options such as transport mode, travel distance and travel time (De Vos et al., 2019; St-Louis et al., 2014). More recently, the influence of subjective characteristics (such as travel preferences) and the characteristics of the built environment on commute satisfaction have also been studied, especially the built environment of the residence (Gao et al., 2017; Ye and Titheridge, 2017; Mouratidis et al., 2019). Despite extensive literature on the *determinants* of commute satisfaction, there is still much to learn about the *consequences* of commute (dis)satisfaction. Do individuals change where they live, where they work, or how they commute in subsequent years to cope with dissatisfying commuting patterns or do they tolerate the dissatisfaction? By accounting for these factors, we can gain valuable insights into the extent to which individuals are really able to make significant life changes in response to dissatisfaction, as well as identify the most common type of change.

Commuting dissatisfaction could be the result of a mismatch between commuting behaviour and travel preferences or attitudes (Chatterjee et al., 2020; De Vos & Singleton, 2020). For instance, Mao et al. (2016) found a U-shaped relation between transport flexibility and commuting satisfaction among commuters in Beijing, China. This means that people with high flexibility in mode choice (i.e. are not limited to a single mode of transport) report higher commute satisfaction, presumably because they have an option to choose their preferred mode of transport. However, commuters with a lack of flexibility also reported relatively higher satisfaction with their commute, presumably because they did not have an alternative transport mode to compare their satisfaction level with. It could also be that these people do not have experience with other competing modes of transport, or they lack means and flexibility to make a switch. Similar results indicating higher satisfaction among commuters with mode constraints were also reported by Handy and Thigpen (2018) for Davis, California. On the other hand, Ye and Titheridge (2019) observed lower satisfaction with commuting among lower income commuters in Xi'an, which is presumably due to the gap between their preferred transport mode and travel attitudes. Similarly, De Vos (2018) argue that commuting by preferred mode of transport translates in higher satisfaction for commuting. The large body of evidence from these studies suggests that changes in commuting behaviour and travel preferences could lead to changes in satisfaction with commuting. However, changes in commute satisfaction could also lead to changes in life events to cope with dissatisfying commute patterns.

Most of the existing but limited studies on the relationship between commuting satisfaction and life events such as residential or workplace relocations are based on cross-sectional studies that focus on the current state of travel satisfaction. Some exceptions include De Vos et al. (2019); Monteiro et al. (2021); Wang et al. (2020) for a longitudinal analysis of the impact of a residential relocation on commuting satisfaction. For example, De Vos et al. (2018) found higher satisfaction with commuting due to shorter commute distances and use of active transport among individuals who moved their residence to an urban neighbourhood in Ghent. Likewise, Schneider and Willman (2019) found changes in satisfaction with

commuting among University of Wisconsin-Milwaukee employees after moving to a different workplace or school. Gerber et al. (2020) observed an increase in commuter satisfaction due to a decrease in the daily commute time of employees following a hospital relocation in Montreal, Canada. In contrast, Sprumont et al. (2020) witnessed a decrease in commuter satisfaction of University employees following the relocation of the University campus from the city centre of Luxembourg to a location in the south of the country. All of these studies provide evidence on how commute satisfaction changes *after* a change in life event such as after a residential move or change in workplace. No study, however, examines how being dissatisfied with commuting could *result* in a change of residence or workplace. A conceptual paper on workplace relocation hypothesises a feedback loop between satisfaction with (and changes in) commuting and workplace relocation (Maheshwari et al., 2022a). The failure to take this prospective approach into account therefore raises important questions about the extent to which dissatisfaction with commuting may trigger an important life event in the future. We assume that certain individuals will indeed experience changes in certain life events in subsequent years to deal with commuting dissatisfaction, as commuting is often considered one of the least enjoyable activities (Kahneman et al., 2004) and is often referred to as ‘the stress that doesn’t pay’ (Stutzer & Frey, 2008).

Furthermore, as individuals commute between their home and their workplaces, it seems useful to also consider the characteristics of the workplace. According to Erdogan et al. (2012) and Heller et al. (2002), work satisfaction is a key construct in the organisational psychology and is defined as the way employees feel about their workplace and think about their work (Locke, 1969; Weiss, 2002). Prior theories and research suggest a link between work dissatisfaction and employee turnover or leaving a company. That is, employees may leave the company altogether in response to work dissatisfaction (Farrell & Rusbult, 1981). The turnover theory proposed by Mobley et al. (1979) and alternative structural theories that have re-analysed and validated Mobley's theory also suggest a positive impact of work dissatisfaction on the probability of quitting (Bannister & Griffeth, 1986; Dlessio et al., 1986; Hom et al., 1984). In these theories, structural equation modelling (SEM) was used to conceptualise how dissatisfaction translates into the intention to quit, which ultimately leads to quitting the job. Hom et al. (1992) used meta-analysis and SEM and validated these different turnover theories.

Although the relationship between work satisfaction and important phenomena such as turnover has not been widely established by empirical research, an implicit assumption in theorizing work satisfaction is that dissatisfaction with work will trigger a change in individual’s work situation (Withey & Cooper, 1989). Only a handful of studies have shown that work dissatisfaction can serve as a catalyst for change, especially among individuals who are looking for innovative ways to improve their current work situation (Staw, 1984; Van Gundy, 1987). Therefore, we argue that certain individuals who are dissatisfied with their work may be forced to quit and take another job because of work dissatisfaction. Additionally, due to the relative importance of commute dissatisfaction and work dissatisfaction it will also be interesting to see which responses to commute and work dissatisfaction are the more common.

Thus, to offset these shortcomings, this study aims to examine the relative importance of dissatisfaction with commuting and work on life events, in particular changing workplaces, residences and/or car ownership in subsequent years. We implicitly analyse dissatisfaction with both commuting and work, as previous studies have indicated a high correlation between these variables, especially for 32 European

countries (Maheshwari et al., 2022b). Nevertheless, we are aware that there could be other drivers provoking changes in workplace location such as irregular work shifts, a lack of flexible working arrangements, and alternative commuting methods such as changes in modes of transportation (Golden & Kim, 2017; Schneider & Willman, 2019b; Xiao et al., 2021); however, in this study we focus on how individuals respond to dissatisfying work and commutes. Doing so, this study becomes the first to offer insights into the prospective approach to commuting and work satisfaction. This study will not only help policymakers but also employers to identify areas for targeted interventions to enhance work environments, reduce commute time and promote the well-being of the employees. Additionally, this knowledge can help identify the most common coping strategies individuals use to respond to dissatisfaction in order to improve their overall well-being or determine their tolerance for dissatisfaction.

The next section introduces the dataset and the methodology employed in this study. Section 4.3 outlines the results. Lastly, Section 4.4 provides a discussion on the results and concludes the study with avenues for future research.

4.2 Research design

4.2.1 Sample

This study uses the Luxembourg Panel Socio-Economique Liewen on Lëtzebuerg 3 (P-SELL III) dataset, which is coordinated by Eurostat (2018). This panel-based survey includes individual and household data for 2013, 2014 and 2015 from a sample representative of the Luxembourg residents. Respondents were asked about, among other things, their occupational situation, housing situation, satisfaction and well-being, and socio-demographic characteristics. In total, data were collected for 16,319 individuals living in 6,619 households (HH). Only those respondents who reported their satisfaction with commuting time (CTS) and satisfaction with work (WS) were included in this analysis (n = 3,029). Unemployed respondents were not included as these respondents cannot report their CTS and WS and so we cannot know if dissatisfaction in the previous year resulted in any change the following years. Thus, we have less than 0.5% missing values in the restricted sample. Table 4.1 provides the socio-demographics of the respondents against the country's average (STATEC, 2011).

Table 4.1: Socio-demographic characteristics of the respondents

		Respondents in 2013 (in %)	STATEC 2011 (in %)
Age		41.5 years	38.7 years
Gender	Female	51.6	50.2
	Male	48.4	49.8
Education	Low level (secondary technical)	12.4	34.5
	Secondary level (Baccalaureate)	55.2	35.5
	Tertiary level (University degree or higher)	32.4	30.0
Health	Bad health	4.5	-
	Neutral	15.2	-
	Good	80.3	-
Cohabitation	Living with someone	58.8	-
	Living alone	41.9	-

Nationality	Luxembourgish	53.7	57.0
	Non-Luxembourgish	46.3	43.0

4.2.2 Measurement of key variables

The 2013 individual questionnaire included questions on respondents' satisfaction with commuting time. Respondents were asked to indicate on an 11-point Likert scale (ranging from 0 = very poor to 10 = very good) how satisfied they were with their commuting time. The questionnaire also included a question about how satisfied respondents were with their work and asked them to indicate their satisfaction on an 11-point Likert scale (ranging from 0 = very poor to 10 = very good). These two satisfaction variables are central to our analysis, as not many studies examine respondents' satisfaction with life domains. Consequently, we will analyse them under the **'Domain satisfactions'** block

The individual questionnaire for both 2013 and 2015 included questions regarding the municipality of the residential location and the workplace location of the respondents. For data protection reasons, the exact place of residence and place of work was not disclosed to the research team, but an anonymised value was formed. Instead of a spatial analysis, we therefore carried out a statistical analysis by forming change variables for both the questions in two time periods: change from 2013 to 2014 and change from 2013 to 2015. For calculating the change within years in Wave 1, those who reported a change in 2014 (whether in their workplace, place of residence or car ownership) were included, i.e. the change from 2013 to 2014, while for calculating the change within years in Wave 2, those who waited another year to make a change in their lives were included but in 2015, i.e. the change from 2013 to 2015. Responses with a value of 0 in the new variable were considered as no change, while a non-zero response was considered as a change.

Moreover, the household questionnaire for 2013-2015 included the following question: *"How many private cars does the household own?"* To link the number of cars per HH to the individuals belonging to that HH, we used a unique identifier that was available in both the household and individual repositories. In this way, we obtained the information on car ownership at the individual level. Two separate variables were then created to analyse changes in car ownership: Increase in car ownership, and Decrease in car ownership. This was done for both waves. Individuals living in a HH where car ownership increased were given a value of 1, while those living in a HH where car ownership decreased were given a value of 2. The persons for whom car ownership has not changed formed the reference category, with the value 0 representing no change. These change variables will be referred to in our analyses under the **'Life events'** block as labelled by [Clark et al. \(2016\)](#) and [Verhoeven et al. \(2005\)](#). Finally, results are controlled for **socio-demographic** variables including age, gender, marital status, health, education and nationality. The nationality variable can be useful to distinguish between native Luxembourgers and non-native Luxembourgers. It could be that non-native Luxembourgers, especially those from non-EU countries, face relatively more constraints in the labour market than native Luxembourgers ([Hartmann-Hirsch, 2002](#)).

Although the dataset is somewhat older, we believe that within the travel satisfaction literature, this is the only dataset that offers the necessary information to study how individuals overcome dissatisfaction in their personal lives, as respondents were asked to indicate their satisfaction with commute time in 2013 and changes in life events were captured for three consecutive years (2013-2015). Other HH panels or longitudinal datasets do not usually have such information on satisfaction with commuting and work

together in year 1 and changes in life events in subsequent years. This is the only dataset that provides this information and is representative of the Luxembourg population. We therefore believe that the results will provide better insight into the combined and separate effects of commuting and work (dis)satisfaction on changes in residence, workplace and/or car ownership in the subsequent years, and serve as a starting point for a new type of longitudinal research in the travel satisfaction literature that can hopefully be replicated with other panel studies.

In hindsight, it is also important to acknowledge the limitations of this dataset. First, the data on commute time and work satisfaction is only available for 2013. Thus, whether life changes have led to improvements in commute time and work cannot be analysed due to the (partial) longitudinal nature of this dataset. Second, respondents were asked to indicate their satisfaction with commuting time instead of satisfaction with commuting. This could be seen as a limitation of this dataset, but we recognise it as a strength, as the literature of travel satisfaction, especially commuting satisfaction, recognises commute time as an important determinant of commuting satisfaction. Furthermore, it is worth noting that several surveys ask respondents to indicate their overall satisfaction with commuting. We believe that this can pose challenges for respondents as they may find it difficult to differentiate their satisfaction with commute mode, commute time, or other related variables. In contrast, a specific question related to commute time satisfaction makes it comparatively easier for individuals to provide a focused response. Third, the P-SELL survey did not include the traditional commute variables such as commute mode, travel distance and travel time. Finally, the data is only available for three years. For a better understanding of the longitudinal picture of how individuals deal with dissatisfaction and for a robust analysis, a longer time span would have been beneficial. Despite these limitations, P-SELL is the only dataset available in Luxembourg allowing for a (partial) longitudinal analysis of how commuting time and work dissatisfaction triggers changes in residences, workplaces and/or car ownership in subsequent years.

4.2.3 Methodology

This study aims at estimating the influence of dissatisfaction in 2013 on the occurrence of certain life events (i.e., changing workplaces, changing residences and changing car ownership) in subsequent years. This could be done by means of a logistic regression. However, using the original CTS and WS scales as independent variables in the regression model was not possible because there are significant and strong correlations among them (Variance Inflation Factor (VIF) > 10). Even combining the satisfaction variables by simply averaging the CTS and WS scores for each respondent only offered insights into the combined effect of CTS and WS, but not detailed insights into which combination of CTS and WS had the strongest effect on the likelihood of changing in subsequent years. For that reason, we decided to do first a cluster analysis of these two satisfaction variables.

To determine the optimal number of clusters with maximum heterogeneity between clusters and maximum homogeneity within clusters, different options with 2 to 10 clusters were tested using two-step clustering as well as a K-means clustering (Milligan & Cooper, 1987; Sarstedt & Mooi, 2010). Validation

approaches included the silhouette method⁵, the elbow method⁶ and the F-ratio⁷ of variance. A value of more than 0.5 in the silhouette measure indicates a good solution; in this case, it was 0.6. All cluster options except the one with 9 and 10 clusters have satisfactory quality. In the elbow method, a kink in the curve i.e., a sharp twist in the line plot was observed for cluster solutions with 2, 3, 4 and 6 clusters'. This was also confirmed by the F-ratio of variance with high significance ($p < 0.001$) for cluster solutions with 3, 4 and 6 clusters. However, due to small cluster sizes, cluster solutions with 7 or more clusters were excluded from the optimal cluster solution. Consequently, the 6-cluster solution seemed to be the most promising. Further evidence for this choice is the fact that the cluster centres of the 6-cluster solution did not change after the seventh iteration. Moreover, the one-way ANOVA was significant for CTS and WS at $p < 0.001$ with high variance ($F = 2256.405$ for CTS and 1711.68 for WS).

Table 4.2 shows the final cluster centres for CTS and WS levels on the 11-point scale. Scores closer to 10 indicated higher satisfaction, whereas scores closer to 0 indicated lower satisfaction. Cluster 1 consists of highly satisfied respondents. Cluster 2 consists of respondents with high CTS but low WS, while cluster 5 consists of the opposite combination. Cluster 3 consists of respondents with high CTS but moderate WS, and cluster 4 consists of respondents with only moderate CTS and WS. Finally, cluster 6 consists only of dissatisfied respondents. Of all the clusters, cluster 1 has the largest share of respondents, while cluster 6 has the smallest share of respondents, with all of them having at least more than 100 observations.

Table 4.2: Final cluster centres for a six-cluster solution

	1	2	3	4	5	6
	High CTS-High WS	High CTS-Low WS	High CTS-Mod. WS	Mod. CTS-Mod. WS	Low CTS-High WS	Low CTS-Low WS
N	1066	197	848	610	190	118
CTS	8.86	8.03	9.26	6.10	3.33	2.92
WS	9.11	3.66	7.12	7.13	7.89	3.12

Table 4.3 presents a socio-demographic description of these six clusters. The proportion of female respondents is higher, except in clusters 2, 4 and 6, which are also very close to the majority. The average age is between 40 and 43 years in all clusters. In all clusters, there is a clear majority of individuals living with their partner or spouse. Finally, the majority of the respondents in most clusters are born in Luxembourg and living in Luxembourg (native Luxembourgers); however, in cluster 6, where none of the

⁵ The silhouette measure is based on a visual interpretation of a graph that provided a general goodness-of-fit of cohesion (how tight clusters are within) and separation (how far clusters are from each other).

⁶ The elbow method is based on a visual interpretation of a graph with the number of clusters (k) at the X-axis and the within sum of square at the Y-axis.

⁷ The F-ratio is calculated by dividing the mean squares *between* groups by the mean squares *within* groups. The higher the F-ratio, the better it is, as it indicates maximum variance *between* clusters (heterogeneous clusters) and minimum variance *within* clusters (homogeneous clusters).

satisfaction variables are satisfactory, there is a clear majority of those who are born outside Luxembourg but living in Luxembourg (non- native Luxembourgers).

Table 4.3: Socio-demographic characteristics across clusters

	1	2	3	4	5	6	Full sample
	High CTS- High WS	High CTS-Low WS	High CTS- Mod. WS	Mod. CTS- Mod. WS	Low CTS-High WS	Low CTS-Low WS	
N (%)	35.2	6.5	28.0	20.1	6.3	3.9	100
Female (%)	53.5	44.7	53.1	49.5	52.6	46.6	51.6
Age (mean)	41.7	42.7	42.2	40.7	40.3	40.9	41.5
Living together (%)	59.2	64.0	58.4	58.7	58.4	52.5	58.8
Native Luxembourgers (%)	59.1	52.8	54.1	46.7	55.6	38.1	46.2

For inter-cluster comparison, Post-hoc Tukey tests were carried out to analyse differences in CTS and WS variables. The difference in means for all six clusters of CTS and WS was significant at the 0.05 level, except for CTS clusters 5 and 6 and WS clusters 3 and 4. A detailed overview of the clusters and the satisfaction levels is shown in Figure 4.1. Instead of just using the averages of CTS and WS, it provides additional information about the satisfaction levels of the respondents. It is important to look at this distribution because high CTS in cluster 1 and in cluster 2 means different things. In cluster 2, all respondents were highly satisfied with their commute time, but in cluster 1 it was a combination of mostly moderately satisfied individuals and some highly satisfied individuals. The same was true for high WS in cluster 1 and in cluster 5.

Therefore, smaller groups were formed with low, moderate and high CTS and WS categories. This distinction also seemed useful because some of the values on the Likert scale from 0 to 10 were 0 or closer to 0 due to very small responses. Thus, three categories were formed that were influenced by the final cluster centres of the CTS-WS profiles. Scores from 0 to 4 represent low satisfaction, 5 to 7 represent moderate satisfaction and 8 to 10 represent high satisfaction. We used the results of the cluster analysis as independent variables in the logistic regression to examine the impact of combined dissatisfaction on the likelihood to change certain life events while controlling for covariates such as age, gender, education, marital status, health and nationality.

4.3 Results

4.3.1 Life events in 2014 and 2015

We first carried out descriptive statistics of the identified sample to understand the proportion of changes in life events between two consecutive waves i.e., changes in 2014 (Wave 1) and changes in 2015 (Wave

2) Table 4.4). Around 13% of the employed individuals changed their workplace, while only 6% changed their residence in Wave 1. These percentages seem to decrease substantially in Wave 2. Regarding changes in car ownership, around 7% of the individuals recorded an increase in their car ownership, while more individuals (9.8%) in Wave 1 experienced a decrease in their HH car ownership.

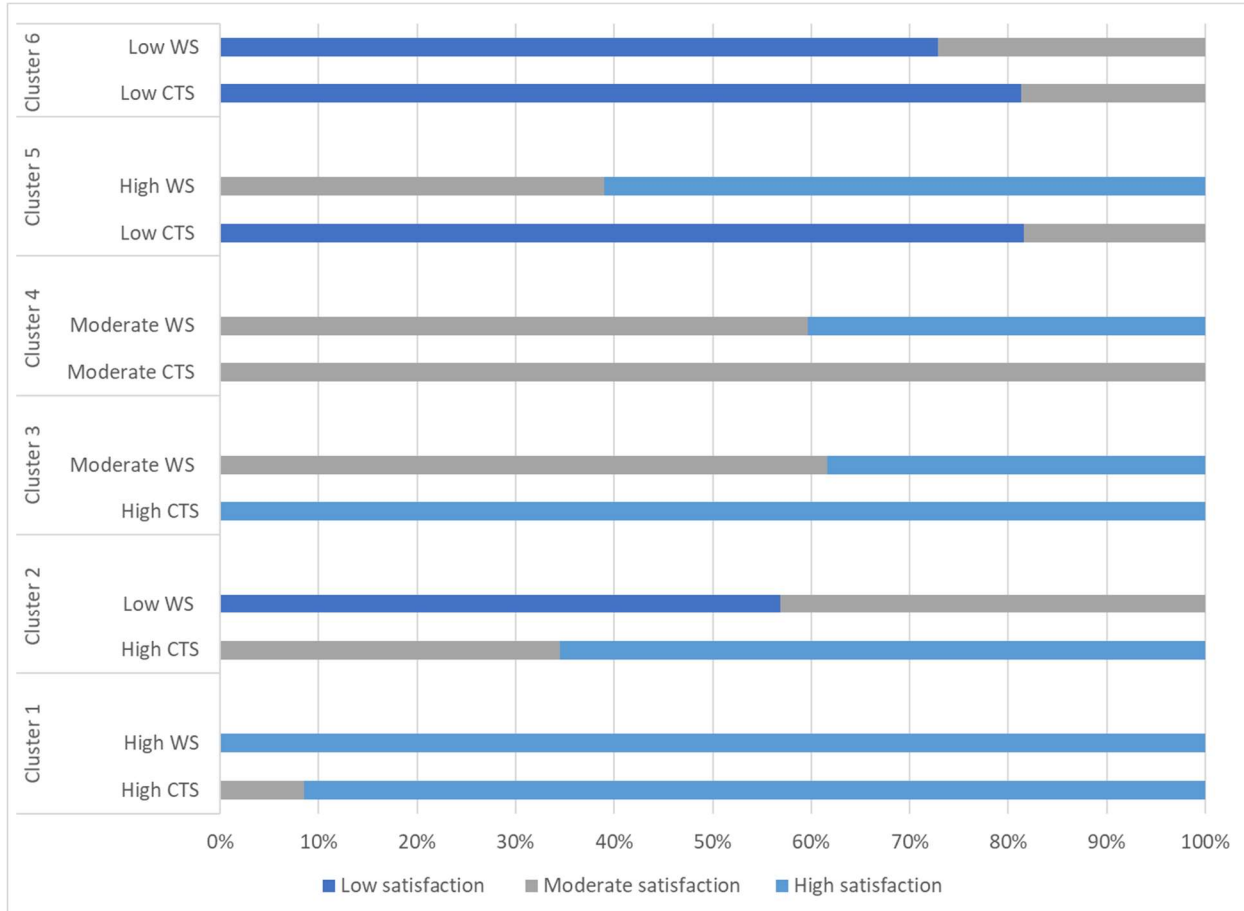


Figure 4.1: Proportion of CTS and WS values per cluster

The results also suggest that changing workplaces is more common than changing residence or car ownership. This makes sense from an economic viewpoint, as a change of residence requires significant effort, time and decisions at the household level, especially if a person lives together with their spouse/partner or have children, as opposed to a change of workplace, which is unlikely to require decisions at multiple levels as long as a change of workplace does not require a change in residential location (see Rouwendal and van der Vlist (2005) on understanding how workplace relocation triggers residential relocation). Moreover, the transaction costs associated with a change of residence outweigh those associated with a change of workplace (Rashidi et al., 2011). This might explain why residential relocations do not occur as frequently as workplace relocations.

