Transportation Research Interdisciplinary Perspectives 15 (2022) 100663

Contents lists available at ScienceDirect

Transportation Research Interdisciplinary Perspectives

journal homepage: www.sciencedirect.com/journal/transportation-research-interdisciplinary-perspectives

The relationship between car shedding and subjective well-being

Ann-Kathrin Hess

University of Basel, Sustainability Research Group, Bernoullistrasse 14-16, Basel 4056, Switzerland

ARTICLE INFO

Keywords:
Car shedding
Sufficiency
Subjective well-being
Life satisfaction
Affective well-being
Fixed-effects models

ABSTRACT

The sufficiency strategy for sustainable development aims to reduce energy and resource consumption beyond technological modifications. One way to do this is to forgo ownership of certain consumer goods, such as cars. Although proponents of sufficiency claim that car shedding (i.e., giving away a vehicle so that the household no longer has its own car) might increase subjective well-being (SWB), there is little empirical evidence supporting this. This paper aims to help fill this gap by adding empirical evidence on the relationship between car shedding and SWB. Data from the Swiss Household Panel is used (2006–2017) with a fixed-effects model assessing the year-to-year changes in evaluative and affective well-being (life satisfaction, leisure satisfaction, joy, and anger) before and after car shedding. Separate analyses for non-affordability-driven and affordability-driven car shedders were conducted. Results show that non-affordability-driven car shedding has a positive effect on feelings of joy one to three years after the event. Affordability-driven car shedding, in contrast, is associated with a decrease in leisure satisfaction and feelings of joy up to three years later. Levels of positive affective wellbeing already decrease in anticipation of affordability-driven car shedding. A sufficiency measure like non-affordability-driven car shedding is not associated with reducing SWB, and this may have policy implications.

Introduction

Car production is a major contributor to environmental resource use, and car usage has adverse effects, such as congestion, air pollution, and road accidents. Hence, reducing car consumption is a pressing issue for sustainability policies. Besides technology-based strategies targeted at improving efficiency, there has been growing interest in sufficiency (Burger et al., 2019; Shove, 2018; Toulouse et al., 2019), targeted at substantial reductions in energy and resource use through "changing existing consumption patterns for more sustainable ones" (Moser et al., 2015, p. 2). These changes comprise alterations in ownership and usage; for example, deliberately shedding one's car may reflect a change in individual preferences and may be related to altering travel patterns and activities. Such changes may not lead to a reduction in well-being, but instead to behaviors that increase it (Burger et al., 2019). This is particularly important in sufficiency discussions, because as a concept, sufficiency aims at achieving substantial reductions in energy and resource consumption compatible with increasing—or at least maintaining—a person's well-being.

In this paper, I link car shedding (as a case for sufficiency) with subjective well-being (SWB). Car shedding is defined as reducing car ownership "through selling or forfeiting ownership of the vehicle as a subsequently unused asset" (Carroll et al., 2017, p. 1).

On one hand, car ownership and usage contributes to SWB as they facilitate activities and are also items fulfilling symbolic or self-image purposes (Litman, 2009; Steg, 2005). On the other hand, zero-car households develop alternative strategies for being mobile and for participating in activities, e.g., by using alternative transportation modes, or by choosing the proximity of everyday activities (Baehler, 2019; Lagrell et al., 2018). Recently, some studies have focused on the different characteristics and travel behavior of voluntarily and involuntarily carless households (Kühne et al., 2018; Mitra and Saphores, 2020; Mitra and Saphores, 2017). Understanding this heterogeneity of zero-car households is important for sustainability policies that focus on reducing car dependency while at the same time tackling transportation disadvantages (Mitra and Saphores, 2020).

There is, however, scant research on the link between zero-car ownership and SWB and whether and how changes in car ownership relate to SWB. There is a lack of research assessing adaptation effects after changes in travel options (Ettema et al., 2016). However, exploring the relationship between car shedding and SWB can shed light on the more generic relation between reducing behavior-based emissions and SWB.

This study aims to address the abovementioned research gaps through the following research questions: What happens to people's SWB when a car is shed? Are there any anticipation and adaptation effects on the development of SWB before and after car shedding? Are these effects different for non-affordability-driven and affordability-

E-mail address: ann-kathrin.hess@unibas.ch.

https://doi.org/10.1016/j.trip.2022.100663
Received 22 October 2021; Received in revised form 17 July 2022; Accepted 17 July 2022
Available online 6 August 2022

driven car shedders and with regard to different dimensions of SWB (life satisfaction, leisure satisfaction, joy, and anger)?

In the following section, I review the literature on the link between car ownership and SWB. Section 3 provides the conceptual framework and hypotheses for this study; Section 4 contains the description of data and measures as well as the model specification. In Sections 5 and 6, the results are presented and discussed before concluding in Section 7.

Literature review

Numerous papers have analyzed travel-related SWB, namely satisfaction with travel, in the context of (changing) car use (De Vos, 2018; Ettema et al., 2011; Pedersen et al., 2011). However, there is scant research on the effects of more radical behavior change, like giving away a car—a typical sufficiency type of behavior change. To adequately position said behavior change, I first review the literature on the characteristics of zero-car households and, second, on the relationship between changes in car ownership and SWB.

Characteristics of zero-car households

Regarding the characteristics and travel behavior of zero-car households, Baehler (2019) found that residents of car-free housing developments in Switzerland and Germany have a very particular profile: highly educated, ethical or altruistic values, mostly families, and living voluntarily without a car. In addition, reasons for being carless include seeing it as normal; moral beliefs and ecological motivations; and the perception of car ownership as something burdensome, e.g., with regard to finding parking or maintenance (Baehler, 2019; Lagrell et al., 2018). Furthermore, Sattlegger and Rau (2016) have pointed to the key role of social support in empowering zero-car ownership and leading to its normalization (Baehler, 2019; Sattlegger and Rau, 2016).

Lagrell et al. (2018) found that voluntarily carless households adapt well to traveling without a car with regard to mandatory activities and routines (e.g., work, school), but that free-time activities were associated with more friction and inconvenience. This finding is in line with Gärling et al. (2000), who found that private car use for work trips was substituted with changing travel modes, whereas for leisure activities and shopping, destinations or trips were changed/chained to reduce car use.

There are recent studies distinguishing between voluntary and involuntary carless households (Kühne et al., 2018; Mitra and Saphores, 2017). This differentiation is important because understanding the characteristics and travel behavior of voluntary carless households is useful for designing policies aiming to reduce car dependency, whereas focusing on involuntary carless households is important for understanding transportation disadvantages (Mitra and Saphores, 2020; Mitra and Saphores, 2017).

There is a whole strand of transportation literature focusing on the links between car ownership/carlessness and vulnerability, for example, with regard to low-income households. For people in precarious employment or housing, a car might be important for keeping their jobs or retaining social connections (Currie and Delbosc, 2011; Mattioli, 2017). At the same time, for this group, buying and maintaining a car means financial insecurity and risks (Klein et al., 2020; Mattioli et al., 2018).

Findings show that, compared to involuntary zero-car households, voluntary carless households live in denser neighborhoods with better public transportation coverage and have a higher household income, a higher percentage in employment, better education, and fewer children (Mitra and Saphores, 2017). Involuntary carless households travel less frequently, their trips are longer and take more time, they walk/bike less, and they depend more on public transportation compared to voluntary carless households (Mitra and Saphores, 2020).

With regard to the dynamics in car access, Klein and Smart (2017) analyzed US panel data to understand variations in car ownership over time. They found that carlessness is mostly a temporary condition but that low-income families, immigrants, and people of color are less likely to have a car than high-income families, US-born people, and whites, respectively.

Clark et al. (2016) found that life events, in particular changes to household composition, driver license availability, employment status, and income, are associated with car ownership level changes. Car shedding is also discussed in the literature on the effects of car sharing (e.g., Giesel and Nobis, 2016; Mishra et al., 2019).

The relationship between changes in car ownership and SWB

There is mixed evidence regarding the relationship between car ownership/use and SWB, depending on the context. Currie and Delbosc (2011, p. 205) concluded that “as long as the desired amount of activities can be maintained, well-being outcomes can be just as good without a car as with one.”.

On the one hand, some studies suggest a positive association between car ownership/use and SWB because this can reduce feelings of depression, strengthen peer group membership, or enable more out-of-home activities (Deka, 2017; Goetzke and Rave, 2015; Morris et al., 2020). In China, Gan et al. (2019) found that car ownership has a significant positive effect on evaluative SWB (subjective evaluations of quality of life; and, in their study, compared to peers) but a limited influence on affective SWB (feeling sad, stressed, and depressed). Gärling et al. (2002) pointed to several negative effects of car use reduction, such as decreased control, increased coordination of trips, and changes in leisure activities, which may result in a reduction of participation and a resulting decrease in SWB.

