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How do workers respond to dissatisfaction with commuting and work? Insights from a panel survey in Luxembourg

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ABSTRACT

Despite extensive literature on commuting satisfaction, the question of how individuals adapt to commuting dissatisfaction has not been thoroughly analysed. This study, using a Luxembourgish panel-based survey from 2013 to 2015, investigates how individuals cope with or tolerate commuting dissatisfaction over subsequent years. Employing cluster analysis, different satisfaction profiles are identified based on commuting time satisfaction (CTS) and work satisfaction (WS) in 2013. Cross-tabulations between these profiles and life events highlight that dissatisfaction predominantly leads to more frequent workplace changes than changes in residences. Logistic regression reveals that low CTS and WS combination clusters have a higher likelihood of changing workplaces in subsequent years compared to high CTS and WS combinations. Notably, the cluster with high CTS-low WS demonstrates a stronger effect on changing workplaces than the reverse combination, suggesting work dissatisfaction may outweigh dissatisfaction with commuting time. Despite these findings, a substantial majority of individuals enduring dissatisfaction are constrained from making a switch. Such findings on the prospective approaches of CTS and WS (i.e. what happens if people are dissatisfied with their commuting and work) are first of its kind and will assist in identifying the most common coping strategies individuals employ to respond to dissatisfaction in their personal lives.

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 and 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 and 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,

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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, commute conditions and travel preferences could lead to changes in satisfaction with commuting.. However, people experiencing dissatisfying commutes could respond to this by modifying their commutes via residential or workplace changes.

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 ask retrospective questions about changes in travel conditions and satisfaction before and after an event. Some exceptions include De Vos et al. (2019); Monteiro et al. (2021); Wang et al. (2020) for a longitudinal analyses 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 neighborhood 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 commute 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 commute 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 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 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 and Frey, 2008). In a similar vein, an often-overlooked aspect in existing research is the 'time' component of commuting. Despite its critical role in shaping overall commute satisfaction, there is a lack of comprehensive exploration on how dissatisfaction with the time spent on commuting influences individuals' decisions to make adjustments, be it in terms of residential relocation or changes in workplace. Therefore, in this study, we explore how satisfaction or dissatisfaction with commuting time influences decisions to change workplaces and/or residences, rather than focusing only on overall commuting satisfaction.

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 and 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 and 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 and 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.

Thus, to offset these shortcomings, this study aims to examine the importance of dissatisfaction with commuting time and work on life events, in particular changing workplaces and/or residences in subsequent years. We analyze 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 and Kim, 2017; Schneider and Willman, 2019; Xiao et al., 2021); however, in this study we focus on how individuals respond to dissatisfying work and commute times. Doing so, this study becomes the first to offer insights into the prospective approach to commuting time 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 subjective well-being or determine their tolerance for dissatisfaction.

The next section introduces the dataset and the methodology employed in this study. Section 3 outlines the results. Lastly, Section 4 provides a discussion on the results and concludes the study with avenues for future research.

2. Research design

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 1 provides the socio-demographics of the respondents against the country's average (STATEC, 2011).

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 anonymized 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. In doing so, we are able to differentiate between the short-term (within a year) and the medium term responses (between one and two years). 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. 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, car ownership level 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).

While the dataset may be outdated, it uniquely stands out in the travel satisfaction literature as the only dataset offering essential insights into how individuals address dissatisfaction in their personal lives. This P-SELL dataset is likely to be unique, not only within Luxembourg but possibly worldwide. Respondents were asked to report their satisfaction with commute time in 2013, and life events were tracked over two consecutive years (2013–2015). Other household panels or longitudinal datasets do not usually have such information about satisfaction with the time component of commute, making it the only and representative source of such information for 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 residential and/or workplace location 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 and not in the subsequent years. Thus, whether life events 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 available only 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, and/or workplaces in subsequent years.

Table 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

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 and changing residences) 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 and Cooper, 1987; Sarstedt and Mooi, 2010). Validation approaches included the silhouette

method,[1] the elbow method[2] and the F-ratio[3] 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 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. We used these six cluster categories as independent variables in the logistic regression to examine the impact of combined dissatisfaction on the likelihood to experience certain life events while controlling for covariates such as age, gender, education, marital status, health and nationality.