Table 4.4: Proportion of changes in life events

Life events	Wave 1 (changes in 2014)	Wave 2 (changes in 2015)

	Yes	No	Total	%	Yes	No	Total	%
Change of work location	253	1662	1915	13.2	89	822	911	9.8
Change of residence	128	1925	2053	6.2	40	1072	1112	3.6
Increase in the no. of cars in HH	152	1738	1890	8.0	85	885	970	8.7
Decrease in the no. of cars in HH	189	1738	1927	9.8	75	885	960	7.8

4.3.2 Association between dissatisfaction and life events

In a next step, we created a cross-tabulation (Table 4.5) between the different CTS-WS profiles presented earlier in section 4.2.3 and the life events discussed above in section 4.3.1. This cross-tabulation provides some insights into potential associations between dissatisfaction and changes in the subsequent years. Cluster 1 consists of respondents who are highly satisfied with their commuting time and work and therefore seem relatively less likely to change their place of work, place of residence or HH car ownership as often as those who are highly dissatisfied with their commuting time and work. Cluster 6, in contrast, shows the lowest satisfaction with both commuting time and work, which could be a key reason why a significant majority of individuals opt to change their workplaces rather than endure their current situation. Interestingly, when it comes to changes in HH car ownership, the majority of shifts occur among those who experience dissatisfaction with their commuting time and work, or at the very least, have low levels of satisfaction with their commuting time. Unlike workplace change, where individuals are more likely to act promptly, most changes in HH car ownership occur after a year of enduring dissatisfaction. Moreover, changes in residence are more common after being moderately satisfied with commuting time and work. There may be some other underlying factors not related to CTS and WS that have a more important impact on the likelihood of changing residence in the next year, but for which the PSELL III dataset does not offer any information. Lastly, significant associations were observed between the clusters and the change variables, particularly changes in workplace location in 2014 (Pearson chi sq.=38.30, p<0.01) and in 2015 (Pearson chi sq.=10.03, p<0.1) and decreasing HH car ownership in 2015 (Pearson chi sq.=17.48, p<0.1).

Table 4.5: Changes in life events across clusters

Life event/ Clusters	(1) High CTS- High WS	(2) High CTS- Low WS	(3) High CTS- Mod. WS	(4) Mod. CTS- Mod. WS	(5) Low CTS- High WS	(6) Low CTS- Low WS
Wave 1 (changes in 2014)						
Change workplace (%) ***	10.6	21.4	8.9	16.8	20.7	25.4
Change residence (%)	6.4	6.2	5.4	7.6	6.1	3.6
Increase in the no. of cars in HH (%)	7.9	7.4	8.8	7.9	4.0	11.8

Decrease in the no. of cars in HH (%)	10.2	8.9	10.5	9.1	7.0	10.6
Wave 2 (changes in 2015)						
Change workplace (%) *	7.2	13.2	10.6	9.0	16.4	20.0
Change residence (%)	3.1	5.3	3.5	5.2	1.4	2.1
Increase in the no. of cars in HH (%)	9.1	8.1	10.4	4.1	11.3	13.9
Decrease in the no. of cars in HH (%) *	8.4	4.2	9.7	4.1	14.0	5.1
*** p<0.01, ** p<0.05, * p<0.10						

4.3.3 Impact of combined dissatisfaction on changing workplace

In the last step, we performed a logistic regression to examine the effect of dissatisfaction in 2013 potentially leading to changes in a life event (such as workplace relocation, residential relocation or changes in car ownership) in 2014. From the results of descriptive statistics in section 4.3.1, it was noticed that the most frequent life event that occurs in the subsequent years is workplace relocation, whereas from the cross-tabulations in section 4.3.2 it was understood that there was a significant association only between the clusters and workplace changes in both years. For these two reasons, it made sense to perform a logistic regression only with 'changing workplaces' as the dependent variable (Table 4.6)⁸. This information was combined with the satisfaction profiles as independent variables in the analysis to identify which type of satisfaction (CTS, WS) has the strongest impact and which combination most strongly triggers change of workplaces in the subsequent years. Additionally, we also controlled for co-occurrence of other life events. After all, changing workplaces might also be linked to changing residences or car ownership.

Table 4.6: Results of a binary logistic regression for change of workplace in 2014

Variables	Coefficient (p-value)
Changes in life event from 2013 to 2014	
Change of residence (ref: no change)	0.38 ***
Increase in the number of cars in the HH (ref: no change)	0.21
Decrease in the number of cars in the HH (ref: no change)	0.09
Clusters (ref: Cluster 1 High CTS-High WS)	
Cluster 2 High CTS-Low WS	0.73 ***
Cluster 3 High CTS-Mod. WS	- 0.22
Cluster 4 Mod. CTS-Mod. WS	0.47 ***

⁸ For Odds ratio, see Appendix 2.

Cluster 5 Low CTS-High WS	0.55 ***
Cluster 6 Low CTS-Low WS	0.86 ***
Socio-demographic characteristics	
Age	- 0.02 ***
Female (ref: male)	0.03
Secondary education (ref: low education)	-0.33
Tertiary education (ref: low education)	-0.19
Living with partner/ spouse (ref: Living without partner/ spouse)	-0.19
Neutral health (ref: good health)	0.20
Bad health (ref: good health)	0.65 **
Non-native Luxembourgers (ref: Native Luxembourgers)	0.34 **
Intercept	-2.12
N	1878
Degrees of freedom	16
Log-Likelihood	- 698.63
McFadden's Pseudo R2	4.7%
Likelihood-ratio test (Prob > Chi2)	0.00
Unstandardized coefficients reported *** p<0.01, ** p<0.05, * p<0.10	

In the regression analysis, cluster 1 was selected as the reference category due to its high levels of satisfaction and a larger number of observations. To assess multicollinearity among the independent variables, the VIF was calculated, and all values were below 2.0, indicating no significant multicollinearity issues. The logistic regression model was then estimated using the maximum likelihood estimation method, focusing on analysing the impact of dissatisfaction on changes in workplace location in the subsequent year. Goodness-of-fit measures, such as the log-likelihood ratio and McFadden's Pseudo-R2, were reported to assess the model fit. Additionally, bootstrapping technique was used to get robust p-values. Finally, an independent validity check of the full model was carried out on the estimation sample, which showed that 86.8% of the values in the model were correctly predicted, representing a good model.

Change of workplace and the six clusters

The six CTS-WS cluster profiles were included as independent variables in the regression model to analyse the relationship between dissatisfaction in 2013 and life events in the subsequent years (in this case: changing workplaces). A comparison of the coefficient size and significance level was made to understand how the impact of these clusters correspond to each other. All clusters, except cluster 3, have a significant and positive impact on the likelihood to changing workplace. The insignificant effect of cluster 3 is not a

surprise, as the profile is characterized by high CTS and moderate WS, and therefore comes close to cluster 1.

Compared to cluster 1, cluster 6 (the most dissatisfied CTS and WS individuals) seems to have the greatest impact on the likelihood of changing workplaces, as the regression coefficient is the largest. This makes sense, as individuals who are so dissatisfied with their commute time and work have a stronger desire to change their workplaces in the next year. After that, cluster 2 seems to have the second strongest effect, as it is very close to cluster 6. These are the profiles with high CTS but low WS. This suggests that satisfaction with work seems to be somewhat more important than satisfaction with commuting time, and that individuals who are dissatisfied with their work are likely to change their workplaces in the following year. Cluster 5 with low CTS and high WS then has the third strongest impact on the likelihood of switching. Those who are moderately satisfied with their commuting time and work have the lowest impact (cluster 4). Since the magnitude of this cluster is lowest among all other clusters, but higher than cluster 1, it seems that moderate satisfaction with commuting time and work is not enough to keep individuals in the same job. It is possible that some underlying effects play a role here.

Change of workplace and other life events

There is a significant relationship between changing workplaces and changing residence from 2013 to 2014 at $p < 0.001$. The high significance between these variables indicates that those who change residences are also more likely to change their workplaces in the same year (i.e. 8.3% of the total sample). However, no significant associations were found between changing car ownership and workplaces, which contrasts with the results of previous studies that indicated that changing car ownership was often related to starting a job or losing a job (Clark, 2012; Oakil et al., 2016).

Change of workplace and covariates

Of all the covariates, age, health and nationality have significant associations with changing workplaces. The negative significance between age and changing workplaces indicates that younger people are more likely to change workplaces than older adults. This is in line with earlier research (Ngotngamwong, 2019). The relationship between non-native Luxembourgers and the likelihood of changing workplace in the next year compared to native Luxembourgers needs to be further investigated.

4.4 Discussion and conclusion

The purpose of this study is to investigate whether dissatisfaction in one year may lead to life changes (be it a changing workplace, residence or car ownership) in the following years. To answer our research question, we started our analysis by identifying different CTS-WS profiles of individuals using a cluster analysis and then coupled the results with a logistic regression analysis. The regression model allowed us to examine which combination of CTS-WS profiles has the strongest influence on workplace change and whether CTS or WS has a stronger influence in subsequent years.

The descriptive analysis first reported the percentage of individuals making a change in life events in Wave 1 (change in 2014) and in Wave 2 (change in 2015). Although the percentage of individuals making a change in each life event is relatively low (about 13% changing workplace, 6% changing residence, 8%

increasing a car in the HH and 10% decreasing a car in the HH) in Wave 1, these percentages drop substantially in Wave 2, especially for changing workplaces and residences. Of all the changes, changing workplace is the most common. When we combine this information with the profiles of the dissatisfaction clusters, we find a significant association between combined (dis)satisfaction in 2013 and change of workplace and car ownership in the following year(s). Strictly speaking, respondents with the lowest CTS and WS reported the most changes in their workplaces and car ownership, while respondents with moderate CTS and WS reported the most changes in their residence (although not significant). In addition, most changes in workplaces and residences were observed immediately in the next year (2014) when individuals were dissatisfied with their commute time and work, rather than in the next year (2015), in contrast to those who increased or decreased their car ownership in the HH, which was more common in 2015. However, since the percentage of individuals who make a change is relatively low, this could also mean that some dissatisfied individuals are not able to change their lives and continue to tolerate dissatisfying commuting and working patterns.

The logistic regression indicates that combined dissatisfaction has the strongest significant effect on changing workplace compared to combined satisfaction. The effect of high CTS and low WS (cluster 2) has a stronger impact on the likelihood of changing workplaces than the effect of low CTS and high WS (cluster 5). In other words, dissatisfaction with work might outweigh dissatisfaction with commuting time. However, further research with more confounding variables of work and commute is needed to more accurately identify whether the effect of WS on the likelihood of changing workplace is stronger than that of CTS. Although there is a strong correlation between changing residences and workplaces, the proportion of individuals making this combined change is very low, presumably due to the higher transaction costs associated with residential mobility, which requires a significant investment of time, effort and money, as well as household-level decisions (Rashidi et al., 2011). Nonetheless, no significant relationship was found between increasing or decreasing car ownership per HH and changing workplaces. This means that evidence on the co-occurrence of events i.e. whether an individual belonging to a HH increases or decreases a car and changes workplaces, is not significant. Furthermore, we ran another logistic regression model with change of workplace in 2015 as the dependent variable; however, since the workplace change mainly occurs in the next year (in 2014) and not two years later (in 2015), the results of a logistic regression were not robust due to the issue of small sample size.

Even with such notable associations between the variables, it is difficult to establish causal relationships in the absence of other confounding variables that might equally contribute to the decision to change workplaces. After all, the decision to change workplace in the following year may not only be due to dissatisfaction with commuting and work. Furthermore, it is also worth noting that this dataset only provides information on changes in workplace, residence and car ownership in subsequent years. However, it is important to recognise that there may have been additional responses to dissatisfaction with commuting and work, such as flexible working hours, working from home, working fewer hours or commuting at off-peak times rather than make a change in life to cope with commuting and work dissatisfaction. This is a limitation of this data set and should be explored further to gain a more comprehensive understanding of whether individuals make changes in their lives or tolerate dissatisfaction.

Moreover, longitudinal data over a longer period of time could provide better evidence of causality than the present dataset, which is only available for a limited period of three years. The claim of a causal relationship between commuting time and work satisfaction and change of workplace location therefore needs to be further investigated with a more rigorous panel design. Lastly, data on CTS and WS is only known in 2013 and whether changes in life made improvements in CTS or WS in 2014 cannot be analysed due to the partial longitudinal nature of this dataset. Therefore, future research should provide a more comprehensive take on this prospective approach to model the causal effects of dissatisfaction.

Nonetheless, it might also be interesting to know the order in which life events change, whether individuals change workplaces first and then places of residence, or vice versa. This would perhaps require the use of another method such as structural equation modelling (SEM), which can be used to estimate and compare more than one model to determine which life event comes first. With SEM, it is also possible to estimate the direct effect of CTS on changing life events and the indirect effect mediated by WS. This technique will be useful to cross-validate our finding that dissatisfaction with work has a stronger effect on the likelihood of changing workplaces than dissatisfaction with commuting time. For the analysis of the P-SELL panel data set, cross-lagged SEM can also be useful to model the outcome variable of interest from one wave (usually the most recent) and regress it against covariates including the outcome of interest from earlier waves. This technique has been used many times in traffic studies for panel data (Simma & Axhausen, 2003; Thøgersen, 2006), but also for cross-sectional data using a traditional SEM (Friman et al., 2017; Gao et al., 2017; Ye & Titheridge, 2017).

Against this background, the novelty of this study lies in being the first study to analyse how individuals overcome combined dissatisfaction in subsequent years. To the best of our knowledge, no study examines the effect of CTS and WS, both combined and separately, on the likelihood of changing a life event, whether workplace, residence or car ownership in the following year. Such an analysis combining descriptive statistics, especially cross-tabulations between life events and CTS-WS profiles, and the impact of domain satisfaction on the likelihood of changing workplaces has not been discussed in the relevant literature on commuting satisfaction and workplace relocation, although there is some evidence on the fact that dissatisfaction with life domains may trigger an impact on where individuals live, where they work, how they commute and their overall life satisfaction (Diener, 1984; Kahneman et al., 1999). Since this study uses a panel data set, it might be transferable to other panel studies that try to explain the impact of commuting satisfaction on life events. However, this effect could be counteracted by other contextual factors not considered in this study, such as traffic congestion, labour laws and the expensive housing market. These are local factors that would have been important to control for in the Luxembourg case. For example, a poor commute may become more acceptable if it is supported by higher wages. In contrast, a daily commute may be less satisfactory if there is heavy congestion every day from commuters and cross-border commuters. For these reasons, it is important to be aware of these consequences for the transferability of the results of this panel data.

In terms of policy implications, it should be noted that while the percentage of individuals who experience change in subsequent years may be relatively low, the percentage of those who do not change and are still dissatisfied with their commute time and work may be relatively higher. This means that the majority of individuals are dissatisfied with their commute time and work, but are unable to change anything about

their lives due to less flexibility and financial resources, and therefore continue to accept the dissatisfaction. Perhaps for them it is a matter of affordability rather than preference. Therefore, policy makers and practitioners should pay attention to improving commuting conditions such as providing efficient and effective transport infrastructure, promoting last mile connectivity to and from work, relaxing policies on working from the office or offering flexible working arrangements, providing affordable parking at work and alternatives to affordable housing to increase users' satisfaction with commuting and work (Anderson et al., 2002; Beutell, 2010; Cervero & Landis, 1992; Cumming et al., 2019; Ettema et al., 2016; Sprumont, 2017). As much research on travel satisfaction has focused on the effects of travel characteristics, subjective characteristics and built environment characteristics on commuting satisfaction, we believe it is now important to consider commuting satisfaction not only as an endpoint, but also as a starting point (trigger) and to reflect on which life domains could potentially be affected by commuting dissatisfaction. In this study, we looked at three common life events, i.e. changing workplace, changing residence and changing household car ownership. However, other life events such as obtaining a driving license, a change in employment status or access to free transport can also be a response to dissatisfying commute patterns (Bamberg et al., 2003; Clark et al., 2014; Goodwin, 1993; Thøgersen & Møller, 2008; Verhoeven et al., 2005). Furthermore, it is also important to be aware of the consequences of commuting dissatisfaction, as decisions made on the basis of commuting dissatisfaction could have a significant impact on individuals' quality of life and overall life satisfaction. It is equally important for policy makers to focus on how to address (dis)satisfaction with work, as the findings suggest that it outweighs dissatisfaction with commuting time. Labour market policies may need to be institutionalised to increase employees' satisfaction at work. Finally, policy makers and practitioners are also advised to investigate why combined satisfaction also leads to changes in subsequent years. It is possible that some underlying effects, such as satisfaction with life domains other than commuting and work, play an important role in triggering change. Maybe individuals who tolerate dissatisfaction might have a have a negative impact on their time-use satisfaction due to time-poverty that arises from commuting longer distances or for longer time, which obviously comes at the expense of dissatisfaction with leisure-time or personal relationships. Future research should therefore address the question of whether people make changes in their lives, for example by changing workplace location or residence, or whether they tolerate dissatisfaction with commuting, which in turn could affect their satisfaction with other life domains and SWB. This will help practitioners and policy makers in formulating the necessary transport and planning policies to accommodate these dissatisfied commuters.

CHAPTER 5. Voluntary versus Involuntary workplace relocation

Maheshwari, R., Ettema D. Are workers more satisfied with their commute after a voluntary workplace relocation compared to those who changed workplaces involuntarily? Ready to submit.

Despite the significant role that life events such as a change of residence or workplace have on travel behaviour in general and commute trips in particular, little attention has been paid to the effects of changes in commute characteristics on commuting satisfaction (CS). This study focuses on changes in workplace location, distinguishing between voluntary and involuntary change. Using data from a large scale online retrospective survey, the findings reveal that dynamic variables such as changing commuting mode, time and workplace relocation may be more important than static variables such as current commuting mode, time and travel attitudes, as they explain a larger proportion of the variation in CS than static variables, at least shortly after the change of workplace. Most importantly, individuals seem to be more satisfied with their commute after a voluntary workplace relocation than those who changed workplaces involuntarily. However, the question of how lasting this effect of a workplace relocation on CS is and whether CS changes over time as people become accustomed to the changed environment (treadmill effect) is open for future research.

5.1 Introduction

The act of commuting between the place of residence and workplace is a common but complex phenomenon resulting from the spatial discrepancy between the two locations (Rouwendaal & van der Vlist, 2005). Extensive empirical studies have shed light on how various commute characteristics, such as commute mode, travel time, travel distance, and attitudes towards commuting, influence people's commuting satisfaction (CS) (De Vos et al., 2016, 2019; Gao et al., 2017; St-Louis et al., 2014; Ye & Titheridge, 2017). However, little attention has been paid to the effects of changes in commute characteristics on commuting satisfaction, despite the significant role that life events such as a change of residence or workplace have on travel behaviour in general and commute trips in particular (Clark et al., 2014). Understanding the dynamics of commuting satisfaction is crucial as people's travel behaviour inevitably changes after a life event, whether for better or for worse, depending on the changes in commute characteristics and attitudes towards them (Beige & Axhausen, 2017; Lanzendorf, 2003).

While some studies have investigated how travel behaviour changes after a major life event, most have focused on changes in the place of residence, neglecting changes in the workplace (De Vos, 2018; De Vos et al., 2019; Monteiro et al., 2021; Wang et al., 2020). This lack of attention is particularly surprising given that commuting is an important daily activity that depends not only on residential location choices but also workplace location choices (Maheshwari et al., 2022a). To address these two research gaps, this study aims to investigate the effects on commuting satisfaction of a change in workplace location, whether voluntary or involuntary. The distinction between voluntary and involuntary workplace relocation is of particular interest as commute characteristics could be a consideration or even the main reason for a voluntary relocation as opposed to an involuntary relocation where workers have less control pertaining to their commute due to the forced nature of this relocation. Thus, this study is not only the first to show differences in CS between those who change jobs willingly versus those who are forced to move with their employer, but it also contributes to the existing literature on travel satisfaction by improving our understanding of the volatility in CS.

The remainder of the paper is organised as follows. Section 5.2 describes the data and describes the methodology. Section 5.3 presents the findings of this study, while Section 5.4 concludes the research and provides recommendations on how changes in the labour market i.e. not forcing vs forcing employees to move to another work location can affect their commute satisfaction.

5.2 Literature Review

5.2.1 Effect of static variables on CS

Commuting can either be a stress-inducing activity or a valuable transition between the personal and professional lives (Jain & Lyons, 2008; Redmond & Mokhtarian, 2001). Analysing individuals' satisfaction with commuting sort of depends on several other factors such as (but not limited to) commute characteristics, built environment, subjective characteristics, and socio-demographic factors. Previous research using cross-sectional data sets have shown that use of active modes of transport like walking or cycling, tend to result in higher CS levels compared to the use of motorized and public transport (De Vos et al., 2016; Legrain et al., 2015; Mao et al., 2016; Morris & Guerra, 2015; Ye & Titheridge, 2017). Within

the latter, train users tend to be more satisfied than bus users (Handy & Thigpen, 2018; St-Louis et al., 2014). A possible explanation could be that active travellers do not suffer from traffic congestion, whereas car users are mostly annoyed by travel elements like congestion, experienced traffic safety, parking availability (Ettema et al., 2013; Morris & Hirsch, 2016). Likewise, public transport users associate their satisfaction with elements like comfort, cleanliness, safety and reliability of the system (van Lierop & El-Geneidy, 2016).

Travel time also plays a significant role in individuals' CS (Olsson et al., 2013). While it is generally assumed that shorter travel times lead to higher CS, recent research has presented alternative perspectives. Theories of positive utility of travel time and worthwhileness of travel time counteract the linear relationship between travel time and CS, suggesting that people often prefer nonzero commute time to create a clear separation between their personal and work lives - emphasizing that travel time is not wasted time (Cornet et al., 2022; Mokhtarian & Salomon, 2001). As for the travel **distance**, shorter distance can lead to higher CS (Ettema et al., 2012, 2013; Manaugh & El-Geneidy, 2013). Next, the built environment indirectly influences CS through its impact on modal choices (Handy & Thigpen, 2018; Mokhtarian et al., 2015; Ye & Titheridge, 2017). Denser urban areas with more active transport options tend to result in higher CS levels. Subjective characteristics such as **attitudes** towards travel also have a direct effect on CS (De Vos et al., 2016; Ye & Titheridge, 2017). The authors suggested that people who travel with their preferred mode of transport tend to experience higher satisfaction level with their travel. Handy and Thigpen (2018) obtained similar results. All these static effects of commuting are noteworthy of attention owing to their implication on the well-being of the populace at large.