On the other hand, some studies suggest that car ownership/use does not have a positive effect on SWB. In Finland, Höysniemi and Salonen (2019) found that reducing car use is associated with increased life satisfaction and that car ownership/use is considered a “necessary evil” that is to be avoided whenever possible. Jakobsson Bergstad et al. (2011) found that car use plays a minor role in affective SWB, suggesting that households may adjust their daily schedules to be less car dependent. Emmerling and Qari (2017) found that car purchases had a negative impact on life satisfaction after the purchase, although it remains unclear why this decrease occurs.

Although there have been advances in understanding the characteristics and travel behavior of zero-car households, little is known about the relationship between car shedding and SWB or about the time course of adaptation after car shedding. There is generally little research on the relationship between “giving away” (consumer goods or the like) and SWB and little research that considers adaptive mechanisms. Gaining insights into the links between car shedding and SWB is, however, important with regard to policies aiming toward a less car-dependent society in particular and for adding sufficiency measures into policy portfolios in general—the latter being a highly contested field (cf. the “energy efficiency first principle,” which is pursued in the energy policies of many countries).

Conceptual framework and hypotheses

Car shedding and sufficiency

This paper links the concept of sufficiency with SWB by focusing on car shedding as a case for sufficiency. I argue that car shedding is qualitatively different from car use reduction because giving away a car completely is associated with a more substantial change in the “material element” of mobility practices. This argument is based on a social practice theory framework. A practice is a routinized type of behavior that is shaped by three elements: materials, meanings, and competences (Reckwitz, 2002; Shove et al., 2012). The resource intensity of existing practices can be reduced by changing the elements that make up those practices (Spurling et al., 2013). When the car is *shed*, the material element for *numerous* mobility-related practices changes. When car use is only *reduced*, the material element simply changes for a *selective choice* of mobility-related practices. For example, a person might decide to switch to another mode of transportation for the practice of "going to work." However, for the practice of "engaging in a nice leisure activity," the car could still be used with no changes. Nevertheless, reducing car use might be a preliminary stage to car shedding if it makes individuals realize that the car is not needed.[1]

The various definitions of sufficiency share the idea of "favoring behaviors and activities that are intrinsically low on energy use, at individual and collective level" (Toulouse et al., 2017, p. 60). There is an ongoing theoretical debate about the relationship between sufficiency and SWB (Alexander, 2012; Burger et al., 2019; Toulouse et al., 2019). In a recent article, Burger et al. (2019) argue that changes in individuals' preferences and values may lead to behaviors that actually support well-being. Framed in that way, sufficiency is not about renunciation but about a change in preferences, which may result in building new resource-light habits and routines (Burger et al., 2019).

Sufficiency is closely related to concepts such as voluntary simplicity or downshifting (Toulouse et al., 2019) and is based on the idea that people who consume fewer materials and resources can maintain or increase their well-being (Burger et al., 2019). Sufficiency is not only about individuals and their wants but also about the frame conditions of these wants and associated lifestyles (Akenji, 2014; Burger et al., 2015).

Subjective well-being (SWB)

SWB has received increased attention in behavioral science, including the idea that people's own evaluations of their lives should be considered an important aspect of a good life (Diener et al., 2018). The literature has particularly distinguished between two dimensions of SWB (Diener et al., 1999; Kapteyn et al., 2015). The first dimension—*evaluative well-being*—comprises general life satisfaction and satisfaction with certain life domains, such as satisfaction with one's leisure activities. The second dimension is *affective well-being* and is usually assessed by the frequency with which certain emotions are experienced, such as joy and anger. In addition, the year-to-year changes in SWB before and after a life event or status change have been used to assess anticipation and adaptation effects concerning life satisfaction (e.g., Odermatt and Stutzer, 2019).

Several researchers found that evaluative and affective well-being have different predictors (Kahneman and Deaton, 2010; Kapteyn et al., 2015; Luhmann et al., 2012). For example, income and education are more closely related to evaluative well-being, but health and loneliness are stronger predictors of affective well-being (Kahneman and Deaton, 2010).

Hypotheses

Against the backdrop of the demonstrated association between car ownership and both types of SWB (evaluative and affective), I propose three hypotheses to assess the link between car shedding and SWB dimensions. Furthermore, by conceptualizing sufficiency as deliberate changes in consumption patterns (following Burger et al., 2019), all hypotheses refer to households who shed their cars for reasons other than affordability.[2] The research question "are these effects different for non-affordability-driven and affordability-driven car shedders?" is dealt with within the framework of an exploratory component.

In societies where cars are not regarded as intrinsically valuable, there seems to be a negative association between car ownership and life satisfaction (Höysniemi and Salonen, 2019). Three mechanisms may further support this relationship. First, car shedding may contribute to feeling competent/self-determined to manage everyday life in a less car-dependent way (Lagrell et al., 2018). Second, a relatively recent study shows that the positive relationship between environmentally friendly behavior and life satisfaction is mostly due to self-image (i.e., one's own assessment of how environmentally friendly one's behavior is) (Binder and Blankenberg, 2017). Third, giving up a costly consumer good like a car also frees up one's budget for other types of consumption and activities that may increase life satisfaction. Consequently, the following association is expected:

H1 Non-affordability-driven car shedding has a positive impact on life satisfaction.

Regarding free-time activities, the literature suggests that these were associated with more friction and inconvenience in carless households compared to, for example, work trips (Gärling et al., 2000; Lagrell et al., 2018). Leisure seems to be the domain of real sacrifices for carless households (e.g., ruling out hobbies that children want to do) (Lagrell et al., 2018). Based on this indication, I hypothesize the following:

H2 Non-affordability-driven car shedding has a negative impact on satisfaction with leisure activities.

Many carless households prefer not to own a car because they perceive it as burdensome (e.g., parking and maintenance) (Lagrell et al., 2018). As car ownership might present daily hassles for people who voluntarily shed their cars, I developed the following hypothesis:

H3 Non-affordability-driven car shedding reduces negative affective wellbeing.

Materials and methods

In the following, I describe the data and measures for this study, descriptive statistics of all relevant study variables, and the model employed for the analysis of the four SWB dimensions for car shedding.

Data and measures

The empirical analysis is based on data from the Swiss Household Panel (SHP), which is comparable in structure and scope to other European household panels. One person from each household completes the household questionnaire, and all household members aged 14 or older are eligible to answer individual questionnaires (Tillmann et al., 2016).

Four dependent variables were used in this study: life satisfaction, leisure satisfaction, feelings of joy, and feelings of anger. The SHP assesses general life satisfaction by asking respondents, "In general, how satisfied are you with your life, if 0 means 'not at all satisfied' and 10 means 'completely satisfied'?" Using the same scale, satisfaction with leisure activities is assessed by asking, "How satisfied are you with your leisure time activities?" and emotional well-being with, "How frequently do you generally experience the following emotions?" In this paper, I focus on joy and anger as components of pleasant and unpleasant affect, respectively (see e.g., Diener et al., 1999). Furthermore, these two emotions play a role in the relationship between sufficiency and SWB. Advocates of sufficiency argue that appropriate behaviors are enjoyable, e.g., shopping at the nearby weekly market instead of at the supermarket. On the other hand, anger is mentioned in the study by Lagrell et al. (2018) as an emotion related to car ownership (finding parking spaces and taking care of car maintenance). For these reasons, I have focused on these two emotions.

The main independent variable of interest was car shedding. In the SHP, the household is asked, "Do you have a car? (private/company vehicle available for private use)." If the answer is "no," they are asked why: "Is it because you cannot afford to have one or for another reason?" Based on these questions, I built two indicator variables: (1) carless due to lack of affordability and (2) carless for reasons other than affordability. Following the strategies presented by Clark et al. (2008), Clark

[1] I thank an anonymous reviewer for suggesting this point.

[2] Affordability-driven car shedders may include transportation-disadvantaged groups. It is beyond the scope of this paper to discuss the (possible) links and considerations with regard to vulnerabilities and sufficiency.

Table 1
Number of households before and after car shedding.

	Non-affordability-driven car shedding	Affordability-driven car shedding
Before car shedding		
4 years or more	307	86
4–3 years	89	43
3–2 years	109	47
2–1 years	155	60
1–0 years	199	93
After car shedding		
0–1 years	221	94
1–2 years	114	41
2–3 years	62	17
3 years or more	162	29
Total	1418	510

Source: SHP.

Table 2
Descriptive statistics of the sample used to analyze SWB related to non-affordability-driven car shedding.

