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Windows of change as precursors to changing travel behaviour aligned with sustainable mobility

By

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ABSTRACT: There is increasingly a greater focus on ways in which we can achieve behavioural change associated with improved sustainability outcomes in the transport sector. In societies where the car is the dominant passenger transport mode with all of its associated interpretations of convenience, we continue to search for ways to change travel habits that result in a switch out of the car in favour of public transport and active modes. The focus of this paper is on identifying windows of change (WoC) that have subsequently had an influence on the travel mobility preferences of individuals, hopefully in ways that support sustainability outcomes. We categorise the WoCs into four broad areas: lifestyle and household changes (e.g., changes in living arrangements, family structure, or personal habits), work and commuting-related changes (e.g., changes in employment, workplace incentives or commuting patterns), transport and mobility changes (e.g., changes in vehicle ownership, public transport use or travel habits), and social and environmental considerations (including awareness and influence of others). A series of negative binomial count models are estimated to identify the relationship between the WoCs and modal one-way trip frequency in a typical week, after controlling for various socioeconomic effects and country dummy variables. Data is collected from over 4,000 respondents spread across Australia, Finland, New Zealand, the United States, the United Kingdom, Singapore, and Sweden, investigating respondents' WoC over the period 2023–2025 and their most recent weekly travel patterns. The findings provide a rich array of policy advice on what key WoC influences suggest actionable ways to support the switch to more sustainable modes, and what remain as clear barriers to achieving such an outcome.

KEY WORDS: ***Windows of change, trip frequency, negative binomial model, direct elasticities, survey seven countries, sustainability, actionable policy outcomes***

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positions of our industry and government partners; but approval to present these findings is appreciated.

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Introduction

There is an extensive literature on understanding the reasons for choosing a particular passenger mode out of the set on offer, where the main focus is typically on parameterising a model in which the attributes of the alternative modes and socioeconomic characteristics of the traveller are represented at current levels. What is typically given less attention is the role that past influences have had on the status quo of today, and hence a loss of knowledge on how such past influences, which we call windows of change (WoC), have played in determining the modal mobility outcomes observed today. These "windows of change" focus on the moments in life when individuals are more likely to be influenced to change their travel behaviour. If we are to gain a better understanding of current travel behaviour and the historical drivers that have influenced these current behaviours, we can establish the relationship between identified WoCs and current modal preferences as one way of seeing if there are some sufficiently influential WoC that can be used to support behavioural changes that align with (currently) accepted views on sustainable mobility. This can also offer insights into how likely future WoC might impact travel habits.

There are, historically, numerous WoC that might have influenced (or not) currently observed travel behaviour. While the broader literature suggests which are some of these drivers of change (e.g., bought a car, moved house), there is a need for a systematic assessment of the wider identified set of potential WoCs. We have identified 71 possible influences (detailed in a later section), all informed by the existing literature, categorised into four classes: lifestyle and household changes (e.g., changes in living arrangements, family structure, or personal habits), work and commuting-related changes (e.g., changes in employment, workplace incentives or commuting patterns), transport and mobility changes (e.g., changes in vehicle ownership, public transport use or travel habits), and social and environmental considerations (including awareness and influence of others). These influences have been identified through a series of questions to understand what changes have influenced the household's travel habits since 2023. We collected data on the 'typical' number of weekly (7-days) one-way trips for each of six modes and seven trip purposes and estimated negative binomial count models for each mode to identify positive or negative contributions as a direct elasticity behavioural response to weekly trip frequency.

With this context in mind, two research questions were identified: (i) which interventions (both transport and non-transport) are perceived by respondents as most effective for accelerating sustainable transport use? and (ii) how do reference points for behavioural change, such as lifestyle and household changes and changes in work and commuting arrangements, shape public attitudes toward adopting sustainable travel behaviour? Figure 1 summarises all the components of the research focus of this paper.

The paper is organised as follows. We begin with a literature review that focusses on evidence on how WoCs have been shown to influence subsequent travel behaviour. This is followed by an overview of the empirical context in seven countries, including the questions asked that focus on the interest of this paper. A descriptive profile identifies the socioeconomic characteristics of the sample and the incidence of each WoC indicated by respondents as influencing subsequent travel habits. To map these influences into their impact on modal trip frequency, the negative binomial count model is then presented, followed by the estimated models for each mode (pooled across all trip purposes). The rich behavioural responses underlying each model are presented as mean direct (or arc, where appropriate) elasticities, which is the basis of establishing the strength of the relationship between statistically significant WoCs associated with modal trip frequency that can act as triggers behind sustainable behaviour change, playing a crucial role in user adoption of sustainable transport solutions. We conclude the paper with commentary on what policy initiatives should be progressed as a mechanism to promote and achieve behavioural changes aligned with agreed mobility-focussed sustainability objectives.

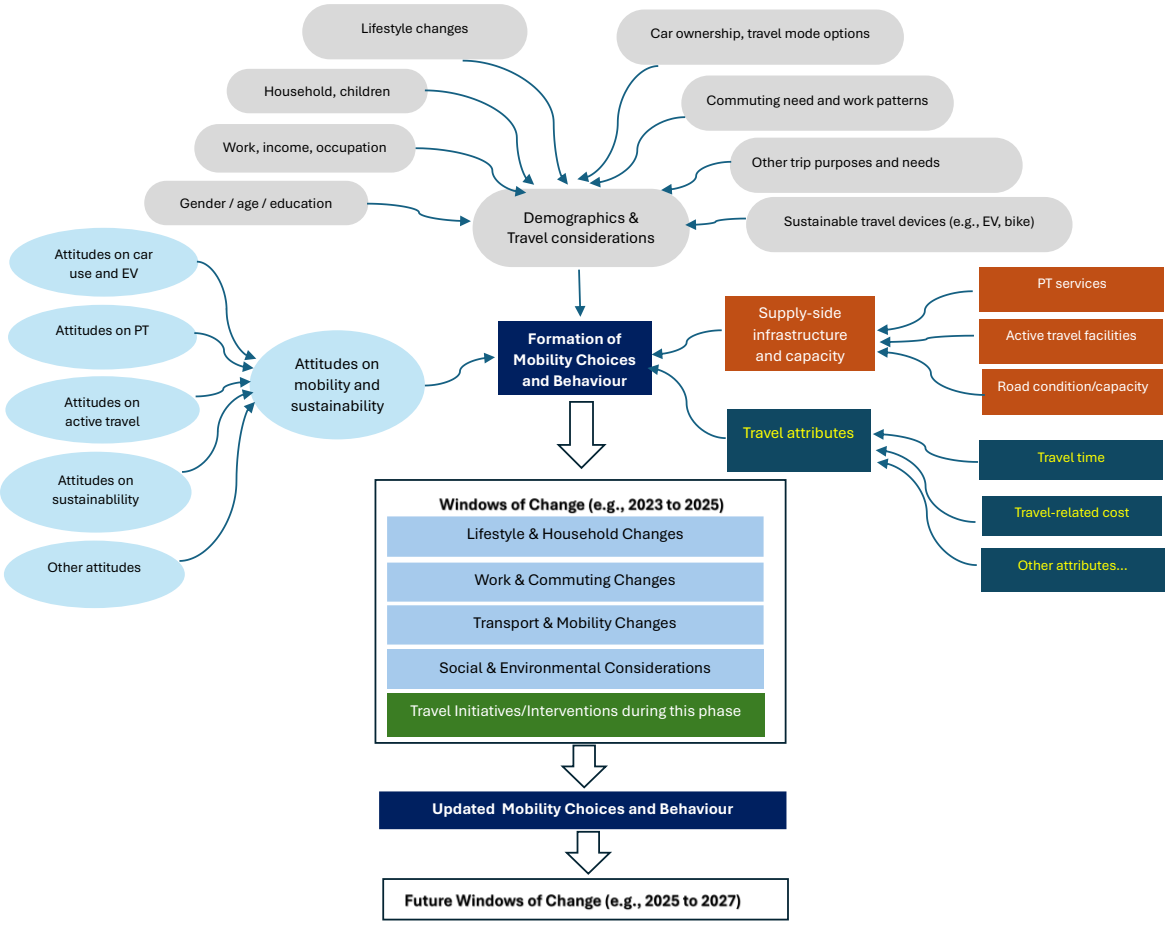

Figure 1. The Framework of the formation and change of mobility choice and travel behaviour

Literature review

Many studies have examined ways to change behaviour in the context of transport, often focusing on designing and reshaping interventions as the primary tools for influencing choices. Recently, there has been a shift toward behavioural science approaches that emphasise understanding the psychology behind change and how it can be used to foster long-term transformations (Cleland et al., 2023; Duckworth and Gross, 2020). This means that insights drawn solely from research within the transport domain related to behavioural change are somewhat limited in their effectiveness at promoting sustainable behaviour (Zhang and Van Acker, 2017). Relevant research has indicated the role of "triggers", in most cases referred to as lifecycle events, or what we term "windows of change" (WoC), that drive travel behaviour change. These include lifestyle shifts and other external influences (Scheiner, 2014; Zarabi and Lord, 2018; Zhao and Lyu, 2022). In this section, we briefly review the literature to investigate the impact of WoCs on travel behaviour change as a starting point to further investigation.

Lifecycle events and behaviour change

Some of the early studies related to lifecycle events and transport were conducted by Van der Waerden et al. (2003). They identified a set of potentially influential life events in their research and reported how the perceived characteristics of different travel modes change after such events. Klöckner (2004) conducted the first detailed online study about lifecycle events with 91 German participants aged 19 to 62 to investigate how life events influence travel mode choice and found that major events such as acquiring a driver's licence, changing schools, starting university, moving to a new town, and starting or losing a job significantly impacted transport preferences. The research identified three distinct

clusters of participants, each showing different patterns of behaviour linked to specific life events: one group whose car use rose sharply in adolescence due to early milestones like getting a driver's licence and buying a car; another whose car use declined after childhood despite similar early events; and a third whose car use remained low until age 25, when major life changes triggered a steady increase.

Scheiner (2014) utilized the German Mobility Panel (GMP) data spanning 1994 to 2010 to analyse how life events impact travel mode-specific trip rates. Key lifecycle events such as childbirth, labour market entry, and changes in residential location, accessibility, and mobility patterns showed notable effects. Notably, gender differences were observed, with men and women responding distinctly to similar life events. However, the study emphasised that while significant, the overall impact of lifecycle events on mode-specific trip rates was relatively modest. In a study from Portland, Oregon, Gehrke et al. (2019) explored mode-switching behaviours through detailed observation periods, emphasising transitions from non-car modes to car usage. Their analysis, employing mixed binary logit regression models, underscored that lifecycle events, particularly marriage, childbirth, and changes in commuting distance, distinctively influenced mode-switching behaviours. These findings aligned with the study by Li and Kamargianni (2019) conducted using Taiyuan citizens' travel behaviour survey in China in 2015. All of these studies emphasised the critical role of targeted policy interventions to prevent shifts toward car dependence during pivotal lifecycle moments, specifically in vulnerable transition periods.

In examining how lifecycle stages mediate the relationship between life events and travel behaviour, Janke et al. (2020) identified distinct patterns across different life stages, such as millennials living alone or with partners, families with children, and older adults without children. Although life stages themselves did not significantly moderate the impact of lifecycle events, they influenced the predominant travel modality types. For example, residential relocations among millennials living with partners and parents with children frequently resulted in shifts toward car dependence.

Residential relocation is one of the most extensively researched lifestyle transitions influencing travel behaviour. Systematic reviews (Ding et al., 2018; Zarabi and Lord, 2018) consistently show that moves can trigger shifts in walking, cycling, and driving, with built environment factors, such as access to public transport and parking exerting strong effects. Ding et al. (2018) found stronger evidence linking relocation to increases in walking, while Zarabi and Lord (2018) highlighted that parking access and availability of quality public transport were decisive in whether employees switched to commuting by car. Beige and Axhausen (2017) showed that people often relocate to shorten commutes, yet when moves coincide with job changes, commuting distances frequently grow longer. Their study also found that car and public transport pass ownership usually increase after relocation, while walking and cycling decline. Gehrke et al. (2019) emphasised that relocation decisions reflect broader lifestyle aspirations, with neighbourhood preferences strongly influenced by desired accessibility and housing qualities. Delbosc and Nakanishi (2017) further observed that Australian millennials planning to start families often end up in locations with poor public transport access, making it harder to maintain sustainable transport habits. Together, these studies underscore that residential moves can serve as critical intervention points for policies aimed at supporting walking, cycling, and transit use.

Segmented approaches

Anable (2005) introduced the segmented approach to travel interventions, suggesting that demographic or simple behavioural classifications alone might oversimplify the market's complexity. Building upon this and lifecycle events, Jin et al. (2020) used joint social sequence clustering to identify distinct life-trajectory cohorts and subsequently examined how lifecycle events differently impacted mode-use within these groups. They found that the timing and sequence of lifecycle events significantly influenced mode-use behaviours, with early-life events producing lasting impacts, particularly for cohorts experiencing family and career formation simultaneously. For instance, their "Have-it-alls" cohort, who completed education, initiated careers, and established families early, demonstrated a marked increase in car use triggered by lifecycle events such as marriage and childbirth. Similarly, Prato

et al. (2016) employed a segmented approach to identify distinct transport-oriented groups in the Copenhagen region - car-oriented, bicycle-oriented, walk/public transport-oriented, and public transport-averse individuals. Rather than further segmenting the population, their research highlighted that specific lifecycle events and stages had unique impacts within these predefined segments, emphasising the need for tailored, targeted policy interventions based on segment characteristics and lifecycle contexts.

Implications for further research

Overall, the literature reveals that while traditional transport interventions have focused primarily on infrastructure and incentives, there is growing recognition that behavioural change must be understood in the context of people's life trajectories. Lifecycle events such as forming a family, changing jobs, or relocating serve as powerful triggers for shifts in travel habits, creating "windows of change" that can either reinforce or disrupt sustainable behaviours. However, evidence suggests that the effects of these events are complex, sometimes modest, and heavily influenced by individual circumstances, timing, and the interplay of multiple life domains. The application of segmented approaches further highlights the importance of tailoring interventions to people's life stages, aspirations, and lifestyle orientations to enhance the likelihood of achieving lasting change. Further, it is vital to focus on developing a deeper understanding of how different types of life events shape travel behaviour over time across varied population groups and the role of targeted initiatives in influencing the complex interplay between life events, attitudes, and evolving transport choices over time.