5.2.2 Effect of dynamic variables on CS

While numerous cross-sectional studies in travel satisfaction literature have examined the influence of the static variables such as commuting mode, travel time, distance and attitudes on CS, studies analysing the effect of the dynamic variables such as changes in commuting mode, travel time, distance and attitudes on CS is still limited. Cross-sectional studies primarily focus on assessing the current state of travel satisfaction; however, to gain a better understanding of the causal relationships and temporal effects of the dynamics in CS, more longitudinal analysis is needed. There is some evidence on the volatility of CS but it is scattered. For instance, De Vos et al. (2019) found that after a change of residence from a suburban to an urban neighbourhood in Ghent, Belgium, the distance and duration of trips decreased and the use of car alternatives increased, thereby increasing CS. Using data from the United Kingdom, Aditjandra et al. (2016) reported that moving to a neighbourhood with more shopping and public transportation options could indirectly increase public transportation use mediated via a reduction in car ownership. Another study found that urban residents who come from less urbanized neighbourhoods are more likely to bike, walk, or use public transportation than to drive, while suburban residents who come from more urbanized neighbourhoods are more likely to drive (De Vos et al., 2018). Cross-border residential relocation from Luxembourg to one of its neighbouring countries showed an increase in car use for commuting, which subsequently lead to a decrease in travel satisfaction (Gerber et al., 2017). These studies together with other studies examine the relationship between various life choices/ events (such as a change in residence or the purchase or sale of a car) on changes in commuting behaviour and

satisfaction over time (Beige & Axhausen, 2017; Cao & Ermagun, 2017; Clark et al., 2016; Dargay & Hanly, 2007; Krizek, 2003; Mokhtarian, 2008; Scheiner & Holz-Rau, 2013; Xinyu et al., 2009).

Additionally, a growing body of literature from the mobility biographies perspective analysed changes in commuting behaviour and to some extent CS induced by a change of workplace over a person's life course. For instance, Schneider and Willman (2019) found increase in CS among University of Wisconsin-Milwaukee employees after moving to an urban campus. Gerber et al. (2020) observed an increase in CS due to a decrease in the daily commute time of employees following a hospital relocation in Montreal, Canada. In contrast, Sprumont et al. (2020) witnessed a decrease in CS of University employees following the relocation of the University campus from the city centre of Luxembourg to a location in the south of the country. Other studies found a decrease in motorized use and an increase in active modes and public transport use after a change of workplace from the suburbs to the city center, possibly due to shorter commute distances, higher car pricing and increase in carpooling (Cumming et al., 2019; Frater et al., 2019; Pritchard & Froyen, 2019). The reverse is true for a workplace relocations into the suburbs, mainly due to due to limited access to public transport and longer commute distances (Aarhus, 2000; Cervero & Landis, 1992; Cervero & Wu, 1998; Hanssen, 1995; Sprumont et al., 2014; Vale, 2013; Yang et al., 2017).

However, it is worth noting that these studies only analyse the impact of an involuntary workplace relocation i.e. where the employee is forced to move along with their employer in order to retain their jobs. Overlooking the impact of a voluntary workplace relocation i.e. where the employee willingly decide to change their workplace marks notable knowledge gaps in the literature on the dynamics of CS from a workplace relocation perspective. In this paper, we therefore argue, that such a distinction between a voluntary and involuntary workplace relocation and a comparison of the two in regard to the changes in CS levels is crucial to address because voluntary commuters may end up with better commute circumstances and CS than involuntary commuters, where workers have less control pertaining to their commute due to the forced nature of their relocation.

Thus to overcome these shortcomings, this study uses a quasi-longitudinal data set to unpack the effect of a workplace relocation on CS, focusing on voluntary and involuntary relocation by answers three research questions: (i) What is the effect of workplace relocation on commuting satisfaction? (ii) Are voluntary commuters more satisfied with their commuting than involuntary commuters after the relocation? (iii) Are static commuting variables still important in explaining satisfaction with commuting? Basing on the review of previous studies, we hypothesis that commute considerations could be a part of a voluntary workplace relocation as opposed to an involuntary workplace relocation, and thus the latter may end up with worse commute circumstances and lower CS than voluntary commuters.

5.3 Research design

5.3.1 Sample

A large-scale online retrospective survey was administered in July 2022 and reminders were sent in October 2022, targeting people who are working in Luxembourg, including residents, but also cross-border workers from neighbouring countries of France, Belgium and Germany. Basing on the General Inspectorate for Social Security (IGSS) repositories, 10,000 workers were invited to participate in the

survey. The resulted in a response rate of 10% that corresponds to 876 responses (see Maheshwari et al. (2023) for an overview on sampling and Appendix 1 for the questionnaire). Given the focus of this study, we only included people who experienced a change in their workplace, resulting in 537 responses. Respondents who did not change their workplace location were excluded from the analysis, as this work focuses on the impact of voluntary or involuntary workplace location change on satisfaction with commuting, and those who did not change cannot provide values for pre- and post-commuting characteristics.

In terms of the demographic characteristics of the respondents, about 55% are male workers. The average age is 40 years. Two thirds of the respondents are either married, in a partnership or living together (68%). About 25% of the respondents have a Bachelor's degree or equivalent and about 45% have a Master's degree or higher. Almost 50% of the respondents lived in households having a net income of more than 6000 euros, and approximately 43% are cross-border commuters.

5.3.2 Measurement of key variables

In this self-organized survey, we asked respondents to self-report their employment and daily mobility characteristics before and after the workplace relocation, along with their socio-demographic characteristics. The dependent variable is **commuting satisfaction** (CS). Respondents were asked to rate their level of satisfaction with their current commute on a five-point Likert scale ranging from 1 - "very dissatisfied" to 5 - "very satisfied". The average score on this scale is 2.9, which corresponds to being neutral with CS. In accordance with the research objective, the independent variables are divided into two groups: Static variables and Dynamic variables.

Static variables include current commute characteristics such as **commute mode** (car, bus/tram, train and active transport), **travel time** one-way (less than 15 minutes, between 15 and 30 minutes, between 30 and 45 minutes and more than 45 minutes) and **travel attitudes**. Commute mode and travel time are categorical variables, while to measure attitudes towards travel, respondents were asked to indicate whether they agreed with a series of eight statements on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree) regarding their liking towards (the use of) active modes, public transport (bus/ tram and train) and cars. We used Cronbach's alpha to measure the internal consistency between statements related to a specific mode of transport. For example, statements such as "I like walking", "I like cycling", "I prefer to walk rather than using other modes" and "I prefer to cycle rather than using other modes" were combined to measure attitudes towards active modes. In this way, we were able to compare attitudes towards the each modes of transport separately, which was not possible with factor analysis due to high cross-loadings between the factors. The reason why no clear distinction could be made between the factors is unclear and perhaps cannot be determined from the data collected in Luxembourg. The internal consistency between the items for each mode of transport is good (Cronbach alpha values for active modes, public transport, and car use: 0.73, 0.81 and 0.68 respectively). This means that items representing active modes of transport (walking and cycling) are well correlated with each other and that they measure the same construct. The same applies to the items representing public transport (bus/ tram and train) and car use. Thus, we advanced the analysis by averaging the statements for each mode separately and then creating three new binary variables, positive attitude towards active modes, public transport use and car use respectively. Finally, to check the effect of a mismatch between commuting

mode and travel attitude on CS, a dummy variable '**mismatch**' was created to represent an interaction between commuting mode and the respective dichotomous attitude variable. The mismatch variable is given the value 1 if the respondent has a negative attitude towards their chosen mode of transport, 0 otherwise.

Dynamic variables were created by examining the differences between the commute characteristics before and after the relocation. For example, to calculate the **change in commuting mode**, the switch per person between car, bus/tram, train, and active transport were determined. Similarly, to calculate the **change in travel time for the one-way commute**, the difference in absolute travel time before and after the relocation was determined. To convert the variable "change in travel time" from a continuous to a categorical variable, the change values were used as input to create quantiles breaks. Quantile breaks divide respondents into different categories (4 in this case) based on differences in travel time before and after the relocation. A specific value was assigned to each quantile category to indicate the magnitude of the change in travel time. For example, respondents who experienced a "far increase" in travel time were assigned a value of 1. Those who experienced an "increase" in their travel time were assigned a value of 2. Those who experienced a "decrease" in their travel time were assigned a value of 3, and those who experienced a "far decrease" in their travel time were assigned a value of 4. Finally, respondents who experienced "no change" in their absolute travel time were added as a reference category with a value of 0. This method of quantile break was useful because it ensured that the distribution of changes in absolute travel time was nearly equal across the quantile categories. This means that each group represents an approximately equal number of respondents, allowing for a fair comparison. In this way, it is possible to examine how changes in travel time across quantiles affect satisfaction with commuting. Regarding the variable "**change of workplace**", respondents were asked two questions. First, "Have you changed your employer/company in the last five years? (Please think about the most recent change)", followed by a second question "Is your workplace still at the same address since you started working here?" Those who indicated "No, I still work for the same employer/company" for the first question and "No" for the second question were classified as involuntary commuters, as these individuals experienced a change of workplace but not a change of employer, indicating a forced move. Those who indicated "Yes, I have changed and now work for another employer/company" to the first question and "Yes" to the second question were classified as voluntary commuters, as these individuals changed both workplace and employer. Using the interaction term, a new dummy variable '**switched to preferred mode**' was created by interacting the mode switch and the respective dichotomous attitude variable. Those who switched to a non-preferred mode were given a value of 1, otherwise 0.

The creation of dynamic variables were possible due to the retrospective nature of the survey. This retrospective technique enabled us to draw comparisons before and after the relocation. With a limited recall bias, this technique examines a longitudinal evolution of change in a person's travel behaviour and uncovers the volatility in CS (Stopher & Stecher, 2006). Lastly, we also controlled for covariates such as age, gender (male, female), education (secondary or lower, bachelor's or equivalent, master's or higher), household income (less than 4k, between 4k - 6k, between 6k - 8k and more than 8k euros), cohabitation (living with a partner or not), and commuter type (domestic, cross-border). The latter is of great

importance for Luxembourg, as the country records about 47% cross-border commuters from neighbouring France, Belgium and Germany (STATEC, 2023)⁹.

5.3.3 Methodology

Given the nature of our dependent variable (CS), we advanced an ordinal logistic regression. In line with our research objectives, we estimate three models: one that measures the effect of static variables, one that measures the effect of dynamic variables, and one that combines the effect of both static and dynamic variables on CS. In this way, we are able to (i) capture the separate effects of static and dynamic variables on CS, (ii) determine whether dynamic variables have a stronger impact on CS than static variables, and (iii) examine the robustness of the combined model in relation to the effect of change of workplace on CS. In all models, we control for the covariates. In addition, we checked for multicollinearity due to multiple covariates by calculating the variance inflation factor (VIF).

5.4 Results and discussion

5.4.1 Descriptive analysis

The use of car commuting is more stable, with a slight increase in modal share from 64.3% before relocation to 66.3% after relocation (see Table 5.1). In terms of public transport, most respondents used bus and trams compared to trains before and after the relocation. Interestingly, only 28.4% of the whole sample switches to another mode of transport after the relocation, with only 12 in 100 car commuters switching to either public or active modes of transport (see row percentages). About 87% of the respondents still use the car. About 23% of respondents have switched from bus/tram to car, about 30% switched from train to car, and almost 30% switched from active transport to car after the relocation.

Table 5.1: Modal choice before and after the relocation

Mode before relocation (%)	Mode after relocation (%)				Total (before)
	Car	Bus/ Tram	Train	Active modes	
Car	56.1	3.4	2.8	1.8	64.3
(row percentage)	87.4	5.4	4.4	2.8	100.0
Bus/ Tram	4.0	10.1	1.4	1.6	17.2
(row percentage)	23.5	58.8	8.2	9.5	100.0
Train	3.6	1.6	4.8	0.4	10.5
(row percentage)	34.6	15.4	46.2	3.8	100.0
Active modes	2.4	2.8	0.8	1.8	7.9
(row percentage)	30.8	35.9	10.3	23.0	100.0
Total (after)	66.3	18.0	9.9	5.6	100.0

Regarding the time variable, the average one-way commute time is 47 minutes compared to 45 minutes before the relocation. Table 5.2 shows the row percentages for the changes in travel time before and after the relocation. Nearly 43% of respondents have increased or far increased their travel time, about 39%

⁹ For detailed cross-tabulations of changes in commuter type, commute mode, and commute time, see Appendix 3.

have decreased or far decreased their travel time, and about 18% have not changed their travel time after the relocation. This suggests that those who change workplace locations do not necessarily experience a large increase in their travel time, which is in contrast to the findings reported in past studies that indicated a change of workplace location to be associated with longer distances after the relocation (Beige & Axhausen, 2017; Rouwendal & van der Vlist, 2005). As for CS, most workers are dissatisfied to very dissatisfied (40%) than satisfied to very satisfied (36%). This indicates that respondents are quite dissatisfied with their CS in general.

Table 5.2: Travel time before and after the relocation

Travel time before relocation (%)	Changes in travel time after relocation (%)					Total (time before)
	Far increased	Increased	No change	Decreased	Far decreased	
Less than 15 minutes	47.5	35.4	12.2	4.9	0.0	100.0
Between 15 and 30 minutes	27.3	25.5	15.4	29.1	2.7	100.0
Between 30 and 45 minutes	19.1	20.9	10.0	30.9	19.1	100.0
More than 45 minutes	12.9	10.8	25.6	20.0	30.7	100.0
Total (time after)	23.1	20.4	17.7	21.9	16.9	100.0

One-way analysis of variance (ANOVA) followed by post-hoc Tukey’s test highlights the differences in CS according to the static variables (see Table 5.3). Active users have highest CS followed by public transport users (bus/ tram and train – in order) and then car users. Lower commute time is associated with higher commute satisfaction. No association was found between travel attitudes and CS, but the interaction term indicating a mismatch between mode and attitude towards the mode is significant. Similar tests were conducted for the dynamic variables (see Table 5.4). The results suggest a significant relationship between individuals who do not switch modes, who switch to a different mode, and their CS. Even among a small percentage of switchers (only 28% of total respondents), post-doc tests show significant differences. Of all switchers, those who switch to active modes are significantly different from those who do not switch or switch to cars or public transportation. Interestingly, some switches are even associated with a lower CS, highlighting that there are people who switch to a mode they are less satisfied with. This could be because these individuals misinterpreted the impact of a mode change on their CS after the relocation (especially for car and bus/ tram users) or because they had no other option after the relocation. The mean CS score is highest among those who experienced a significant reduction in their travel time after the relocation and lowest among those who far increased their travel time. Voluntary or involuntary change of workplace comes out to be non-significant.

Table 5.3: One-way ANOVA and Post-hoc Tukey's test between static variables and CS

Current commute mode, current travel time		Average CS
Commute mode	1. Car	2.79 ⁴

	2. Bus/ Tram	3.04 ⁴
	3. Train	2.94 ⁴
	4. Active modes	3.76 ¹²³
Travel time	1. Less than 15 minutes	3.57 ³⁴
	2. Between 15 and 30 minutes	3.65 ³⁴
	3. Between 30 and 45 minutes	2.88 ¹²⁴
	4. More than 45 minutes	2.33 ¹²³
Mismatch	1. No mismatch between current mode and travel attitude	3.06 ²
	2. Mismatch between current mode and travel attitude	2.64 ¹
<i>Note: Groups 1, 2, 3 and 4 significantly differ from groups 1, 2, 3 and 4 respectively at p<0.01.</i>		

Table 5.4: One-way ANOVA and Post-hoc Tukey's test between dynamic variables and CS

Change in commute mode, Change in travel time		Average CS
Change in commute mode	1. Still using cars	2.88 ⁸
	2. Still using Bus/ Tram	3.14 ⁸
	3. Still using Train	2.95 ⁸
	4. Still using Active modes	3.55
	5. Switched to Cars	2.44 ⁸
	6. Switched to Bus/ Tram	2.89 ⁸
	7. Switched to Train	2.96 ⁸
	8. Switched to Active modes	4.15 ¹²³⁵⁶⁷
Change in travel time	1. No change	2.86 ²⁴⁵
	2. Far increased	2.29 ¹³⁴⁵
	3. Increased	2.86 ²⁴⁵
	4. Decreased	3.31 ¹²³
	5. Far decreased	3.44 ¹²³
Change of workplace	1. Involuntary relocation	2.88
	2. Voluntary relocation	2.96
<i>Note: Groups 1, 2, 3, 4, 5, 6, 7 and 8 significantly differ from groups 1, 2, 3, 4, 5, 6, 7 and 8 respectively at p<0.1.</i>		

Figure 5.1 (a) shows that CS is affected by the two static variables commuting mode and time. Satisfaction with commuting goes down when commute time increases, especially when the commute time is more than 45 minutes one way irrespective of the mode. For respondents traveling by public transport or active mode, the relationship seems non-linear because satisfaction is maximum when the one-way commute time is between 15 and 30 minutes but not longer than 30 minutes. A possible argument for this could be related to the positive utility of travel time. Some studies have highlighted the worthwhileness of travel time, pointing out that people prefer to have a non-zero commute time to disconnect from their professional and personal lives (Cornet et al., 2022; Jain & Lyons, 2008; Mokhtarian & Salomon, 2001; Redmond & Mokhtarian, 2001; Ye et al., 2020). Another argument for an increase in CS when travel time is between 15 and 30 minutes could be that short-distance (< 15 minutes) bus trips tend to be faster and less safe compared to long-distance trips, which provide a greater sense of comfort and safety. Car users have significantly lower CS, which steadily decreases with increase in commute time. CS is – besides affected by static variables – at the same time also affected by dynamic variables (Figure 5.1 (b)). There is a linear negative relationship between the increase in commuting time and CS across all mode changes.

It is interesting to note that the use of active modes is very time-sensitive, while the use of train and bus/tram is less time-sensitive. Furthermore, respondents who have greatly reduced their commute time and switched to trains or active transport have the highest CS, while those who have greatly increased their commute time and switched to cars have the lowest CS. In contrast to previous findings, our dynamic CS results showed that those who switched to public and active transport and reduced their travel time by a large margin were more satisfied with their commute than those who switched to cars after the move (Friman et al., 2017; St-Louis et al., 2014; Ye & Titheridge, 2017). These findings on the comparison of static versus dynamic variables foretell the need to understand the dynamics of CS.

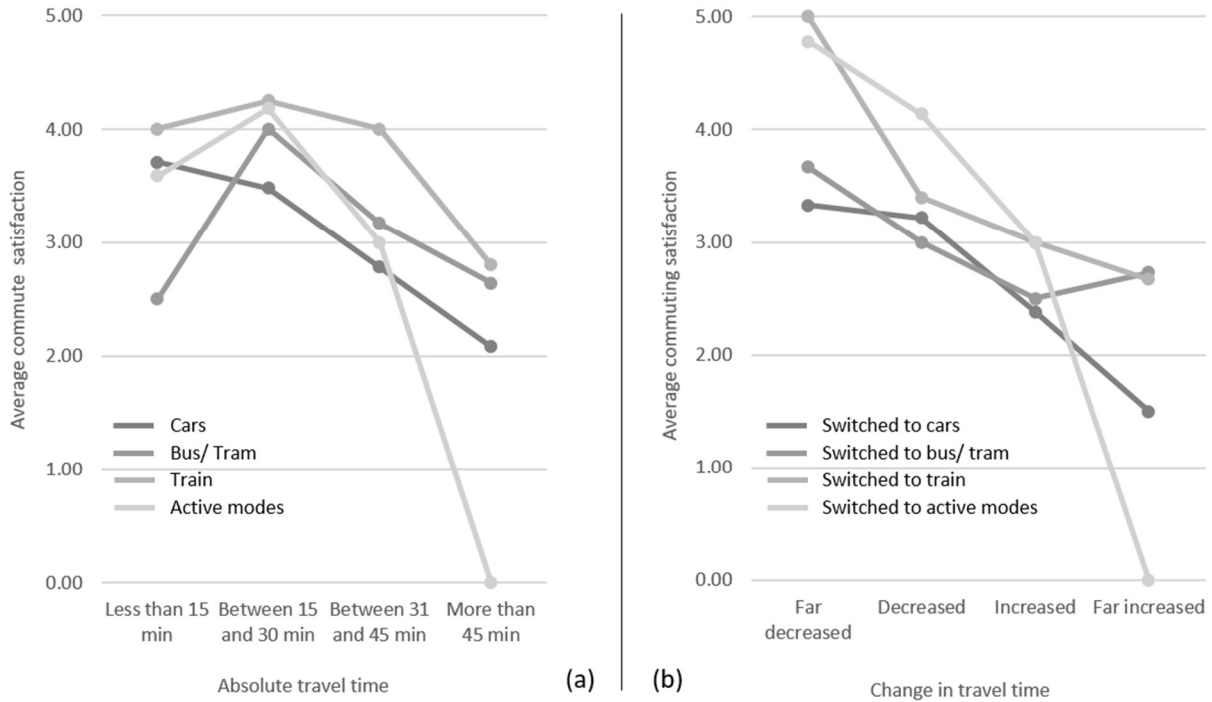


Figure 5.1: Commute satisfaction according to static (a) and dynamic (b) commute characteristics

Nevertheless, we are also interested in how the relationships shown in Figure 5.1 differ between voluntary and involuntary commuters. Therefore, Table 5.5 presents the differences in the commute characteristics between those who changed workplaces voluntarily than those who changed on an involuntary basis, which, although are not significant, are quite interesting. Those who changed workplaces involuntarily (65%) outnumber those who changed voluntarily (35%). As expected, voluntary commuters seem to spend less time commuting, switch to their preferred mode of transport more often and thus might report higher CS after the relocation than involuntary commuters. The percentage of cars, public transport, and active transport users seems to be quite similar in both groups.

Table 5.5: Commute characteristics between voluntary and involuntary commuters

Variables	Voluntary move (n =187)				Involuntary move (n = 350)			
	%	SD	Min	Max	%	SD	Min	Max
Commute time	45 minutes	28.1	1	120	48 minutes	29.6	1	120

Car users	65.2	0.8	0	3	66.4	-	-	-
Bus/ Tram users	18.2	-	-	-	18.2	-	-	-
Train users	11.6	-	-	-	9.0	-	-	-
Active mode users	5.0	-	-	-	6.4	-	-	-
Switched to preferred mode	53.0	-	-	-	49.0	-	-	-
CS (1 - Very dissatisfied to 5 - Very satisfied)	3	1.3	1	5	2.8	1.3	1	5

5.4.2 Ordered logistic regression

The previous sub-section predicts that CS significantly differs accordingly to static and dynamic variables. To further explore whether static variables have a lower impact on CS than dynamic variables, and if voluntary commuters have higher CS due to better commute considerations, we advance the analysis with three ordered logistic regression models with CS as a dependent variable. The first model focuses on the traditional commute variables. Model 2 focuses on the dynamic variables followed by a combined model of static and dynamic variables (Model 3). Socio-demographic variables such as age, gender, education, income and cohabitation as well as residence versus cross-border commuters were included as control variables in all the three models (Table 5.6). A first glance of the three models suggests that the dynamic variables such as change in commute time and modes, and change of workplace better explain CS than the static variables such as current time, mode and mismatch between mode and travel attitude. This is because the explained variance of Model 2 (19.86%) is much higher than the explained variance of Model 1 (10.77%), suggesting that the dynamic variables have a stronger effect on explaining CS than the static variables.