	Mean	Std. dev.	Min.	Max.
Life satisfaction	8.0144	1.253	0	10
Leisure satisfaction	7.6127	1.861	0	10
Feelings of joy	7.4608	1.197	0	10
Feelings of anger	4.0837	1.841	0	10
Car	0.9643	0.186	0	1
Involuntarily carless	0.0158	0.125	0	1
Voluntarily carless	0.0199	0.140	0	1
Years of education	13.8653	3.112	8	21
Disposable household income (yearly, log)	11.4435[1]	0.472	7	15
Age	44.2229	13.210	14	96
Married	0.5982	0.490	0	1
Household size	3.0522	1.328	1	10
Number of children	1.4933	1.298	0	38
Health problem	0.3255	0.469	0	1
Unemployed	0.0034	0.058	0	1
Owner of accommodation	0.5985	0.490	0	1
zMoved since last survey	0.0703	0.256	0	1
Urban	0.4964	0.500	0	1
Change of job or employer	0.1088	0.311	0	1
Commuting: number of minutes daily	43.3896	40.242	0	999
No. of observations	45,714			
No. of individuals	10,144			

Source: SHP.
[1]This refers to an untransformed yearly disposable household income of CHF 104,266.

and Georgellis (2013), and Odermatt and Stutzer (2019), I used the year-to-year changes in SWB to investigate the anticipation and adaptation effects of the two car shedding statuses. The codes for conducting such an analysis are provided as supplemental files in the work of Odermatt and Stutzer (2019).

I considered those observations for which the status change occurred within the sample period, i.e., I excluded respondents whose time point for changing to carlessness was unknown (left-censored spells). The first time an individual changes their status to carless served as the first observation after the status change. In the analyses, I included both, people who changed from car ownership to one of the carless statuses and those who did not change their status. This allowed me to estimate the development of SWB around car shedding compared with general changes in circumstances (Odermatt and Stutzer, 2019).

I used a four-year period before car shedding to assess possible anticipation effects and a three-year period after car shedding to study adaptation. In the literature on lags and leads in SWB, some different time windows have been used to study anticipation and adaptation effects, depending on the event studied and the research question (c.f., Clark et al., 2008; Odermatt and Stutzer, 2019; Pagán-Rodríguez, 2012). The decision regarding the time window is linked to the discussion about the reference period (see Section 5.2). I decided to focus on a relatively short period of three years for adaptation because, compared to disability, widowhood, or birth of a child, car shedding is a minor event, presumably with a shorter adaptation period. Given 12 waves of data, I can potentially observe individuals up to 11 years before or after they shed a car. In the data for this study, individuals can be observed on average 5.0 years before and 2.6 years after non-affordability-driven car shedding, and 4.3 years before and 1.7 years after affordability-driven car shedding.

A full record of observations without missing years was used to observe all status changes, although I concentrated on the first status change observed in the survey period for each individual. To ensure the same sample for all four dependent variables, I restricted the sample period to 2006–2017 and excluded data with missing variables. Furthermore, individuals who experienced a change in car ownership status at the same time as a change in their household ID (i.e., they moved to another household that was also part of the SHP sample) were dropped from the analytical sample to avoid confounding variables in household change. Table 1 presents the number of observations for non-affordability- and affordability-driven car shedders before and after becoming carless. Observations were included as long as individuals retained their respective car shedding status and were excluded if they regained car ownership or changed between the two carless statuses. These restrictions left a final sample of 1,418 households that experienced non-affordability-driven car shedding, and 510 households that experienced affordability-driven car shedding.

Two sets of control variables were used in this study. The first set included sociodemographic characteristics, which were found to be correlated with SWB in previous studies. These variables included years of education; disposable annual household income (log); age (and age squared to account for the nonlinear relationship between age and life satisfaction); a dummy indicating whether the person is married/in a registered partnership or not; household size; the number of children; a dummy for a chronic illness or long-term health problem; and a dummy indicating whether a person is unemployed.

The second set of control variables was comprised of characteristics that might be correlated with car ownership status and were thus included to absorb possible confounding effects. These included a dummy for owning/renting a dwelling, which controls for affluence (Okulicz-Kozaryn et al., 2015); a dummy indicating whether a household has moved since the last survey; a dummy for job or employer change in the last 12 months; and the number of minutes spent on daily commutes. To further account for the availability of public transport and dense neighborhoods which facilitate walking and cycling (Schwanen et al., 2004), a dummy for urban place of residence was included. This dummy was created by recoding the community typology with 22 categories, following the strategy of previous studies (Delbiaggio and Wanzenried, 2016).

Descriptive statistics

Table 2 presents the descriptive statistics for the sample generated to study the effect of non-affordability-driven car shedding.[3]

[3] The descriptive statistics for the sample generated to study the effects of affordability-driven car shedding are presented in Table A.1. The means and proportions as well as the minimum and maximum values per variable are virtually the same. The differences in sample sizes derive from missing values in the indicator variable used to create the sample (i.e., "carless because of a lack of affordability" and "carless because of other reasons").

Table 3
Life satisfaction, leisure satisfaction, joy, and anger related to car shedding.

	Life satisfaction		Leisure satisfaction		Joy		Anger	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	VOL	INVOL	VOL	INVOL	VOL	INVOL	VOL	INVOL
4–3 years hence	0.048(0.118)	0.019(0.210)	−0.025(0.162)	0.091(0.303)	0.170(0.115)	−0.174(0.194)	−0.201(0.179)	0.120(0.283)
3–2 years hence	0.063(0.109)	−0.143(0.281)	−0.023(0.134)	0.046(0.243)	0.018(0.097)	−0.446*(0.220)	−0.157(0.184)	−0.128(0.223)
2–1 years hence	−0.076(0.107)	−0.354(0.262)	−0.088(0.143)	−0.296(0.307)	−0.013(0.100)	−0.451*(0.203)	0.019(0.134)	0.174(0.233)
Within the next year	−0.099(0.097)	−0.189(0.200)	0.036(0.119)	−0.323(0.248)	0.027(0.083)	−0.096(0.135)	0.089(0.130)	0.172(0.214)
0–1 year	−0.086(0.096)	−0.208(0.162)	−0.045(0.121)	−0.439*(0.192)	−0.024(0.091)	−0.275*(0.123)	−0.038(0.136)	−0.124(0.154)
1–2 years	0.003(0.109)	−0.174(0.198)	−0.009(0.196)	−0.488(0.301)	0.196*(0.099)	−0.298(0.230)	−0.172(0.173)	−0.073(0.255)
2–3 years	−0.141(0.140)	−0.271(0.332)	0.248(0.194)	−0.079(0.284)	0.217~(0.131)	−0.516*(0.253)	−0.073(0.193)	−0.136(0.264)
3 or more years	−0.070(0.127)	−0.127(0.368)	0.135(0.177)	−0.344(0.364)	0.054(0.106)	−0.419(0.278)	−0.255(0.175)	0.457(0.363)
No. of observations	45,714	48,300	45,714	48,300	45,714	48,300	45,714	48,300
No. of individuals	10,144	10,681	10,144	10,681	10,144	10,681	10,144	10,681
Adjusted R^2	0.010	0.009	0.003	0.003	0.006	0.006	0.020	0.019
AIC	105,623	111,502	146,055	153,976	104,696	109,715	144,833	152,452

Notes: OLS estimations. Baseline level: 4 or more years prior to car shedding. Standard errors in parentheses. Significance levels: $\sim p < 0.1$, $* p < 0.05$.
VOL, non-affordability-driven car shedding; INVOL, affordability-driven car shedding; AIC, Akaike information criterion.
All models controlled for sociodemographic and car-related controls, as well as for year-fixed effects and individual-fixed effects. Table A2 shows the coefficients for all control variables and year-fixed effects.
Source: SHP.

For most variables, the sample is representative of Switzerland in terms of, for example, income and number of children (BFS, 2019a; BFS, 2019b). Slight deviations were observed in household size (3.1 in the sample versus 2.2 according to Swiss figures), age (44 versus 42), and the number of minutes spent on daily commutes (43 versus 61 min for round trips) (BFS, 2020; BFS, 2019c; BFS, 2017). Larger deviations were detected for those who owned their accommodations (60% versus 37%) and urban residents (50% versus 85%) (BFS, 2019d; BFS, 2019e; EDA, 2017). There were outliers for the number of children and minutes spent on daily commutes, but dropping these outliers did not substantially change the means and proportions, nor did it affect the regression results. Therefore, all observations were kept.

Analysis

Previous research has stressed the importance of using panel data and fixed-effects models when analyzing the relationship between cars and SWB (e.g., Okulicz-Kozaryn et al., 2015). Car ownership/shedding can be considered a proxy for values, preferences, or other attributes of a person, and these attributes might affect car shedding and SWB simultaneously (Okulicz-Kozaryn et al., 2015). The fixed-effects model is an appropriate solution for analyzing panel data by controlling for time-invariant unobserved individual characteristics (such as time-invariant preferences). Accordingly, I employed a fixed-effects model to study the association between car shedding and SWB. In particular, I focused on the development of four SWB measures around the time of car shedding to assess possible anticipation and adaptation mechanisms. Both are important to consider when evaluating the development of SWB around a status change/event (Clark et al., 2008; Hanglberger and Merz, 2015). If a regression model does not account for *anticipation* effects, the actual effect of the status change may be overestimated; if it does not reveal insight into year-to-year changes *after* an event, the length of the *adaptation* period remains uncovered. In addition, anticipation and adaptation effects might be important with regard to the design and analysis of policy programs; for example, if SWB deteriorates after car shedding and does not adapt, then the conditions and opportunities of carless households should receive more political attention (Merz, 2018).