The Empirical Setting

A survey was undertaken in May 2025 with participants from Australia, Finland, New Zealand, the United States, the United Kingdom, Singapore, and Sweden. This cross-cultural approach aims to identify both universal and region-specific insights into behaviour change. In this paper, we draw on that part of the survey investigating respondents' local travel behaviour changes over the past two years (2023–2025). By focusing on "windows of change" (WoC) listed in Table 1, the survey captures how the recent transitions in these broad areas of change have impacted travel habits, in a period when we have moved on from the restrictions of COVID-19, to identify key moments where behaviour might be more susceptible to change.

Table 1. The list of Windows of Change potential influences

Lifestyle and household changes	**Transport and Mobility Changes**
Moved to a new area	Bought a car (previously did not own one)
Upsized to a larger home	Increased the number of cars in the household
Downsized to a smaller home (apartment/townhouse)	Replaced a petrol/diesel car with an electric (hybrid or fully electric) car
Household size increased (e.g., new family members)	Replaced a petrol/diesel car with a more fuel-efficient petrol/diesel car
Household size decreased (e.g., children moved out)	Replaced a petrol/diesel car with a less fuel-efficient petrol/diesel car
I changed marital status	Reduced car use due to high costs
I started or increased caregiving responsibilities (e.g., caring for children, elderly)	We now have more cars than adults in the household
My health improved	We now have fewer cars than adults in the household
I had health concerns that affected my travel	I no longer own a car
I started walking/exercising more for health reasons	Purchased an e-scooter
My financial situation improved	Purchased an e-bike
My financial situation became tighter, affecting my spending/travel choices	Purchased a regular bicycle
I have adjusted my lifestyle to prioritise saving money	Improved accessibility of public transport in my area

Lifestyle and household changes	**Transport and Mobility Changes**
I increased online shopping to reduce personal travel	Improved public transport routes saved me travel time
I have reduced online shopping spending	Public transport is less crowded since COVID-19
I started using click-and-collect more often	Public transport quality has worsened
I now rely more on home delivery	I reduced car use for commuting
I acquired a dog	I started using public transport more for commuting
I no longer have a dog	I reduced overall car use
I retired from the workforce	I increased overall car use
I was temporarily not working	I walk or cycle more
My partner retired	I increased my use of e-bikes or e-scooters
My partner changed jobs	I take children to/from daycare or school on the way to/from work/home
My partner started or re-entered the workforce	I use public transport more because other household members use the car
My partner moved to more flexible working hours	I walk/cycle more because other household members use the car
Work and commuting changes	I use e-bike/e-scooter more because other household members use the car
I was not in the workforce during this period	**Environmental and Social considerations**
I was looking for a job during this period	I am now more conscious of the environmental impact of my travel choices
I changed jobs but stayed in the same residential area	I am now less concerned about the environmental impact of my travel choices
I changed jobs and moved to a new residential area	Friends influenced my decision making
I moved to flexible working hours and days	Family influenced my decision making
I recently had to work in the main office/work location more at the request of employer	Public campaigns or government policies
Free parking	Peer groups and social norms
Charging facilities for electric cars	I tend to use car over public transport on wet days
Showers for walking/cycling commuters	I tend to use car over active travel on wet days
Free on-site health & wellness facilities (e.g., gym, yoga)	Due to industrial action, I shifted from public transport to driving
Perks for using public transport, carpooling, cycling, or e-scooters (e.g., coffee vouchers, preferential parking)	

Piloting the survey

After finalising the draft survey design and content, it was coded into the ITLS web-based platform to enhance user-friendliness and streamline administration. Designed to take no longer than 15 minutes, the survey underwent internal testing to identify typographical errors, assess its length, and resolve inconsistencies. Compatibility with various portable digital devices was also verified. An internal pilot was conducted with the ITLS research team, the Queensland Department of Transport and Main Roads and ITS Australia, after which the survey was revised considering the feedback received. After obtaining approval through the USYD umbrella Human Research Ethics process, the survey was then extended via the panel survey company as a broader pilot to 100 participants across each of the participating countries of Australia, Finland, New Zealand, the USA, the UK, Singapore, and Sweden.

Target Audience, Sampling Strategy and Implementation

The survey primarily targeted respondents in Australia, reflecting the local context and transport policies influencing travel behaviour. With a target sample size of 4,000 participants, it aimed to provide a comprehensive understanding of local travel patterns and relevant interventions. In addition to 1,000 respondents from Australia, a comparative sample of 1,000 from the USA and 400 each from Finland, New Zealand, the UK, Singapore, and Sweden was obtained to offer a broader perspective and enable international comparisons. These countries were selected based on their advanced transport systems, progressive policy initiatives, diverse approaches to sustainable mobility, and the ability of respondents to complete the survey in English. By incorporating insights from multiple regions, the survey sought

to identify common trends, key differences, and best practices in influencing travel behaviour. This comparative approach supports the assessment of the effectiveness of various interventions and the level of awareness across different urban and policy contexts.

A third-party panel survey provider was engaged to ensure robust data collection, with flexibility in sample sizes to adapt to evolving research needs. The ITLS research team continuously monitored data quality throughout the collection period and applied rigorous checks at both the pilot and full implementation stages to ensure the validity of survey responses. Accordingly, 526 responses were excluded due to unacceptable data quality[1]. The final sample includes 1,034 respondents from Australia, 1,009 from the USA, 397 from Finland, 423 from New Zealand, 411 from Singapore, 403 from Sweden, and 411 from the UK, a total of 4,088 respondents.

Descriptive Profile: Windows of Change (WoC) and how they have affected Travel Behaviour since 2023

From the full list of 71 potential WoC influences associated with changing travel behaviour from 2023 to today (June 2025), we categorised them into the four classes listed above, and in each class, a respondent was asked to choose up to three that were the most relevant in impacting travel behaviour change. With four classes, each respondent selected a maximum of 12 relevant influences, although they were able to select fewer, if appropriate. Table 2, for the entire sample across all countries, shows the average number of WoC influences chosen as relevant. The context given to participants in this section was the following: "People change their travel behaviour for many reasons such as changes in lifestyle, work, transport access, or personal circumstances. We would like to understand what changes have influenced your household's travel habits since 2023". We see the average number of WoC responses varies between 1.52 for two classes (i.e., Lifestyle and household changes and Transport and mobility changes), 1.16 for working and commuting, and 1.31 for social and environmental considerations. Importantly, given that a maximum of three WoC influences were allowed per class, and that most participants chose fewer (except in the first class, where 55% chose 3 options, but on average they chose 1.52 options), we can confidently conclude that there is no behavioural bias when comparing responses between classes.

Table 2. Summary of the number of WoC responses provided by the respondents

Number of Influences	Lifestyle and household	Work and commuting	Transport and mobility	Social and environmental
Mean changes selected	1.52	1.16	1.52	1.31
Maximum	3	3	3	3
Minimum	0	0	0	0
How many selected 3	55%	16%	30%	22%
How many selected 2	16%	13%	17%	18%
How many selected 1	16%	42%	28%	29%
How many selected 0	12%	29%	25%	31%

Table 3 summarises the incidence of each WoC influence across the sample, with the influences ranked from least to most cited. We present the all-country findings in Table 3, with country-specific findings summarised in Appendix A. The most cited influence is "I am now more conscious of the environmental impact of my travel choices" by 37.9% of the sample, with the least cited being "I use e-bike/e-scooter more because other household members use the car" by 0.5% of the sample. The majority of WoC influences mentioned by the sample are in the range between 4% and 12% which is enough to suggest that many of the influences are likely to have a positive or negative influence on changes in travel behaviour.

[1] The data cleaning process was based on participants reporting a plausible number of worked hours during the week, the weekend, number of weekly trips, among others.

Table 3. The incidence of selection of a WoC influence across the entire sample

Windows of Change on Travel Habits after 2023	Incidence of Change	Windows of Change on Travel Habits after 2023	Incidence of Change
I use e-bike/e-scooter more because other household members use the car	0.5%	I changed marital status	6.5%
My partner started or re-entered the workforce	0.7%	Replaced a petrol/diesel car with an electric (hybrid or fully electric) car	6.6%
I increased my use of e-bikes or e-scooters	0.7%	Public campaigns or government policies	6.6%
My partner moved to more flexible working hours	0.8%	Purchased a regular bicycle	6.6%
My partner retired	1.5%	Improved public transport routes saved me travel time	7.1%
My partner changed jobs	1.6%	Bought a car (previously did not own one)	7.4%
I walk/cycle more because other household members use the car	1.9%	Household size decreased (e.g., children moved out)	8.0%
We now have more cars than adults in the household	2.0%	I reduced car use for commuting	8.3%
Due to industrial action, I shifted from public transport to driving	2.4%	Improved accessibility of public transport in my area	8.7%
Peer groups and social norms	2.5%	Upsized to a larger home	9.1%
I use public transport more because other household members use the car	2.8%	I have reduced online shopping spending	9.2%
We now have fewer cars than adults in the household	3.1%	Household size increased (e.g., new family members)	9.5%
I was temporarily not working	3.3%	Reduced car use due to high costs	9.9%
Perks for using public transport, carpooling, cycling, or e-scooters (e.g., coffee vouchers, preferential parking)	3.5%	Free parking	10.4%
Replaced a petrol/diesel car with a less fuel-efficient petrol/diesel car	3.6%	I am now less concerned about the environmental impact of my travel choices	10.6%
Purchased an e-scooter	3.7%	I had health concerns that affected my travel	10.9%
I no longer have a dog	4.0%	I recently had to work in the main office/work location more at the request of the employer	11.1%
I retired from the workforce	4.0%	I tend to use car over active travel on wet days	12.0%
Charging facilities for electric cars	4.4%	My financial situation improved	12.1%
Free on-site health & wellness facilities (e.g., gym, yoga)	4.6%	I changed jobs but stayed in the same residential area	12.4%
I now rely more on home delivery	4.7%	I walk or cycle more	13.1%
I changed jobs and moved to a new residential area	5.0%	I reduced overall car use	13.3%
Showers for walking/cycling commuters	5.1%	I was looking for a job during this period	13.5%
I started using click-and-collect more often	5.3%	I increased online shopping to reduce personal travel	13.7%
I started or increased caregiving responsibilities (e.g., caring for children, elderly, or people with disabilities)	5.4%	Friends influenced my travel decisions	14.0%
I increased overall car use	5.4%	I have adjusted my lifestyle to prioritise saving money	15.3%
I started using public transport more for commuting	5.5%	My health improved	16.7%
I no longer own a car	5.8%	I tend to use car over public transport on wet days	17.2%
I take children to/from daycare or school on the way to/from work/home	5.9%	Moved to a new area	17.7%
Increased the number of cars in the household	5.9%	I moved to flexible working hours and days	20.2%
Public transport quality has worsened	5.9%	My financial situation became tighter, affecting my spending/travel choices	21.0%
I acquired a dog	6.0%	I started walking/exercising more for health reasons	22.5%
Downsized to a smaller home (apartment/townhouse)	6.1%	I was not in the workforce during this period	26.1%
Replaced a petrol/diesel car with a more fuel-efficient petrol/diesel car	6.2%	Family influenced my travel decisions	27.5%
Public transport is less crowded since COVID-19	6.3%	I am now more conscious of the environmental impact of my travel choices	37.9%
Purchased an e-bike	6.3%		

Some of the WoC influences are spatial, such as residential and workplace relocation, suggesting the need for strategic transport models to incorporate location change choices. Namely, 11.4% of participants cited changing jobs but staying in the same residential area, while 4.7% cited changing jobs and moving to a new residential area. There are many influences associated with car ownership and use, of which no longer owning a car (5.8%) is an encouraging outcome in achieving sustainability objectives, but we also see greater use of the car (5.4%), and replacing a petrol/diesel car with an electric (hybrid or fully electric) car (6.6%) as likely to increase overall car use despite the environmental gains from electric cars. Some car use decreases due to high costs (9.9%), and 13.1% of respondents cited reducing overall car use. Free parking provided by an employer (10.4%) is clearly a disincentive to switch to more environmentally friendly modes, although such parking is eligible for electric vehicles, but it adds to congestion while reducing emissions. So, we have a number of car-related influences which need to be assessed in the formal modelling to establish the net sustainable mobility impact of the car context.

Encouragingly, we find some positive support for public transport (PT) associated with its use in households where others have taken over the use of the available cars (2%), perks provided by an employer for using PT (3.5%), reduced crowding in PT (6.3%), improved PT routes resulting in travel time savings (7.1%), and improved accessibility of PT in the local area (8.7%); however, this is offset partially by a worsening of PT quality (5.9%).

Active mode responses include started walking and exercising more for health reasons (22.5%), increased walking and cycling (13.1%), purchased a regular bike (6.6%), purchased an e-bike (6.3%), and walking and cycling more because other household members use the car (2.8%).

Whereas these descriptive profiles are of interest, and Appendix A suggests that the influence incidence is comparable across all seven countries, they do not necessarily reflect the key WoC drivers influencing the frequency of modal travel in 2025. Some of the influences, such as ‘improved health’ and ‘started using click and collect more often’, mean nothing in isolation from identifying what modal activity change resulted. We now turn to the Negative Binomial (NegBin) count models to investigate the relationship between weekly one-way modal trip frequency and the WoC influences, in addition to contextual and socioeconomic variables.

The Modelling Approach

The data used in model estimation is count data associated with a typical week’s one-way trips by mode and purpose. The negative binomial model is a popular count model that has served as the most common extension of the Poisson model to allow for overdispersion or latent heterogeneity. Beginning with the specification of the Poisson model, the negative binomial model is obtained by introducing heterogeneity into the conditional mean of the Poisson. The standard Poison model is given in (1).

$$f(y_i \mid \lambda_i, \varepsilon_i) = \text{Poisson, with } \lambda_i = \exp(\boldsymbol{\beta}'\mathbf{x}_i + \varepsilon_i) \qquad (1)$$

where $\exp(\varepsilon_i) = v_i \sim$ Gamma with mean 1, and $f(v_i) = \dfrac{\theta^{\theta}}{\Gamma(\theta)}\exp(-\theta v_i)v_i^{\theta-1}$.