Model 1 somehow mirrors the literature on travel satisfaction. All modes have a positive significant effect on CS. Surprisingly, public transport users seem to be more satisfied with the log-ordered scale of commuting than car users. This is perhaps related to the high car ownership and free public transport in Luxembourg, which is why respondents seem to be more tolerant of trains and buses. However, previous findings on transport modes and satisfaction have shown that car drivers are more satisfied with their commute than public transport users (Ye & Titheridge, 2017). Within public transport, train users seem to have a strong effect on CS compared to bus users (at $p > 0.001$). Similar results were obtained in past studies (Handy & Thigpen, 2018; St-Louis et al., 2014). Commute time also has a negative effect on CS, indicating an increase in commute time to be associated with a decrease in the log-ordered scale of CS. Surprisingly, no association was found between travel attitudes and CS, which is contrary to the findings of De Vos et al. (2018). However, the interaction between current mode and attitudes towards that mode is significant for bus/ tram and train users. This indicates that respondents who use public transport but do not have a positive attitude towards it seem to have lower satisfaction with the log-ordered scale of CS.

Model 2 indicates that switch to active modes has a strong, positive and significant effect on CS compared to those who switched to cars. This could be because past studies have found active travel to be associated with positive moods and higher physical activity which translates into higher CS (Páez & Whalen, 2010; Schneider & Willman, 2019a). A significant decrease in commuting time is associated with an increase in CS. A possible explanation for these respondents having the highest CS could be either that their actual commute time (ACT) is now equal to their ideal commute time (ICT) or that their ACT is lower than ICT after the move. Similar findings were reported by Ye et al. (2020). We checked the difference between ACT and ICT as we had information on the ideal commute time variables in the survey, and found that the respondents who greatly reduced their commute time were those whose ACT was lower than their ICT, thereby suggesting higher CS. Furthermore, mismatch between mode and travel attitudes has a negative effect on CS. This means that switching to cars with a negative attitude towards them triggers dissatisfaction with commuting. Similar results were obtained by De Vos (2018). Nonetheless, the effect of voluntarily versus involuntary workplace relocation on CS was insignificant. This is not very surprising, because even in the descriptive results, we could not find a significant relationship between voluntary and involuntary workplace relocation and CS (see Table 5.4). This could mean that the effect of workplace relocation on CS is masked by other variables that may be work-related, such as type of job, employment contract, job satisfaction, and salary, etc. Lastly, the difference in explained variance for Model 2 is much higher than for Model 1, suggesting that changes in the commuting context may be more important than actual static values. In other words, perhaps people are comparing more to what they had rather than making an independent assessment of what they have following a workplace relocation.

The final combined model shows that the effect of commute time remains significant while the effect of interaction effect between current mode and travel attitudes becomes insignificant for public transport, and instead is picked up for active modes. In other words, those who walk or cycle to work with negative attitudes towards active modes experience lower satisfaction with their commute compared to pro active mode users. The positive effect of commuting by active modes is maintained controlling for other variables. A majority of commute time variables are significant than commute mode variables, suggesting that time is an important aspect of commuting than mode as it explains CS in a better way. This is in line with the limited literature that looks at the dynamics of CS (Beige & Axhausen, 2017; Oakil et al., 2016). The effect of voluntary or involuntary workplace relocation on CS is positive and significant in model 3, suggesting that voluntary commuters are more satisfied with their commute than involuntary commuters. This is consistent with our hypothesis that voluntary commuters have the freedom to consider their commuting circumstances, in contrast to involuntary commuters who have less control pertaining to their commute characteristics due to the forced nature of that relocation. It is also worth noting that this effect is significant only in Model 3, which includes both static and dynamic commuting characteristics. This may suggest that the effect of workplace relocation on CS is influenced by respondents' current and past commuting characteristics. For example, a voluntary workplace relocation may be associated with a change to a preferred mode of transport or a significant reduction in commute time, making the effect significant in Model 3 and non-significant in Model 2. However, this effect is only significant at the 90% level, suggesting that it is not very strong. Lastly, the difference in the explained variance of Model 3 (27.5%) compared to Model 1 and 2 highlight the importance of including dynamic variables to better understand the volatility in CS.

Table 5.6: Results of an ordered logistic regression for commute satisfaction.

	Regression coefficient		
	Model 1 Static variables	Model 2 Dynamic variables	Model 3 Combined
Current mode (ref. = car)			
Bus/ Tram	0.71*		1.23
Train	1.57***		1.21
Active modes	1.24**		3.51**
Current time (ref. = less than 15 minutes)			
Between 15 and 30 minutes	-0.24		-2.21**
Between 30 to 45 minutes	-1.47***		-2.74***
More than 45 minutes	-2.42***		-4.19***
Travel attitudes (ref. = negative attitudes)			
Pro-car user	-0.07		-0.15
Pro-PT user	-0.15		-0.15
Pro-active mode user (walking/ cycling)	-0.05		-0.40
Mismatch between mode and attitudes (ref. = no mismatch)			
Mismatch among car users	-0.32		-1.15
Mismatch among bus and tram users	-1.15**		-1.71 *
Mismatch among train users	-1.08*		-0.32
Mismatch among active mode users	-1.19		-3.53**
Change in commute mode (ref. = switched to cars)			
Switched to Bus/ Tram		0.35	omitted
Switched to Train		0.67	omitted
Switched to Active modes		2.76***	omitted
Change in travel time (ref. = no change)			
Far increased		-0.11	0.99
Increased		0.51	0.65
Decreased		0.62	0.18
Far decreased		2.22**	2.23**
Change of workplace (ref. = involuntary relocation)			
Voluntary relocation		0.60	0.82*
Switched to a preferred mode (ref. = yes)			
Switched to a non-preferred mode: Cars		-1.28**	omitted
Switched to a non-preferred mode: Bus/ Tram		-0.45	omitted
Switched to a non-preferred mode: Train		-0.94	omitted
Switched to a non-preferred mode: Active modes		-1.57	omitted
Socio-demographic characteristics			
Age	0.01	0.00	0.03
Female (ref. category = Male)	-0.18	-0.35	-0.43

Bachelor or equivalent (ref. Secondary or lower)	0.28	0.74	1.07
Master or above (ref. Secondary or lower)	-0.07	0.69	1.25*
HH income between 4k-6k (ref. = HH income less than 4k)	-0.02	0.71	1.66
HH income between 6k-8k (ref. = < 4k)	0.37	1.12	1.57**
HH income more than 8k (ref. = < 4k)	0.47	1.29*	1.20*
Living with partner (ref: living alone)	0.31	-0.36	-0.08
Cross-border commuter (ref: resident commuter)	0.33	-0.74	-0.08
Thresholds between the categories of CS			
Threshold 1 (1 (very dissatisfied) 2 (dissatisfied))	-2.60***	0.27	-0.84
Threshold 2 (2 (dissatisfied) 3 (neutral))	-1.28*	1.19	0.17
Threshold 3 (3 (neutral) 4 (satisfied))	-0.08	2.44	1.58
Threshold 4 (4 (satisfied) 5 (very satisfied))	1.61**	4.47***	4.19**
n	409	105	105
Degrees of freedom	22	20	26
Log-Likelihood	-580.66	-135.25	-120.41
McFadden's Pseudo R²	10.77%	19.86%	27.55%
Likelihood-ratio test (Prob > chi2)	<0.0001	<0.0001	<0.0001
*** p<0.01, ** p<0.05, * p<0.1			
Note: The effect of change in mode and switch to a preferred mode is omitted by the system due to multicollinearity between the static and dynamic variables.			

5.5 Conclusion

Due to changes in spatial circumstances, i.e. a change of residence or workplace, travel behaviour and satisfaction with travel inevitably change (Lanzendorf, 2003). Despite the significant role that these life events, such as a change in residence or workplace location, have on travel behaviour in general and commuting trips in particular (Clark et al., 2014), little attention has been paid to the effects of changes in commute characteristics linked to life events on commuting satisfaction (CS). Thus, the aim of this paper was to investigate the effects on commuting satisfaction of a change in workplace location, distinguishing between a voluntary and an involuntary change.

Concurrent with expectations, longer commute times following a workplace relocation are associated with lower CS than shorter commute time (less than 15 minutes), confirming findings of Gerber et al. (2017), but for a residential relocation. While commuting by active modes is associated with a higher CS than commuting by car, commuting by public transport also yields higher CS than commuting by car. This finding contrasts with previous studies examining the relationship between commuting mode and satisfaction, which consistently indicate that car users are more satisfied with their commute than public transport users (Friman et al., 2017; St-Louis et al., 2014; Ye & Titheridge, 2019). It is possible that the higher share of CS on public transport stems from the fact that individuals do not have to pay for their trips on trains, buses or trams, as public transport is free in Luxembourg (Luxembourg, 2022). For this reason, people have perhaps become more tolerant of and satisfied with public transport compared to

car use, which at the same time involves longer travel times due to heavy congestion at peak hours caused by both resident and cross-border commuters.

Findings regarding the dynamic commute variables indicate that those who switched to active modes of transport have higher CS than those who switched to cars after a workplace relocation. Those who decreased their commute time by a great difference reported higher CS than those who experienced no change in their commute time. Those who commute by car but have negative attitudes towards cars reported lower CS than those who switched to their preferred mode of transport. Most importantly, those who changed their workplace location voluntarily were more satisfied with their commute than those who were forced to move with their employer to retain their jobs. This is consistent with our hypothesis. A possible argument for this could be that voluntary commuters are better able to choose their preferred mode of transport and opt for a shorter travel time, and therefore have higher CS than those who were forced to change with their employer. A study by [Mao et al. \(2016\)](#) found that people who have more choice or flexibility in their commuting characteristics have higher travel satisfaction.

Overall, the results suggest that dynamic variables such as changing commuting mode, time and workplace relocation may be more important than static variables such as current commuting mode, time and travel attitudes, as they explain a larger proportion of the variation in CS than static variables, at least shortly after the change of workplace. Maybe this changes later in time, which may be a topic for future research. Even though the association between workplace relocation and CS is weak ($p < 0.1$), this suggests in part that commuters who change workplaces voluntarily are happier because they have the opportunity to determine their own commuting characteristics than if they were a captive traveller. In addition, commute mode, travel time and changes in travel time have a stronger significant effect on CS than changes of workplace, suggesting that people may be more sensitive to what changes have occurred rather than focusing only on workplace changes.

All in all, this study is the first to examine the dynamic variable of workplace relocation and its impact on CS by distinguishing between voluntary and involuntary workplace relocation. It adds a new layer to the static interpretation of the current literature on commuting satisfaction by showing that dynamic variables explain commuting satisfaction more strongly than static variables. Therefore, we suggest that future studies examine dynamic commuting variables, especially the workplace change variable for policy makers or employers when thinking about forced relocation of workplace location and the long-term consequences this might have on individual's commute satisfaction. Again, the question is how lasting this is, and whether CS changes over time when people get accustomed to the changed environment (treadmill effect). Another starting point for future studies is the analysis of workplace change in relation to change of residence. Few studies have shed light on the co-occurrence of residential mobility and job mobility, with the former being a consequence of job mobility and having long-term implications for people's future mobility decisions ([Clark et al., 2016](#); [Rouwendal & Rietveld, 1994](#); [Rouwendal & van der Vlist, 2005](#)). Therefore, more studies are needed that address how life events influence travel behaviour and satisfaction by using life-oriented approaches to gain a better understanding of the life choices an individual makes with regard to changes in their travel behaviour to enable a better evaluation of transport and land-use policies.

CHAPTER 6. Commuting versus Teleworking

Maheshwari, R., Van Acker, V., Gerber, P. How working-from-home practices impact on the relationship between commuting satisfaction and subjective well-being: Evidence from Luxembourg. Submitted to and under review with Transportation Research Part-A.

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 spill over effects of life domains other than commuting has certainly led to an overestimation of the impact of CS on SWB. Coupling this knowledge gap with the recent changes in commuting practices/working conditions associated with the increase in working from home (WFH) since the pandemic, is the focus of this study. 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 overall well-being. The results suggest that hybrid teleworkers foretell 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 seem to be important for policymakers to identify not only areas where employee well-being can be improved, but also how.

6.1 Introduction

Over the past years, the literature on travel satisfaction, especially 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 in people's lives and a stress that does not pay (Stutzer & Frey, 2008), it is likely that commuting characteristics affect people's satisfaction with commuting, which in turn influences their subjective well-being (SWB) (Bergstad et al., 2011; Ettema et al., 2011). Few studies examine how CS contributes to SWB, and even fewer studies explore the spill over effect of commuting on other areas of life and thus 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 analyse the impact of CS on SWB, taking into account satisfaction with life domains such as time use, leisure, health, etc.

Nonetheless, the impact of CS on SWB can again be questioned due to recent changes in commuting practices/working conditions associated with the increase in working from home (WFH) since the pandemic. 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 6.2 offers insight into the relationships between the fundamental components of the study. Section 6.3 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 6.4 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 6.5 discusses the key findings and concludes the paper with recommendation for policymakers who seek to enhance the well-being of their populace.

6.2 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.

6.2.1 Satisfaction with commuting and subjective well-being

Commuting is one of the most important activities in a worker's life. For many people, it is often a source of stress and frustration. For example, most studies have shown that people with longer commute time (regardless of travel mode) have 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). Some studies have also reported how commuting at peak hours has detracted an individual's overall sense of happiness and satisfaction (Ettema et al., 2012; Morris & Hirsch, 2016; Wang, 2015). In contrast, a shorter commute has been found to have a positive impact on overall well-being (Mouratidis et al., 2019). For example, several studies have shown that commuting to work using active modes of transport such as walking or cycling provides a sense of enjoyment and happiness during the commute, which in turn has a positive impact on people's well-being (De Vos et al., 2019; Páez & Whalen, 2010; Scheepers et al., 2014; Schneider & Willman, 2019; St-Louis et al., 2014). In addition, some studies reported that individuals who are able to choose their own mode of transport, live in their preferred neighbourhood or control their commuting schedule may experience higher commuting satisfaction (De Vos, 2018; De Vos & Singleton, 2020; Ma et al., 2021; Mokhtarian, 2008). This could then contribute to their greater well-being.

6.2.2 Satisfaction with commuting and other life domains

The effect of CS on SWB refers to a bottom up approach that explains how domain-specific satisfaction contributes to people's overall well-being (Diener, 1984; Heady et al., 1991). In other words, people seek to maximize their happiness in each of the life domains to achieve the ultimate goal of higher SWB. However, commuting satisfaction is just one of the many life domains and not the dominant one (Sprumont, 2017). In fact, there are other domains affected by (longer) commuting, such as satisfaction with job, time-use, leisure, personal relationships, accommodation or health. Longer commuting time limits the amount of time available for other activities and thus affect people's SWB. A few limited studies have shown that the cost of commuting has a negative impact on satisfaction with life domains. 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) analysed 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. Nevertheless, a

very few studies so far investigated how CS affects SWB by simultaneously considering satisfaction with other life domains (exception: [Gao et al., 2017](#); [Kroesen, 2014](#); [Maheshwari et al., 2022b, 2022a](#)). Failure to account for the mediated effect of satisfaction with life domains may have led to an overestimation of the effect of CS on SWB. Therefore, further research is needed to establish the relationship between CS and SWB and the interactions with other life domain satisfaction better.

6.2.3 Working from home and subjective well-being

The concept of WFH has been around for several years ([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. A recent report by [Eurofound \(2020\)](#) found that WFH increased by 40% due to the pandemic. 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' overall well-being, 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 ([Pablonia & Vernon, 2021](#)). WFH also has the potential to improve people's work-life balance and overall well-being ([Allen et al., 2015](#); [Blahopoulou et al., 2022](#); [Pablonia & Vernon, 2021](#)). While WFH can have several benefits, it can also lead to negative externalities. 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](#); [Solís, 2017](#); [Song & Gao, 2020](#)).

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 and contextual circumstances. Not taking into account the extent of WFH and the impact of individual (age, gender) and trip characteristics (commuting mode and travel time) on the relationship between CS, domain satisfaction and SWB could lead to inconclusive and conflictual results.

6.2.4 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 Figure 6.1: Conceptual model, each layer symbolizes the different WFH frequency, while controlling for those who never work from home.

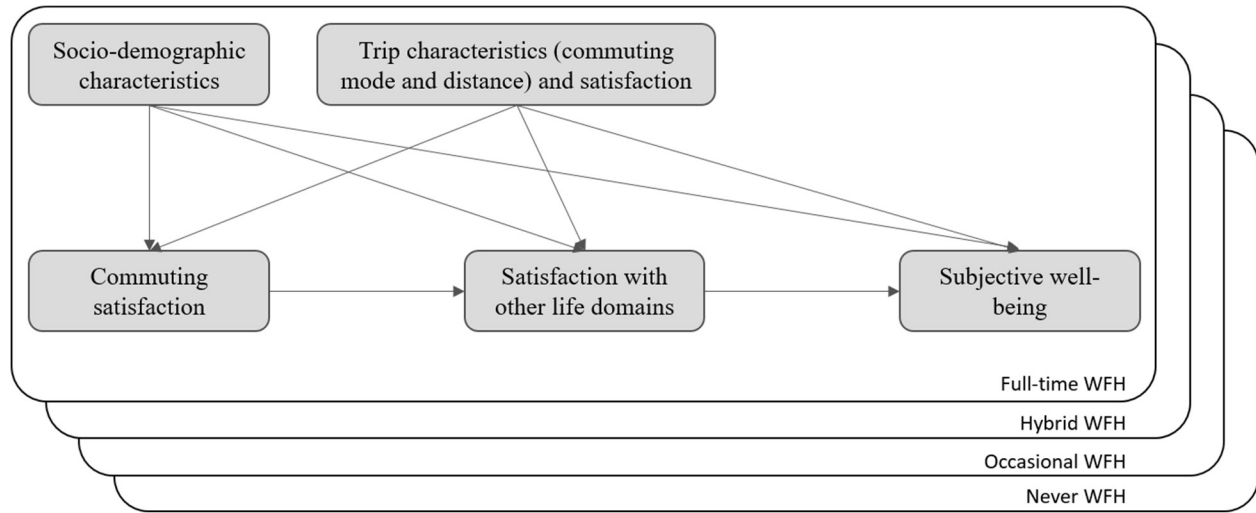


Figure 6.1: Conceptual model describing the relationships between the satisfaction variables

6.3 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.

6.3.1 Sample

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 neighbouring 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 6.1 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.

Table 6.1: Socio-demographic characteristics

	IGSS	Survey	STATEC
	Sample (10,000) (In %)	Respondents (n=852) (In %)	(Employed) population of Luxembourg (in % as on 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

6.3.2 Measurement of 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-select their satisfaction with different life domains such as job, place of work, time-use, leisure time, health, personal relationships, accommodation 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, including SWB.

As seen in Figure 6.1, the endogenous variable in our conceptual model refers to **subjective well-being** (SWB). Respondents were asked to self-select 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, 2021a; 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, 2018b). However, due to the high correlation between the accommodations and residential place 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 travel 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 6.2 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.

Table 6.2: 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				

In the analysis, we also controlled for trip characteristics variables such as travel mode (public transport, active modes and cars) and commuting time (less than 30 minutes one-way, between 30-60 minutes one-way and more than 60 minutes 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 in Figure 6.1, four new variables were created, namely Never WFH, Occasional WFH, Hybrid WFH and Full-time WFH. Respondents who selected 'never' answer option were categorized as 'Never WFH' variable (52%). Those who selected 'less than once a week' and 'once a week'

were put into 'Occasional WFH' variable (30%). Those who selected 'twice a week' and '2-3 times a week' were classified as 'Hybrid WFH' variable (12%) while those who selected '4 or more times a week' were labelled a 'Full-time WFH' (6%).

6.3.3 Methodology

All the relationships discussed in the section 6.2 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, Figure 6.1 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 relationships between the exogenous and endogenous variables. Path models are increasingly used in travel behaviour 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 programme 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 Figure 6.2. 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 Figure 6.2).

Nevertheless, we are also interested in whether and how the relationships as depicted in Figure 6.2 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 Figure 6.2, WFH variables are not included as explanatory variables but instead as a grouping variable.

To advance a multiple group path analysis, we need to compare a model with cross-group equality constraints (restricted model - with full sample) against another model without such constraints. 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 constraint 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 unconstraint these relationships across the four groups and allow them to be estimated freely.

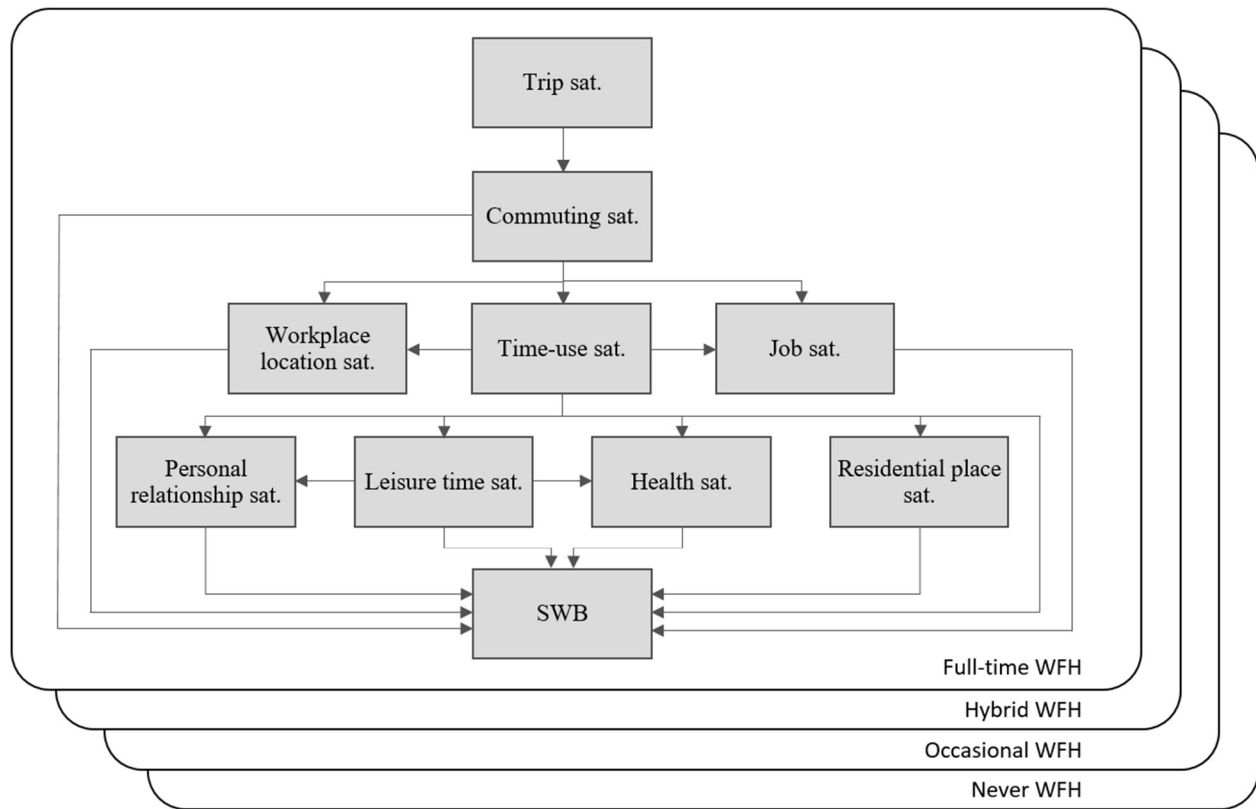


Figure 6.2: Multiple group path model for different working from home frequencies

6.4 Results

6.4.1 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 having the highest levels of SWB than the latter. Table 6.3 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.