To specify the regression model, I built dummy variables for the years preceding and following a change in car ownership status from having a car to one of the two carless statuses (see Section 4.1). I estimated the following model to reveal anticipation and adaptation mechanisms with regard to car shedding and SWB:

$$Y_{it} = \alpha_i + \tau_t + \sum_{j=-4}^{3} \theta_j E_{it}^j + \delta' X_{it} + \gamma' Z_{it} + \varepsilon_{it}$$

The model is estimated separately for four dependent variables (Y_{it}): life satisfaction, leisure satisfaction, feelings of joy, and feelings of anger, each for individual i at time t. The main variable of interest is E_{it}^j, which indicates the number of years, j, before and after car shedding. Two samples were created, one in which E_{it}^j indicates the number of years before and after non-affordability-driven car shedding and another in which E_{it}^j indicates the number of years before and after affordability-driven car shedding. All the years preceding the four-year period serve as the reference level.

X_{it} is a vector of control variables related to SWB, and Z_{it} is a vector of car-ownership-related control variables. A fixed-effects model controls for any time-invariant characteristics by including an individual-fixed effect, α_i. This implies that the estimations of the coefficients are based on variations within the same person over time. Furthermore, I included year-fixed effects, τ_t, to control for changes in SWB over time. Standard errors were clustered at the individual level to account for possible serial correlation of the idiosyncratic errors, ε_{it}, and to avoid underestimation of standard errors.

Results

In this section, I present the results and robustness checks. The results are discussed in more detail in Section 6.

Regression results

Table 3 shows the changes in SWB before and after car shedding compared to a baseline level of four years or more before car shedding. In the following, I discuss the estimation results regarding the development of SWB around the time of car shedding. The estimation results of the control variables are not discussed in the main body but can be seen in Table A2.

There was no significant effect on *life satisfaction* before and after car shedding for either group of car shedders. For non-affordability-driven car shedders, there was also no effect regarding *leisure satisfaction.* Therefore, I cannot reject the null hypothesis for H1 and H2 (see Section 3). Affordability-driven car shedders experienced a drop in *leisure satisfaction* in the year after they (had to) shed their car. This drop corresponded to an effect of $b = -0.44$; $p < 0.05$. This coefficient is considered large in SWB research (Binder and Blankenberg, 2017).

Non-affordability-driven car shedders experienced an increase in the frequency of *joyful feelings* one to three years after they shed ($b = 0.20$; $p < 0.05$, and $b = 0.22$; $p < 0.1$). Affordability-driven car shedders' *feelings of joy* had already dropped one to three years before car shedding ($b = -0.45$; $p < 0.05$), and they remained low up to three years after ($b = -0.28$; $p < 0.05$ the year after, and $b = -0.52$; $p < 0.05$ two to three years after). There was no effect of car shedding on *feelings of anger* for either non-affordability-driven or affordability-driven car shedders; hence, the null hypothesis of H3 regarding non-affordability-driven car shedders cannot be rejected.

Robustness checks

To check the appropriateness of the fixed-effects modeling technique, I compared the fixed-effects model against a random-effects specification using the Hausman test. For all four dependent variables and for both car shedding statuses, the test indicated that the fixed-effects model is more appropriate than a random-effects model.

Qari (2014) emphasized the importance of checking the robustness of the results with regard to the reference period. Thus, in addition to the model presented in Table 3, I estimated another model with a shorter reference period (three or more years prior to car shedding; Appendix, Table B1), but the results did not change substantially.

Discussion

In this section, I discuss the findings on the relationship between car shedding and SWB. The limitations of the study and prospects for future research are also presented.

The relationship between car shedding and SWB

This study aimed to answer the following questions: What happens to people's SWB when a car is shed? Are there any anticipation and adaptation effects on the development of SWB before and after car shedding? Are these effects different for non-affordability-driven and affordability-driven car shedders and with regard to different dimensions of SWB (life satisfaction, leisure satisfaction, joy, and anger)?

The findings show that there are different effects for non-affordability-driven and affordability-driven car shedders and for different SWB dimensions. Affordability-driven car shedders had a lower level of satisfaction with their leisure activities after car shedding. After one year, they adapted and returned to their baseline satisfaction levels. Furthermore, they also experienced a drop in joy after car shedding. In contrast, for non-affordability-driven car shedders, significantly higher joy was reported one to three years after shedding, compared to a baseline level of four or more years prior to the event.

The results contribute to the debate about sufficiency and SWB. Non-affordability-driven car shedders experienced no change in life satisfaction, satisfaction with leisure activities, or negative affect, but there was an increase in positive affect. The findings support the theoretical considerations of Burger et al. (2019), specifically, that individuals change their preferences when they freely give up their car and would not give it up if they expected a deterioration in SWB. There are two possible explanations for the findings on the group of non-affordability driven car shedders:

First, activity participation might still be possible for these households in a desired way, leading to equal levels of evaluative SWB (life satisfaction and leisure satisfaction) before and after car shedding. Although previous research indicated that leisure activities might be a crucial area in which voluntarily carless households had to lower their expectations, the literature also suggests that households adapt their leisure activities to those within reach by public transport or ensure access to a car when they need one through car sharing or borrowing (Baehler, 2019; Lagrell et al., 2018).

Second, car ownership might be less relevant as a contributor to the travel-related opportunity space. This finding can be contextualized for Switzerland where in particular, in Swiss cities, car ownership is not pronounced. In the two most densely populated cities, Basel and Zurich, on average only about one in three residents own a car. In addition, Switzerland has a very dense public transport network, and it is, in principle, possible to live without a car in many places.

The well-being of affordability-driven car shedders is more affected by car shedding than that of their non-affordability-driven counterparts. One possible way to interpret anticipation effects (i.e., a drop in positive feelings three years before car shedding) is a progression toward a goal (MacLeod and Conway, 2005). It might be that affordability-driven car shedders actually aim to keep the car, but due to changing circumstances that are out of their control, such as higher expenses in other domains, they anticipate the need to shed. Affordability-driven car shedders are also adversely affected in leisure satisfaction. This drop indicates that affordability-driven car shedders cannot pass time in their desired way without a car. They might not be able to compensate as quickly as non-affordability-driven car shedders to adapt their leisure activities, but after a year, they adapted and returned to baseline leisure satisfaction.

The differentiation between the two car shedding groups and the distinction between evaluative and affective well-being proved fertile grounds for the analysis. Former research has shown that fulfilling psychological needs, such as autonomy and using one's skills, is more strongly associated with affective well-being than with evaluative well-being (Diener et al., 2010). Hence, the positive association between non-affordability-driven car shedding and pleasant affect might indicate that decisions may be affected by underlying motivations, such as to live in a less car-dependent way and count on social support more (Lagrell et al., 2018; Sattlegger and Rau, 2016). The decrease in joy among affordability-driven car shedders might indicate that for this group, the car fulfilled underlying psychological needs, such as autonomy.

Limitations

The main contribution of this study is the empirical advancement of the conceptual debate on the relationship between sufficiency and SWB. However, four limitations should be pointed out, related to context dependency, the control variables, the underlying reasons for car shedding, and measures for affective SWB.

First, SWB research is highly context dependent. Many researchers have stated that, for example, evidence from a US context cannot be transferred to a European context (Okulicz-Kozaryn et al., 2015; Seiler Zimmermann and Wanzenried, 2019). In addition, the present research has to be understood in context. Switzerland is a very densely populated country with a high level of public transport, so living without a car in Switzerland is not likely to be related to a decrease in flexibility and autonomy—and, consequently, a deterioration in SWB—to the same degree as in other countries. In addition to the study's context dependency, the sample used in the present analysis is biased toward car-owning, rural, home-owning households (see Section 4.2). Nevertheless, as I analyzed *changes* in car ownership status, the lack of representativity with regard to these variables should not be an issue for drawing conclusions beyond the sample.

The second limitation relates to other control variables, such as access to and membership of car-sharing schemes, having a driver's license, and access to alternative mobility options besides a private car. Perhaps in the future, studies could match individual data from mobility surveys (which capture variables related to mobility options) to household panels (which usually measure SWB) to enable the analysis of a richer set of control variables.

The third limitation relates to the lack of information about the reasons for car shedding. Although the study differentiated between those who could not afford a car and those who shed their car for other reasons, limited conclusions can still be drawn about whether "other reasons" also include nonvoluntary reasons (e.g., illness). Although this analysis controlled for chronic illness, it might be preferable to explicitly ask why households have no car (e.g., because they did not want one) to study non-affordability-driven car shedding (Mitra and Saphores, 2020).

These questions would also allow researchers to capture underlying preferences and possible changes in car ownership. Furthermore, caution should be exercised in declaring that car shedding for affordability reasons is affordability-driven because it might be a budgetary decision. In Switzerland, most households could probably afford a car. Thus, the question about affordability may be an assessment of other financial priorities.