The unconditional density is

$$\log \text{Prob}[Y_i = j] = \log L_i = \log \Gamma(\theta + y_i) - \log \Gamma(\theta) - \log[\Gamma(y_i+1)] + \theta \log u_i + y_i \log(1 - u_i) \qquad (2)$$

where $\theta = 1/\alpha$, and $u_i = \theta / (\theta + \lambda_i)$.

Whereas in the Poisson model, $\text{Var}[y_i|\lambda_i] = E[y_i|\lambda_i]$, in the negative binomial model, it is given as (3) to account for overdispersion.

$$\text{Var}[y_i|\lambda_i] = E[y_i|\lambda_i] + \alpha\, E[y_i|\lambda_i] > E[y_i|\lambda_i] \quad (3)$$

To compute an initial estimate of the overdispersion parameter, α, we compute the OLS slope in an artificial regression based on the relationship between the Poisson and negative binomial models as (4).

$$[(y_i - \lambda_i)^2 / \lambda_i - 1] = \alpha\lambda_i + w_i. \quad (4)$$

The negative binomial model, as a modification of the Poisson model, has a mean μ_i, respecified so that

$$\log \mu_i = \log\lambda_i + \varepsilon_i = \boldsymbol{\beta}'\mathbf{x}_i + \varepsilon_i, \quad (5)$$

where $\exp(\varepsilon_i)$ has a gamma distribution with mean 1.0 and variance α.The resulting conditional probability distribution is

$$\text{Prob}(Y = y_i|\varepsilon_i,\mathbf{x}_i) = \frac{\exp[-(\exp(\varepsilon_i)\lambda_i)][\exp(\varepsilon_i)\lambda_i]^{y_i}}{y_i!}, y_i = 0,1,... \quad (6)$$

where $$f[\exp(\varepsilon_i)] = \frac{\theta^\theta}{\Gamma(\theta)} e^{-\theta\exp(\varepsilon_i)}[\exp(\varepsilon_i)]^{\theta-1}, \theta = 1/\alpha, \exp(\varepsilon_i) > 0.$$

The unconditional distribution of y_i is obtained by taking the expectation with respect to $\exp(\varepsilon_i)$ of the conditional probability. For convenience, let $\tau_i = \exp(\varepsilon_i)$. Then

$$\text{Prob}(Y = y_i|\mathbf{x}_i) = \int_0^\infty \frac{\exp[-\tau_i\lambda_i][\tau_i\lambda_i]^{y_i}}{y_i!} \frac{\theta^\theta}{\Gamma(\theta)} e^{-\theta\tau_i}\tau_i^{\theta-1} d\tau_i \quad (7)$$

This is a gamma integral that can be simplified. Collecting terms, and using results for the gamma integral, this reduces to

$$\text{Prob}(Y = y_i|\mathbf{x}_i) = \frac{\theta^\theta\lambda_i^{y_i}}{\Gamma(\theta)y_i!} \frac{\Gamma(y_i+\theta)}{(\lambda_i+\theta)^{y_i+\theta}} \quad (8)$$

We can reparameterise the probability distribution in terms of θ to simplify the formulation and computation of the log likelihood and its derivatives, given in (9).

$$\text{Prob}(Y = y_i|\mathbf{x}_i) = \frac{\Gamma(\theta+y_i)}{\Gamma(\theta)\Gamma(y_i+1)} u_i^\theta(1-u_i)^{y_i} \quad (9)$$

where $u_i = \theta / (\theta + \lambda_i)$
and $\theta = 1/\alpha$.

Model Estimates

Table 5 summarises the estimated NegBin models for each mode, noting that we have aggregated regular bicycle, e-bike and e-scooter because of a relatively low usage, which were separate in data collection – see Table 4. The average number of weekly one-way trips is 18.243 (or 2.61 daily one-way trips), with car driver being the dominant mode at 9.724 weekly one-way trips (Table 4). Walking is the next highest door-to-door trip at an average of 3.185, with public transport at 2.537 trips. The active and micro-mobility modes average 0.97 one-way weekly trips, which suggests that such modal activity is present, especially for recreational trips and shopping for walking and regular bike, but a much more even spread across trip purposes for e-mobility modes. However, we need to see what types of WoC

influences have contributed to this growth. The continuing challenge is to increase PT trips while reducing car-related trips, and encourage active modes, particularly to those who currently use their car.

Table 5 shows that, as expected, the influence of each WoC varies significantly between the modal frequency models, with some WoC attributes being excluded on grounds of not being statistically significant at an 80% confidence level in any of the models. Importantly it must be recognised that even where a particular modal activity such as "walking and cycling more now" is associated with having a statistically significant positive influence on car driving trips, although less so than on walking and active mode usage, this simply suggests that there has been a co-modal frequency effect which is not totally due to a WoC. It could also be possible that those who have always used their car as drivers frequently (and still do) have tried to walk and cycle more now, although, given that we only have participants' most recent travel behaviour patterns (and not the ones before the WoC), we are not able to infer this with our dataset.

The great majority of WoC influences do not impact on all modal frequencies but there are some exceptions such as "I no longer own a car", "I am now less concerned about the environmental impact of my travel choices", "I purchased a regular bicycle", "Public campaigns or government policies", and "I walk and cycle more now", all of which influence PT, walk, active modes, with 'no longer owning a car' impacting all five modal models but with a negative sign for car driver and retaining a positive sign for car passenger.

A number of socioeconomic characteristics, together with country-specific dummy variables are included in the models to control for any contextual influences. Gender, age, occupation, household composition, whether in the workforce or not, whether living in a major metropolitan area or not, and the number of cars, bikes and e-mobility modes in the household, all have varying statistically significant influences on the frequency of trips by each mode.

The overall fit of each model on the McFadden pseudo-R^2 is within the commonly observed range (0.2-0.4) with the exception of the active mode model, which is 0.067, despite many statistically significant influences which is what is the main focus of the paper. The dispersion parameter α is >0 and statistically significant in all five modal frequency models, indicating overdispersion and hence using the NegBin model in contrast to the Poisson model is justified since the mean does not equal the variance. This improves model fit and inference accuracy.

Table 4. The mode and purposes used to obtain one-way weekly trip frequencies

All Countries	**Car as Driver**	**Car as Passenger, (incl taxi)**	**Train, Tram, Bus, Ferry**	**Walk**	**Regular Bicycle**	**E-Scooter, e-Bike**
To / from work	2.36	0.183	0.751	0.475	0.113	0.047
To / from the shops	1.945	0.419	0.371	0.923	0.143	0.056
Visiting friends and relatives	1.165	0.342	0.357	0.347	0.079	0.028
Care trips: e.g., taking children to school/childcare, taking care of family members.	1.308	0.207	0.193	0.253	0.046	0.025
Personal business	1.217	0.253	0.306	0.342	0.086	0.036
Recreational activities	1.261	0.322	0.346	0.674	0.165	0.059
Education/Training for students	0.468	0.101	0.213	0.171	0.053	0.034
Total	**9.724**	**1.827**	**2.537**	**3.185**	**0.685**	**0.285**

In the next section, we present and discuss the mean direct elasticity results, which are the best behavioural response indicators of the role played by the WoC influences in the subsequent quantum of modal trip activity.

Table 5. The NegBin Models – mean parameter estimates (t-values in brackets)

WoC name and other variables	Estimates Car Driver	Estimates Car Passenger	Estimates Public Transport	Estimates Walk	Estimates Active Travel (Regular Bikes, E-bikes/E-scooter)
Constant	1.5302 (20.28)	0.6849 (9.58)	1.0463 (15.47)	1.3603 (16.73)	0.9272 (32.10)
Moved to a new area (0,1)	0.0907 (2.63)	0.1776 (4.95)	0.1268 (3.65)		
Upsized to a larger home (0,1)	-0.0953 (-2.01)	0.0961 (1.91)			0.0827 (2.67)
Downsized to a smaller home (0,1)			0.1827 (3.98)	0.1158 (2.18)	
Household size increased (0,1)		0.1684 (3.53)			
Household size decreased (0,1)	0.0890 (1.89)	0.1542 (3.23)			
My financial situation improved (0,1)	0.1562 (3.73)			-0.0701 (-1.58)	0.0766 (2.98)
My financial situation became tighter (0,1)	0.1007 (2.96)				
I started using click-and-collect more often (0,1)	0.1744 (2.80)				
I acquired a dog (0,1)			-0.1521 (-2.32)		
I no longer have a dog (0,1)	0.1111 (1.87)				
I increased online shopping to reduce personal travel (0,1)		0.1338 (3.44)	-0.0798 (-1.92)		-0.0611 (-1.89)
I changed marital status (0,1)		0.1065 (1.85)			
I started or increased caregiving responsibilities (0,1)		0.1601 (2.75)		0.2286 (3.45)	
My health improved (0,1)		0.0717 (1.95)		0.1636 (4.61)	
I had health concerns that affected my travel (0,1)		0.1426 (3.19)			
I have adjusted my lifestyle to prioritise saving money (0,1)		0.1023 (2.91)			
I have reduced online shopping spending (0,1)		0.1130 (2.68)			
My partner changed jobs (0,1)		0.3169 (3.17)			
I started walking/exercising more for health reasons (0,1)			0.0725 (2.23)	0.1430 (4.13)	-0.0539 (-2.16)
I now rely more on home delivery (0,1)				-0.2108 (-3.02)	
I was temporarily not working (0,1)				0.1632 (2.01)	
My partner moved to more flexible working hours (0,1)				-0.2704 (-1.27)	
My partner retired (0,1)					0.1298 (2.36)
I was not in the workforce during this period (0,1)	-0.1336 (-3.69)	0.1196 (3.45)	-0.1065 (-3.00)	-0.0897 (-2.24)	
I was looking for a job during this period (0,1)	-0.0804 (-2.05)	0.0752 (1.93)		-0.1492 (-3.44)	
I changed jobs but stayed in the same residential area (0,1)	-0.0776 (-1.90)	0.1416 (3.32)	0.1360 (3.68)		-0.0383 (-1.49)
Free parking (0,1)	0.1712 (3.88)	-0.2166 (-4.57)	-0.3521 (-7.59)	-0.1598 (-3.53)	
Free on-site health & wellness facilities (0,1)	0.1120 (1.79)				
Charging facilities for electric cars (0,1)		0.2566 (3.89)			
Perks for using public transport, carpooling, cycling, or e-scooters (0,1)		0.2117 (3.25)		0.1759 (2.74)	

I recently had to work in the main office/work location more (0,1)				0.0657 (1.50)	0.0625 (2.20)
Showers for walking/cycling commuters (0,1)				-0.1620 (-2.40)	
Free on-site health & wellness facilities (0,1)					0.0904 (2.42)
Bought a car (previously did not own one) (0,1)	0.1993 (3.86)		-0.1122 (-2.11)		0.0753 (2.31)
Replaced a petrol/diesel car with an electric (hybrid or fully electric) car (0,1)	0.1750 (3.03)	0.1000 (1.79)		-0.1644 (-2.81)	
Replaced a petrol/diesel car with a more fuel-efficient petrol/diesel car (0,1)	0.1538 (2.97)	-0.1683 (-2.77)		-0.1458 (-2.27)	
Replaced a petrol/diesel car with a less fuel-efficient petrol/diesel car (0,1)	-0.1256 (-1.79)		0.1210 (1.95)		0.1649 (3.44)
Reduced car use due to high costs (0,1)	0.1520 (3.33)				
I no longer own a car (0,1)	-0.9187 (-16.9)	0.2998 (6.32)	0.4134 (8.09)	0.1902 (3.26)	0.1939 (5.75)
Purchased a regular bicycle (0,1)	-0.0856 (-1.60)		0.0991 (2.03)	0.0890 (1.57)	0.4181 (13.27)
Improved accessibility of public transport in my area (0,1)	-0.1024 (-2.31)		0.4156 (9.74)	0.1830 (3.59)	
Improved public transport routes saved me travel time (0,1)	-0.1205 (-2.59)		0.2908 (6.20)		
I started using public transport more for commuting (0,1)	-0.1100 (-2.15)	0.3251 (5.70)	0.6273 (11.58)	0.1591 (2.59)	
I walk or cycle more (0,1)	-0.1160 (-2.89)		0.0915 (2.26)	0.4680 (10.72)	0.2180 (8.44)
I take children to/from daycare or school on the way to/from work/home (0,1)	0.3965 (6.11)	-0.1155 (-1.97)	-0.1439 (-2.14)	-0.1628 (-2.51)	
I walk/cycle more because other household members use the car (0,1)	-0.2878 (-3.27)		0.2096 (2.31)	0.3570 (3.54)	
Public transport quality has worsened (0,1)		0.1315 (2.51)		0.2009 (3.46)	
I reduced overall car use (0,1)		-0.1513 (-3.22)			
I increased overall car use (0,1)		0.1337 (2.67)		-0.1293 (-2.03)	
I use e-bike/e-scooter more because other household members use the car (0,1)		0.2631 (1.34)			0.6450 (7.15)
Increased the number of cars in the household (0,1)				0.1018 (1.61)	
I use public transport more because other household members use the car (0,1)			0.2986 (3.99)		
We now have more cars than adults in the household (0,1)					0.3455 (6.62)
Purchased an e-scooter (0,1)					0.5858 (17.91)
I increased my use of e-bikes or e-scooters (0,1)					0.7489 (8.23)
Family influence my travel decisions (0,1)	0.1161 (3.74)	0.1201 (3.97)			
I am now more conscious of the environmental impact of my travel choices (0,1)			0.0500 (1.71)	0.0615 (1.87)	
I am now less concerned about the environmental impact of my travel choices (0,1)		-0.1444 (-3.13)	-0.1306 (-2.97)	-0.0766 (-1.63)	-0.0755 (-2.31)
Public campaigns or government policies (0,1)		0.1392 (2.25)	0.1660 (3.80)	0.1142 (2.07)	0.1114 (3.60)
I tend to use car over public transport on wet days (0,1)	0.1776 (4.90)				
I tend to use car over active travel on wet days (0,1)	0.1668 (3.98)		-0.1704 (-3.69)		
Age	0.0054 (5.39)	-0.0043 (-4.40)	-0.0066 (-6.81)	-0.0029 (-2.52)	
Female (0,1)	-0.1180 (-4.33)	0.3166 (11.11)	-0.0787 (-2.88)	-0.0972 (-3.38)	