Table 6.3: 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

6.4.2 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 subsamples). 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 6.4, the direction of the relationship between CS and SWB, satisfaction with life domains and SWB, and control variables and SWB (in most cases) is the same for the constrained and the unconstrained model. However, the sign of the coefficient differs significantly between the models. 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.

Table 6.4: Model estimation results for SWB (unstandardized total effect)

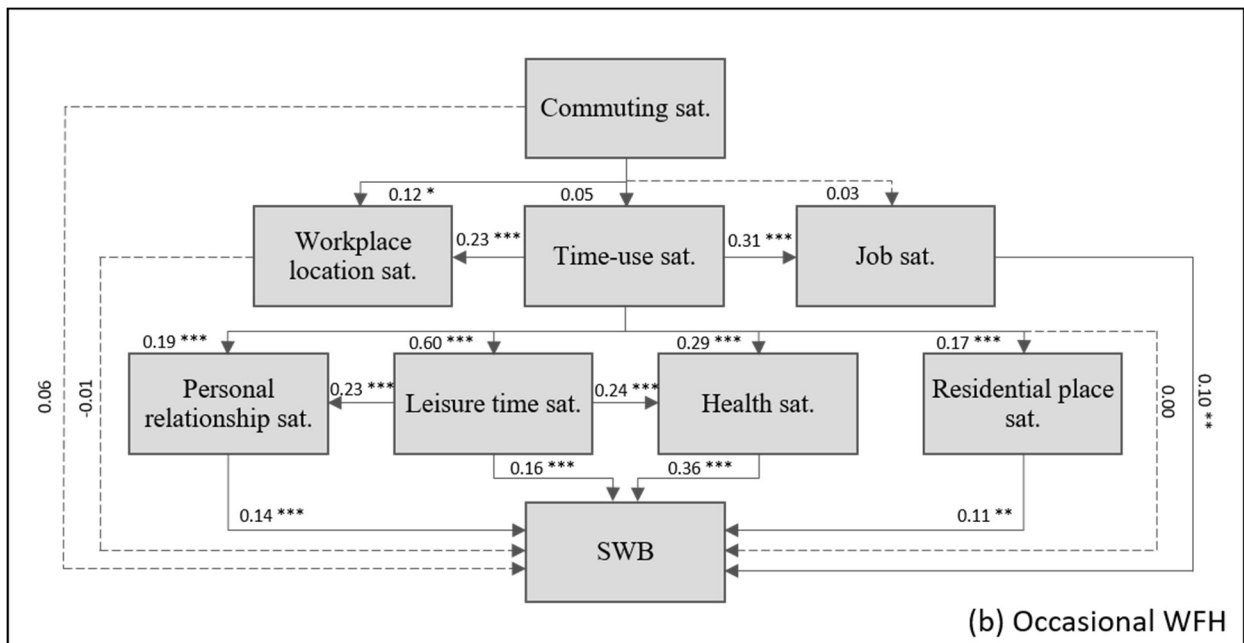
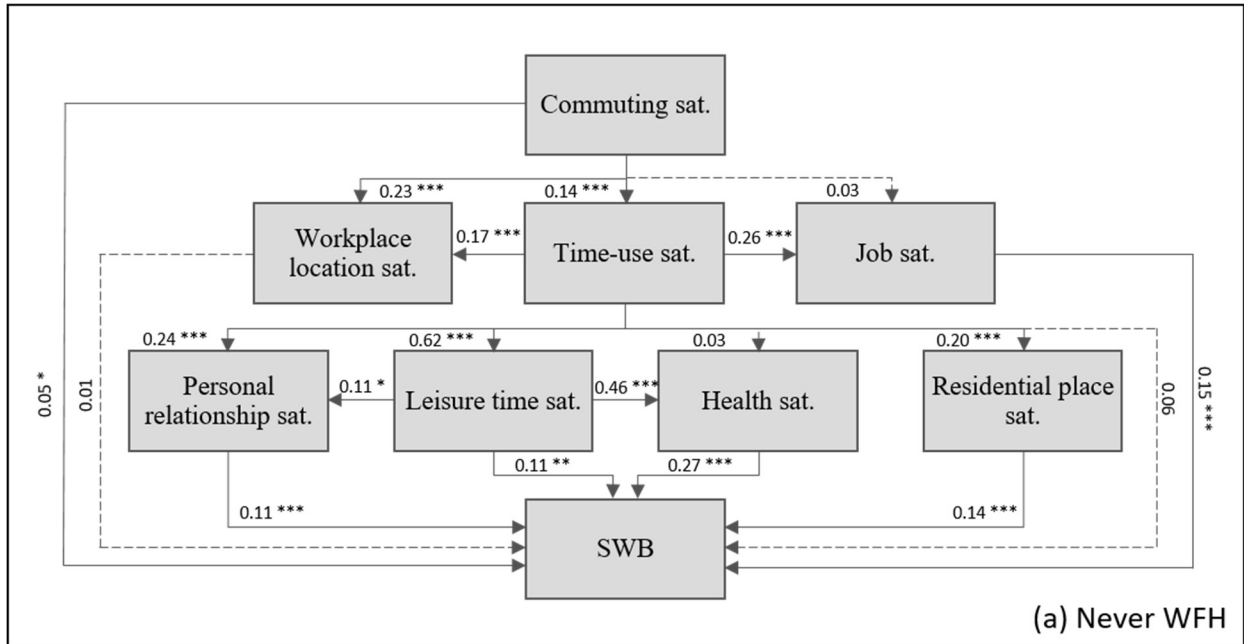
	Constrained model	Unconstrained model			
		Never WFH	Occasional WFH	Hybrid WFH	Full-time WFH
Trip satisfaction	0.12 ***	0.09 ***	0.17 ***	0.09 ***	0.08
Commute satisfaction	0.10 ***	0.11 ***	0.08 *	0.07 *	0.13
Job satisfaction	0.12 ***	0.15 ***	0.10 **	0.06	-0.02
Workplace location satisfaction	-0.00	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

6.4.3 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 Figure 6.3 (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 Figure 6.3, 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 6.5. The results for the group that never works from home 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.

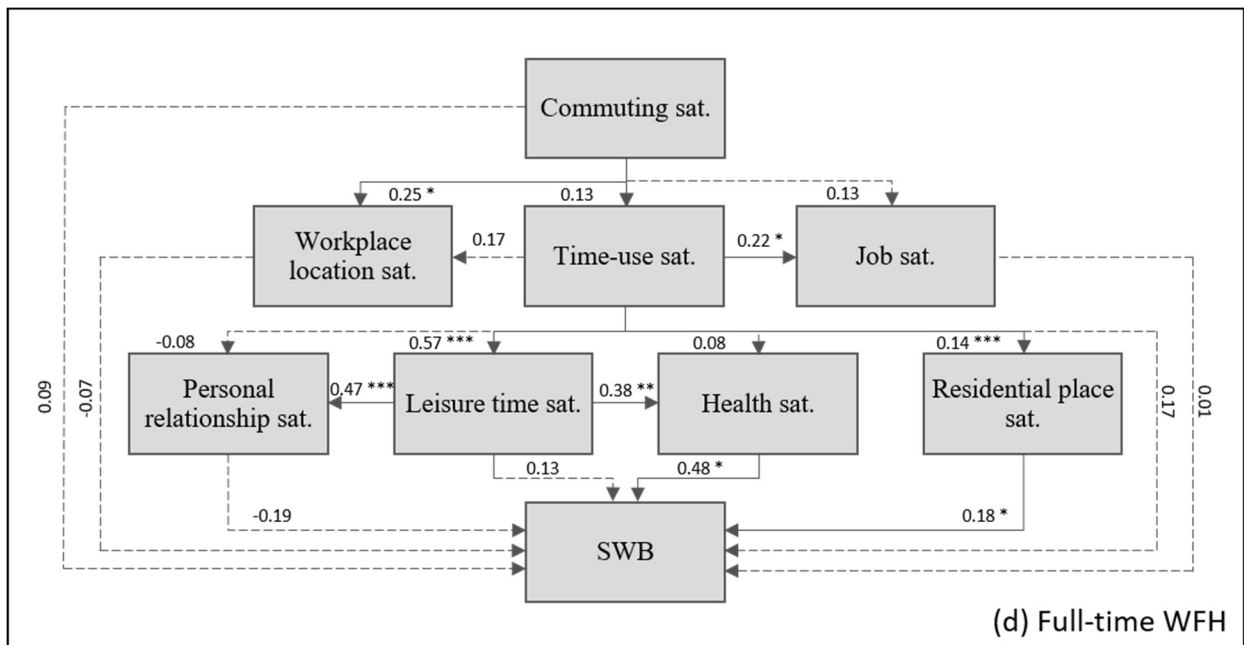
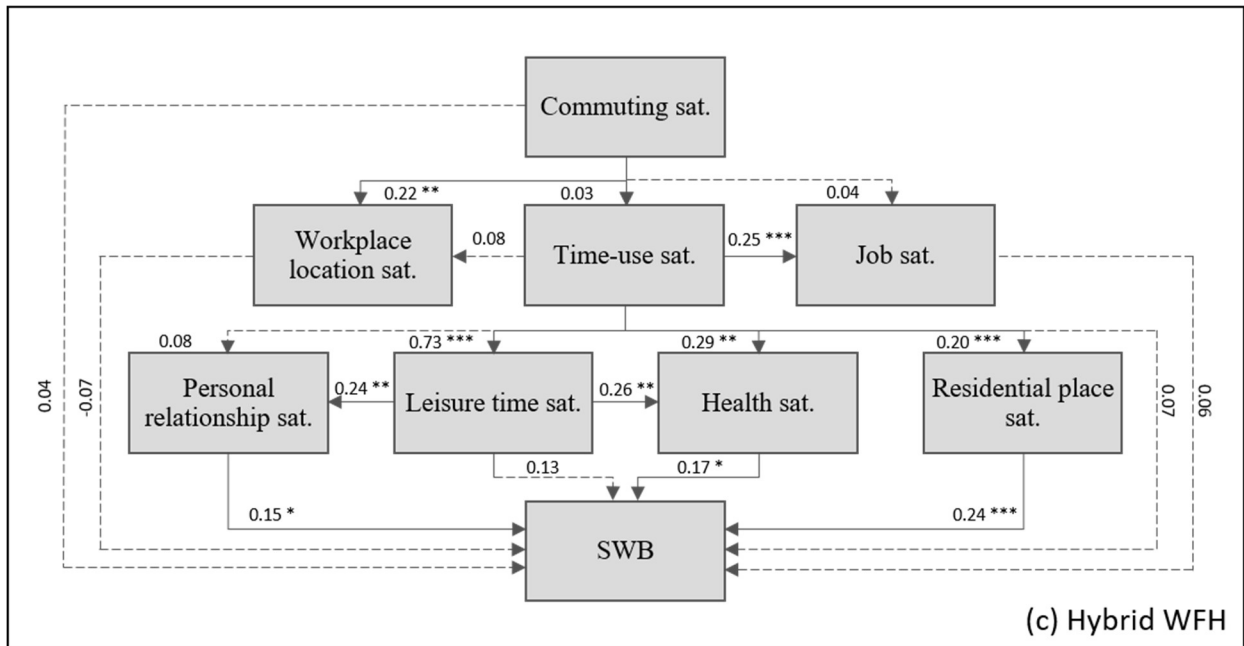


Figure 6.3 (a-d): Model estimates for four working from home frequencies

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 well-being.

However, this is only true for people who never or only 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 well-being. 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 works from home, 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. 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.

Table 6.5: Direct, indirect and total effect of endogenous variables on SWB

	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
	<i>0.13</i>	<i>0.00</i>	<i>0.13</i>	<i>0.15</i>	<i>0.00</i>	<i>0.15</i>	<i>0.17</i>	<i>0.00</i>	<i>0.17</i>	<i>-0.02</i>	<i>0.00</i>	<i>-0.02</i>
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
	<i>0.16</i>	<i>0.00</i>	<i>0.16</i>	<i>0.11</i>	<i>0.00</i>	<i>0.11</i>	<i>0.27</i>	<i>0.00</i>	<i>0.27</i>	<i>0.17</i>	<i>0.00</i>	<i>0.17</i>
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
	<i>0.00</i>	<i>0.22</i>	<i>0.17</i>	<i>0.00</i>	<i>0.30</i>	<i>0.30</i>	<i>0.00</i>	<i>0.17</i>	<i>0.17</i>	<i>0.00</i>	<i>0.14</i>	<i>0.01</i>
Unstandardized coefficients and standardized coefficients in italics *** < 0.01; ** < 0.05; * < 0.10												

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 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 neighbourhood 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 foretell highest SWB and occasional WFH individuals have the lowest levels of SWB.

Table 6.6 shows no significant relationship between the presence of children in the household and workers' SWB, which contrasts with the results of Pataki-Bittó and Kun (2022). In terms of gender, female respondents who never or occasionally engage in WFH had lower levels of SWB than male respondents. The indirect effect of gender on SWB is through satisfaction with trip and commuting. In the remaining 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). In terms of travel characteristics, public transport users are significantly the most satisfied, followed by active transport users (walking and cycling) and then car users. The influence of mode on SWB is through trip satisfaction, CS and WPLS. However, this effect only holds for the groups of never and occasional WFH. For the other groups, there is no significant effect of mode on SWB. Many studies have reported that active transport is generally the most satisfying (Gerber, 2012;

Gerber et al., 2020) or that car users are the most satisfied (Friman et al., 2017; St-Louis et al., 2014; Ye & Titheridge, 2017) and that this is related to SWB; however, our results on the relationship between commute mode and SWB contradict previous findings. Finally, workers with a commute time of less than 30 minutes each way are the most satisfied compared to their counterparts. 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.

Table 6.6: Direct, indirect and total effect of exogenous variables on SWB

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

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

6.5 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 well-being 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 were listed.

First, hybrid teleworkers (who WFH 2-3 days per week and in the office the rest of the week) seem to 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)¹⁰. 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 (Table 6.4) 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 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 well-being 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 well-being can be improved, but also how.

Third, our model (see Figure 6.3) 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

¹⁰ 3.64 mean SWB for never WFH and 3.61 mean SWB for full-time WFH.

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 well-being (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 well-being 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, 2014a; Maheshwari et al., 2022a, 2022b). Besides the direct effects of the individual life domains on SWB, domains such as CS, TUS and LTS 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 between life domains and how these contribute to SWB.

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 well-being (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 well-being 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 labour 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](#)).

CHAPTER 7. Conclusions

The overarching aim of this dissertation was to explore how commuting satisfaction (CS) affects subjective well-being (SWB) via satisfaction with other life domains, while taken into account changes in workplace location and changes in working conditions (i.e., working from home). In light of this, this dissertation combines a retrospective and prospective approach of CS. Understanding CS is important owing to its implications on people's SWB. Using a retrospective approach, we examined, for example, the theoretical and empirical interactions between CS, satisfaction with life domains such as job, accommodation, leisure time, time use, and health, and SWB, particularly with regard to post-pandemic mobility. We also examined how life events influence and are influenced by CS, the latter addressing the limited research on the prospective side of CS.

To shed light on these elements of CS and answer the five research questions described in Chapter 1, we used data from secondary surveys as well as a self-organized online survey. This chapter summarizes the main findings, policy recommendations, contributions to the transport field and avenues for future research.

7.1 Main findings

1. What are the important knowledge gaps in the well-documented literature on commuting satisfaction and subjective well-being from a workplace relocation perspective?

To identify the key knowledge gaps in the well-documented literature on commuting behaviour (CB), commuting satisfaction (CS) and subjective well-being (SWB) from a workplace relocation (WPR) perspective, we systematically reviewed 35 empirical studies, selected from 143 studies in Chapter 2. The syntax included synonyms of WPR and/or synonyms of CB, CS and SWB and was searched across three databases. An in-depth review of these studies revealed that the relationship between WPR and CB, WPR and CS, WPR and SWB or WPR, CB, CS and SWB is mainly addressed from four disciplinary perspectives.

First, studies that examined the relationship between WPR and changes in commuting mode, highlighting a shift towards (or away from) sustainable modes were classified under the *sustainability perspective* (N = 10). These studies mainly focused on the direction of the move (from the city centre to the suburbs, indicating a shift from sustainable modes to the car, while the opposite direction promotes sustainable urban travel). Second, studies that analysed the relationship between WPR and CB (such as commuting mode, distance and time) or WPR, CB and CS were assigned to the *mobility biographies perspective* (N = 7). These studies went one-step further by examining the impact of WPR on changes in CB and then on changes in CS, focusing on a before/after WPR comparison. Alternatively, some of these studies also analysed a spill over effect on satisfaction with other life domains such as social relationships, job, health and financial situation due to changes in CS. Third, studies that looked at the restructuring of household activities in response to one household member's WPR were classified under the *household interaction perspective* (N = 6). This limited number of studies generally addressed how changes in a person's job may have a cascading impact on their satisfaction with different life domains and on the life domains of other household members, especially spouses and/or children. Finally, studies that analysed the interaction between WPR and SWB for those who changed their workplace falls under the *socio-psychological*

perspective (N = 12). The most common and widely discussed impact of a WPR on employee's SWB was that they felt more stressed and had poorer mental health after a WPR.

An in-depth analysis of each perspective and how it embeds into the next perspective, starting with WPR and moving through CB and CS to SWB, has led to the development of a conceptual model for WPR. As this model is based on the four disciplinary perspectives mentioned above, it includes both individual and household level interactions. In essence, a WPR could affect four relationships, namely (i) a person's commuting behaviour (ii) followed by their satisfaction with commuting, (iii) their activity behaviour/life domains other than commuting followed by their satisfaction with these life domains, and (iv) their social psychological characteristics. Changes in activity behaviour could also be related to the interaction between the worker who experienced a WPR and his/her household members. Although these four perspectives are closely related and interdependent, there are still major knowledge gaps in the current literature. First, the impact of WPR on satisfaction with life domains other than commuting and SWB has not been sufficiently studied. It is important to investigate satisfaction with life and life domains, as there is evidence that time spent commuting affects time spent on other activities and thus SWB (Christian, 2012; Hilbrecht et al., 2014; Nie & Sousa-Poza, 2018). Because the interaction with other life domains is neglected, especially through a WPR lens, studies so far have not examined how individuals cope with travel dissatisfaction in their personal lives, leading to the second gap. Do they tolerate the dissatisfaction or do they make changes in their lives such as changing workplaces or residences? In other words, life events such as change of workplace or residence could be a consequence of commute dissatisfaction and thus additional research exploring the feedback effect is needed.

Third, most of the studies included in this review focuses on involuntary workplace relocation i.e. where an employee is forced to move with their employer to a different location to continue their employment. However, the impacts of a voluntary workplace relocation i.e. where an employee willingly decides to move to a different location in search of better job prospects or work-life balance on CS are poorly understood. Understanding the impact of a voluntary versus involuntary workplace relocation on CS is important as commute characteristics could be a consideration or even the main reason for a voluntary relocation as opposed to an involuntary relocation where workers have less control pertaining to their commute due to the forced nature of this relocation. Finally, the feedback effects of life domain satisfaction on CS and SWB on CS also present significant knowledge gaps. To combat the partial understanding and for a holistic conceptualization of CS, these limitations need to be addressed, as indicated in the conceptual model of this chapter.

2. What is the interaction between commuting satisfaction, satisfaction with non-travel related life domains and subjective well-being, controlling for covariates and contextual differences?

Commuting is an important daily activity and the time spent commuting to work has an impact on SWB. This relationship can also be bidirectional, but is somewhat less explored. Therefore, in Chapter 3, we analysed how satisfaction with life and life domains affects satisfaction with commuting, also taking into account employment, personality and socio-demographic characteristics. For the analysis, we used the EU-SILC data where respondents were asked to indicate their satisfaction with the time component of commuting (i.e. satisfaction with commuting time, CTS) instead of asking about their satisfaction with commuting in general. Thus we specifically examined how CTS is influenced by the other domain

satisfaction variables and overall life satisfaction. It is worth noting that apart from the analysis based on the full sample (Model 1), we also took into account the contextual differences, as the EU-SILC survey is available for 32 countries, by distinguishing between less- (Model 2) and well-developed (Model 3) European countries using the Human Development Index.

The results indicated a positive relationship between CTS, overall life satisfaction and satisfaction with life domains in all three models. Among all life domains, satisfaction with job and time use had by far the largest coefficients among the variables measured on the same scale. In addition, these two variables remained statistically significant even in a separate analysis of life domains and CTS for all 32 countries. This showed that job and time-use satisfaction have the strongest influence on CTS, instead of other obvious variable such as overall life satisfaction (OLS). OLS is significant in all models, but at a higher p-value for less developed countries, suggesting that the relationship between OLS and CTS is weaker in these countries. It could be that workers in these countries somehow put up with an unsatisfactory commute because it still allows them to reach an adequately paid job. Furthermore, in the less developed countries, two life domains were negatively associated with CTS: satisfaction with financial situation (although not significant) and satisfaction with recreational space (although significant with a higher p-value than in the well-developed countries). Further research is needed to explain why these two life domains yield different results in less developed and well-developed countries.

Regarding employment variables, part-time workers had higher CTS compared to full-time workers, possibly due to shorter commutes, proximity to workplace, or one of the two daily commutes being in off-peak hours (Dijst & Vidakovic, 2000; Schwanen & Dijst, 2002). Temporary workers often reported lower CTS compared to permanent workers, possibly due to the constant pressure to find another job and subsequently adapt to a different commuting pattern (Bruno et al., 2013; Graaf-Zijl, 2005; Waaijer et al., 2016). Finally, employees who did not experience any change in their jobs exhibited higher CTS than those who experienced a change, perhaps because they did not have to make adjustments or adapt to a new commuting routine/habit (see for an overview (Gardner, 2009)). Regarding personality traits, individuals with negative feelings had lower CTS than those with positive feelings, possibly because commute trips are often associated with stress, worry and frustration compared to non-commute trips (Bergstad et al., 2011; Mokhtarian et al., 2015; Morris & Guerra, 2015; Stutzer & Frey, 2008). On the other hand, trust was positively associated with CTS, suggesting that people who have trust in their political and legal system are more satisfied with their CTS, presumably because they are satisfied with their overall life (Denters & Klok, 2010). In general, we could conclude that feelings and trust have a significant impact on CTS, but whether positive or negative depends on the context of the country. Covariates such as female, good health, adult (>30 and <50), higher income and living in suburban, followed by urban and then rural areas, were associated with higher CTS. People in well-developed countries were more satisfied with their living domains. The HDI, which controlled for contextual differences between less and well-developed countries, also confirmed this result. The novelty of this study thus lied in testing the relationship between some less research determinants of CTS and CTS, including satisfaction with life domains. These findings helped to identify further innovative ways to improve CTS and illustrated that wealthier countries are more satisfied with CTS than people in lower income countries.