Fourth, data availability restricted the choice of emotions making up the measures of affective SWB. There are several established scales to measure affective SBW, including the construction of an affect balance based on positive and negative feelings; however, these measures were not available in the data used for this study. Further research may rely on established scales to measure affective SWB.

Directions for further research

This paper adds empirical evidence to the debate about car shedding (as a form of sufficiency) and SWB. Based on this, there are interesting avenues for future research.

First, future research may use alternative measures of SWB, such as the PERMA-Profiler, which aims to monitor well-being across multiple psychological domains, such as meaning and relationships (Butler and Kern, 2016; Seligman, 2011). Applying such measures may provide answers regarding the mechanisms that underlie the association between non-affordability-driven/affordability-driven car shedding and SWB (e.g., autonomy or relatedness).

Second, subsequent research may assess changes in preferences or attitudes toward car ownership and how these changes relate to SWB. This assessment might be possible when attitudes and preferences are explicitly rated in a questionnaire and then taken as control variables in a fixed-effects model.

Finally, future research could analyze car shedding and its relation to SWB by considering other consumption domains. This may contribute to the analysis of possible rebound or spillover effects and may shed light on the environmental footprint of households that shed their cars.

Conclusions and policy implications

This paper provides empirical insights into an issue that has become increasingly pressing for sustainable mobility: How is car shedding related to SWB? This study advances the conceptual debate on the relationship between sufficiency and SWB by analyzing car shedding as a change in materials for mobility-related practices. The development of evaluative and affective SWB was analyzed around the time of car shedding, distinguishing between non-affordability-driven and affordability-driven car shedders.

The results show that non-affordability-driven car shedders experienced an increase in the level of feelings of joy after shedding their car; however, there were no effects with regard to life satisfaction, leisure satisfaction, and feelings of anger. Affordability-driven car shedders experienced a drop in leisure satisfaction and in the level of feelings of joy after car shedding. A decrease in feelings of joy was already apparent in anticipation of car shedding.

The findings of this paper contribute to the research on sustainability, travel behavior, and SWB. Regarding sustainability science, the study adds to the theoretical debate about the relationship between sufficiency (i.e., changing existing consumption patterns for resource-light ones) and SWB. Exploring this relationship is important for achieving sustainability goals, but little empirical research has been undertaken, so this paper contributes to filling this gap.

Furthermore, the paper contributes to travel behavior research by focusing on a change in the material element of mobility practices (from car ownership to zero-car ownership) and its relationship to SWB. The distinction between evaluative and affective well-being provides insights into different associations according to SWB dimensions.

Various policy measures can promote the shift to carlessness (see also Haefeli et al., 2020): 1. maintain and strengthen the quality of public transport, 2. enable flexible car sharing, 3. promote low-car living, 4. support and encourage customized Mobility as a Service offers, 5. think about voluntary carlessness in the metropolitan area, and 6. implement infrastructural measures (e.g., expanding infrastructure for cyclists and pedestrians, lanes for car-sharing). The aim of these *pull measures* is to make car alternatives more attractive. In addition, *push measures* can be implemented to make car ownership less attractive, such as restrictive parking policy (e.g., through higher parking fees) and traffic regime (30 km/h speed limit in general, pedestrian zones). Push and pull measures can be complemented with *persuasive measures*, such as information for private households (e.g., about transportation options at a new place of residence) and trainings (e.g., to increase cycling skills, to show older people how to use public transport).

Policies to reduce car ownership could be applied in many countries. In urban areas, the infrastructure would have to be adapted accordingly, i.e., away from a car-centric infrastructure and spatial design (as it still exists in many cities around the world today) towards one that makes alternative modes of transportation more attractive. Furthermore, in addition to car-sharing, further rental offers could be launched, so that longer distances can also be covered where there may be no public transport network in a country.

In rural regions, however, it is harder to offer economically viable alternatives to the car. However, here, too, various efforts are conceivable to reduce car dependency, such as increased remote working, village stores or markets, and local leisure activities.

When designing policy measures to reduce car ownership rates, the implications for vulnerable target groups should also be considered in each case. A mix of policy instruments, combining pull, push, and persuasive measures will increase the likelihood to reach different target groups. When evaluating policies, impacts on the well-being of different socio-economic groups should receive more attention. If policy measures have the effect that, on the one hand, the car ownership rate decreases and, on the other hand, the well-being of the population remains the same or even increases, then they can be understood as successful policy measures in the sense of a sufficiency strategy.

In this paper, I have attempted to shed empirical light on the relationship between sufficiency and SWB, in the hopes that this paper will inspire researchers to further empirically investigate sufficiency-oriented changes in practices and their relation to different aspects of well-being.

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.

Data availability

The SHP data can be accessed free of charge on SWISSUbase.

Acknowledgments

This research was supported by the Mercator Foundation Switzerland (project number 2014-0603) and by a research fund for junior researchers at the University of Basel. It was also part of the activities of SCCER CREST (the Swiss Competence Center for Research in Energy, Society and Transition), which was financially supported by Innosuisse, the Swiss Innovation Agency.

This study was conducted using data collected by the Swiss Household Panel (SHP), which is based at the Swiss Centre of Expertise in the Social Sciences FORS. The project is financed by the Swiss National Science Foundation.

I am thankful to Reto Odermatt for the time he dedicated to discussing my research ideas. Furthermore, I am grateful to Paul Burger and Robin Samuel for supervising this work and for their helpful comments on earlier versions of this paper. Likewise, I thank Anne Baumgartner for her helpful feedback and Adam Hearn for proofreading and linguistic tips. I am grateful for the helpful comments and suggestions of the two anonymous reviewers.

Appendix A

Tables A1 and A2.

Table A1
Descriptive statistics of the sample used to analyze SWB related to affordability-driven car shedding.

	Mean	Std. dev.	Min.	Max.
Life satisfaction	8.0170	1.252	0	10
Leisure satisfaction	7.6088	1.859	0	10
Feelings of joy	7.4563	1.191	0	10
Feelings of anger	4.0825	1.837	0	10
Car	0.9222	0.268	0	1
Involuntarily carless	0.0096	0.097	0	1
Voluntarily carless	0.0682	0.252	0	1
Years of education	13.9682	3.143	8	21
Disposable household income (yearly, log)	11.4408[a]	0.472	7	15
Age	44.1901	13.163	14	96
Married	0.5902	0.492	0	1
Household size	3.0202	1.335	1	10
Number of children	1.4606	1.298	0	38
Health problem	0.3228	0.468	0	1
Unemployed	0.0032	0.057	0	1
Owner of accommodation	0.5814	0.493	0	1
Moved since last survey	0.0717	0.258	0	1
Urban	0.5174	0.500	0	1
Change of job or employer	0.1083	0.311	0	1
Commuting: number of minutes daily	44.0995	40.855	0	999
No. of observations	48,300			
No. of individuals	10,681			

Source: SHP.
[a]This refers to an untransformed yearly disposable household income of CHF 103,938.

Table A2
Life satisfaction, leisure satisfaction, joy, and anger related to car shedding.

	Life satisfaction		Leisure satisfaction		Joy		Anger	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	VOL	INVOL	VOL	INVOL	VOL	INVOL	VOL	INVOL
4–3 years hence	0.048 (0.118)	0.019 (0.210)	−0.025 (0.162)	0.091 (0.303)	0.170 (0.115)	−0.174 (0.194)	−0.201 (0.179)	0.120 (0.283)
3–2 years hence	0.063 (0.109)	−0.143 (0.281)	−0.023 (0.134)	0.046 (0.243)	0.018 (0.097)	−0.446* (0.220)	−0.157 (0.184)	−0.128 (0.223)
2–1 years hence	−0.076 (0.107)	−0.354 (0.262)	−0.088 (0.143)	−0.296 (0.307)	−0.013 (0.100)	−0.451* (0.203)	0.019 (0.134)	0.174 (0.233)
Within the next year	−0.099 (0.097)	−0.189 (0.200)	0.036 (0.119)	−0.323 (0.248)	0.027 (0.083)	−0.096 (0.135)	0.089 (0.130)	0.172 (0.214)
0–1 year	−0.086 (0.096)	−0.208 (0.162)	−0.045 (0.121)	−0.439* (0.192)	−0.024 (0.091)	−0.275* (0.123)	−0.038 (0.136)	−0.124 (0.154)
1–2 years	0.003 (0.109)	−0.174 (0.198)	−0.009 (0.196)	−0.488 (0.301)	0.196* (0.099)	−0.298 (0.230)	−0.172 (0.173)	−0.073 (0.255)
2–3 years	−0.141 (0.140)	−0.271 (0.332)	0.248 (0.194)	−0.079 (0.284)	0.217~ (0.131)	−0.516* (0.253)	−0.073 (0.193)	−0.136 (0.264)
3 or more years	−0.070 (0.127)	−0.127 (0.368)	0.135 (0.177)	−0.344 (0.364)	0.054 (0.106)	−0.419 (0.278)	−0.255 (0.175)	0.457 (0.363)
Years of education	0.003 (0.009)	−0.002 (0.009)	−0.014 (0.012)	−0.011 (0.012)	0.003 (0.007)	−0.000 (0.007)	−0.027* (0.011)	−0.022* (0.011)