Capital city (0,1)	-0.1352 (-2.27)		0.3652 (5.95)	0.0725 (1.25)	
Student (0,1)		-0.1369 (-1.73)	0.4286 (6.08)	0.1551 (1.75)	
Doing paid work (0,1)	0.4043 (11.96)			-0.2052 (-4.61)	
Retired (0,1)				-0.1729 (-3.27)	
Family household (0,1)	0.1220 (3.50)	0.3090 (8.22)		-0.0993 (-2.30)	
Couple family with no children (0,1)		0.2830 (7.35)		-0.1165 (-3.13)	
Couple family with children (0,1)	0.2154 (6.09)	0.2760 (6.60)		-0.0848 (-1.93)	
One parent family (0,1)	0.2029 (3.45)				
Manager (0,1)			0.2391 (6.42)		
Professional (0,1)		-0.0806 (-1.96)	0.2553 (6.59)	0.1467 (3.44)	
Community and personal services (0,1)		-0.2195 (-3.01)			
Clerical (0,1)		-0.0317 (-0.70)	0.3024 (6.91)	0.2193 (4.53)	
Sales (0,1)		-0.1701 (-2.60)			
Labourer (0,1)		-0.2432 (-3.31)			
Personal income		-0.0018 (-3.16)			
Number of petrol/diesel car(s)	0.2117 (14.98)		-0.2207 (-14.56)	-0.1745 (-14.8)	-0.0961 (-8.44)
Number of electric car(s)				0.0909 (6.97)	
Number of hybrid car(s)	0.1192 (4.26)	0.0829 (3.17)	-0.0500 (-1.82)		
Number of push bike(s)	0.0247 (1.89)			0.0676 (4.97)	0.1160 (13.93)
Number of e-bike(s)	-0.0677 (-2.46)	0.1027 (3.71)	0.1266 (4.86)	-0.0640 (-2.16)	0.1697 (13.48)
Number of e-scooter(s)		0.0787 (2.58)	0.1071 (3.33)		
Australia (0,1)	0.0326 (0.59)	0.0488 (0.88)	0.1210 (1.97)	0.3688 (6.35)	
Finland (0,1)	-0.2398 (-4.77)	-0.3518 (-6.53)	0.2215 (4.54)	0.4129 (7.98)	
New Zealand (0,1)	0.0110 (0.20)	-0.1466 (-3.13)	0.1421 (2.63)	0.3818 (7.39)	
Singapore (0,1)	-0.9064 (-20.39)	-0.0253 (-0.54)	1.1343 (23.59)	0.5208 (9.58)	
Sweden (0,1)	-0.4082 (-8.29)	-0.2069 (-4.09)	0.5029 (10.87)	0.5409 (10.31)	
UK (0,1)	-0.3151 (-6.43)	-0.0739 (-1.26)	0.3900 (7.65)	0.6788 (13.02)	
Dispersion parameter for count model					
alpha	0.5725 (33.31)	0.5488 (21.49)	0.4906 (22.68)	0.6722 (24.33)	0.1785 (19.73)
Model Statistics for Negative Binomial Regression					
Log-Likelihood	-13,162.57	-8,560.94	-8,731.95	-9,933.92	-7,978.24
McFadden Pseudo-Rho squared	0.3375	0.1902	0.2033	0.2705	0.0670
AIC	26,419.1	17,227.9	17,547.9	19,971.8	16,004.5
AIC/N	6.463	4.214	4.293	4.885	3.915
Number of observations	4,088	4,088	4,088	4,088	4,088

Identifying Behavioural Responses to Sustainable Mode Trips through Elasticity Response

The mean direct elasticities summarised in Figures 2 to 4 (and Tables in Appendix B) refer to the relationship between the percentage change in an explanatory variable and the percentage change in the number of one-way weekly trips for each of the three classes of sustainable door-to door main modal activity, namely public transport, walking and active modes (regular bike, e-bike and e-scooter) as well as car as driver and car as passenger. The majority of the variables are binary variables, and hence an arc elasticity formulation is appropriate. To interpret the arc elasticity effects, given the formula (exp(β)-exp(0))/(0.5*(exp(β)+exp(0)), taking the WoC influence 'upsized to a larger home' and the car driver trip model (Figure 5) as an example, the mean direct elasticity is -0.0952. Given the average number of trips is 9.724, in going from 0 to 1 (as a dummy variable), we get a reduction of weekly car driver trips of 9.724*0.0952=0.93 trips, close to 1 trip per week. That is, if an individual moves to a larger home, he/she does, on average, 9.56% fewer trips (0.93/9.724) as car driver.

Sustainable Transport Modes

Except for age related to public transport use and number of regular bikes and hybrid cars related to active travel use, the variables are dummy variables and, hence, an arc elasticity formula is applied to all but these two variables. These results provide the richest behavioural response evidence on how windows of change (WoC) prior to 2023 have influenced travel habits and trip frequency changes in travel behaviour from 2023 to today (June 2025).

Figure 2 shows that ten WoC influences have had a negative influence on growth in public transport (PT) use; and 19 WoC influences have had a positive impact on the growth in PT trips. Results show that the USA (which was the base in the models) has the lowest use of PT, in Australia they do 12.1% more PT weekly trips than the USA, in New Zealand 14.2% more, in Finland 22.1% more, in the UK 38.5% more, in Sweden 49.3% more and, in Singapore, 102.7% more (all relative to the USA). Looking at the WoC influences, the greatest negative impact on the growth in PT is free parking by employers (if free parking is offered, there is a 34.9% reduction in PT use). As expected, the changing car-related circumstance represented by an increase in the number of household petrol/diesel cars (elasticity of -0.246), suggesting that a household that has one petrol/diesel car relative to one that has none, makes 24.6% fewer PT trips. Other influential car-related circumstances refer to: purchasing a car when previously a person did not own a car (11.2% fewer PT trips), and a relatively inelastic one is the number of hybrid cars in the household at the beginning of 2023 (going from did not have to have one would reduce number of PT trips by 0.7%).

The higher use of car on wet days implies a 17% reduction in PT trips, as does acquiring a dog (15.2% reduction), and increase in online shopping (8% reduction), and a lesser concern about the environmental impact of travel choices (13% reduction). Older individuals and females are less likely to exhibit more PT trips. The continuing popularity of the car remains a barrier to growing PT use which is not new but reinforced by our study, although we now have online shopping, acquiring a dog and not interested in environmental consequence of travel choices as strong challenging negative influences in growing sustainable PT trips.

On the positive side, we see a number of mode-related influences aiding the growth in PT travel, with improved accessibility of PT in the local area (41% more PT trips), no longer owning a car (40.8% more), improved PT routes that save travel time (28.9% more), and replacing a petrol/diesel car with a less fuel efficient one (12.1% more). Although the evidence strongly supports investment in PT (better access and frequency of services, which is something a transport authority can influence), its combination with a person no longer owning a car are significant windows of change influences on PT

trip growth. Capital city residents, compared to other locations, clearly have a greater use of PT simply because services are better, as indeed we see various occupations (manager, professional, clerical) and students showing strong positive support for using PT compared to other individuals. Moving to a new area has a positive influence on PT use (12.7% more PT trips), and we also note that changing jobs while staying in the same residential location (13.6% more PT trips) and downsized to a smaller home (18.2% more PT trips) tend to support greater PT use. This suggests that residential and workplace location decisions are really important influences on PT use and hence there should be a greater focus on understanding these choices through location choice models built into strategic transport models. There is a small positive behavioural response associated with greater consciousness related to environmental concerns associated with travel choices, but the 0.050 impact is much smaller than the negative impact of being less concerned about the environment (-0.130). This is not surprising given that the car remains a dominant modal choice, and environmental consciousness seems to play a more relevant role in mobility decisions for people who are less conscious (moving away from PT) than those who are (moving towards PT). The strong positive behavioural response associated with starting to use PT more for commuting since the generally accepted end of COVID-19, might be explained by a return to PT, given the decline in PT use during COVID-19 compared to driving a car. Finally, and encouragingly, we see that communication campaigns do have a positive influence on using PT (16.6% more PT trips).

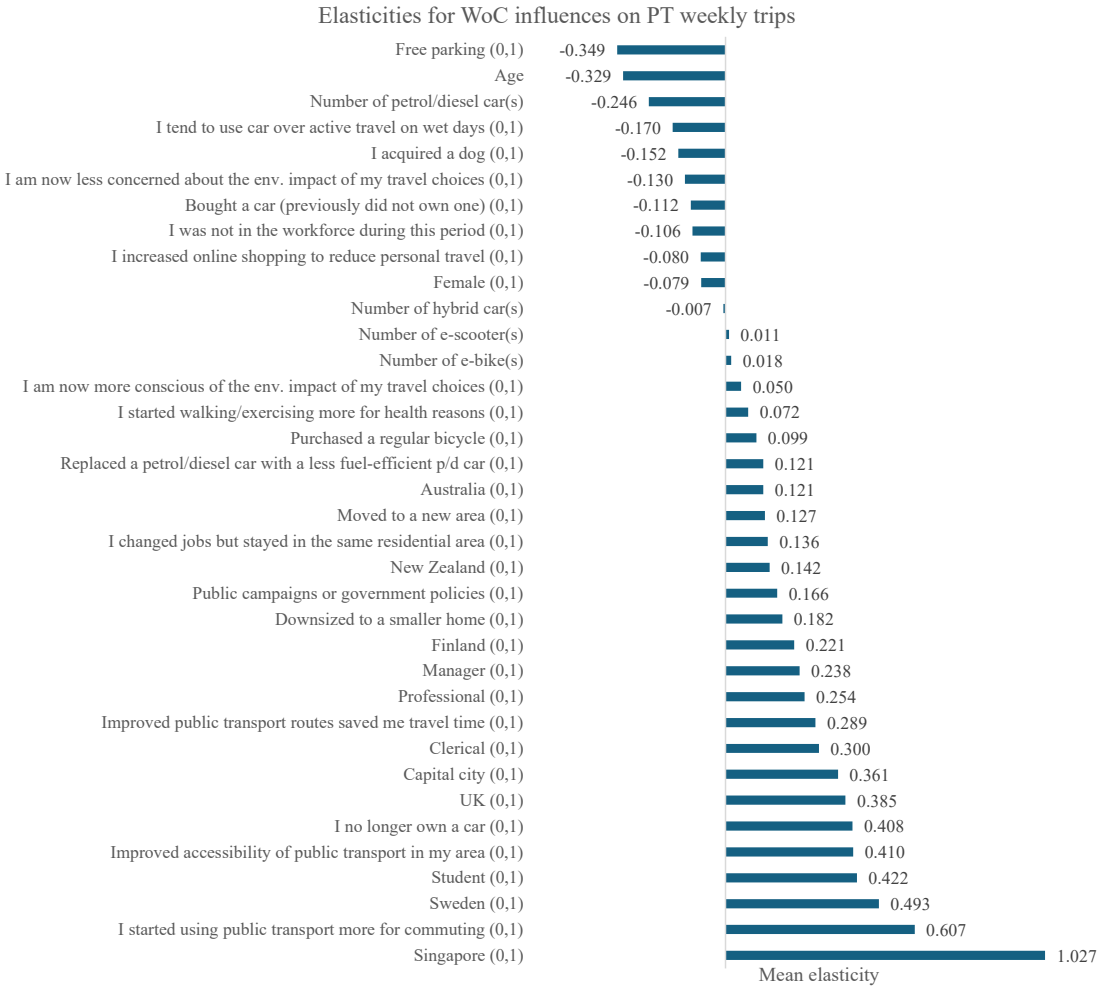

Figure 2. Mean direct and arc elasticities sorted in magnitude for PT frequency trip model

Turning to door-to door walk trips (Figure 3), the most significant positive behavioural response associated with increased walking trips, after controlling for country and a number of socioeconomic characteristics such as occupation and residence being a capital city, is "walking more because other household members use the car" (35.3% more walking trips). This is followed by "starting or increasing caregiving responsibilities" (22.8% more walking trips), presumably occurring locally where walking

is feasible, and maybe support to household members in getting them out and about locally. Downsizing to a smaller home (11.6% more walking trips) is often a switch from a house to an apartment, which feels more confined and could encourage individuals to walk more in open spaces, and also this change could release time for increased walking, possibly linked to no more garden and pool, and greater housekeeping and maintenance to have to contend with. It is also relevant to note that when looking at residential changes, people tend to do more walking and PT trips (as discussed above), which are encouraging results as they might be suggesting that, all else remaining equal, people might prioritise more sustainable travel patterns when deciding their residence location.