3. How do commuters respond to dissatisfaction with commuting and work in subsequent years? Does dissatisfaction with commuting outweigh dissatisfaction with work or vice versa?

In Chapter 2, we presented a conceptual model for WPR. A part of this model that points to a feedback loop from CS to WPR is quantified in chapter 4. Considering the prospective approach to CS is important because, compared to research on the determinants of commuting satisfaction, research on the consequences of commuting (dis)satisfaction is limited. There is not enough evidence on how people cope with dissatisfied commuting patterns. Do they change where they live, where they work, or how they commute in subsequent years or do they tolerate dissatisfaction? Therefore, a panel dataset from Luxembourg was used in this chapter. This longitudinal dataset offered information on satisfaction with commuting time (CTS) and work (WS) in year 2013, and life events such as changing residence and/or workplace and buying or selling a car in three consecutive years (2013, 2014 and 2015).

First, findings of a cross-tabulation revealed changing workplaces as the most common life change due to dissatisfaction with work and commuting patterns in the previous year. Interestingly, the data also indicated that the highest number of changes in life events occurred within the immediate year (Wave 1: change in 2014) following the onset of dissatisfaction (in 2013) compared to a year later (Wave 2: change in 2015). Second, results of a cluster analysis showed an association between six cluster profiles of CTS and WS (i.e., combined dissatisfaction, combined satisfaction, moderate CTS-WS, high CTS-low WS, low CTS-high WS and high CTS-moderate WS) and changes in subsequent years, with combined dissatisfaction indicating maximum changes in workplace and car ownership, and moderate CTS-WS indicating maximum changes in place of residence in the following year. The overall percentage of life changes was low, suggesting that some individuals remain trapped in dissatisfied commuting and work patterns. Third, the results of the logistic regression from Wave 1 with changing workplace as the dependent variable showed that individuals with combined dissatisfaction were more likely to change workplace in the following years than individuals with combined satisfaction. Work dissatisfaction outweighed commute dissatisfaction, as the effect of high CTS-low WS was stronger than the effect of low CTS-high WS on changing workplace. The proportion of people who changed residence in the next year was low, probably due to the high transaction costs associated with residential mobility. Furthermore, we ran another logistic regression model with change of workplace in 2015 as the dependent variable; however, since the workplace change mainly occurs in the next year (in 2014) and not two years later (in 2015), the results of a logistic regression were not robust due to the issue of small sample size.

4. What is the effect of workplace relocation on commuting satisfaction? Are voluntary commuters more satisfied with their commuting than involuntary commuters after the relocation? Are static commuting variables still important in explaining satisfaction with commuting?

The aim of chapter 5 was to investigate the effects of a change of workplace on commuting satisfaction (CS), focusing on voluntary and involuntary relocation. Voluntary workplace relocation occurs when the employee willingly decide to change their jobs, while the latter occurs when the employee is forced to move with their employer in order to retain their jobs. Understanding whether the level of satisfaction with commute differs between these two groups was important because commute characteristics could be a consideration or even the main reason for a voluntary relocation as opposed to an involuntary relocation where workers have less control pertaining to their commute due to the forced nature of this

relocation. This chapter thus addressed the missing link as pointed out in the conceptual framework of chapter 2.

Concurrent with expectations, longer commute times following a workplace relocation led to lower CS, but active modes and public transport offered higher CS than cars. A possible argument for higher CS on public transport could be the fact that it is free in Luxembourg, which makes people more tolerant towards it. Findings regarding the dynamic commute variables indicated that those who switched to active modes of transport, decreased their commute time by a great difference, and those who started commuting with their preferred mode of transport indicated higher CS following a workplace relocation. Most importantly, those who changed their workplace location voluntarily were more satisfied with their commute than those who were forced to move with their employer to retain their jobs.

Overall, the results suggested that dynamic variables such as changing commuting mode, time and workplace location may be more important than static variables such as current commuting mode, time and travel attitudes, as they explained a larger proportion of the variation in CS than static variables at least shortly after the change of workplace. Maybe this changes later in time, which may be a topic for future research. Even though the association between workplace relocation and CS was weak ($p < 0.1$), this suggested in part that commuters who changed workplaces voluntarily are now happier maybe because they have the opportunity to determine their own commuting characteristics than if they were a captive traveller. In addition, commute mode, travel time and changes in travel time had a stronger significant effect on CS than change of workplace, suggesting that people may be more sensitive to what changes have occurred in their commute characteristics rather than focusing only on workplace changes. In sum, this study was the first to examine the dynamic variable of workplace relocation and its impact on CS by distinguishing between voluntary and involuntary workplace relocation. It added a new layer to the static interpretation of the current literature on commuting satisfaction by showing that dynamic variables explain commuting satisfaction more strongly than static variables. Therefore, we suggest that future studies examine dynamic commuting variables, especially the workplace change variable for policy makers or employers when thinking about forced workplace relocation and the long-term consequences this might have on individual's CS. Again, the question is how lasting this is, and if CS changes over time when people get accustomed to the changed environment (treadmill effect).

5. How do differences in working from home frequency affect the relationships between commuting satisfaction and subjective well-being while accounting for satisfaction with non-travel related life domains?

In chapter 6, we examined the extent to which the relationships between CS, satisfaction with other life domains, and SWB still hold true today, in post-pandemic times where working from home (WFH) became more important than ever. Overall, seven key findings emerged from a multiple-group structural equation model (SEM) using data from the self-organized online survey. First, hybrid workers (WFH 2-3 days per week) reported the highest SWB (3.80), possibly due to less commuting stress, the ability to interact with their colleagues from time to time, and the ability to have control over their time use. In contrast, occasional WFH (engaging in WFH one day per week or less) reported the lowest SWB (3.55), which could be due to the constant commuting that can cause negative feelings such as stress and frustration. Second, the impact of CS on SWB via satisfaction with life domains was misinterpreted when the frequency of

WFH was not taken into account. For example, the relationship from CS on SWB is stronger for employees that never work from home compared to full-time teleworkers, as commuting activity dominates in the first group while it is quite limited in the second. Although this seemed like an obvious finding, it highlighted that commuting can actually lengthen occasional workers' total workday and reduce the time they could have spent on other non-travel activities. As for the hybrid workers, the time saved by not commuting to work every day influenced the time they spent on other non-travel activities such as household chores, childcare and sleep. Such an in-depth analysis is needed to determine not only in which areas employees' well-being can be improved, but also how.

Third, certain life domains became more important than others after analysing the differences in WFH frequency. For example, the impact of CS on SWB via health satisfaction (HS) is less strong for full-time teleworkers compared to those who never or occasionally work from home, possibly due to the lower physical activity associated with the increase in WFH. Fourth, we found that life domains other than commuting were distributed on two levels. CS first directly affected time use satisfaction (TUS), workplace location satisfaction (WPLS) and job satisfaction (JS), and then influenced SWB. However, for other life domains, including WPLS and JS, the effect of CS was mediated through TUS before it affected SWB. This means that the life domains act at two levels but also in two ways – with CS and TUS followed by the rest of the domains. This highlighted the dominant role of TUS in explaining the indirect effect of CS on SWB, leading to our fifth finding. It might suggest that individuals can maximize their utility and thus their overall SWB as long as they are free to optimize their time. Next, life domains such as TUS, leisure time satisfaction (LTS) and HS had significant effects on SWB in all models, regardless of WFH frequency, highlighting their importance. However, CS had no direct impact on HS and LTS. This was rather surprising, as one would expect longer commuting times to be associated with frustration and stress and thus lower levels of satisfaction with mental health. Emphasizing this non-relationship between CS and life domains was also important because it predicted that ultimately it is all about how people allocate and optimize their time. Finally, our model suggested interactions between the life domains of commuting, time use and leisure time satisfaction. This made our study one of the firsts to go beyond the direct impact of CS on SWB in the travel satisfaction literature, providing insights for policy makers and implementers to improve individual's SWB.

7.2 Policy recommendations

Improving worker's well-being by increasing commuter satisfaction is the goal of this dissertation. The findings of this dissertation indicate that commuting satisfaction (CS) affects subjective well-being (SWB) through its impact on satisfaction with other life domains. Moreover, the analyses take into account the dynamics in CS by considering changes in workplace location and the changes in working conditions (i.e., working from home). Consequently, it seems that the process of improving workers' subjective well-being by increasing their satisfaction with commuting and other life domains necessitates decision-making at different levels and involvement of numerous stakeholders/ mobility players. At the national level, state/ ministries have the opportunity to evaluate both the advantages and challenges associated with promoting CS and SWB. However, in the pursuit of improving CS, it is crucial to engage employers as well as employees in the decision-making process as mobility in general, and commuting in particular is a result of both collective decisions and personal choices. For these reasons, a comprehensive (but not exhaustive)

set of policy recommendations has been drafted, which all three mobility players can apply to improve the CS and SWB of the populace at large, thereby contributing to the UN Sustainable Development Goals of improving health and well-being (i.e., Sustainable Development Goal 3: Good health and well-being).

State/ Ministry

The results of Chapters 3 and 6 indicate a strong relationship between satisfaction with commuting, job and time use. It is important that policy makers understand that increasing CS goes beyond conventional approaches such as changing commuting mode, reducing commute time and minimizing distance, as suggested in previous studies. Rather, a more innovative and effective approach is to focus on satisfaction with important aspects of the job (employment-related characteristics) and time use (management). To achieve this, it is important that the Ministry looking after mobility planning and the Ministry-related to employment conditions work together in developing commuting policy. By integrating the perspectives of both ministries, policies can be developed that not only prioritize the convenience of commuting, but also create a conducive work environment, such as promoting working from home or flexible working hours to optimize individuals' satisfaction with time use. Alternatively, policy makers can use spatial planning as a tool to strategically locate businesses that generate a high volume of travel near public transport stops or within walking distance. This makes it easier for workers to chain trips so that they can complete multiple tasks in a single trip. Thus, investing in more research on how to improve time-use satisfaction (TUS) seems to very important as our findings strongly indicate a dominant and mediating role of TUS on SWB stemming from CS.

Moreover, policy makers can also invest in building co-working centres that allow cross-border or long-distance commuters to work from these satellite offices instead of commuting to their traditional offices that are far from their homes. In this way, cross-border commuters can save time by shortening their commute, while working in an office environment that encourages them to be more productive and efficient in return for less commuting. There are several ways in which policy makers can promote CS and SWB by improving commuters' TUS. Lastly, the results of chapter 4 indicate that while a relatively small percentage of individuals who make changes in their workplace, place of residence or car ownership in response to work and commute dissatisfaction, a large proportion of commuters continue to endure unsatisfactory commute and work patterns. For those who are unable to make any change in their lives, their tolerance of dissatisfaction may stem more from financial constraints rather than personal preferences. Therefore, policy makers and practitioners should look to find ways to improve these individuals' dissatisfaction with commuting and work, e.g. by providing efficient and effective transport infrastructure, promoting last mile connections to and from workplace locations, flexible working arrangements or working from home.

Employers

The findings of Chapters 2, 3, 5 and 6 suggest that employers can play an important role in improving workers' commuting experience and satisfaction. First, by promoting a hybrid WFH model, employers can significantly contribute to improving CS and thus SWB of their employees (see findings of Chapter 6). Our results suggest that a poor commute can become satisfactory if employees do not have to do it every day. Second, employers can offer flexible working arrangements such as flexible working hours or working

from a satellite office, home or a co-working center. This way, employees can avoid congestion during peak hours, have better control over their commute and do not have to travel long distances to work, but can instead work a satellite office or co-working centre closer to their place of residence. This is especially helpful for employees who do not have an office provision at home.

Third, employers can enhance CS of employees who are unable to WFH due to the nature of their jobs, such as doctors, nurses, and construction workers. This can be done through the implementation of a mobility management plan, which incorporates initiatives like carpooling, ridesharing, travel subsidies or workplace wellness programs. For instance, the plan may begin by collecting data from employees about their commute characteristics, where they live, their commuting preferences and their daily activity patterns through an interactive dashboard or website, and using this information to identify carpooling opportunities within the workforce, increasing vehicle occupancy rate, subsidies for those who use active and public transport to commute to work, and a tailor-made commuting plan for each employee, among other things. Fourth, employers can also offer electric cars and bicycles or shuttle services from the main transport hub to the workplace, thereby promoting sustainable mobility. Such a plan can also assess whether employees express a desire for amenities such as on-site gym, wellness centre, or a day care service to optimize/ reduce the trip chaining of the employees. This approach can incentivize employees to use active or public transport by limiting their travel from point A to point B and back to point A.

Finally, employers can also seek the help of external mobility experts to identify potential locations for relocating their offices (if necessary), rather than simply relocating without considering the existing transport infrastructure. This will not only improve the commute of old employees, but also that of new employees who might be attracted to the new location, which is closer to public transport and other commercial establishments. Such a mobility management plan can have many benefits, as it can ultimately increase the attractiveness of the company, help retain old employees even after an involuntary relocation of their workplace and improve workers CS by encouraging them to use sustainable transport alternatives such as electric vehicles, bicycles, walking, or public transport, thereby reducing the CO2 emissions.

Employees

The results from most of all chapters point to important links between CS and satisfaction with life domains. On the one hand, satisfaction with time use and job has the strongest influence on CS, while on the other hand, CS has the strongest influence on satisfaction with time use (TUS) and then on SWB. This suggests that individuals who are largely satisfied with their time use may also be satisfied with their other life domains, which in turn may have a positive impact on their SWB. Therefore, commuters should pay attention to how they can maximize their time-use in order to improve their SWB. For instance, long distance commuters can engage in reading, working, or other activities during the travel, thereby making travel time worthwhile (Cornet et al., 2022). Additionally, by leveraging flexible working arrangements, commuters can greatly enhance their CS by commuting at least one way during off-peak hours or by travelling shorter distances to a satellite/co-working office near their home instead of commuting to a traditional workplace location, thereby increasing their CS and SWB. Of course, flexible working arrangements need to be supported by decisions of the higher authorities, thus reinforcing our argument

to involve all mobility stakeholders in this collective decision-making, as sustainable mobility can only be achieved if all stakeholders involved in shaping the future of mobility work towards a common goal.

To conclude, in the pursuit of improving CS and SWB, a comprehensive set of policy recommendations has been put together that fall under the jurisdiction of either the state/ ministries, employers, employees or other stakeholders such as the NGOs and mobility companies to become more sustainable. The transition to sustainable mobility can pose some challenges, as workers often find commuting by car more convenient because of the benefits associated with it. However, the results of the self-organized survey indicated that car use is associated with lower CS among the working population in Luxembourg. Consequently, there is a greater opportunity to tap into by offering readily available sustainable mobility alternatives, thereby encouraging the use of active and public transport.

7.3 Contributions to the transport field and avenues for future research

This dissertation contributed to the field of travel satisfaction by exploring the relationship between CS and SWB and investigates the dynamics of commuting. For the analysis, secondary data (EU-SILC, P-SELL III) as well as self-collected data from an online survey about changes in workplace location and working conditions were collected. The combination of these datasets allows the exploration of three important aspects of the relationship between CS and SWB. First, the direct and indirect effects of CS on SWB are examined by considering the interplay with satisfaction with other life domains than commuting, including among others work, accommodation, time-use, leisure time, personal relationships, and health. This is an important contribution to the field of travel satisfaction because it provides an in-depth analysis of how SWB depends not only on satisfaction with a typical commute to work, but also on satisfaction with other activities that are linked to commuting. Our findings indicated that commuting is not a stand-alone life domain, but is connected to all other life domains, especially time-use satisfaction. Thus, recommendation for future studies is to invest more in time-use research to understand the complexity and interplay between CS and SWB. This could be achieved using alternative survey methods that deviate from the current cross-sectional or retrospective surveys dependent on self-reported answers about regular experiences and satisfaction. One potential avenue for exploration involves implementing time use tracking, enabling questions about momentary experiences of time use and corresponding satisfaction levels. Such tracking survey methods could provide valuable insights into the relationship between CS and satisfaction with life domains, in particular how people spent their time during the travel and what impact this has on their SWB.

Second, in this dissertation we were able to scratch the surface of the dynamics of commuting by analysing the impact of life events on commuting (dis)satisfaction, and the reverse. Our findings suggested that a large proportion of people continue to tolerate commute dissatisfaction, while a small percentage of people change either their workplace, residence or car ownership to cope with dissatisfying commute patterns. On the one hand, these individuals who tolerate commuting dissatisfaction in their personal lives might simultaneously have a negative impact on their time-use satisfaction due to time-poverty that arises from commuting longer distances or commuting for longer time, which obviously comes at the expense of dissatisfaction with leisure-time or personal relationships. On the other hand, instead of changing workplace or residences, coping mechanisms could also include other responses to

dissatisfaction, such as flexible working hours, working from home, working fewer hours or commuting at off-peak times. Future research should therefore address the question of whether people tolerate dissatisfaction with commuting, which in turn could affect their satisfaction with other life domain and SWB or whether they make changes in their lives. Investing in researching this prospective approach of CS will help practitioners and policy makers in formulating the necessary transport and planning policies to accommodate these dissatisfied commuters or to gain a better understanding of individual coping mechanisms.

In line with the dynamics of commuting, the third finding revealed that dynamic variables explain a larger proportion of the variation in CS than static variables, at least shortly after a life event, in this case a workplace relocation. However, the effect of a workplace relocation on CS could change over time. This raises the important question of how lasting the effect on CS is and whether CS changes over time as people get used to the changed environment (treadmill effect). Thus recommendation for future studies is to investigate the dynamics of commuting in more detail, possibly using a rigorous panel design, as this is an important starting point for policies aimed at changing travel behaviour as commute habits are consciously reconsidered after a life event (e.g. change of workplace), especially an involuntary change where workers have less control pertaining to their commute characteristics. In this way, this dissertation has not only contributed to the border picture on how through commuting different non-travel-related life domains and SWB are affected, but also to provide a wider understanding of the temporal dimension of CS that adds a dynamic layer to the current static interpretation of travel satisfaction.

Fourth, this dissertation allowed us to examine the extent to which the relationships between CS, satisfaction with other life domains, and SWB were still applicable today, in post-pandemic times where working from home became more important than ever. It found that hybrid workers (who work from home two to three days per week) seem to have higher levels of SWB compared to occasional teleworkers (who work from home less than one day per week). This implies that the well-documented relationship between CS and SWB needs to be re-examined as commuting has been limited for some people due to the outbreak of the COVID-19 pandemic as they have shifted to working from home. This is an important contribution to the field of travel satisfaction as it provides first-hand insights into how the relationship between CS and SWB differs in post-pandemic times. Future research is therefore needed to identify whether commuting actually lengthens occasional teleworkers' total workday and reduces the time they could have spent on other non-travel activities, and whether the time hybrid workers save by not commuting to work every day influences the time they spend on other non-travel activities such as household chores, childcare and sleep. Such an in-depth analysis of the interplay between CS, SWB and satisfaction with non-travel-related life domains is indeed needed to determine not only in which areas employees' well-being can be improved, but also how.

On a final note, although commuting has a significant impact on individuals' SWB, it is not necessarily the most important life domain. Previous studies have shown that commuting is a stressful activity and has a direct negative impact on individual SWB; however, the results of this dissertation did not find a negative relationship between CS and SWB. In contrast to previous findings, we conclude that satisfaction with time use has the strongest total effect on SWB; regardless of how often individuals commute to work. This might suggest that individuals can maximize their utility and thus their overall SWB as long as they are

free to optimize their time. As for the prospective approach of CS, we know that dissatisfaction with commute triggers changes in life event, such as (but not limited to) changing workplace or residence. However, for the majority of dissatisfied individuals who are unable to make a change, the question of how this dissatisfaction spill over onto satisfaction with non-travel-related life domains due to time poverty that results from commuting longer distances seeks further investigation. As for the dynamics, although workers who voluntarily changed their workplace have higher CS than those who changes on an involuntary basis, the question of how lasting this is, and whether CS changes over time when people get accustomed to the changed environment (treadmill effect), is a topic for future research.

In terms of causality, findings from Chapter 4 suggest that people who reported combined dissatisfaction with commuting and work in Year 1 were more likely to change workplace locations in subsequent years (Year 2 and Year 3). However, even if there is a significant relationship between these variables, it is difficult to establish causal relationships. This is because we could not isolate the impact of dissatisfaction on changing workplaces without taking into account other confounding variables, such as dissatisfaction with financial situation, workplace location or longer commute times, which could potentially influence the decision to change workplaces. Moreover, the results of Model 3 in Chapter 5 suggest that individuals who voluntarily changed their place of work tend to be more satisfied with their commute after the move than individuals who involuntarily changed their place of work. Model 3 examines the differences in CS as a function both static variables referring to current commuting behaviour (e.g., current commuting time, commuting mode) and dynamic variables referring to changes in commuting behaviour (e.g., changing from previously using public transport to commute to work to now using a car, and changing workplaces). By controlling for both static and dynamic variables, it seems possible to isolate the effect of workplace change on CS and thus demonstrate a potential causal relationship between these variables.

However, in order to provide better evidence of causality, additional research with multiple time points using longitudinal data, rather than a quasi-longitudinal data is needed. One possible recommendation could be to combine the existing quantitative research with a qualitative analysis. This can be done by interviewing people who have considered changing workplaces and then observing them over a period of time through online surveys. In this way, a better understanding of the causal relationship between changing workplace location and commuting satisfaction can be gained. Furthermore, taking into account additional confounding factors may also be a possible recommendation to gain a comprehensive understanding of the causal claims between workplace relocation and CS. In summary, the circular relationship between workplace location change and satisfaction with commuting has been addressed to some extent in this dissertation, but further understanding of the causal relationships between these variables as well as satisfaction with commuting and SWB using a rigorous panel design and additional confounding variables is strongly recommended to understand the impact of commute dissatisfaction on SWB over a person's life course.

Methodologically, different types of statistical tests (ANOVA and Chi-square), regression analysis (linear, logistic and ordinal), cluster analysis, and structural equation model were used in this dissertation with the help of cross-sectional, quasi-longitudinal and (partial) longitudinal datasets. However, the longitudinal secondary datasets were limited in scope. For instance, data on the commute time and work satisfaction variables were only known for year 1, and it was not known whether a response to the

combined dissatisfaction (e.g. a change of workplace) observed in 2014 led to an improvement in commute time and work satisfaction in 2014. The question of whether life events help people cope with their dissatisfaction could not be captured through the secondary datasets and therefore is a topic for future research to gain a more comprehensive understanding of CS changes. This could be achieved by repeating the satisfaction questions in the panel surveys over time. Another improvement to the data analysis could have been to include a spatial analysis. Since we are discussing changes related to workplace location in this dissertation, it would have been informative to capture the preferred spatial work locations and analysing if the preferred work location matches or not with the actual work location. Such a spatial understanding would have contributed to the development of policy recommendations.