(continued on next page)

Table A2 (*continued*)

	Life satisfaction		Leisure satisfaction		Joy		Anger	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	VOL	INVOL	VOL	INVOL	VOL	INVOL	VOL	INVOL
Disposable household income (yearly, log)	0.200*** (0.027)	0.195*** (0.026)	0.034 (0.033)	0.030 (0.033)	0.084*** (0.023)	0.076*** (0.022)	−0.026 (0.033)	−0.012 (0.032)
Age	−0.071*** (0.010)	−0.067*** (0.009)	−0.042** (0.015)	−0.037* (0.015)	−0.059*** (0.009)	−0.057*** (0.009)	−0.089*** (0.014)	−0.087*** (0.013)
Age squared	0.001*** (0.000)	0.001*** (0.000)	0.000** (0.000)	0.000** (0.000)	0.001*** (0.000)	0.000*** (0.000)	0.000* (0.000)	0.000* (0.000)
Married = 1	0.234*** (0.044)	0.228*** (0.042)	−0.106* (0.051)	−0.105* (0.050)	0.097** (0.035)	0.098** (0.034)	−0.009 (0.047)	−0.009 (0.046)
Household size	−0.014 (0.013)	−0.014 (0.012)	−0.020 (0.017)	−0.028∼ (0.017)	−0.017 (0.011)	−0.014 (0.011)	0.043* (0.017)	0.052** (0.016)
Number of children	−0.002 (0.016)	−0.009 (0.016)	−0.095*** (0.025)	−0.104*** (0.024)	0.009 (0.022)	0.007 (0.021)	0.047 (0.029)	0.040 (0.027)
Health problem = 1	−0.044** (0.016)	−0.040* (0.016)	−0.025 (0.025)	−0.027 (0.024)	−0.018 (0.016)	−0.022 (0.015)	0.050* (0.023)	0.042∼ (0.023)
Unemployed = 1	−0.306* (0.143)	−0.368* (0.145)	0.022 (0.176)	0.058 (0.172)	−0.078 (0.129)	−0.046 (0.126)	−0.114 (0.159)	−0.054 (0.167)
Owner of accommodation = 1	0.030 (0.028)	0.040 (0.028)	0.020 (0.042)	0.019 (0.041)	−0.014 (0.025)	−0.002 (0.025)	0.057 (0.039)	0.045 (0.038)
Moved since last survey = 1	0.034∼ (0.020)	0.051** (0.020)	−0.054∼ (0.031)	−0.049∼ (0.030)	0.044* (0.020)	0.049* (0.019)	−0.003 (0.030)	−0.014 (0.029)
Urban = 1	−0.061 (0.048)	−0.057 (0.047)	−0.067 (0.062)	−0.071 (0.060)	−0.060 (0.038)	−0.035 (0.037)	0.046 (0.053)	0.068 (0.051)
Change of job or employer in last 12 months = 1	0.025 (0.018)	0.026 (0.017)	0.039 (0.028)	0.037 (0.027)	0.025 (0.016)	0.019 (0.015)	−0.104*** (0.026)	−0.104*** (0.025)
Commuting: number of minutes daily	0.000 (0.000)	−0.000 (0.000)	−0.001*** (0.000)	−0.001*** (0.000)	0.000 (0.000)	0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)
Year = 2007	0.020 (0.022)	0.012 (0.021)	−0.076* (0.035)	−0.067* (0.034)	0.054* (0.022)	0.059** (0.021)	−0.076* (0.034)	−0.064∼ (0.033)
Year = 2008	0.005 (0.021)	−0.002 (0.021)	−0.070* (0.035)	−0.066* (0.034)	0.016 (0.022)	0.019 (0.021)	−0.064∼ (0.033)	−0.062∼ (0.032)
Year = 2009	0.011 (0.021)	0.000 (0.020)	−0.062∼ (0.032)	−0.054∼ (0.031)	0.019 (0.020)	0.010 (0.020)	−0.129*** (0.032)	−0.130*** (0.031)
Year = 2010	0.016 (0.020)	0.004 (0.020)	−0.123*** (0.032)	−0.115*** (0.031)	−0.005 (0.020)	−0.009 (0.019)	−0.136*** (0.031)	−0.129*** (0.030)
Year = 2011	−0.000 (0.020)	−0.011 (0.019)	−0.070* (0.031)	−0.066* (0.030)	−0.011 (0.020)	−0.006 (0.019)	−0.079** (0.030)	−0.077** (0.029)
Year = 2012	−0.084*** (0.021)	−0.089*** (0.020)	−0.064* (0.030)	−0.056∼ (0.029)	0.055** (0.019)	0.054** (0.019)	0.168*** (0.030)	0.158*** (0.029)
Year = 2013	0.022 (0.020)	0.016 (0.019)	0.014 (0.031)	0.020 (0.030)	−0.033 (0.020)	−0.014 (0.019)	−0.058∼ (0.031)	−0.068* (0.029)
Year = 2014	0.028 (0.020)	0.017 (0.019)	0.028 (0.030)	0.029 (0.030)	0.017 (0.020)	0.022 (0.019)	−0.091** (0.030)	−0.099*** (0.029)
Year = 2015	0.045* (0.018)	0.034* (0.017)	0.003 (0.027)	0.004 (0.026)	0.131*** (0.017)	0.133*** (0.017)	0.206*** (0.028)	0.203*** (0.027)
Year = 2016	0.004 (0.017)	−0.005 (0.016)	−0.040 (0.028)	−0.042 (0.027)	0.016 (0.017)	0.020 (0.017)	−0.005 (0.027)	−0.011 (0.026)
Constant	7.261*** (0.331)	7.303*** (0.324)	8.691*** (0.457)	8.588*** (0.454)	7.988*** (0.294)	8.086*** (0.284)	7.759*** (0.437)	7.420*** (0.427)
No. of observations	45,714	48,300	45,714	48,300	45,714	48,300	45,714	48,300
No. of individuals	10,144	10,681	10,144	10,681	10,144	10,681	10,144	10,681
Adjusted R^2	0.010	0.009	0.003	0.003	0.006	0.006	0.020	0.019
AIC	105,623	111,502	146,055	153,976	104,696	109,715	144,833	152,452

Notes: OLS estimations. Baseline level: 4 or more years prior to car shedding. Standard errors in parentheses. Significance levels:$\sim p < 0.1$, $^* p < 0.05$.
VOL, non-affordability-driven car shedding; INVOL, affordability-driven car shedding; AIC, Akaike information criterion.
All models controlled for individual-fixed effects. Year 2006 forms the reference level; year 2017 is omitted because of collinearity.
Source: SHP.

Appendix B

Table B1.

Table B1
Life satisfaction, leisure satisfaction, joy, and anger related to car shedding (reference period: 3 or more years prior to car shedding).

	Life satisfaction		Leisure satisfaction		Joy		Anger	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	VOL	INVOL	VOL	INVOL	VOL	INVOL	VOL	INVOL
3–2 years hence	0.055 (0.102)	−0.147 (0.256)	−0.019(0.129)	0.027(0.239)	−0.009(0.090)	−0.409~ (0.210)	−0.125 (0.181)	−0.153 (0.214)
2–1 years hence	−0.083(0.102)	−0.357 (0.251)	−0.084(0.140)	−0.311(0.291)	−0.038(0.096)	−0.422*(0.199)	0.048(0.135)	0.154(0.220)
Within the next year	−0.105(0.093)	−0.192 (0.190)	0.039(0.115)	−0.334(0.239)	0.004(0.078)	−0.074(0.131)	0.115(0.132)	0.157(0.212)
0–1 year	−0.092(0.095)	−0.209 (0.161)	−0.042(0.118)	−0.449*(0.187)	−0.045(0.089)	−0.258*(0.124)	−0.013 (0.138)	−0.136 (0.154)
1–2 years	−0.003(0.107)	−0.176 (0.196)	−0.006(0.192)	−0.498~ (0.300)	0.174~ (0.098)	−0.279(0.232)	−0.146 (0.176)	−0.086 (0.253)
2–3 years	−0.148(0.137)	−0.274 (0.332)	0.251(0.189)	−0.091(0.283)	0.193(0.129)	−0.493*(0.250)	−0.044 (0.195)	−0.152 (0.263)
3 or more years	−0.077(0.127)	−0.130 (0.364)	0.139(0.174)	−0.356(0.361)	0.032(0.105)	−0.395(0.277)	−0.228 (0.176)	0.441(0.364)
No. of observations	45,714	48,300	45,714	48,300	45,714	48,300	45,714	48,300
No. of individuals	10,144	10,681	10,144	10,681	10,144	10,681	10,144	10,681
Adjusted R^2	0.010	0.009	0.003	0.003	0.006	0.006	0.020	0.019
AIC	105,622	111,500	146,053	153,974	104,697	109,714	144,833	152,451

Notes: OLS estimations. Baseline level: 3 or more years prior to car shedding. Standard errors in parentheses. Significance levels: $\sim p < 0.1$, $* p < 0.05$.
VOL, non-affordability-driven car shedding; INVOL, affordability-driven car shedding; AIC, Akaike information criterion.
All models controlled for sociodemographic and car-related controls, as well as for year-fixed effects and individual-fixed effects.
Source: SHP.