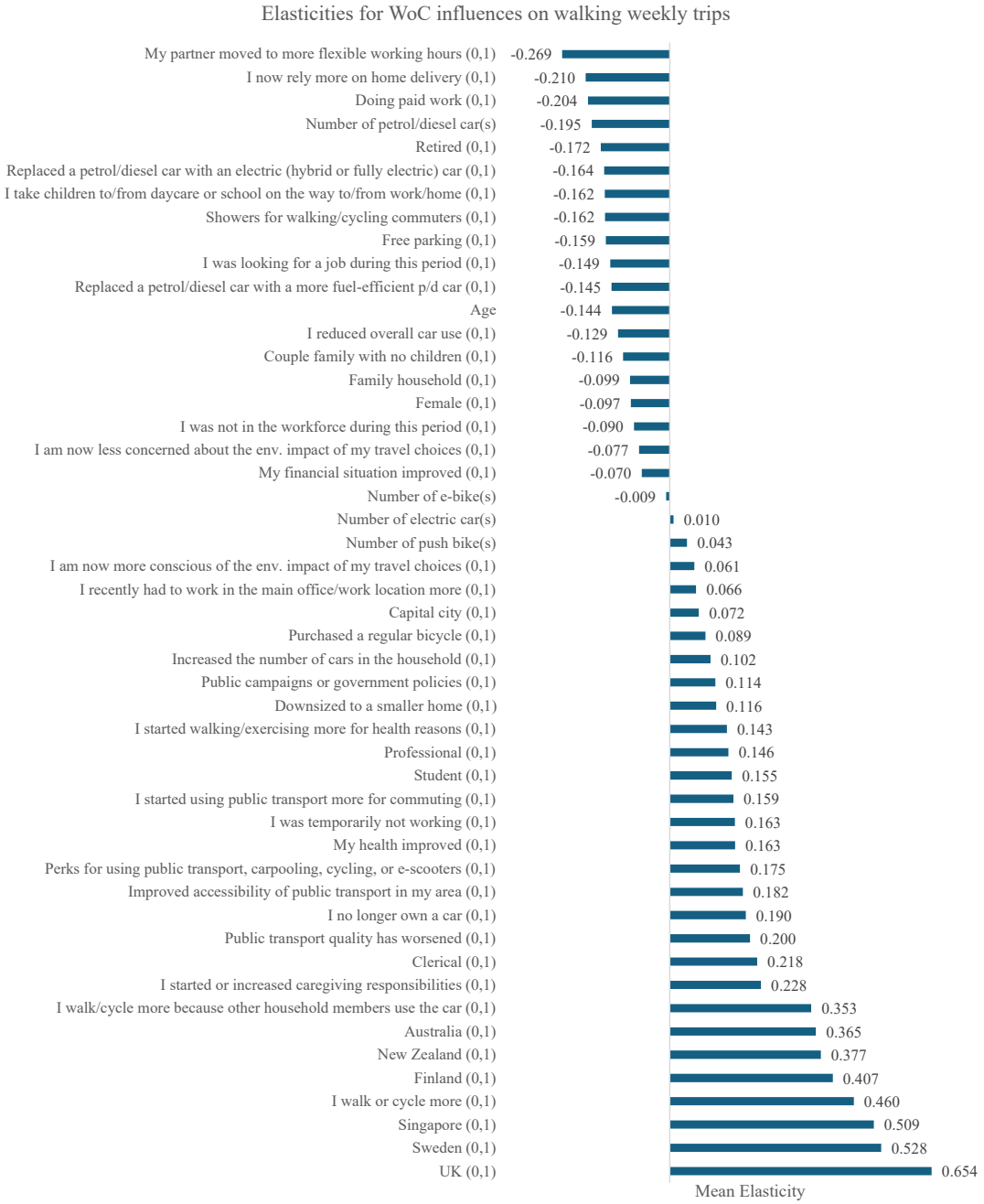

Figure 3. Mean direct and arc elasticities sorted in magnitude for walk mode frequency trip model

The changing nature of PT is of interest with worsening quality of PT for some individuals claiming that the worsening of PT quality (20% more) has resulted in increased walking trips; however, at the same time improved accessibility of PT in the local area (18.2%) and started using PT more for commuting (15.9%) has resulted in increased walking trips. On close inspection, we conclude that there

seems to be an opportunity offered up for more time to undertake walking trips because my travel by PT opens up more time to do such modal activity, even if the quality of PT has worsened; that is, a better network has not delivered better-quality PT, even if accessibility is improved. On the negative side, we see changing work status having a strong effect on reduced walking activity (I retired, 17.2% fewer walking trips). The car impact is reflected in free parking at work (15.9% fewer walking trips), taking children to/from day care or school on the way to or from work (16.2% fewer walking trips), and replacing a petrol/diesel car with a more fuel-efficient petrol/diesel car (16.4% fewer walking trips). We see that reduced car use, all else remaining equal, is associated with reduced walking trips (by 12.9%), suggesting some overall amount of trip reduction. It is important to assess the modal impacts across all modes as well as within each mode's trip frequency model, since this gives us additional clues on why particular behaviour responses associated with a mode occur.

In Figure 4, the active mode classification includes door-to-door trips by a regular bike, an e-bike, or an e-scooter. Purchasing a regular bike or e-scooter has a strong behavioural response in support of increased active mode trips (with the overall number of e-bikes and regular bikes in a household having a positive effect on active modal activity), as expected; but of interest are also no longer owning a car (19.3% more active travel trips), a partner retiring (13.0%), effective public campaigns or government policies (11.1%), and free on-site health and wellness facilities at work (9.0%) that all contribute positively to increase active travel. On the downside, the main influence on reduced active travel is the number of petrol/diesel cars in the household (where a house with one car relative to one with none does 10.7% fewer active travel trips). Other influences, such as less concern about the environmental impact of travel (7.6% fewer), increased online shopping (6.1% fewer), increased preference to walk for health reasons (5.4% fewer) and job location changes (3.8% fewer) all had negative impacts on active mode trips activity. Interestingly, participants who had to work in the main office/work location more often, did 6.3% more active travel trips, and 6.6% more walking trips (Figure 2), while it was not statistically significant in the other modal models.

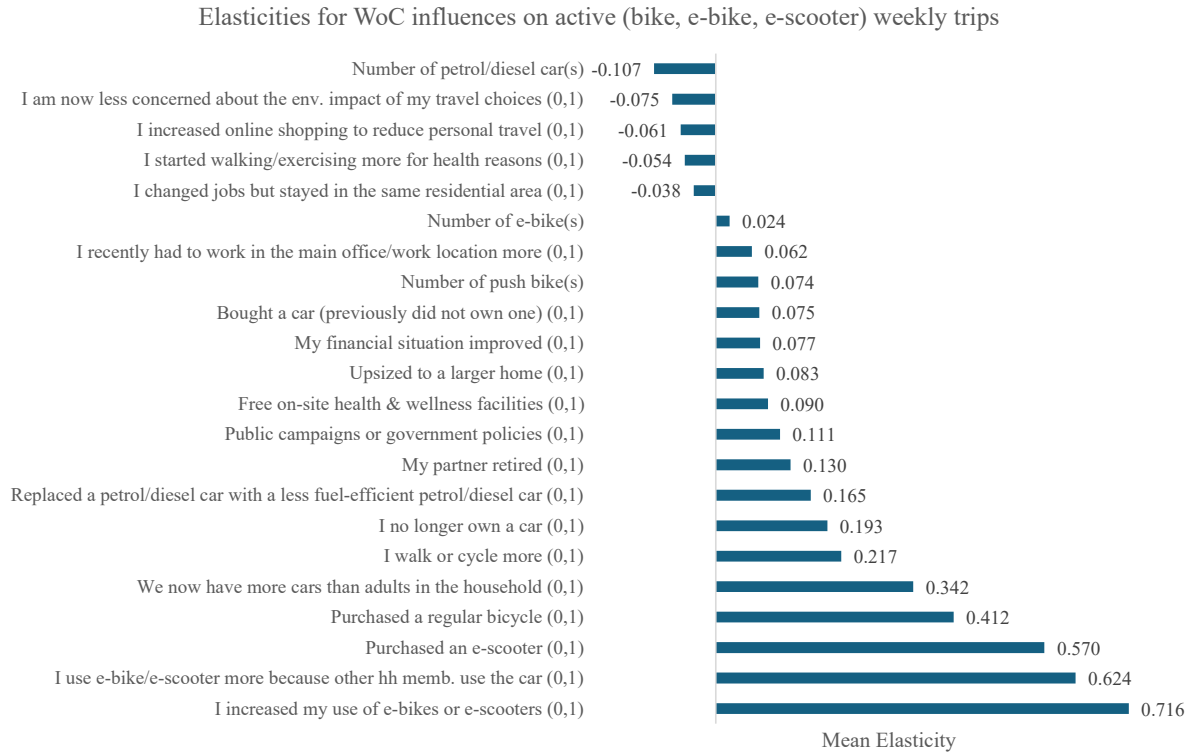

Figure 4. Mean direct and arc elasticities sorted in magnitude for active mode frequency trip model

Car driver and passenger Transport Modes

There are 28 statistically significant WoC influences on the number of car driver weekly one-way trips of which 12 have a negative impact on car driver trip making (Figure 5). The greatest elasticity response is due to 'I no longer own a car' (85.9% fewer car trips) which is expected followed by "I walk/cycle more because other household members use the car" (28.6% fewer car trips). Improved PT routes saved travel time had a negative impact on car use (12.0% fewer car trips) as well as improved accessibility to PT in the local area (10.2% fewer car trips). Positive elasticity impacts that are against the sustainable mobility agenda include "buying a car for the first time" (19.9% more car trips), replaces an ICE car with an electric car (17.5% more car trips), "free parking" provided by an employer (17.1% more car trips), and "I started using click and collect more often for online shopping" (17.4% more car trips). "Doing paid work for the first time" and "taking children to day care and way to work and collecting them on the way home" both exhibit a high level of relative elasticity (39.1% and 39.9% respectively). Notably, having care responsibilities associated with children positively affects car use, while negatively affects both public transport and walking trips. This suggests that when individuals travel with children - trips that are predominantly undertaken by women (Jara-Díaz and Tirachini, 2013; Havet et al., 2021) - their mobility needs are not adequately supported by these modes, often leading to increased reliance on private vehicles. These findings underscore a critical opportunity for transport authorities to address the specific needs of caregivers and promote more inclusive and accessible transport options.

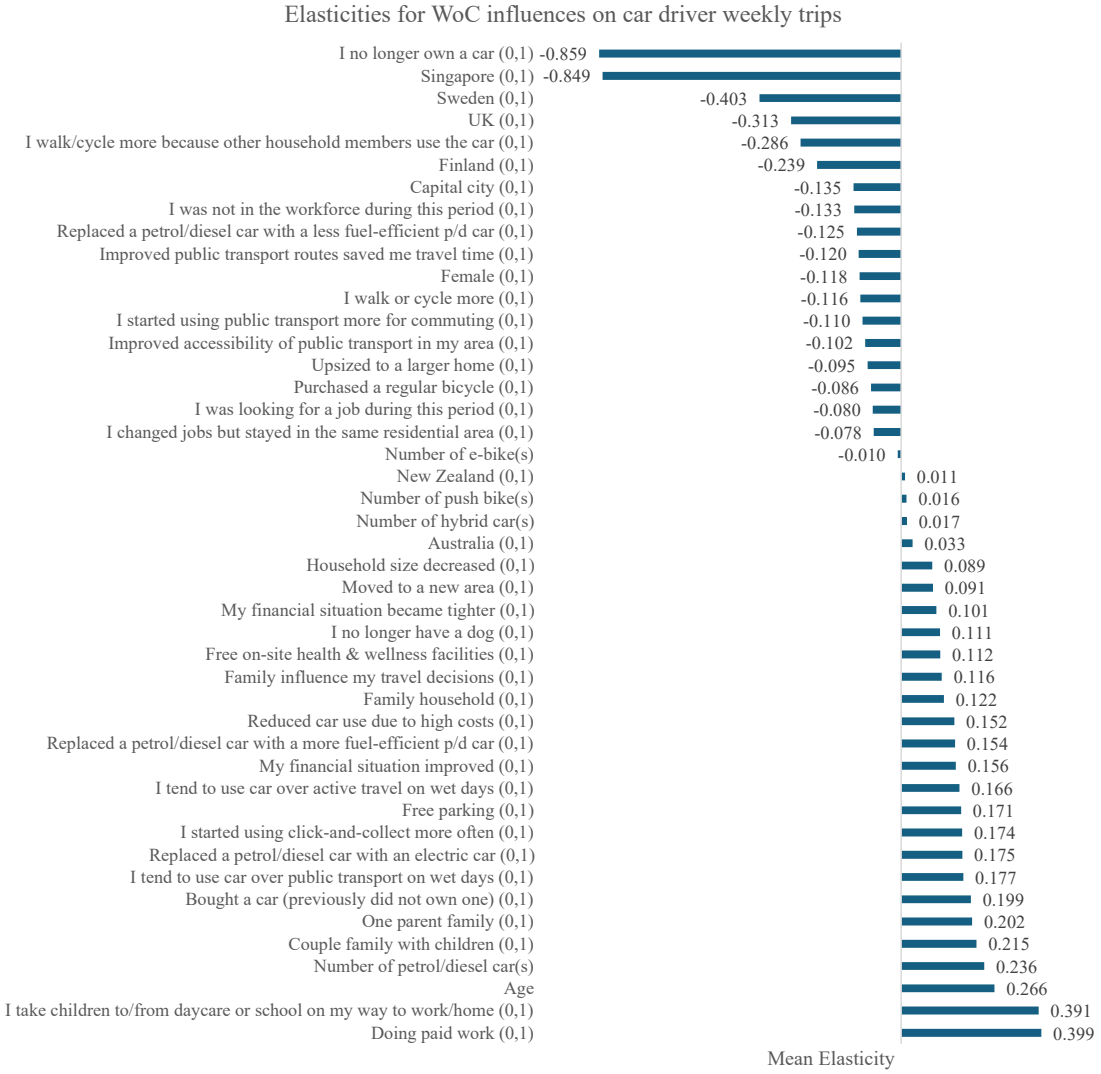

Figure 5. Mean direct and arc elasticities sorted in magnitude for car driver mode frequency trip model

For car passenger trip activity, there were 26 statistically significant WoC influences, of which only five had a negative impact on car passenger trip frequency (Figure 6). There are far more socioeconomic context influences compared to the other modes, which is of interest in itself, suggesting that socio context plays a very powerful role in trip modal activity related to being a car passenger, with age (-0.213) and gender (+0.314) having the greatest relative elasticity responses. For the role of the WoCs, free parking had the greater negative behavioural response (presumably encouraging driving instead), with 'no longer owning a car' (29.8% more car pax trips) and switching to PT for some commuting trips (32.2% more car pax trips), the latter linked in part to what appears to be a new mix of car passenger and PT trips compared to fewer car driver trips. The increase in car passenger trips also appears to be aligned with perks associated with car-pooling (21.1% more), worsening quality of PT (13.1% more), and greater use of active modes because regular car in household was used by others (26.2%), although in the last WoC influence we can surmise that there is a correlation between reduced car use as driver and switch to car passenger and active modal trips.