In hindsight, the self-organized survey was based only on single item questions instead of using the measurement scales such as the Satisfaction with travel scale (STS), the Positive and Negative Experience Scale (SPANES) and the Flourishing Scale to measure CS and SWB. This decision was taken mainly for pragmatic reasons, in particular to limit the length of the questionnaire and to achieve a balance between collecting the necessary data and keeping the survey manageable and clear for the participants. While we recognize that answering single-item questions can be quick and easy, there may be a lack of comprehensive understanding that could have been gained through an established scale. Future research could therefore explore the use of these validated scales in combination with longitudinal data to improve understanding of CS and SWB. In addition, the self-organized survey asked respondents, "How satisfied are you with your commute in general?" This question seems to be a bit broad and encompasses all aspects of CS. Therefore, it may sometimes pose challenges to respondents as they may find it difficult to differentiate their satisfaction with commute mode, commute time, or other related variables. In contrast, a specific question related to satisfaction with commuting time or mode would have made it comparatively easier for respondents to give a specific answer. Finally, the life domains included in the survey were inspired by existing European surveys, but other life domains such as neighbourhood satisfaction, mental health, physical health and work-life balance could have been included as well.

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Appendix 1

Self-organized online survey



LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de la Mobilité
et des Travaux publics
Département de la mobilité
et des transports



Luxembourg National
Research Fund

Start of Block: Introduction

INTRODUCTION

Satisfaction with commuting and quality of life in Luxembourg

Dear Participant,

The Luxembourg government is committed to bringing about real change in the implementation of the measures and projects proposed in its National Mobility Plan. In particular, the aim is to reduce congestion at peak times, develop public transport systems and increase soft mobility, while pursuing the objectives of sustainable economic development. In this context, the quality of commuting plays a very important role, as it can have an impact on well-being at work and more generally on the quality of life of the people.

In order to contribute to sustainable mobility, and answer important questions such as are people happy with their commute and work or does a poor commute affect their quality of life, the Luxembourg Institute of Socio-Economic Research (LISER), in collaboration with Ghent University has organised a large-scale online survey. The survey is supported by the Ministry of Mobility and Public Works, funded by the Fonds National de la Recherche (FNR) and is part of the CASInO project at LISER, which focuses on commuting satisfaction.

As an employee, your participation in the survey is extremely valuable but voluntary. It will take you a maximum of 15 minutes to complete this survey, which is available in four languages (Luxembourgish, French, German and English). The response collected through this survey will allow for in-depth analysis and the development of concrete policy recommendations to improve your travel conditions, satisfaction and well-being, especially during peak hours.

Note: We try to promote gender equality and therefore use gender-neutral language in most cases.

DATA PROTECTION

What is the purpose of the survey?

The Luxembourg Institute of Socio-Economic Research (LISER, <https://www.liser.lu>) would like to study the impact of a workplace relocation. Workplace relocation has a significant impact on our lives. Not only does it change our satisfaction with our daily commute to work, but it also impacts our satisfaction with other areas of our lives, such as where we live, how we spend our time, and our well-being. This study is

part of the project “The Happy Commuter- a life-oriented approach towards commuting satisfaction (CASInO)”, funded by the Luxembourg research national funding agency FNR - Fonds National de la Recherche (<https://www.fnr.lu>) and the Research Foundation - Flanders (FWO) – Fonds Wetenschappelijk Onderzoek (<https://www.fwo.be/en/>).

What categories of personal data are processed?

The questionnaire contains the following categories of questions: (i) employment characteristics; (ii) daily mobility behaviour; (iii) subjective and psychological well-being; and (iv) personal background such as your place of residence and place of work. The location variable is important to us because it helps us analyse how the characteristics of where people live and work affect their travel behaviour and subjective well-being. Please note that providing this information may help identify you, especially if you live in sparsely populated areas, but that is not the purpose of this study. Your responses to this survey will be collected and processed anonymously. Your first and last name will not be collected, but you may provide an email address at the end of the survey if you would like to take part in the raffle or receive the results of the survey. This email address will not be associated with your survey responses.

Who is responsible for managing my responses?

The Luxembourg Institute of Socio-Economic Research (LISER) is responsible for processing your responses in this survey.

How is my data processed?

Your personal data is processed on the basis of the General Data Protection Regulation.

Who can access my responses?

The database is managed by the Data Center at LISER. It is responsible for granting access to the researchers involved in this project. A possible reuse for scientific purposes is foreseen, but only anonymized data will be shared.

Will the data be shared outside the European Union?

Personal data will not be shared outside of the European Union.

How long do you keep my data?

Your responses will be available until the end of the project, which is December 31, 2023. For reasons of reproducibility, data used in scientific publications will be archived for five years after the end of the project and then destroyed.

What are the possible risks associated with my participation?

We do not foresee any risks occurring from your participation. We take the security of your data very seriously. If you have any questions or concerns, please contact the appropriate person (see below).

What are the possible benefits of my participation?

Although there is no immediate benefit to individuals for participating, you will have a unique opportunity to contribute to a data collection effort that will form the basis of an analysis that will help identify effective interventions and strategies needed during, immediately after, and over time following a workplace relocation. In addition, your responses will also contribute to valuable societal research for the common good in the quality of life large domain.

What rights do I have?

The members of the Consortium are committed to facilitating your exercise of the following data protection rights: right of access; right of modification; right of erasure; right to object or restrict processing. To find out about your rights, you can consult <https://cnpd.public.lu/en/particuliers/vos-droits.html>. To exercise these rights, please contact the LISER contact point (see below). In addition, if you are not satisfied with the response, you can file a complaint with the Luxembourg supervisory authority, the Commission Nationale pour la Protection des Données (CNPD) – www.cnpd.lu.

Who can I contact for further information?

If you have any questions about this project, please contact us at worksurvey@liser.lu or at the following address: LISER, 11 Porte des Sciences, L-4366 Esch-Sur-Alzette. If you have any questions regarding data protection, please contact LISER's Data Protection Officer: dpo@liser.lu or at the following address: LISER - DPO, 11 Porte des Sciences, L-4366 Esch-Sur-Alzette.

CONSENT

I agree to the processing of my data for the Happy Commuter project.

End of: Introduction

Start of: Eligibility check

ELIGIBILITY CHECK

To participate in this restricted survey, you need a valid token. If you have been issued a token, please enter it in the box below and click continue.

Token * : _____

1. Are you working in Luxembourg? *
 - A. Yes, I am working in Luxembourg.
 - B. No, I am not working in Luxembourg.
 - C. No, I am unemployed (Student, housewife/husband, unpaid internship, retired).

If the respondent selects option "B" or "C" in question 1, they get the following end message.

"Thank you for your time. Unfortunately, you are not eligible to participate in this survey".

End of: Eligibility check

Start of: Working groups

WORKING GROUPS

2. Are you ... *
- A. Employed
 - B. Self-employed

If the respondent selects option "A" of question 2, they get the following follow-up question.

3. Have you changed your employer/company in the **last five years**? * (Please think about your most recent change)
- A. No, I still work for the same employer/company.
 - B. Yes, I was unemployed before and now I am working.
 - C. Yes, I have changed and am now working for a different employer/company.

If the respondent selects option "B" of question 2, they get the following follow-up question.

4. Have you changed your company in the **last five years**? * (Please think about your most recent change)
- A. No, I still work in my own company.
 - B. Yes, I was unemployed before and now I am self-employed.
 - C. Yes, I have changed and now work in my own company.

The following questions will appear to everyone.

5. Is your workplace still at the same address since you started working here? *
- A. Yes
 - B. No
6. How long have you been working here? *
- A. Five years or more.
 - B. Less than five years.

If a person selects "A" in question 3 or 4 and "A" in question 5 and "A" in question 6, then that person falls into the "Control group" category and is directed to Questionnaire A.

7. Based on your responses, we have directed you to "Questionnaire A". Please click the box below and then click "Next" to continue with the rest of the questionnaire. *
- Questionnaire A

If a person selects ("A" in question 3 or 4 and "B" in question 5) or ("B" or "C" in question 3 or 4 and "B" in question 5) then that person falls into the "Involuntary relocation" category and is directed to Questionnaire B.

8. Based on your responses, we have directed you to "Questionnaire B". Please click the box below and then click "Next" to continue with the rest of the questionnaire. *
- Questionnaire B

If a person selects ("B" in question 3 or 4 and "A" in question 5) or ("A" in question 3 or 4 and "A" in question 5 and "B" in question 6), then that person falls into the "Moving from unemployment to employment" category and is directed to Questionnaire C.

9. Based on your responses, we have directed you to “Questionnaire C”. Please click the box below and then click “Next” to continue with the rest of the questionnaire. *
- Questionnaire C

If a person selects “C” in question 3 or 4 and “A” in question 5, then that person falls into the “Voluntary relocation” category and is directed to Questionnaire D.

10. Based on your responses, we have directed you to “Questionnaire D”. Please click the box below and then click “Next” to continue with the rest of the questionnaire. *
- Questionnaire D

End of: Working groups

Start of: Employment characteristics

EMPLOYMENT CHARACTERISTICS

11. Do you have a fixed place where you mainly go to work or does it change every day? * (For example – if you are a painter or a driver, you do not have a fixed workplace and you work in different places for different clients).
- A. Fixed workplace
 - B. Non-fixed workplace

If a person selects option “B” in question 11, they will get the following end message.

“Thank you for your time. Unfortunately, you are not eligible to participate in this survey”.

EMPLOYMENT CHARACTERISTICS - PART A

The following questions will appear to everyone.

*Please think about your **current** employment characteristics to answer the following questions.*

12. In which commune/ municipality are you **currently** working?
13. What is your **current** employment status?
- Working full-time
 - Working part-time
14. What is your **current** employment contract?
- Permanent contract (CDI)
 - Fixed-term (CDD) or temporary contract

The following question will appear to Questionnaire B, C or D.

15. How many times have you changed jobs during your career, including the last change?

The following question will appear to Questionnaire A.

16. How many times have you changed jobs during your career?

The following question will appear to everyone.

17. When did you start your **current** job?
- YYYY/MM

EMPLOYMENT CHARACTERISTICS - PART B

The following questions will appear to Questionnaire B.

*Please think about your **previous** employment characteristics to answer the following questions.*

18. In which country was your company located **before** moving here?
- Luxembourg
 - France
 - Germany
 - Belgium
 - Other
19. In which commune/ municipality was your company located **before** moving here?
20. What was the main reason for moving with the employer?
- To retain the job
 - To work closer to home to shorten daily commute between home and work
 - To solve household mobility problems
 - Because of COVID
 - Other
21. What was your employment status at your **previous** job?
- Employed full-time
 - Employed part-time
 - Self-employed with full-time employment
 - Self-employed with part-time employment
22. What type of contract did you have at your **previous** job?
- Permanent contract (CDI)
 - Fixed-term (CDD) or temporary contract

EMPLOYMENT CHARACTERISTICS - PART C

The following questions will appear to Questionnaire D.

*Please think about your **previous** employment characteristics to answer the following questions.*

23. In which country **did you work before** you started working here?
- Luxembourg
 - France
 - Germany
 - Belgium
 - Other
24. In which commune/ municipality **did you work before** you started working here?
25. What was the main reason for changing jobs?
- End of a fixed-term or temporary contract

- Changed for employer reasons (business closure, redundancy, early retirement, dismissal etc.)
 - Changed for family reasons (sale or closure of personal/family business, custody of children or other dependents, relocation of spouse/partner or marriage, residential relocation, etc.).
 - Looking for a better-paid job
 - To work closer to home to shorten daily commute between home and work
 - To solve household mobility problems
 - Because of COVID
 - Other
26. What was your employment status at your **previous** job?
- Employed full-time
 - Employed part-time
 - Self-employed with full-time employment
 - Self-employed with part-time employment
27. What type of contract did you have at your **previous** job?
- Permanent contract (CDI)
 - Fixed-term (CDD) or temporary contract

EMPLOYMENT CHARACTERISTICS - PART D

The following questions will appear to Questionnaire C.

28. What was the main reason for unemployment?
- End of a fixed-term contract or temporary contract
 - Forced to leave the job for employer reasons (business closure, redundancy, early retirement, dismissal etc.)
 - Forced to leave the job for family reasons (sale or closure of personal/family business, custody of children or other dependents, relocation of spouse/partner or marriage, residential relocation, etc.)
 - Leave the job willingly
 - Looking for a (new) job
 - Unfit for work
 - Retired
 - I was a Student/ a Pupil/at an unpaid work experience/ fulfilling domestic tasks
 - To solve household mobility problems
 - Because of COVID
 - Other

The following question will appear to everyone.

29. During your period of unemployment, were you registered at ADEM? (ADEM is an agency that helps unemployed people to find a job in Luxembourg).
- Yes
 - No

End of: Employment characteristics

Start of: Daily mobility behaviour

DAILY MOBILITY BEHAVIOUR – PART A

The following questions will appear to everyone.

Please think about your **current** daily mobility behavior to answer the following questions.

30. Which mode of transport do you generally use to for a one-way trip to your **current** job? (If you use more than one mode of transport, select the mode of transport you use for the largest distance).

Walk	
Bike	
Bus/Tram	
Train	
Car, as a driver	
Car, as a passenger	
Other? E.g.: E-scooter	

If the respondent selects the “Bus/Tram” or “Train” category in question 30, they get the following follow-up question).

31. How do you go to the Bus/Tram stop or the Train station?

Walk	
Bike	
Car, as a driver	
Car, as a passenger	

If the respondent selects the “Car, as a driver” or “Car, as a passenger” category in question 30 or 31, they get the following follow-up question).

32. Is it ...

your own car	
your company car	
a car of a colleague or a friend	

If the respondent selects the “Bike” category in question 30 or 31, they get the following follow-up question).

33. Generally, is this an electric bike?

- Yes
- No

The following question will appear to everyone.

34. Overall, how satisfied are you with your **current** daily commute?

Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied
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The following question shall not appear to respondents who select "Car, as a driver" or "Car, as a passenger" category in question 30.

35. Do you spend your commuting time performing a certain activity (apart from travelling itself)?

- Working/studying
- Listening to music
- Playing games
- Watching movie/series
- Making phone calls
- Sleeping
- Chat with the person(s) travelling with me
- Looking outside, scenery
- Other

The following questions will appear to everyone.

36. How many days a week do you currently work from home?

- A. Never
- B. Less than once a week
- C. Once a week
- D. Twice a week
- E. 2-3 times a week
- F. 4 or more times a week

The following question will appear only to those who select options B, C, D, E or F of question 36.

37. Do you miss the experience of commuting to work?

- A. I do not miss commuting at all
- B. I miss some aspects of commuting
- C. I miss commuting a lot

The following question will appear only to those who select option B or C of question 37.

38. Which aspect of commuting do you miss the most?

- Working/studying
- Listening to music
- Playing games
- Watching movie/series
- Making phone calls
- Sleeping / Resting
- Feeling independent in where and when I can go

- Chat with the person(s) travelling with me
- Other

The following questions will appear to everyone.

39. Think about your recent commute and tick the box that best corresponds with the emotions that you had experienced during your commute to work.

	More (1)	(2)	(3)	Neutral (4)	(5)	(6)	More (7)	
Hurried								Relaxed
Worried								Confident
Stressed								Calm
Tired								Alert
Bored								Enthusiastic
Fed up								Engaged
Travel was the worst I can think of								Travel was the best I can think of
Travel was of low standard								Travel was of high standard
Travel did not go well								Travel went well

40. On a normal day, how long is your average door-to-door commuting between home and work (one-way, in minutes)?

41. What would be the ideal commuting time between home and work (in minutes) to enjoy commuting?

42. Do you plan to make any of the following changes within a year or so?

	Yes	No
Increase the number of cars in your household		
Decrease the number of cars in your household		
Get a car driving license		
Move (alone)		
Move-in together		
Marry		
Divorce		
Welcome a child in your household		
Return to study		
Change your job		
Quit job		
Relocate your home		

43. Please indicate the extent to which you agree with the following statements about your travel in general rather than specifically about your commute to work.

	Completely disagree	Disagree	Neutral	Agree	Completely agree
I like walking					
I like riding a bike					
I like travelling by public transport					
I like driving					
I prefer to walk rather than using other modes					
I prefer to bike rather than using other modes					
I prefer to take public transport rather than using other modes					
I only prefer to drive					
I prefer to organize my errands so that I make as few trips as possible					
The trip to/from work is a useful transition between home and work					
When I need to buy something, I usually prefer to get it at the closest shop possible					

The following questions will appear to Questionnaire B or D.

Please think about your **previous** daily commute to answer the following questions.

44. What mode of transport did you generally use for a one-way trip to your **previous** place of work? (If you used more than one mode of transport, select the mode of transport you used for the largest distance).

Walk	
Bike	
Bus/Tram	
Train	
Car, as a driver	
Car, as a passenger	
Other? E.g.: E-scooter	

If the respondent selects the "Bus/Tram" or "Train" category in question 44, they get the following follow-up question).

45. How did you **previously** go to the Bus/Tram stop or the Train station?

Walk	
Bike	
Car, as a driver	
Car, as a passenger	

If the respondent selects the "Car, as a driver" or "Car, as a passenger" category in question 44 or 45 they get the following follow-up question).

46. Was it ...

your own car	
your company car	
a car of a colleague or a friend	

If the respondent selects the "Bike" in question 44 or 45, they get the following follow-up question.

47. Generally, was it with an electric bike?

- Yes
- No

The following questions will appear to Questionnaire B or D.

48. Overall, how satisfied were you with your daily commute at your **previous** job location?

Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied
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49. **Before** you changed jobs, how long was your average door-to-door commute between home and work (one-way, in minutes)?

50. After moving to another place of work, did you ...?

	Yes	No
increase the number of vehicles in your household?		
decrease the number of vehicles in your household?		
get a car driving license?		
move-in together?		
get married?		
get divorced?		
welcome a child into your home?		
return to study?		
change jobs?		
quit working?		
change your place of residence?		

End of: Daily mobility behaviour

Start of: Subjective and psychological well-being

SUBJECTIVE AND PSYCHOLOGICAL WELL-BEING

The following question will appear to everyone.

*Please reflect on your **current** satisfaction with the different areas of life and answer the following questions.*

51. How satisfied are you **currently** with each of your life domains?

	Completely dissatisfied	Dissatisfied	Neutral	Satisfied	Completely satisfied
Satisfaction with your job (feeling fulfilled or enjoying your work)					
Satisfaction with your salary					
Satisfaction with your personal relationship (meeting relatives, friends, work colleagues, etc.)					

Satisfaction with your time-use (the amount of time you have available for things you need/want to do)					
Satisfaction with your residence (area of the house, presence of a balcony, energy efficiency of the house, etc.)					
Satisfaction with the location of your residence (access to stores, public transport, school, proximity to a park, etc.)					
Satisfaction with your workplace location (access to public transport, car parking, the distance between workplace and residence, etc.)					
Satisfaction with your leisure time (time spent running, cycling, playing sports, going out with family or friends, going to the movies, etc.)					
Satisfaction with your general health					
Satisfaction with overall life (taking into account all aspects of your life)					

The following question will appear to Questionnaire B or D.

52. To what extent has your satisfaction with the following life domains changed after you changed your work location?

	Far less satisfied	Less satisfied	Not less or more satisfied	More satisfied	Far more satisfied
Satisfaction with your job (feeling fulfilled or enjoying your work)					
Satisfaction with your salary					
Satisfaction with your personal relationship (meeting relatives, friends, work colleagues, etc.)					
Satisfaction with your time-use (the amount of time you have available for things you need/want to do)					
Satisfaction with your residence (area of the house, presence of a balcony, energy efficiency of the house, etc.)					
Satisfaction with the location of your residence (access to stores, public transport, school, proximity to a park, etc.)					
Satisfaction with your workplace location (access to public transport, car parking, the distance between workplace and residence, etc.)					

Satisfaction with your leisure time (time spent running, cycling, playing sports, going out with family or friends, going to the movies, etc.)					
Satisfaction with your general health					
Satisfaction with overall life (taking into account all aspects of your life)					

The following question will appear to Questionnaire C.

53. To what extent has your satisfaction with the following life domains changed after you moved from unemployment to employment?

	Far less satisfied	Less satisfied	Not less or more satisfied	More satisfied	Far more satisfied
Satisfaction with your job (feeling fulfilled or enjoying your work)					
Satisfaction with your salary					
Satisfaction with your personal relationship (meeting relatives, friends, work colleagues, etc.)					
Satisfaction with your time-use (the amount of time you have available for things you need/want to do)					
Satisfaction with your residence (area of the house, presence of a balcony, energy efficiency of the house, etc.)					
Satisfaction with the location of your residence (access to stores, public transport,					

school, proximity to a park, etc.)					
Satisfaction with your workplace location (access to public transport, car parking, the distance between workplace and residence, etc.)					
Satisfaction with your leisure time (time spent running, cycling, playing sports, going out with family or friends, going to the movies, etc.)					
Satisfaction with your general health					
Satisfaction with overall life (taking into account all aspects of your life)					

The following question will appear to everyone.

54. Please indicate the extent to which you agree with the following statements about workplace attachment.

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I am presently feeling attached to my job location					
I plan to work in this company for the next five years					
I would recommend working at this company to a friend or a family member					

The following question will appear to Questionnaire B or D.

55. After changing your work location, has your work productivity ...

... decreased	... remained the same	... increased
---------------	-----------------------	---------------

If the respondent selects "Increased" in question 60, they get the following follow-up question.

56. Why do you think your work productivity has increased? (Choose the most important reason)
- The new location has better internal conditions (more skilled employees, less work pressure, better work ethics and environment, interesting roles and responsibilities).
 - The new location has better external conditions (presence of a canteen, access to public transport, parking space, presence of a gym, or other amenities).
 - The new location offers a better balance between professional and private life.
 - Other

If the respondent selects "Decreased" in question 60, they get the following follow-up question.

57. Why do you think your work productivity has decreased? (Choose the most important reason).
- The new location has worse internal conditions (less skilled employees, more work pressure, worse work ethics and environment, bad roles and responsibilities).
 - The new location has worse external conditions (no canteen/ restaurant, no/ poor access to public transport, no parking, no gym, or no other amenities).
 - The new location leads to a certain imbalance between professional and private life.
 - Other

The following question will appear to Questionnaire B or D.

58. To what extent did you feel stressed by the following aspects in connection with your change of work location?

	Not at all stressful	Only slightly stressful	Somewhat stressful	Quite a bit stressful	Very stressful
Starting job in another location					
Establishing new relationships at work					
Losing ties with colleagues at the old job					
Adapting to another commuting route					

The following question will appear to Questionnaire C.

59. To what extent did you feel stressed by the following aspects in connection with your change from unemployment to employment?

	Not at all stressful	Only slightly stressful	Somewhat stressful	Quite a bit stressful	Very stressful
Starting a job					
Establishing new relationships at the new location					
Developing a new commuting route					

End of: Subjective and psychological well-being

Start of: Personal background

PERSONAL BACKGROUND

The following questions will appear to everyone.

60. What is your **current** country of residence?
- Luxembourg
 - France
 - Germany
 - Belgium
 - Other
61. What is your **current** commune/ municipality of residence?
62. What is your **current** zip code?

The following questions will appear to Questionnaire C.

63. Have you changed your place of residence **after taking up your job**?
- Yes
 - No

The following questions will appear to Questionnaire A.

64. Did you change your place of residence in the **last five years**?
- Yes
 - No

The following questions will appear to everyone.