References

Akenji, L., 2014. Consumer scapegoatism and limits to green consumerism. J. Clean. Prod., Special Volume: Sustainable Production, Consumption and Livelihoods: Global and Regional Research. Perspectives 63, 13–23. https://doi.org/10.1016/j.jclepro.2013.05.022.

Alexander, S., 2012. The optimal material threshold: Toward an economics of sufficiency. Real-World Econ. Rev. 61, 2–21.

Baehler, D., 2019. Living in a Car-Free Housing Development: Motivations and Mobility Practices of Residents in Nine Developments in Switzerland and Germany. University of Lausanne, Lausanne.

BFS. 2020. Privathaushalte, nach Haushaltsgrösse 2018 [online]. URL https://www.bfs.admin.ch/bfs/de/home/aktuell/medienmitteilungen.assetdetail.12647639.html (accessed 8.13.20).

BFS. 2019a. Haushaltseinkommen und -ausgaben [online]. URL https://www.bfs.admin.ch/bfs/de/home/statistiken/wirtschaftliche-soziale-situation-bevoelkerung/einkommen-verbrauch-vermoegen/haushaltsbudget.html (accessed 8.13.20).

BFS. 2019b. Geburten und Todesfälle [online]. URL https://www.bfs.admin.ch/bfs/de/home/statistiken/bevoelkerung/geburten-todesfaelle.html (accessed 8.13.20).

BFS. 2019c. Durchschnittsalter der ständigen Wohnbevölkerung nach Staatsangehörigkeitskategorie, Geschlecht und Kanton, 2010-2018 [online]. URL https://www.bfs.admin.ch/bfs/de/home/statistiken/bevoelkerung.assetdetail.9466659.html (accessed 8.13.20).

BFS. 2019d. Motorisierungsgrad nach Kanton 1970-2018 [online]. URL https://www.bfs.admin.ch/bfs/de/home/statistiken/kataloge-datenbanken/tabellen.assetdetail.7226333.html (accessed 8.29.19).

BFS. 2019e. Bewohnte Wohnungen nach Bewohnertyp und Wohneigentumsquote, nach Kanton 2010-2017 [online]. URL https://www.bfs.admin.ch/bfs/de/home/statistiken/kataloge-datenbanken/tabellen.assetdetail.7346178.html (accessed 10.4.19).

BFS. 2017. Pendlermobilität [online]. URL https://www.bfs.admin.ch/bfs/de/home/statistiken/mobilitaet-verkehr/personenverkehr/pendlermobilitaet.html (accessed 8.13.20).

Binder, M., Blankenberg, A.-K., 2017. Green lifestyles and subjective well-being: More about self-image than actual behavior? J. Econ. Behav. Organ. 137, 304–323. https://doi.org/10.1016/j.jebo.2017.03.009.

Burger, P., Bezençon, V., Bornemann, B., Brosch, T., Carabias-Hütter, V., Farsi, M., Hille, S.L., Moser, C., Ramseier, C., Samuel, R., Sander, D., Schmidt, S., Sohre, A., Volland, B., 2015. Advances in understanding energy consumption behavior and the governance of its change – outline of an integrated framework. Front. Energy Res. 3, 1–19. https://doi.org/10.3389/fenrg.2015.00029.

Burger, P., Sohre, A., Schubert, I., 2019. Governance for Sufficiency. A new Approach to a contested Field. In: Hamman, P. (Ed.), Sustainability Governance and Hierarchy. Routledge, London/New York, pp. 157–177.

Butler, J., Kern, M.L., 2016. The PERMA-Profiler: A brief multidimensional measure of flourishing. Int. J. Wellbeing 6, 1–48. https://doi.org/10.5502/ijw.v6i3.526.

Carroll, P., Caulfield, B., Ahern, A. 2017. Exploring a case of car usage and ownership reduction in Dublin through car-shedding interventions. Trinity College Dublin.

Clark, A.E., Diener, E., Georgellis, Y., Lucas, R.E., 2008. Lags and Leads in Life Satisfaction: A Test of the Baseline Hypothesis. F243 Econ. J. 118, F222. https://doi.org/10.1111/j.1468-0297.2008.02150.x.

Clark, A.E., Georgellis, Y., 2013. Back to Baseline in Britain: Adaptation in the British Household Panel Survey. Economica 80, 496–512. https://doi.org/10.1111/ecca.12007.

Clark, B., Chatterjee, K., Melia, S., 2016. Changes in level of household car ownership: the role of life events and spatial context. Transportation 43, 565–599. https://doi.org/10.1007/s11116-015-9589-y.

Currie, G., Delbosc, A., 2011. Mobility vs. Affordability as Motivations for Car-Ownership Choice in Urban Fringe, Low-Income Australia. In: Lucas, K., Blumenberg, E., Weinberger, R. (Eds.), Auto Motives – Understanding Car Use Behaviours. Emerald Group Publishing Limited, Bingley, pp. 193–209. https://doi.org/10.1108/9780857242341-007.

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

Deka, D., 2017. The effect of mobility loss and car ownership on the feeling of depression, happiness, and loneliness. J. Transp. Health 4, 99–107. https://doi.org/10.1016/j.jth.2016.11.005.

Delbiaggio, K., Wanzenried, G., 2016. Wohnflächenkonsum und Wohnflächenbedarf (Studie im Auftrag des Bundesamtes für Wohnungswesen BWO). Lucerne University of Applied Sciences and Arts, Lucerne, Switzerland.

Diener, E., Ng, W., Harter, J., Arora, R., 2010. Wealth and happiness across the world: Material prosperity predicts life evaluation, whereas psychosocial prosperity predicts positive feeling. J. Pers. Soc. Psychol. 99, 52–61. https://doi.org/10.1037/a0018066.

Diener, E., Oishi, S., Tay, L., 2018. Advances in subjective well-being research. Nat. Hum. Behav. 2, 253–260. https://doi.org/10.1038/s41562-018-0307-6.

Diener, E., Suh, E.M., Lucas, R.E., Smith, H.L., 1999. Subjective well-being: Three decades of progress. Psychol. Bull. 125, 276–302. https://doi.org/10.1037/0033-2909.125.2.276.

EDA. 2017. Stadt und Land [online]. URL https://www.eda.admin.ch/aboutswitzerland/de/home/gesellschaft/bevoelkerung/stadt-und-land.html (accessed 8.13.20).

Emmerling, J., Qari, S., 2017. Car ownership and hedonic adaptation. J. Econ. Psychol. 61, 29–38. https://doi.org/10.1016/j.joep.2017.02.014.

Ettema, D., Friman, M., Gärling, T., Olsson, L.E., 2016. Travel Mode Use, Travel Mode Shift and Subjective Well-Being: Overview of Theories, Empirical Findings and Policy Implications. In: Wang, D., He, S. (Eds.), Mobility, Sociability and Well-Being of Urban Living. Springer, Berlin, Heidelberg, pp. 129–150. https://doi.org/10.1007/978-3-662-48184-4_7.

Ettema, D., Gärling, T., Eriksson, L., Friman, M., Olsson, L.E., Fujii, S., 2011. Satisfaction with travel and subjective well-being: Development and test of a measurement tool. Transp. Res. Part F Traffic Psychol. Behav. 14, 167–175. https://doi.org/10.1016/j.trf.2010.11.002.

Gan, Z., Feng, T., Yang, M., 2019. Exploring the Effects of Car Ownership and Commuting on Subjective Well-Being: A Nationwide Questionnaire Study. Sustainability 11, 84. https://doi.org/10.3390/su11010084.

Gärling, T., Gärling, A., Johansson, A., 2000. Household choices of car-use reduction measures. Transp. Res. Part Policy Pract. 34, 309–320. https://doi.org/10.1016/S0965-8564(99)00039-7.

Gärling, T., Gärling, A., Loukopoulos, P., 2002. Forecasting Psychological Consequences of Car Use Reduction: A Challenge to an Environmental Psychology of Transportation. Appl. Psychol. 51, 90–106. https://doi.org/10.1111/1464-0597.00080.

Giesel, F., Nobis, C., 2016. The Impact of Carsharing on Car Ownership in German Cities. Transportation Research Procedia 19, 215–224.

Goetzke, F., Rave, T., 2015. Automobile access, peer effects and happiness. Transportation 42, 791–805. https://doi.org/10.1007/s11116-015-9647-5.

Haefeli, U., Artho, J., de Haan, P., Arnold, T. 2020. Autofreie Haushalte in der Stadt Zürich (Forschungsprojekt FP-1.25 No. Bericht Nr. 60). Energieforschung Stadt Zürich.