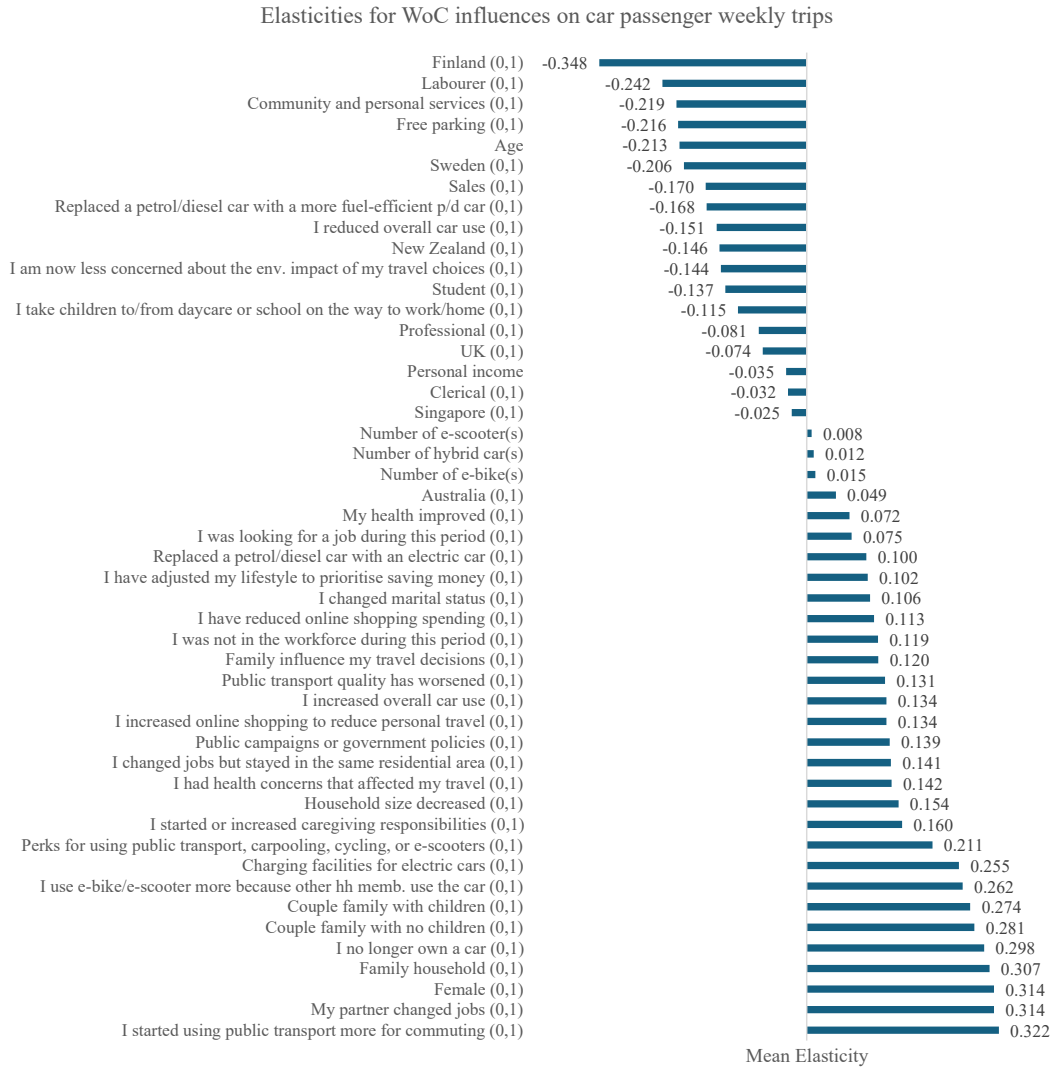

Figure 6. Mean direct and arc elasticities sorted in magnitude for car passenger mode frequency trip model

Making sense of the evidence to promote actional policy initiatives

We have identified a rich array of windows of change influences that have translated into impacts on the frequency of weekly one-way trips by each of the available modes. Despite many such influences being statistically significant, it is unlikely that all WoCs offer evidence to prescribe an action plan that can achieve growth in sustainable mobility outcomes. For example, change in marital status, residential and workplace changes, clearly influence modal activity change, but we are unable to manipulate these influences to achieve sustainability-aligned mobility impacts. This is despite the recognition in the broader literature reviewed that specific lifecycle events and stages had unique impacts within predefined segments, emphasising the need for tailored, targeted policy interventions based on segment characteristics and lifecycle contexts. The challenge now is to distil from the 71 WoC influences, which ones can be used to promote actionable change, given their association with each of the mode trip frequency models. This study identifies parenthood as a key life stage during which individuals tend to shift away from more sustainable transport modes—such as public transport and walking—towards increased car use. These caregiving trips, which are predominantly undertaken by women and often involve trip chaining, present distinct mobility needs that are not currently well supported. Addressing these needs represents a critical area of action for transport authorities seeking to promote equitable and sustainable mobility.

We have identified 25 WoC influences out of the 71 considered, shown in Table 6, that were found to have a statistically significant influence on changes in travel behaviour, and which we suggest are actionable change initiatives (ACIs), some of which have resulted in changes aligned with improved sustainable mobility, and some having the opposite effect. Table 6 includes the mean direct and arc elasticities; however, it must be noted that the absolute change in the average number of one-way weekly trips will also be dependent on the average number of mode-specific trips as given in Table 4. For example, while the ACI associated with an increased use of an e-bike or e-scooter, shows a weekly average of 0.285 trips, this translates into a small increase of 0.20 active mode trips per week. Employer-provided free parking results in an increased number of car driver weekly trips of 1.66 weekly trips. Analysts and policy advisers can use columns 3-7 of Table 6 (using trip activity in Table 4) to identify what ACIs can have the greatest desired impact in delivering on a sustainable mobility agenda. We have highlighted 20 behavioural responses that, when enacted, change weekly one-way trips by more than an average of 0.6. The greatest trip frequency response is associated with increases in car driving, with the switch from an ICE to an electric car having the greatest significant impact (averaging 1.7 extra weekly car driving trips). This should be a concern for increased traffic congestion, even where emissions at the tailpipe are reduced, and hence, it is a questionable sustainable mobility ACI.

Online shopping tends on balance to increase car driving trips overall with some additional walking trip activity, but some trips would be replaced by light commercial delivery vehicles (and are not captured in this study), which on balance may turn out to be a negative sustainable outcome. Limiting the assessment to passenger mobility, it appears that there is an increase in car-based trips associated with click and collect. The actionable change initiative is to ensure that the growth in car use compared to light vehicle growth is, on balance, a desirable outcome in terms of emissions and congestion. We conclude that this is not known and needs close assessment.

Employers can play a strong positive role in supporting mobility activity aligned with achieving sustainability goals, and indeed, this can play well into the social licence obligation or desires of employers. Removing free parking but providing parking for electric cars and on-site health and wellbeing facilities (typically applicable to active travel, although they can have positive health effects regardless of what modes are used to commute) are ACIs that can be influenced by an employer. It may be that some employers offered free parking as a return to the office incentive post-COVID-19

restrictions. Offering perks to employees when they use PT or carpool or use active modes are obvious and desirable ACIs that also accord well with social licence objectives, as does the provision of shower facilities for those who walk and bike. This evidence suggests a greater role for non-mobility service providers (NMSPs) in supporting a remixing of modal activity for the commute in particular, within a Mobility as a Feature (MaaF) ecosystem (Hensher and Heitenan 2023), but even more generally for all modal activity of employees (see Kandanaarachchi et al. 2025, Hensher and Nelson 2025).

The challenge for government, in particular, is to offer incentives to replace less fuel-efficient ICE cars with more fuel-efficient ICEs and preferably electric cars, but the evidence suggests that this results in an increase in car use – this is an important finding. However, individuals who have replaced an ICE with a less fuel-efficient ICE car appear to moderate their car trips, presumably due to fuel costs and some concern for the environment and see some increased trips by PT. This is where a road pricing reform program can have a desirable effect. This clearly places decision making and incentives in a quandary with a focus today on electrification of cars and purchasing more fuel-efficient cars, which only serves to exacerbate traffic congestion (since an electric car is still a car), but, in its favour, there is some switch to public transport to save on car use costs.

It is encouraging to confirm yet again that improvements in PT can deliver desirable sustainable mobility outcomes and are clear ACIs. Improved network coverage to achieve greater frequency, connectivity, and visibility is a clear ACI. These are all measures that can be directly influenced by a public transport authority and operator. Some attention to service quality is also required since there is a switch out of PT into car as a passenger and walking, which may, on balance, be a positive sustainability outcome although it is not clear, hence -,+ in Table 6.

The active modes will require incentives, be they financial or non-financial, to encourage the purchase and use of regular bikes and e-modes such as e-bikes and e-scooters, although we can see a positive uptake since 2023. There are health benefits which should be promoted, especially for walking and regular bikes, and so we have some clear ACIs, although it is acknowledged that e-micromobility is associated with reduced physical activity. It is encouraging to see that additional walking and cycling trips (1.47+0.21) offsetting car driver trips -1.13

The role of communication strategies is clearly a very important ACI and one that has perhaps been neglected in the past, although the elasticity response in increasing weekly trips by non-car as driver modes is small compared to some of the other ACIs (hence a lower ranking in Table 6). Public campaigns in particular are associated with changing travel in favour of a growth in PT, walking, active modes, and car passenger travel, but having no effect at all, as far as we can find, on car driver activity. The elasticities suggest, on average, that public campaigns that impacted on a WoC increased the average number of weekly trips by 0.26 for car as passenger, 0.42 trips for public transport, 0.36 walking trips and 0.032 active modal trips.

Although work location activity is aligned with the employer, we have separated it out since it has become a successful broad-based societal policy initiative (forced on us initially by COVID-19; see Hensher et al. 2026), which has shown to have a positive outcome in terms of reduced travel, which in itself can deliver positive sustainable mobility outcomes. The model evidence suggests that “I recently had to work in the main office/work location” had a positive impact on the amount of active mode activity (and was not an influence on other modes), but that “my partner moved to more flexible working hours” resulted in a reduction of walking trips. What we cannot discern from this evidence is the impact this has had on other modal activity, despite finding no evidence that the specific WoC changed the frequency of other modal activity.

Table 6. Identified potentially actionable policy initiatives

CD=car driver, CP=car passenger, PT=public transport, WK=walk, ACT=active modes *Net impact sign: - = reduces sustainable mobility, + = increases sustainable mobility*	**Elasticity**	**Impact on # weekly one-way trips:**					**Net weekly One-way trip change**
		Car driver	**Car passenger**	**PT**	**Walk**	**Active Modes**	
Online Shopping Effects							
I started using click-and-collect more often	0.174 (CD)	**1.69**					*1.69*
I increased online shopping to reduce personal travel	0.134 (CP), -0.08 (PT), -0.061 (ACT)		0.24	-0.20		-0.06	-0.02
I now rely more on home delivery	0.210 (WK)				**0.67**		0.67
Employer-linked incentives							0.00
Free parking	0.171 (CD), -0.216 (CP), -0.349 (PT), -0.159 (WK)	**1.66**	-0.39	**-0.89**	-0.51		-0.12
Free on-site health & wellness facilities	0.090 (ACT)					0.09	0.09
Perks for using public transport, carpooling, cycling, or e-scooters	0.175 (WK)				0.56		0.56
Showers for walking/cycling commuters	-0.162 (WK)				-0.52		-0.52
Charging facilities for electric cars	0.255 (CP)		0.47				0.47
Car Related							0.00
Replaced a petrol/diesel car with an electric (hybrid or fully electric) car	0.175 (CD), 0.099 (CP), -0.164 (WK)	**1.70**	0.18		-0.52		*1.36*
Replaced a petrol/diesel car with a more fuel-efficient petrol/diesel car	0.154 (CD), -0.168 (CP), -0.145 (WK)	**1.50**	-0.31		-0.46		0.73
Replaced a petrol/diesel car with a less fuel-efficient petrol/diesel car	-0.125 (CD), 0.121 (PT), 0.165 (ACT)	**-1.22**		0.31		0.16	-0.75
Public Transport							0.00
Improved accessibility of public transport in my area	-0.102 (CD), 0.410 (PT), 0.183 (WK)	**-0.99**		**1.04**	0.58		0.63
Improved public transport routes saved me travel time	-0.120 (CD), 0.289 (PT)	**-1.17**		0.73			-0.43
I started using public transport more for commuting	-0.109 (CD), 0.322 (CP), 0.607 (PT), 0.159 (WK)	**-1.06**	0.59	**1.54**	0.51		*1.57*
Public transport quality has worsened	0.131 (CP), 0.200 (WK)		0.24		**0.64**		0.88
Active and micro-mobility modes							0.00
Purchased a regular bicycle	-0.086 (CD), 0.099 (PT), 0.089 (WK), 0.412 (ACT)	**-0.84**		0.25	0.28	0.40	0.10
I walk or cycle more	-0.116 (CD), 0.460 (WK), 0.217 (ACT)	**-1.13**			**1.47**	0.21	0.55
I use e-bike/e-scooter more because other household members use the car	0.262 (CP), 0.624 (ACT)		0.48			**0.61**	*1.08*
Purchased an e-scooter	0.570 (ACT)					0.55	0.55
I increased my use of e-bikes or e-scooters	0.716 (ACT)					**0.69**	0.69
Social and environmental promotion							0.00
I am now less concerned about the environmental impact of my travel choices	-0.144 (CP), -0.130 (PT), -0.077 (WK), -0.076 (ACT)		-0.26	-0.33	-0.25	-0.07	-0.91
Public campaigns or government policies	0.139 (CP), 0.166 (PT), 0.114 (WK), 0.111 (ACT)		0.25	0.42	0.36	0.11	*1.15*
Family influences my travel decisions	0.116 (CD), 0.120 (CP)	**1.13**	0.22				*1.35*
Flexi-time and Flexi-place work							0.00
I recently had to work in the main office/work location more	0.066 (WK), 0.063 (ACT)				0.21	0.06	0.27
My partner moved to more flexible working hours	-0.269 (WK)				**-0.86**		-0.86

Finally, the change in the total number of one-way weekly trips shown in the last column of Table 6 summarises the overall change in the number of trips, with some significant increases above the average in Table 4, notably more than 1 extra one-way trip on average per week due to starting to use click and collect more often, replacing a petrol/diesel car with an electric car, increasing use of public transport for commuting, family decisions influencing travel behaviour, the role of public campaigns or government policies, and the use of an e-bike or e-scooter because the car is being used by other family members. The evidence shows which ACIs will result in positive switching out of the car as a driver to alternative, more sustainable mobility options; however, we see not just modal substitution but growth and decline in overall weekly trips, which should also be recognised where it has positive or negative impacts on the sustainability mobility agenda. The greatest concern is one we have always known about, and that is the ownership and use of the car as a driver; however, what our research has revealed is that the switch to cleaner energy cars, including improved fuel efficiency of ICEs, exacerbates the growth of the car in undesirable ways.

Conclusions

Looking back to the recent past can offer insights on current traveller behaviour that are often not known when the focus is on collecting data on the actions today and the associated current levels of the modal attributes, and the contextual influences such as current socioeconomic characteristics of an individual and their household. Behavioural change is a dynamic concept that is typically conditioned on what people have done in the past, and how decisions in the past have determined current travel habits and behaviour.