65. What is your gender?
- Female
 - Male
 - Other
 - I prefer not to say
66. What is your marital status?

- Single / Never married
 - Married / Partnership (Pacs) / Living together without getting married
 - Widow(er)
 - Divorced
67. What is your highest level of education?
- Primary education
 - Secondary education
 - Bachelor level or equivalent
 - Master level or equivalent
 - Doctoral level or equivalent (PhD)
68. What is the monthly net income of your household? (i.e. a total of net salaries of all the working members in the household including family allowance, pension or any other sources).
- Less than 1,250 euros
 - Between 1,251 to 2,000 euros
 - Between 2,001 to 4,000 euros
 - Between 4,001 to 6,000 euros
 - Between 6,001 to 8,000 euros
 - Between 8,001 to 12,500 euros
 - Greater than 12,501 euros
 - I prefer not to say
69. What is your age? (in years)
70. Including yourself, how many people live in your household?
71. Out of these {Q70} people in your household, how many are between the age of ...

0 to 6 years	
7 to 14 years	
15 to 17 years	
18 years and more	

The following question will appear to only those who select the "18 years and more" category in question 71.

72. Including yourself, how many of these '18 years and more' have a valid driver's license?

The following questions will appear to everyone.

73. How many cars do you have in your household (including company cars)?
- 0
 - 1 car
 - 2 cars
 - 3 or more cars

The following questions will appear to Questionnaire B or D.

74. Do you think the change of your job location was influenced by the outbreak of the COVID 19 pandemic?
- Yes
 - No
 - I am not sure

The following questions will appear to everyone.

75. Would you like to be contacted by email to receive the results of this survey?
- Yes
 - No
76. LISER is collecting email addresses of volunteers who are willing to participate in behavioural surveys (consumer behaviour, behaviour in relation to work, in relation to mobility, etc.). Participation in these surveys is optional. Are you interested in being contacted with invitations to these surveys?
- Yes
 - No

If the respondent selects "Yes" to either question 75 or 76 or both, they get the following question; otherwise, they directly go to question 78.

77. Please provide your email address (*Your email address will be stored separately from your survey responses. Researchers and analysts will never have access to your email address. An automated system within LISER Data Center will send information about the results of this study. The LISER Data Center will permanently delete the email addresses recorded for this survey from its system 12 months after the end of the study.*)
- _____

78. If you have any comments about this survey or this topic, please write them below:
- _____

End of: Personal background

Start of: The end

Thank you very much for your valuable time in participating in our survey! **<Submit>**

End of: The end

This questionnaire is also available in Luxembourgish, French and German languages upon request.

Appendix 2

Supporting estimation results for chapter 4

The below table presents the results of a binary logistic regression for changing workplaces in 2014, reporting the odds ratio instead of the unstandardized coefficients, to gain better insight into how the odds of the outcome variables change in response to changes in the predictor variables. The results suggest that the odds of changing workplaces in the next year are higher if one is dissatisfied with the work than if one is dissatisfied with the commute time.

Results of a binary logistic regression for change of workplace in 2014

Variables	Odds ratio (p-value)
Changes in life event from 2013 to 2014	
Change of residence (ref: no change)	1.46 ***
Increase in the number of cars in the HH (ref: no change)	1.24
Decrease in the number of cars in the HH (ref: no change)	1.09
Clusters (ref: Cluster 1 High CTS-High WS)	
Cluster 2 High CTS-Low WS	2.13 ***
Cluster 3 High CTS-Mod. WS	0.79
Cluster 4 Mod. CTS-Mod. WS	1.61 ***
Cluster 5 Low CTS-High WS	2.08 ***
Cluster 6 Low CTS-Low WS	2.36 ***
Socio-demographic characteristics	
Age	- 0.02 ***
Female (ref: male)	1.03
Secondary education (ref: low education)	0.71
Tertiary education (ref: low education)	0.82
Living with partner/ spouse (ref: Living without partner/ spouse)	0.81
Neutral health (ref: good health)	1.23
Bad health (ref: good health)	1.92 **
Non-native Luxembourgers (ref: Native Luxembourgers)	1.40 **
Intercept	0.42
N	1878

Degrees of freedom	16
Log-Likelihood	- 698.63
McFadden's Pseudo R2	4.7%
Likelihood-ratio test (Prob > Chi2)	0.00
*** p<0.01, ** p<0.05, * p<0.10	

Appendix 3

Supporting estimation results for chapter 5

Cross tabulation between commuter type and changes in commute mode after a workplace relocation.

Commuter type	Still using ...				Switched to ...				Total
	Cars	Bus/ Tram	Trains	Active modes	Cars	Bus/ Tram	Trains	Active modes	
Resident commuter	132	39	10	8	26	30	14	16	275
row percentage	48.00%	14.18%	3.64%	2.91%	9.45%	10.91%	5.09%	5.82%	100%
Cross-border commuter	135	9	13	1	24	8	8	2	200
row percentage	67.50%	4.50%	6.50%	0.50%	12.00%	4.00%	4.00%	1.00%	100%
Total	267	48	23	9	50	38	22	18	475
row percentage	56.21%	10.11%	4.84%	1.89%	10.53%	8.00%	4.63%	3.79%	100%
Pearson $\chi^2(7) = 39.09, p < 0.01$									

Cross tabulation between commuter type and changes in commute time after a workplace relocation.

Commuter type	Change in commute time after relocation					Total
	Far increased	Increased	No change	Decreased	Far decreased	
Resident commuter	53	63	42	70	46	274
row percentage	19.34%	22.99%	15.33%	25.55%	16.79%	100%
Cross-border commuter	58	33	44	35	36	206
row percentage	28.16%	16.02%	21.36%	16.99%	17.48%	100%
Total	111	96	86	105	82	480
row percentage	23.13%	20.00%	17.92%	21.88%	17.08%	100%
Pearson $\chi^2(4) = 13.16, p < 0.01$						

Appendix 4

Supporting estimation results for chapter 6

Ordered logistic regression estimating the impact of working from home frequency and level of subjective well-being on commuting satisfaction.

Variables	Coefficients
Working from home frequency	
Occasional WFH (ref: Never WFH)	-0.522***
Hybrid WFH (ref: Never WFH)	0.0816
Full-time WFH (ref: Never WFH)	0.573**
Subjective well-being	
Dissatisfied SWB (ref: Very dissatisfied)	1.370**
Neutral SWB (ref: Very dissatisfied)	1.624***
Satisfied (ref: Very dissatisfied)	2.234***
Very satisfied (ref: Very dissatisfied)	2.685***
Thresholds between the categories of CS	
Threshold 1 (1 (very dissatisfied) 2 (dissatisfied))	0.236
Threshold 2 (2 (dissatisfied) 3 (neutral))	1.483**
Threshold 3 (3 (neutral) 4 (satisfied))	2.387***
Threshold 4 (4 (satisfied) 5 (very satisfied))	4.050***
n	852
Degrees of freedom	7
Log-Likelihood	-1301.85
McFadden's Pseudo R ²	27.7%
Likelihood-ratio test (Prob > chi2)	<0.0001
*** p<0.01, ** p<0.05, * p<0.1	

Pearson correlation matrix including satisfaction with life domains and SWB.

	CS	JS	TUS	WPLS	RPS	PRS	LTS	HS	SWB
CS	1.00								
JS	0.1353*	1.00							
TUS	0.2745*	0.3140*	1.00						
WPLS	0.4034*	0.2301*	0.3181*	1.00					
RPS	0.0893*	0.2256*	0.2538*	0.1819*	1.00				
PRS	0.0722*	0.3839*	0.3865*	0.1529*	0.3056*	1.00			
LTS	0.2369*	0.2164*	0.6671*	0.2901*	0.2822*	0.3742*	1.00		
HS	0.1839*	0.2885*	0.4460*	0.1752*	0.2708*	0.3676*	0.5272*	1.00	
SWB	0.2367*	0.4036*	0.4797*	0.2287*	0.3888*	0.4497*	0.5237*	0.6029*	1.00

* Correlation is significant at $p < 0.05$

Path analysis for the constraint model highlighting the effect of commute time on life domains and SWB.

Endogenous		Exogenous	Estimates
Trip satisfaction	<---	Betw_30_60	-0.88 ***
Trip satisfaction	<---	Morethan_60	-1.55 ***
CS	<---	Betw_30_60	-0.61 ***
CS	<---	Morethan_60	-0.89 ***
TUS	<---	Morethan_60	-0.18 **
WPLS	<---	Morethan_60	-0.27 **
PRS	<---	Betw_30_60	0.12 *
SWB	<---	Betw_30_60	0.11 *
SWB	<---	Morethan_60	0.09 *

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

SUMMARY

[EN]

This dissertation examines the relationship between commuting satisfaction (CS) and subjective well-being (SWB) and investigates the dynamics of commuting. For the analysis, secondary data (EU-SILC, PSELL III) as well as self-collected data from an online survey about changes in workplace location and working conditions were collected. The combination of these datasets allows the exploration of three important aspects of the relationship between CS and SWB. First, the direct and indirect effects of CS on SWB are examined by considering the interplay with satisfaction with other life domains than commuting, including among others work, accommodation, time-use, leisure time, personal relationships, and health. This is an important contribution to the field of travel satisfaction because it provides an in-depth analysis of how SWB depends not only on satisfaction with a typical commute to work, but also on satisfaction with other activities that are linked to commuting. Previous studies have examined the relationship between commuting satisfaction and SWB but have largely ignored satisfaction with other life domains. This is rather surprising given that commuting depends to a large extent on decisions people make regarding other life domains such as where to live and work. This dissertation thus provides a broader conceptualization of commuting satisfaction, avoiding certain biases that otherwise might exist when interactions with satisfaction with other life domains are ignored. Second, it explores the dynamics of commuting by analyzing the impact of life events on commuting (dis)satisfaction, and the reverse. This temporal dimension of CS adds a dynamic layer to the current static interpretation of travel satisfaction by examining changes in individuals' longer-term life decisions, such as residence and/or workplace location, focusing on voluntary and involuntary relocation. Voluntary workplace relocation occurs when the employee willingly decide to change their jobs, while the latter occurs when the employee is forced to move with their employer in order to retain their jobs. This distinction in terms of workplace relocation thus provides a first empirical analysis on the dynamics of CS. Third, it allows us to examine the extent to which the relationships between CS, satisfaction with other life domains, and SWB are still applicable today, in post-pandemic times where working from home became more important than ever. This is an important contribution to the field of travel satisfaction as it provides first-hand insights into how the relationship between CS and SWB differs in post-pandemic times.

The main findings from this consolidated work on travel satisfaction, particularly commuting satisfaction, are manifold. First, commuting is not a stand-alone life domain, but is connected to all other life domains, especially time-use satisfaction. Therefore, it is recommended for future studies to invest more in time-use research to understand the complexity and interplay between CS and SWB. Second, individuals who are dissatisfied with their commute do not necessarily have the financial resources and stability to change either residence or workplace to cope with dissatisfying commute patterns. These individuals who tolerate commuting dissatisfaction in their personal lives might simultaneously have a negative impact on their time-use satisfaction due to time-poverty that arises from commuting longer distances or for longer time, which obviously comes at the expense of dissatisfaction with leisure-time or personal relationships. Future research should therefore address the question of whether people make changes in their lives, for

example by changing workplace location or residence, or whether they tolerate dissatisfaction with commuting, which in turn could affect their satisfaction with other life domains and SWB. This will help practitioners and policy makers in formulating the necessary transport and planning policies to accommodate these dissatisfied commuters. Fourth, people seem to be more satisfied with their commute after a voluntary workplace relocation than those who changed workplaces involuntarily. However, the question of how lasting this effect of a workplace relocation on CS is and whether CS changes over time as people become accustomed to the changed environment (treadmill effect) remains unanswered. Future research to understand the dynamics of commuting is therefore needed, using a rigorous panel design. Fifth, a workplace relocation could also lead to residential mobility. This is often noted in previous studies and somewhat addressed in this dissertation, but is not fully explored in the travel satisfaction literature. Therefore, further research is needed on the co-occurrence of life events and their impact on CS, i.e. how a workplace relocation triggers residential mobility and how lasting are its impact on CS. This can be achieved using a life-course approach to gain a better understanding of the life choices individuals make in terms of changes in their travel behavior and satisfaction, to enable better evaluation of transport and land use policies. Finally, hybrid workers (who work from home two to three days per week) seem to have higher levels of SWB compared to occasional teleworkers (who work from home less than one day per week). This implies that the well-documented relationship between CS and SWB needs to be re-examined as commuting has been limited for some people due to the outbreak of the COVID-19 pandemic as they have shifted to working from home. Future research is therefore needed to identify whether commuting actually lengthens occasional teleworkers' total workday and reduces the time they could have spent on other non-travel activities, and whether the time hybrid workers save by not commuting to work every day influences the time they spend on other non-travel activities such as household chores, childcare and sleep. Such an in-depth analysis of the interplay between CS, SWB and satisfaction with non-travel-related life domains is indeed needed to determine not only in which areas employees' well-being can be improved, but also how.

On a final note, although commuting has a significant impact on individuals' SWB, it is not necessarily the most important life domain. Previous studies have shown that commuting is a stressful activity and has a direct negative impact on individual SWB; however, the results of this dissertation did not find a negative relationship between CS and SWB. In contrast to previous findings, we conclude that satisfaction with time use has the strongest total effect on SWB; regardless of how often individuals commute to work. This might suggest that individuals can maximize their utility and thus their overall SWB as long as they are free to optimize their time. As for the prospective approach of CS, we know that dissatisfaction with commute triggers changes in life event, such as (but not limited to) changing workplace or residence. However, for the majority of dissatisfied individuals who are unable to make a change, the question of how this dissatisfaction spill over onto satisfaction with non-travel-related life domains due to time poverty that results from commuting longer distances seeks further investigation. As for the dynamics, although workers who voluntary changed their workplace have higher CS than those who changes on an involuntary basis, the question of how lasting this is, and whether CS changes over time when people get accustomed to the changed environment (treadmill effect), is a topic for future research.

[NL]

Dit proefschrift onderzoekt de relatie tussen tevredenheid met woon-werkverkeer ('commuting satisfaction', of CS) en subjectief welzijn ('subjective well-being', of SWB) en onderzoekt de dynamiek van woon-werkverkeer. Voor de analyse werden zowel secundaire gegevens (EU-SILC, P-SELL III) als zelfverzamelde gegevens uit een online enquête over veranderingen in werkplaats en werkomstandigheden verzameld. De combinatie van deze datasets maakt het mogelijk om drie belangrijke aspecten van de relatie tussen CS en SWB te onderzoeken. Ten eerste worden de directe en indirecte effecten van CS op SWB onderzocht door rekening te houden met de wisselwerking met tevredenheid over andere levensdomeinen dan woon-werkverkeer, waaronder werk, huisvesting, tijdsbesteding, vrije tijd, persoonlijke relaties en gezondheid. Dit is een belangrijke bijdrage aan het onderzoeksdomein rond mobiliteitstevredenheid omdat het een diepgaande analyse biedt van hoe SWB niet alleen afhangt van de tevredenheid met een typische woon-werkverplaatsing, maar ook van de tevredenheid met andere activiteiten die verband houden met woon-werkverkeer. Eerdere studies hebben de relatie tussen tevredenheid met woon-werkverkeer en SWB onderzocht, maar hebben tevredenheid met andere levensdomeinen grotendeels genegeerd. Dit is nogal verrassend, aangezien woon-werkverkeer in grote mate afhangt van beslissingen die mensen nemen met betrekking tot andere levensdomeinen, zoals waar ze willen wonen en werken. Dit proefschrift biedt dus een bredere conceptualisering van tevredenheid met woon-werkverkeer, waarbij bepaalde vertekeningen worden vermeden die anders zouden kunnen bestaan wanneer interacties met tevredenheid met andere levensdomeinen worden genegeerd. Ten tweede onderzoekt het de dynamiek van woon-werkverkeer door de impact van levensgebeurtenissen op de (on)tevredenheid over woon-werkverkeer te analyseren, en omgekeerd. Deze temporele dimensie van CS voegt een dynamische laag toe aan de huidige statische interpretatie van mobiliteitstevredenheid door veranderingen in langetermijn levensbeslissingen van individuen te onderzoeken, zoals de woonplaats en/of werkplaats, met een focus op vrijwillige en onvrijwillige verandering van locatie. Een vrijwillige verandering van de werkplaats doet zich voor wanneer de werknemer vrijwillig besluit om van job te veranderen, terwijl dit laatste gebeurt wanneer de werknemer gedwongen wordt om met zijn werkgever mee te verhuizen om zijn job te behouden. Dit onderscheid in termen van werkplaatsverandering biedt dus een eerste empirische analyse van de dynamiek van CS. Ten derde stelt het ons in staat om te onderzoeken in hoeverre de relaties tussen CS, tevredenheid met andere levensdomeinen en SWB vandaag de dag nog steeds van toepassing zijn, in post-pandemische tijden waarin thuiswerken belangrijker is dan ooit. Dit is een belangrijke bijdrage aan het veld mobiliteitstevredenheid omdat het uit de eerste hand inzichten geeft in hoe de relatie tussen CS en SWB verschilt in post-pandemische tijden.

De belangrijkste bevindingen van dit geconsolideerde werk over mobiliteitstevredenheid, in het bijzonder tevredenheid met woon-werkverkeer, zijn velerlei. Ten eerste, woon-werkverkeer is geen op zichzelf staand levensdomein, maar is verbonden met alle andere levensdomeinen, in het bijzonder de tevredenheid met tijdsbesteding. Daarom is het aanbevolen voor toekomstige studies om meer te investeren in tijdsbestedingsonderzoek om de complexiteit en wisselwerking tussen CS en SWB te begrijpen. Ten tweede hebben mensen die ontevreden zijn met hun woon-werkverkeer niet noodzakelijk de financiële middelen en stabiliteit om van woon- of werkplaats te veranderen om zo het hoofd te bieden aan woon-werkverkeerpatronen waarmee ze ontevreden zijn. Deze individuen die ontevredenheid over

het woon-werkverkeer tolereren in hun persoonlijke leven, zouden tegelijkertijd een negatieve impact kunnen hebben op hun tevredenheid met tijdsbesteding als gevolg van tijdarmoede die ontstaat door langere pendelafstanden en tijden, wat uiteraard ten koste gaat van hun tevredenheid met vrije tijd of persoonlijke relaties. Toekomstig onderzoek zou zich daarom moeten richten op de vraag of mensen veranderingen in hun leven aanbrengen, bijvoorbeeld door van werk- of woonplaats te veranderen, of dat ze ontevredenheid over het woon-werkverkeer tolereren, wat op zijn beurt hun tevredenheid met andere levensdomeinen en SWB zou kunnen beïnvloeden. Dit zal praktijk- en beleidsmedewerkers helpen bij het formuleren van noodzakelijke vervoers- en planningsbeleid om deze ontevreden pendelaars tegemoet te komen. Ten vierde lijken mensen meer tevreden te zijn met hun woon-werkverkeer na een vrijwillige verandering van werkplaats dan degenen die onvrijwillig van werkplaats veranderden. De vraag hoe blijvend dit effect van verandering van werkplaats op CS is en of CS in de loop van de tijd verandert als mensen gewend raken aan de veranderde omgeving ('treadmill effect'), blijft echter onbeantwoord. Toekomstig onderzoek om de dynamiek van woon-werkverkeer te begrijpen is daarom nodig, met behulp van een rigoureuus panel design. Ten vijfde kan een werkplaatsverandering ook leiden tot residentiële veranderingen. Dit wordt vaak opgemerkt in eerdere studies en enigszins behandeld in dit proefschrift, maar is niet volledig onderzocht in de literatuur over mobiliteitstevredenheid. Daarom is verder onderzoek nodig naar het samen voorkomen van levensgebeurtenissen en hun impact op CS, d.w.z. hoe verandering van werkplaats residentiële mobiliteit triggert en hoe duurzaam de impact op CS is. Dit kan worden bereikt met behulp van een levensloopbenadering om een beter begrip te krijgen van de levenskeuzes die individuen maken in termen van veranderingen in hun mobiliteitsgedrag en -tevredenheid, om een betere evaluatie van vervoer en ruimtelijke ordening beleid mogelijk te maken. Tot slot lijken hybride werknemers (die twee tot drie dagen per week thuiswerken) hogere SWB-niveaus te hebben dan occasionele telewerkers (die minder dan één dag per week thuiswerken). Dit impliceert dat de goed gedocumenteerde relatie tussen CS en SWB opnieuw moet worden onderzocht, aangezien het woon-werkverkeer voor sommige mensen beperkt is door de uitbraak van de COVID-19 pandemie en ze zijn overgeschakeld op thuiswerken. Toekomstig onderzoek is daarom nodig om vast te stellen of de woon-werkverplaatsing de duur van de totale werkdag van occasionele telewerkers daadwerkelijk verlengt en op die manier de tijd vermindert die ze aan andere activiteiten hadden kunnen besteden, en of de tijd die hybride werknemers besparen door niet elke dag naar het werk te pendelen, van invloed is op de tijd die ze besteden aan andere niet-mobiliteitsgerelateerde activiteiten zoals huishoudelijke taken, kinderopvang en slaap. Een dergelijke diepgaande analyse van de wisselwerking tussen CS, SWB en tevredenheid met niet-mobiliteitsgerelateerde levensdomeinen is inderdaad nodig om niet alleen te bepalen op welke gebieden het welzijn van werknemers kan worden verbeterd, maar ook hoe.

Tot slot, hoewel woon-werkverkeer een significante invloed heeft op SWB van individuen, is het niet noodzakelijkerwijs het belangrijkste levensdomein. Eerdere studies hebben aangetoond dat woon-werkverkeer een stressvolle activiteit is en een directe negatieve invloed heeft op individuele SWB; de resultaten van dit proefschrift vonden echter geen negatieve relatie tussen CS en SWB. In tegenstelling tot eerdere bevindingen concluderen wij dat tevredenheid met tijdsbesteding het sterkste totale effect heeft op SWB, ongeacht hoe vaak individuen pendelen naar hun werk. Dit zou erop kunnen wijzen dat individuen hun nut en dus hun totale SWB kunnen maximaliseren zolang ze de vrijheid hebben om hun tijd te optimaliseren. Wat de prospectieve benadering van CS betreft, weten we dat ontevredenheid over

woon-werkverkeer leidt tot veranderingen in levensgebeurtenissen, zoals (maar niet beperkt tot) het veranderen van werk- of woonplaats. Voor de meerderheid van de ontevreden individuen die niet in staat zijn om te veranderen, moet echter verder onderzocht worden hoe deze ontevredenheid overslaat op tevredenheid met andere levensdomeinen dan mobiliteit, als gevolg van tijdgebrek door langere woon-werkverplaatsingen. Wat betreft de dynamiek, hoewel werknemers die op vrijwillige basis van van werkplaats veranderden een hogere CS hebben dan degene die op onvrijwillige basis veranderden, is de vraag hoe blijvend dit is, en of CS verandert in de loop van de tijd wanneer mensen gewend raken aan de veranderde omgeving ('treadmill effect'), een onderwerp voor toekomstig onderzoek.

PUBLICATIONS

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COMMUTING SATISFACTION AND
SUBJECTIVE WELL-BEING

Linking life domains, workplace relocation and
working from home practices