Hanglberger, D., Merz, J., 2015. Does self-employment really raise job satisfaction? Adaptation and anticipation effects on self-employment and general job changesErhöht eine Selbständigkeit wirklich die Arbeitszufriedenheit? Adaptions- und Antizipationseffekte der Selbständigkeit und genereller Arbeitsplatzwechsel. J. Labour Mark. Res. 48 (4), 287–303.

Höysniemi, S., Salonen, A.O., 2019. Towards Carbon-Neutral Mobility in Finland: Mobility and Life Satisfaction in Day-to-Day Life. Sustainability 11, 5374. https://doi.org/10.3390/su11195374.

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

Kahneman, D., Deaton, A., 2010. High income improves evaluation of life but not emotional well-being. Proc. Natl. Acad. Sci. 107, 16489–16493. https://doi.org/10.1073/pnas.1011492107.

Kapteyn, A., Lee, J., Tassot, C., Vonkova, H., Zamarro, G., 2015. Dimensions of subjective well-being. Soc. Indic. Res. 123, 625–660. https://doi.org/10.1007/s11205-014-0753-0.

Klein, N.J., Smart, M.J., 2017. Car today, gone tomorrow: The ephemeral car in low-income, immigrant and minority families. Transportation 44, 495–510. https://doi.org/10.1007/s11116-015-9664-4.

Klein, N.J., Tran, M., Riley, S., 2020. "Desperately Need a Car": Analyzing crowdfunding campaigns for car purchases and repairs on Gofundme.com. Travel Behav. Soc. 21, 247–256. https://doi.org/10.1016/j.tbs.2020.07.004.

Kühne, K., Mitra, S.K., Saphores, J.-D.-M., 2018. Without a ride in car country – A comparison of carless households in Germany and California. Transp. Res. Part Policy Pract. 109, 24–40. https://doi.org/10.1016/j.tra.2018.01.021.

Lagrell, E., Thulin, E., Vilhelmson, B., 2018. Accessibility strategies beyond the private car: A study of voluntarily carless families with young children in Gothenburg. J. Transp. Geogr. 72, 218–227. https://doi.org/10.1016/j.jtrangeo.2018.09.002.

Litman, T., 2009. Mobility as a Positional Good: Implications for Transport Policy and Planning. In: Conley, J., McLaren, A.T. (Eds.), Car Troubles: Critical Studies of Automobility and Auto-Mobility. Ashgate Publishing Ltd, Surrey, England, pp. 199–219.

Luhmann, M., Hawkley, L.C., Eid, M., Cacioppo, J.T., 2012. Time frames and the distinction between affective and cognitive well-being. J. Res. Personal. 46, 431–441. https://doi.org/10.1016/j.jrp.2012.04.004.

MacLeod, A.K., Conway, C., 2005. Well-being and the anticipation of future positive experiences: The role of income, social networks, and planning ability. Cogn. Emot. 19, 357–374. https://doi.org/10.1080/02699930441000247.

Mattioli, G., 2017. 'Forced Car Ownership' in the UK and Germany: Socio-Spatial Patterns and Potential Economic Stress Impacts. Soc. Incl. 5, 147–160. https://doi.org/10.17645/si.v5i4.1081.

Mattioli, G., Wadud, Z., Lucas, K., 2018. Vulnerability to fuel price increases in the UK: A household level analysis. Transp. Res. Part Policy Pract. 113, 227–242. https://doi.org/10.1016/j.tra.2018.04.002.

Merz, J., 2018. Are Retirees More Satisfied? – Anticipation and Adaptation Effects of Retirement on Subjective Well-Being: A Panel Analysis for Germany (SOEP Paper No. 986). Social Science Research Network.

Mishra, G.S., Mokhtarian, P.L., Clewlow, R.R., Widaman, K.F., 2019. Addressing the joint occurrence of self-selection and simultaneity biases in the estimation of program effects based on cross-sectional observational surveys: case study of travel behavior effects in carsharing. Transportation 46, 95–123. https://doi.org/10.1007/s11116-017-9791-1.

Mitra, S.K., Saphores, J.-D.-M., 2020. How do they get by without cars? An analysis of travel characteristics of carless households in California. Transportation 47, 2837–2858. https://doi.org/10.1007/s11116-019-09994-6.

Mitra, S.K., Saphores, J.-D.-M., 2017. Carless in California: Green choice or misery? J. Transp. Geogr. 65, 1–12. https://doi.org/10.1016/j.jtrangeo.2017.09.016.

Morris, E.A., Blumenberg, E., Guerra, E., 2020. Does lacking a car put the brakes on activity participation? Private vehicle access and access to opportunities among low-income adults. Transp. Res. Part Policy Pract. 136, 375–397. https://doi.org/10.1016/j.tra.2020.03.021.

Moser, C., Rösch, A., Stauffacher, M., 2015. Exploring Societal Preferences for Energy Sufficiency Measures in Switzerland. Front. Energy Res. 3, 1–12. https://doi.org/10.3389/fenrg.2015.00040.

Odermatt, R., Stutzer, A., 2019. (Mis-)Predicted Subjective Well-Being Following Life Events. J. Eur. Econ. Assoc. 17, 245–283. https://doi.org/10.1093/jeea/jvy005.

Okulicz-Kozaryn, A., Nash, T., Tursi, N.O., 2015. Luxury car owners are not happier than frugal car owners. Int. Rev. Econ. 62, 121–141. https://doi.org/10.1007/s12232-015-0223-2.

Pagán-Rodríguez, R., 2012. Longitudinal Analysis of the Domains of Satisfaction Before and After Disability: Evidence from the German Socio-Economic Panel. Soc. Indic. Res. 108, 365–385.

Pedersen, T., Friman, M., Kristensson, P., 2011. Affective Forecasting: Predicting and Experiencing Satisfaction With Public Transportation. J. Appl. Soc. Psychol. 41, 1926–1946. https://doi.org/10.1111/j.1559-1816.2011.00789.x.

Qari, S., 2014. Marriage, adaptation and happiness: Are there long-lasting gains to marriage? J. Behav. Exp. Econ. 50, 29–39. https://doi.org/10.1016/j.socec.2014.01.003.

Reckwitz, A., 2002. Toward a theory of social practices: a development in culturalist theorizing. Eur. J. Soc. Theory 5, 243–263.

Sattlegger, L., Rau, H., 2016. Carlessness in a car-centric world: A reconstructive approach to qualitative mobility biographies research. J. Transp. Geogr. 53, 22–31. https://doi.org/10.1016/j.jtrangeo.2016.04.003.

Schwanen, T., Dijst, M., Dieleman, F.M., 2004. Policies for urban form and their impact on travel: The Netherlands experience. Urban Stud. 41, 579–603. https://doi.org/10.1080/0042098042000178690.

Seiler Zimmermann, Y., Wanzenried, G., 2019. Are Homeowners Happier than Tenants? Empirical Evidence for Switzerland. In: Brulé, G., Suter, C. (Eds.), Wealth(s) and Subjective Well-Being, Social Indicators Research Series. Springer International Publishing, Cham, pp. 305–321. https://doi.org/10.1007/978-3-030-05535-6_14.

Seligman, M.E.P., 2011. Flourish: A Visionary New Understanding of Happiness and Well-Being. Free Press, New York.

Shove, E., 2018. What is wrong with energy efficiency? Build. Res. Inf. 46, 779–789. https://doi.org/10.1080/09613218.2017.1361746.

Shove, E., Pantzar, M., Watson, M., 2012. The Dynamics of Social Practice: Everyday Life and How It Changes. SAGE Publications, London.

Spurling, N.J., McMeekin, A., Shove, E.A., Southerton, D., Welch, D., 2013. Interventions in Practice: Re-framing Policy Approaches to Consumer Behaviour. Sustainable Practices Research Group. Report.

Steg, L., 2005. Car use: lust and must. Instrumental, symbolic and affective motives for car use. Transp. Res. Part Policy Pract. Positive Utility of Travel 39, 147–162. https://doi.org/10.1016/j.tra.2004.07.001.

Tillmann, R., Voorpostel, M., Kuhn, U., Lebert, F., Ryser, V.-A., Lipps, O., Wernli, B., Antal, E., 2016. The Swiss Household Panel Study: Observing social change since 1999. Longitud. Life Course Stud. 7, 64–78. https://doi.org/10.14301/llcs.v7i1.360.

Toulouse, E., Gorge, H., Le Dû, M., Semal, L., 2017. Stimulating energy sufficiency: barriers and opportunities, in: Eceee Summer Study Proceedings. Presented at the eceee Summer Study, pp. 59–68.

Toulouse, E., Sahakian, M., Bohnenberger, K., Bierwirth, A., Lorek, S., Leuser, L. 2019. Energy sufficiency: how can research better help and inform policy-making? In: Eceee Summer Study Proceedings. Presented at the eceee Summer Study. 331–339.