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

For inter-cluster comparison, Post-hoc Tukey tests were conducted to analyse differences in CTS and WS variables among the six clusters. Significant differences in means were observed for all clusters of CTS and WS at the 0.05 level, with the exception of CTS clusters 5 and 6, and WS clusters 3 and 4. To enhance clarity, respondents were categorized into three sub-groups based on their satisfaction levels. Scores from 0 to 4 indicate low satisfaction, 5 to 7 represent moderate satisfaction, and 8 to 10 denote high satisfaction. Fig. 1 provides a detailed overview of the clusters and satisfaction levels, offering additional insights into the satisfaction levels within and across clusters than merely looking at the one average value per cluster. Examining this distribution is crucial because high CTS in cluster 1 and cluster 2 signifies different scenarios. In cluster 2, all respondents were highly satisfied with their commute time, while in cluster 1, it was a mix of moderately satisfied and highly satisfied individuals. A similar pattern was observed for high WS in cluster 1 and cluster 5.

Table 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

[1] 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).

[2] 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.

[3] 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).

3. Results

3.1. Life events in 2014 and 2015

We first carried out descriptive statistics of the identified sample to understand the proportion of life events between two consecutive waves i.e., changes in 2014 (Wave 1) and changes in 2015 (Wave 2) (Table 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. The results suggest that changing workplaces is more common than changing residence. 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.

3.2. Association between dissatisfaction in 2013 and life events in 2014 and 2015

In a next step, we created a cross-tabulation (Table 5) between the different CTS-WS profiles presented earlier in section 2.2 and the life events discussed above in section 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 or residence 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. 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, $p < 0.1$).

3.3. Impact of combined dissatisfaction in 2013 on changing workplace in 2014

In the last step, we performed a logistic regression to examine the effect of dissatisfaction in 2013 potentially leading to a life event (such as workplace relocation, and/or residential relocation) in 2014. From

Table 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

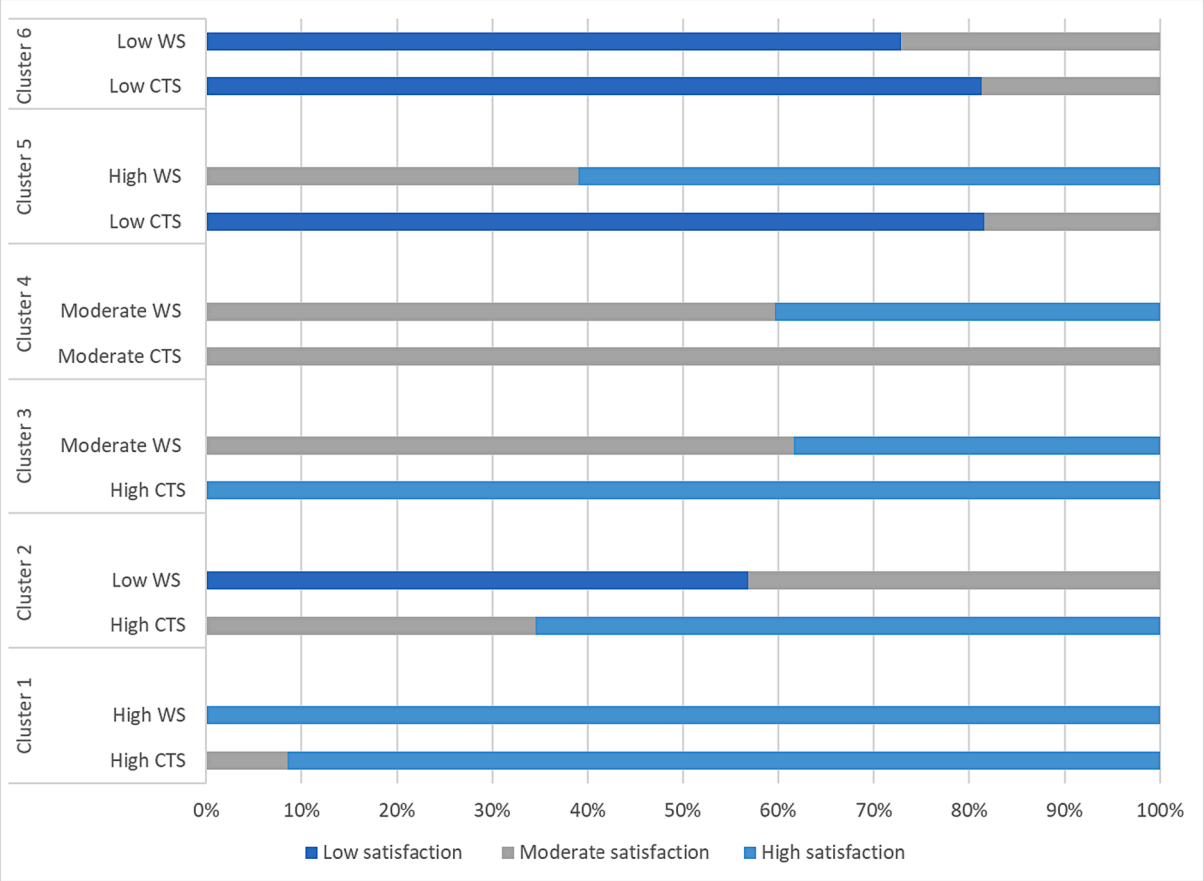

Fig. 1. Proportion of CTS and WS values per cluster.