This paper has focussed on assessing the role that 71 influences in the past, that we call windows of change, might have contributed to current travel activity as defined by the typical weekly one-way door-to-door trips for six modes and seven trip purposes. Drawing on a sample of over 4,000 individuals residing in seven countries, all English speaking (be they native English speaking or well versed in the language through school) and with similar cultural settings, we have identified the incidence of a particular WoC being stated as having an influence on subsequent travel behaviour, and when these influences are mapped into a negative binomial count model to establish a statistical significant influence on weekly modal trip frequency or not, we have been able to identify a number of past influences that we should work with as a set of future actionable change initiatives, or ACIs.

The next steps associated with strategic and policy planning in the transport sector, mainly by government, although employers have a significant role in line with their social licence objectives, are to harness the 25 WoC actions that show demonstrated evidence of making a real difference in changing travel habits in ways that can support sustainable mobility outcomes. The best positive ACIs from our research are clearly employer-incentives, public transport network improvements, and marketing and communication campaigns to educate the community on the environmental, health and wellbeing benefits of particular travel habits, and incentives (financial and non-financial) to acquire active travel modes to support walking and PT activity.

We must, however, recognise that all of these ACIs should ideally strive to discourage car use, and simply offering attractive alternatives to the convenience of car use may not achieve the desired switch to sustainable mobility. Tinkering at the margin will then remain a challenge. It is also clear from the evidence in this paper that reducing car ownership or owning no cars is the most powerful antidote in switching to other modes, and the presence of free parking at the office as well as conversion to electric cars (with charging facilities provided at the office) is a recipe likely to continue to support growth and high modal share for car travel, especially as a driver. There are, however, car-related initiatives that can partly compensate for this car growth, and they relate to perks offered by an employer for carpooling; but without a serious effort to re-price the use of the car, it is not likely that we will move

the dial on mode share towards greater sustainable mobility. This is a not a new finding, but it needs to be said, since despite the great majority of politicians being opposed to road pricing reform, re-pricing can reduce traffic congestion, emissions, and if priced fairly, can benefit both users and treasuries (Hensher and Mulley 2014, Hensher and Bliemer 2014, Yang et al. 2016).

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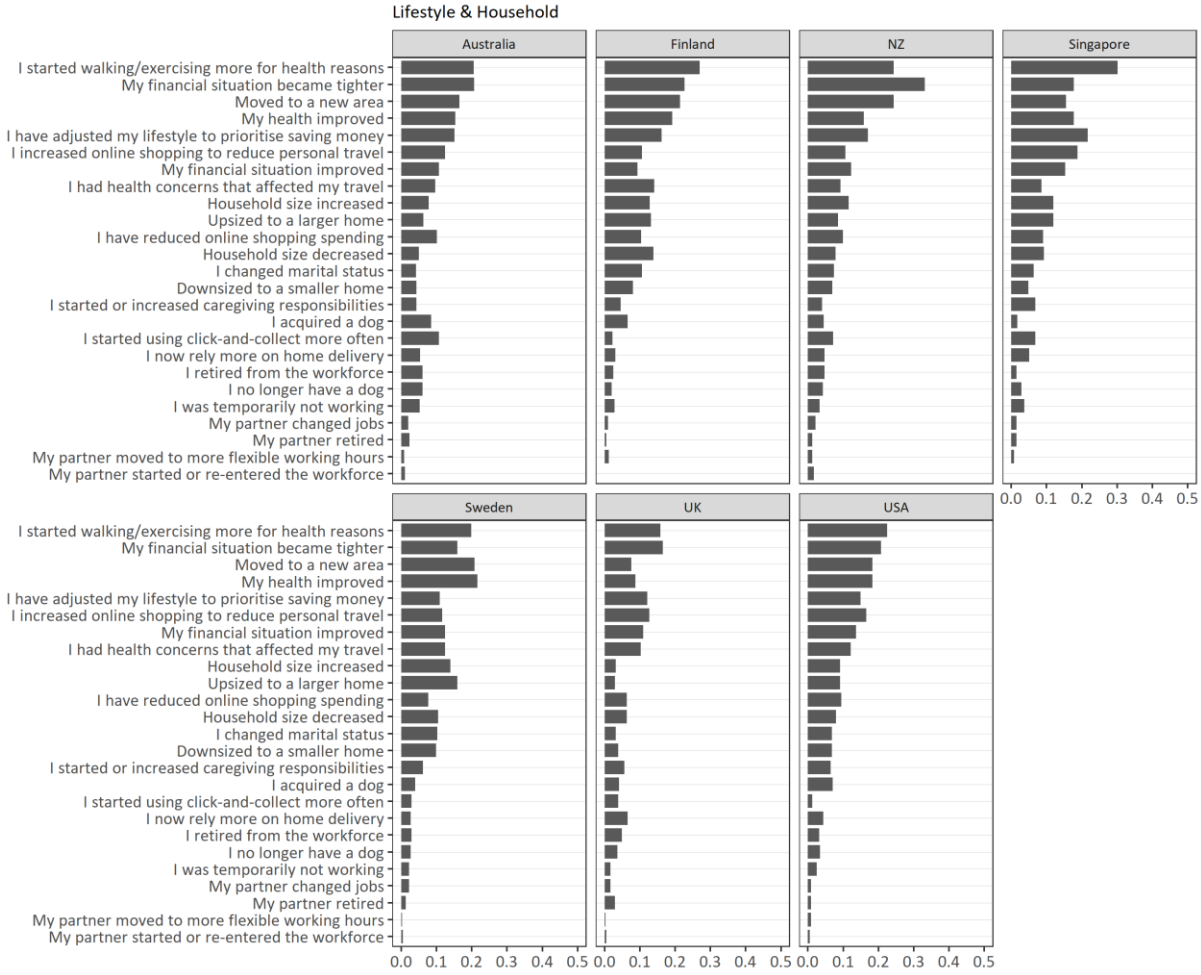
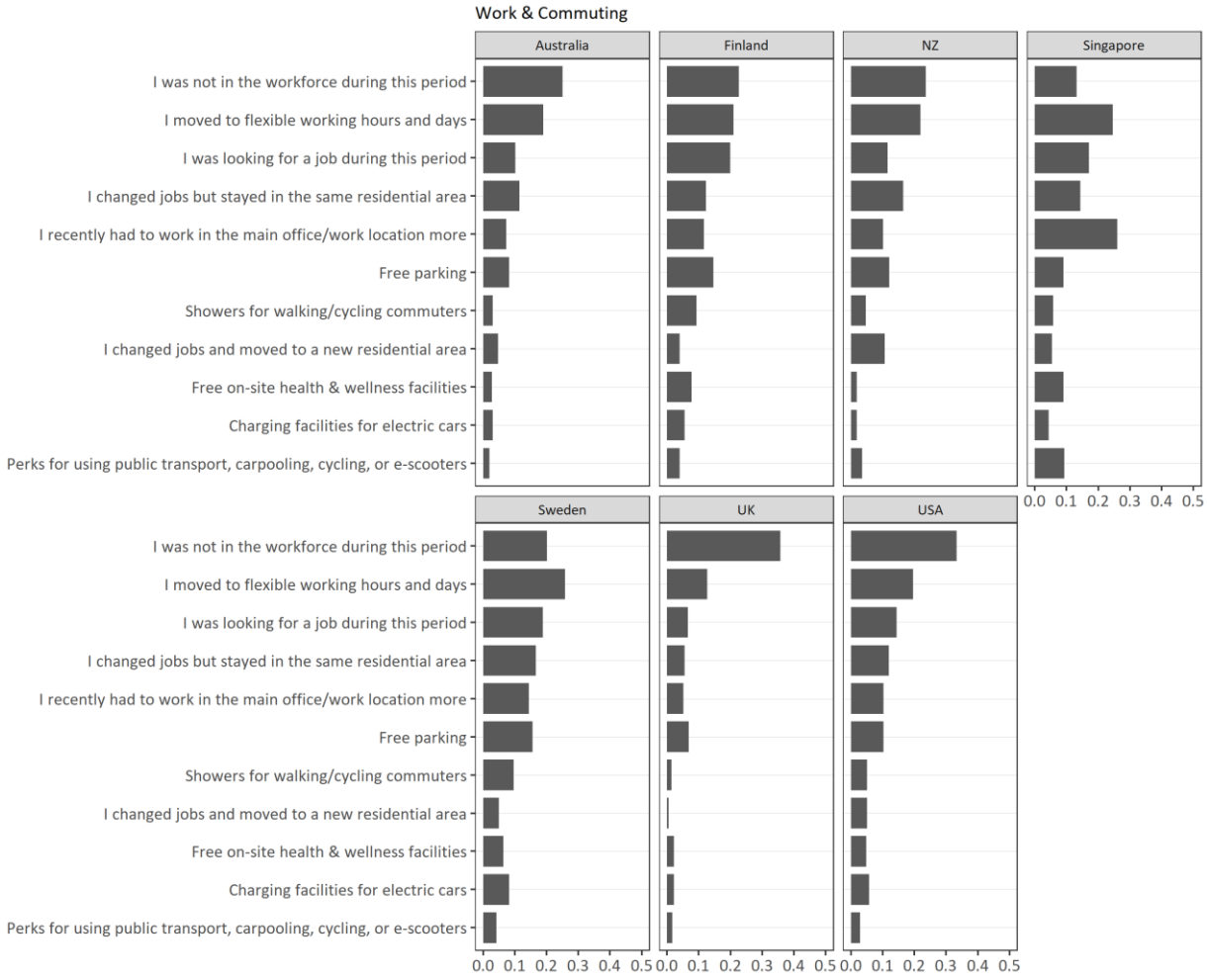
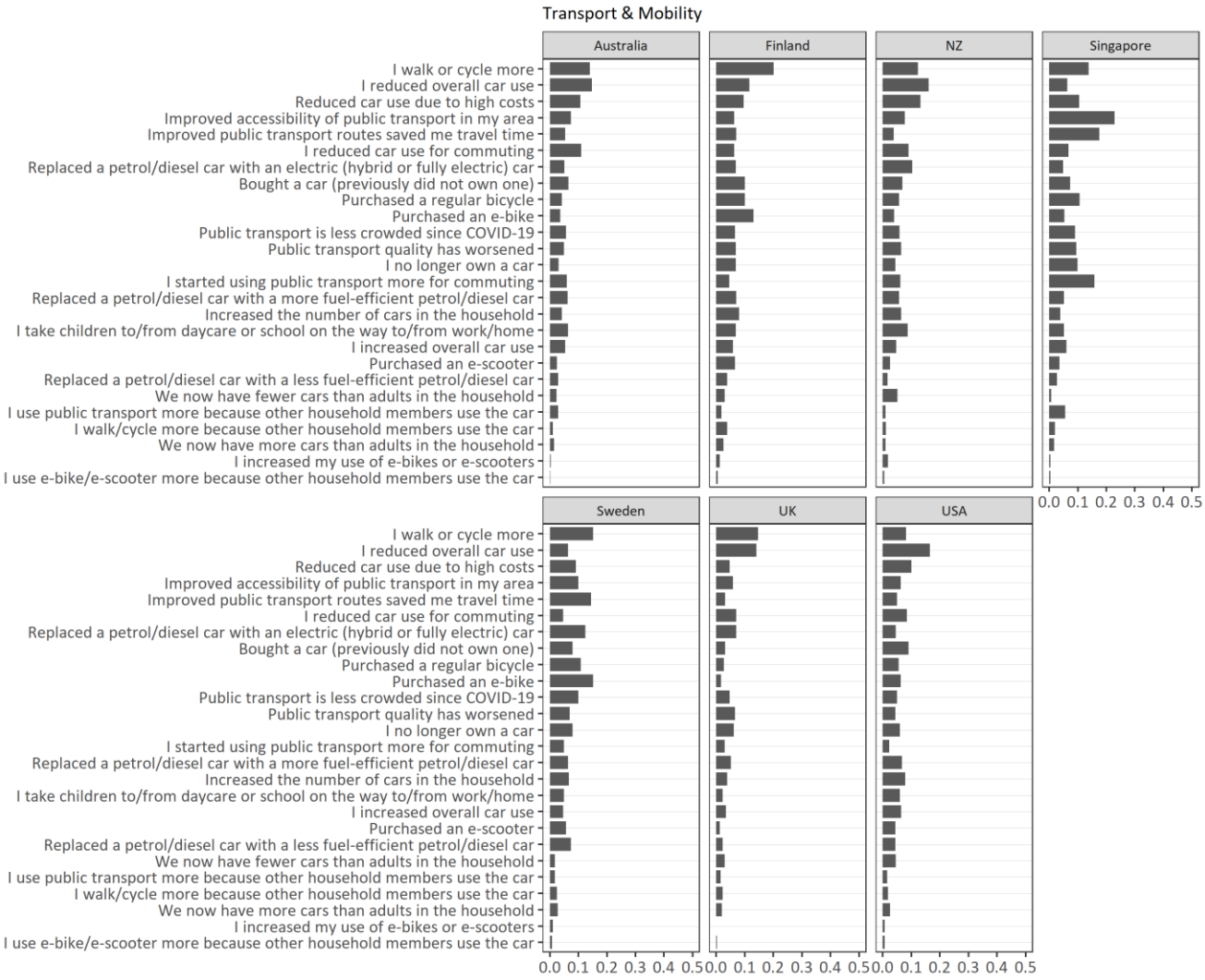
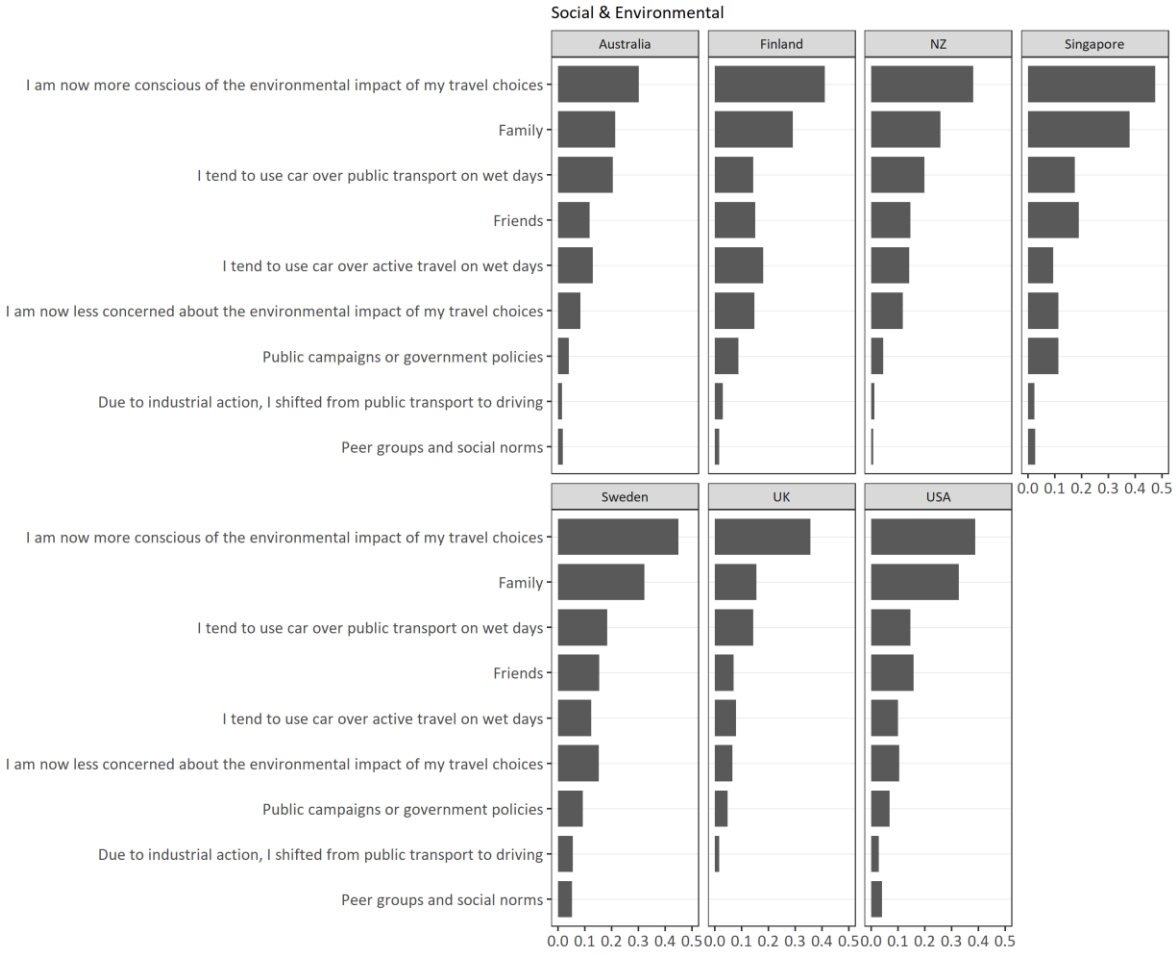
Appendix A: Percentage of participants that selected each WoC influence by Country




Work & Commuting
Australia
Finland
NZ
Singapore
Sweden
UK
USA
I was not in the workforce during this period
I moved to flexible working hours and days
I was looking for a job during this period
I changed jobs but stayed in the same residential area
I recently had to work in the main office/work location more
Free parking
Showers for walking/cycling commuters
I changed jobs and moved to a new residential area
Free on-site health & wellness facilities
Charging facilities for electric cars
Perks for using public transport, carpooling, cycling, or e-scooters
0.0 0.1 0.2 0.3 0.4 0.5


Transport & Mobility
Australia
Finland
NZ
Singapore
Sweden
UK
USA
I walk or cycle more
I reduced overall car use
Reduced car use due to high costs
Improved accessibility of public transport in my area
Improved public transport routes saved me travel time
I reduced car use for commuting
Replaced a petrol/diesel car with an electric (hybrid or fully electric) car
Bought a car (previously did not own one)
Purchased a regular bicycle
Purchased an e-bike
Public transport is less crowded since COVID-19
Public transport quality has worsened
I no longer own a car
I started using public transport more for commuting
Replaced a petrol/diesel car with a more fuel-efficient petrol/diesel car
Increased the number of cars in the household
I take children to/from daycare or school on the way to/from work/home
I increased overall car use
Purchased an e-scooter
Replaced a petrol/diesel car with a less fuel-efficient petrol/diesel car
We now have fewer cars than adults in the household
I use public transport more because other household members use the car
I walk/cycle more because other household members use the car
We now have more cars than adults in the household
I increased my use of e-bikes or e-scooters
I use e-bike/e-scooter more because other household members use the car
0.0 0.1 0.2 0.3 0.4 0.5


Social & Environmental
Australia
Finland
NZ
Singapore
Sweden
UK
USA
I am now more conscious of the environmental impact of my travel choices
Family
I tend to use car over public transport on wet days
Friends
I tend to use car over active travel on wet days
I am now less concerned about the environmental impact of my travel choices
Public campaigns or government policies
Due to industrial action, I shifted from public transport to driving
Peer groups and social norms
0.0 0.1 0.2 0.3 0.4 0.5

Appendix B: Elasticity Results

Table B1: Direct Elasticity results for all models – mean (t-values in brackets)

WoC name and other variables	Elasticities Car Driver	Elasticities Car Passenger	Elasticities Public Transport	Elasticities Walk	Elasticities Active Travel (Regular Bikes, E-bikes/E-scooter)
Moved to a new area (0,1)	0.0906 (2.63)		0.1267 (3.66)		
Upsized to a larger home (0,1)	-0.0952 (2.01)				0.0826 (2.68)
Downsized to a smaller home (0,1)			0.1822 (4.00)	0.1157 (2.19)	
Household size increased (0,1)					
Household size decreased (0,1)	0.0889 (1.90)	0.1539 (3.24)			
My financial situation improved (0,1)	0.1559 (3.75)			-0.0701 (1.58)	0.0766 (2.98)
My financial situation became tighter (0,1)	0.1006 (2.97)				
I started using click-and-collect more often (0,1)	0.1739 (2.81)				
I acquired a dog (0,1)			-0.1518 (2.33)		
I no longer have a dog (0,1)	0.1110 (1.88)				
I increased online shopping to reduce personal travel (0,1)		0.1336 (3.45)	-0.0797 (1.93)		-0.0611 (1.89)
I changed marital status (0,1)		0.1064 (1.85)			
I started or increased caregiving responsibilities (0,1)		0.1598 (2.77)		0.2276 (3.48)	
My health improved (0,1)		0.0717 (1.95)		0.1633 (4.63)	
I had health concerns that affected my travel (0,1)		0.1424 (3.20)			
I have adjusted my lifestyle to prioritise saving money (0,1)		0.1022 (2.91)			
I have reduced online shopping spending (0,1)		0.1129 (2.69)			
My partner changed jobs (0,1)		0.3143 (3.22)			
I started walking/exercising more for health reasons (0,1)			0.0725 (2.23)	0.1428 (4.14)	-0.0539 (2.16)
I now rely more on home delivery (0,1)				-0.2101 (3.04)	
I was temporarily not working (0,1)				0.1629 (2.01)	
My partner moved to more flexible working hours (0,1)				-0.2687 (1.29)	
My partner retired (0,1)					0.1296 (2.36)
I was not in the workforce during this period (0,1)	-0.1334 (3.70)	0.1194 (3.46)	-0.1064 (3.00)	-0.0896 (2.25)	
I was looking for a job during this period (0,1)	-0.0803 (2.05)	0.0751 (1.93)		-0.1489 (3.46)	
I changed jobs but stayed in the same residential area (0,1)	-0.0776 (1.90)	0.1413 (3.34)	0.1358 (3.70)		-0.0383 (1.49)
Free parking (0,1)	0.1707 (3.89)	-0.2157 (4.61)	-0.3485 (7.75)	-0.1595 (3.55)	

Free on-site health & wellness facilities (0,1)	0.1119 (1.80)				
Charging facilities for electric cars (0,1)		0.2552 (3.93)			
Perks for using public transport, carpooling, cycling, or e-scooters (0,1)		0.2109 (3.27)		0.1755 (2.75)	
I recently had to work in the main office/work location more (0,1)				0.0656 (1.50)	0.0625 (2.21)
Showers for walking/cycling commuters (0,1)				-0.1617 (2.41)	
Free on-site health & wellness facilities (0,1)					0.0903 (2.42)
Bought a car (previously did not own one) (0,1)	0.1986 (3.89)		-0.1120 (2.11)		0.0753 (2.31)
Replaced a petrol/diesel car with an electric (hybrid or fully electric) car (0,1)	0.1746 (3.05)	0.0999 (1.80)		-0.1640 (2.82)	
Replaced a petrol/diesel car with a more fuel-efficient petrol/diesel car (0,1)	0.1535 (2.98)	-0.1679 (2.78)		-0.1455 (2.28)	
Replaced a petrol/diesel car with a less fuel-efficient petrol/diesel car (0,1)	-0.1254 (1.79)		0.1208 (1.95)		0.1646 (3.46)
Reduced car use due to high costs (0,1)	0.1517 (3.34)				
I no longer own a car (0,1)	-0.8591 (19.38)	0.2976 (6.41)	0.4076 (8.32)	0.1897 (3.28)	0.1933 (5.78)
Purchased a regular bicycle (0,1)	-0.0856 (1.60)		0.0990 (2.03)	0.0890 (1.57)	0.4121 (13.66)
Improved accessibility of public transport in my area (0,1)	-0.1023 (2.32)		0.4097 (10.02)	0.1825 (3.61)	
Improved public transport routes saved me travel time (0,1)	-0.1204 (2.60)		0.2888 (6.29)		
I started using public transport more for commuting (0,1)	-0.1098 (2.15)	0.3222 (5.80)	0.6075 (12.35)	0.1588 (2.60)	
I walk or cycle more (0,1)	-0.1159 (2.89)			0.4596 (11.12)	0.2172 (8.51)
I take children to/from daycare or school on the way to/from work/home (0,1)	0.3914 (6.27)	-0.1153 (1.97)		-0.1624 (2.52)	
I walk/cycle more because other household members use the car (0,1)	-0.2859 (3.32)			0.3532 (3.62)	
Public transport quality has worsened (0,1)		0.1313 (2.52)		0.2002 (3.48)	
I reduced overall car use (0,1)		-0.1510 (3.23)			
I increased overall car use (0,1)		0.1335 (2.68)		-0.1291 (2.04)	
I use e-bike/e-scooter more because other household members use the car (0,1)		0.2616 (1.35)			0.6236 (7.66)
Increased the number of cars in the household (0,1)				0.1017 (1.61)	
We now have more cars than adults in the household (0,1)					0.3421 (6.75)
Purchased an e-scooter (0,1)					0.5696 (18.95)
I increased my use of e-bikes or e-scooters (0,1)					0.7157 (9.02)
Family influence my travel decisions (0,1)	0.1160 (3.75)	0.1199 (3.98)			
I am now more conscious of the environmental impact of my travel choices (0,1)			0.0500 (1.71)	0.0614 (1.87)	
I am now less concerned about the environmental impact of my travel choices (0,1)		-0.1442 (3.14)	-0.1304 (2.98)	-0.0766 (1.63)	-0.0755 (2.31)
Public campaigns or government policies (0,1)		0.1390 (2.26)	0.1656 (3.82)	0.1140 (2.07)	0.1113 (3.61)
I tend to use car over public transport on wet days (0,1)	0.1772 (4.92)				
I tend to use car over active travel on wet days (0,1)	0.1665 (4.00)		-0.1700 (3.71)		
Age	0.2657 (5.39)	-0.2134 (4.40)	-0.3293 (6.81)	-0.1445 (2.52)	
Female (0,1)	-0.1179 (4.34)	0.3140 (11.29)	-0.0787 (2.89)	-0.0971 (3.39)	
Capital city (0,1)	-0.1350 (2.28)		0.3612 (6.08)	0.0725 (1.25)	

Student (0,1)		-0.1367 (1.74)	0.4222 (6.27)	0.1548 (1.75)	
Doing paid work (0,1)	0.3989 (12.28)			-0.2045 (4.64)	
Retired (0,1)				-0.1724 (3.29)	
Family household (0,1)	0.1218 (3.51)	0.3065 (8.35)		-0.0992 (2.30)	
Couple family with no children (0,1)		0.2811 (7.45)		-0.1164 (3.14)	
Couple family with children (0,1)	0.2146 (6.14)	0.2742 (6.69)			
One parent family (0,1)	0.2022 (3.48)				
Manager (0,1)			0.2380 (6.48)		
Professional (0,1)		-0.0806 (1.96)	0.2540 (6.66)	0.1464 (3.45)	
Community and personal services (0,1)		-0.2186 (3.03)			
Clerical (0,1)		-0.0317 (0.70)	0.3001 (7.02)	0.2184 (4.57)	
Sales (0,1)		-0.1697 (2.61)			
Labourer (0,1)		-0.2420 (3.34)			
Personal income		-0.0348 (3.16)			
Number of petrol/diesel car(s)	0.2364 (14.98)		-0.2465 (14.56)	-0.1949 (14.80)	-0.1073 (8.44)
Number of electric car(s)				0.0095 (6.97)	
Number of hybrid car(s)	0.0167 (4.26)	0.0116 (3.17)	-0.0070 (1.82)		
Number of push bike(s)	0.0157 (1.89)			0.0428 (4.97)	0.0735 (13.93)
Number of e-bike(s)	-0.0096 (2.46)	0.0145 (3.71)	0.0179 (4.86)	-0.0090 (2.16)	0.0240 (13.48)
Number of e-scooter(s)		0.0083 (2.58)	0.0113 (3.33)		
Australia (0,1)	0.0326 (0.59)	0.0488 (0.88)	0.1209 (1.98)	0.3647 (6.50)	
Finland (0,1)	-0.2387 (4.82)	-0.3482 (6.67)	0.2206 (4.57)	0.4071 (8.21)	
New Zealand (0,1)	0.0110 (0.20)	-0.1464 (3.14)	0.1419 (2.64)	0.3772 (7.57)	
Singapore (0,1)	-0.8491 (23.30)	-0.0253 (0.54)	1.0265 (28.99)	0.5094 (10.02)	
Sweden (0,1)	-0.4026 (8.52)	-0.2062 (4.12)	0.4926 (11.33)	0.5280 (10.82)	
UK (0,1)	-0.3125 (6.54)	-0.0738 (1.26)	0.3851 (7.84)	0.6539 (14.04)	