Table 4
Proportion of life events.

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

the results of descriptive statistics in section 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 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 6). 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.

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 access 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.

Table 5
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
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

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 6
Binary logistic regression with change of workplace from 2013 to 2014 as the dependent variable.

Variables	Coefficient (p-value)
Life event from 2013 to 2014	
Change of residence (ref: no change)	0.43 ***
Clusters (ref: Cluster 1 High CTS-High WS)	
Cluster 2 High CTS-Low WS	0.76 ***
Cluster 3 High CTS-Mod. WS	− 0.24
Cluster 4 Mod. CTS-Mod. WS	0.46 ***
Cluster 5 Low CTS-High WS	0.60 ***
Cluster 6 Low CTS-Low WS	0.90 ***
Socio-demographic characteristics	
Age	− 0.03 ***
Female (ref: male)	0.02
Education (ref: low education)	
Secondary education	−0.31
Tertiary education	−0.17
Living with partner/ spouse (ref: Living without partner/ spouse)	−0.17
Car ownership level (ref: no cars)	
One car per household	−0.22
Two cars per household	−0.32
More than two cars per household	−0.31
Health (ref: good health)	
Neutral	0.18
Bad health	0.62 **
Non-native Luxembourgers (ref: Native Luxembourgers)	0.34 **
Intercept	−258
N	1899
Degrees of freedom	17
Log-Likelihood	− 708.11
McFadden's Pseudo R2	4.7 %
Likelihood-ratio test (Prob > Chi2)	0.00
Unstandardized coefficients reported	
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$	

3.3.1. 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.

3.3.2. 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).

3.3.3. 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 workplaces in the next year, compared to native Luxembourgers, warrants further investigation. There is a possibility that native Luxembourgers experience more job stability than foreigners. Individuals with bad health are more likely to change their workplace in the following year compared to those in good health. This may be attributed to the correlation between bad health, and lower job satisfaction, which perhaps increases the likelihood to change workplaces in the following years (Metcalfe et al., 2003). While examining car ownership levels, no significant association was found between car ownership and changes in workplaces in the subsequent years.

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 and/or residence) 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 undergoing a life event in both Wave 1 (change in 2014) and in Wave 2 (change in 2015). Despite the relatively low occurrence of life events in Wave 1, with around 13 % changing workplaces and 6 % changing residences, these percentages significantly decrease in Wave 2. 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 workplaces in the following year(s). Strictly speaking, respondents with the lowest CTS and WS reported the most changes in their workplaces, 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). 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. Specifically, 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. These findings align with previous studies, (e.g. Gao et al. (2022) and Mouratidis (2020)), which highlight that WS tends to be a considerably more influential predictor of subjective well-being than CS. However, further research with more confounding variables of work and commute is needed to more accurately identify whether the effect of WS is stronger than that of CTS on the likelihood of changing workplace. 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). 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 strong due to small number of 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 and residence in subsequent years. However, it is crucial to acknowledge that responses to dissatisfaction with commuting time and work may extend beyond workplace changes. These responses could encompass actions like quitting the workforce, acquiring a vehicle, opting for flexible working hours, working remotely, reducing working hours, or commuting during off-peak times, instead of making broader lifestyle changes to address 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 the following years 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 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 and Axhausen, 2003; Thøgersen, 2006), but also for cross-sectional data using a traditional SEM (Friman et al., 2017; Gao et al., 2017; Ye and 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 undergoing a life event, whether workplace, and/or residence change 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, 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 subjective well-being (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 tolerate 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 (Anderson et al., 2002; Beutell, 2010; Cervero and 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 two common life events, i.e. changing workplace and changing residence. However, other life events such as obtaining a driving license, buying a car, or a change in employment status can also be a response to dissatisfying commute patterns (Bamberg et al., 2003; Clark et al., 2014; Goodwin, 1993; Thøgersen and 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 subjective well-being. 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 subjective well-being. This will help practitioners and policy makers in formulating the necessary transport and planning policies to accommodate these dissatisfied commuters.

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CRediT authorship contribution statement

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

Declaration of competing interest

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

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