Chapter 2
Empirical Evidence of Behavioral Interdependencies Across Life Choices

Yubing Xiong and Junyi Zhang

Abstract This chapter presents empirical evidence of behavioral interdependencies across more than 80 life choice variables, based on data collected from a cross-sectional survey, a panel survey, and a life history survey in Japan, respectively. Similar analyses are further conducted with respect to more than 20 indicators of life satisfaction and happiness, as a whole life and by life domain. Very complex patterns of cross-domain and within-domain interdependencies are revealed by using statistical modeling approaches. This is the first study in literature to clarify behavioral interdependencies across life choices from such a comprehensive way. Analyses also suggest a variety of research issues for promoting the life-oriented approach.

Keywords Life-oriented approach · Life choices · Life domain · Happiness · Life satisfaction · State dependence · Future expectation · Life history survey · Panel survey · Japan

2.1 Introduction

Many contemporary planning endeavors try to improve people's quality of life, and this goal has become central to the formulation of land use and transportation policies (Lotfi and Solaimani 2009). Quality of life (QOL) have been examined with respect to various life domains, such as residence (Heal and Chadsey-Rusch 1985; Wang and Li 2004; Cao 2016), social life (Honold et al. 2012; Delmelle

Y. Xiong (✉)
School of Transportation and Logistics, East China Jiao Tong University, Nanchang, China
e-mail: xiongmaozai1989@163.com

J. Zhang
Hiroshima University, Higashi-Hiroshima, Japan
e-mail: zjy@hiroshima-u.ac.jp; junyizh24@gmail.com

J. Zhang (ed.), *Life-Oriented Behavioral Research for Urban Policy*,
DOI 10.1007/978-4-431-56472-0_2

et al. 2013; Cambir and Vasile 2015; Lei et al. 2015), health (De Hollander and Staatsen 2003; Sturm and Cohen 2004; Curl et al. 2015; Tsai et al. 2016), education (Frisvold and Golberstein 2011; Winters 2011; González et al. 2016), employment (Huang and Sverke 2007; Zhao and Lu 2010; Tefft 2012), family life (Campbell 1976; Greenhaus et al. 2003; Huang and Sverke 2007), leisure and recreation (Leung and Lee 2005; Brajša-Žganec et al. 2011; Lin et al. 2013; Uysal et al. 2016), finance (Kaplan et al. 2008; Clark et al. 2008; Headey et al. 2008), and travel behavior (Abou-Zeid et al. 2012; Cao et al. 2013; Delmelle et al. 2013). Life choices in different life domains are usually made over different time scales and they are constrained by time and monetary considerations as well as by the various needs of households and their members. Therefore, changes in one of people's life choices may affect other choices. In other words, people's life choices are interdependent. Particularly over time, changes in residence/workplaces or vehicle ownership may have a significant impact on urban people's present/prospective life choices and QOL. Given these considerations, we can see that systematic investigations of various life choices, such as choice of residence and travel behavior, as well as QOL are important, especially from a dynamic and long-term viewpoint. However, many links between essential life choices and QOL embedded in land use and transportation planning are still unclear, because relevant studies are scarce in literature.

Links between transportation and QOL at the individual level have been recognized for several decades. Existing transportation studies have focused mainly on negative aspects of transportation, such as congestion, accidents, and air pollution. This is understandable because transportation policies, as one type of urban policy, must indicate how to mitigate the negative impacts of transportation externalities. In reality, however, travelers usually have both positive and negative feelings about travel activities (Zhang 2009; Ettema et al. 2010). Drivers stuck in traffic jams can experience stress and impatience, but multitasking during the use of transport systems allows people to make efficient use of time, which generates positive utility (Zhang 2009). Travel may also increase people's QOL because people's daily activities tend to be distributed across space, allowing them to strengthen social bonds and achieve personal goals (Ettema et al. 2010). Nordbakke and Schwanen (2013) found that having access to convenient transportation systems (e.g., living close to a public transit network) could generate feelings of freedom, competence, and belonging. A residence provides shelter, a fundamental human need, and people often need transportation to reach their home. Greater mobility (e.g., residential environment change) can also give people confidence and convince them that they are capable of realizing certain goals. Travel behavior is just a part of people's life choices. In this sense, travel behavior results from performing various human activities, as well as being a part of human mobility. People cannot survive without transportation; that is, transportation plays a vital role in meeting individuals' various needs (De Vos 2015).

This chapter has several purposes. First, using cross-sectional data, it: (1) statistically captures the interdependencies of life choices; and (2) clarifies the kinds of life choices, including residential choices and travel behavior, that affect people's

QOL and quantifies the effect sizes of these choices by controlling for the effects of land use attributes. Second, using midterm panel data, it: (1) examines the effects of the determinant factors of people's current life choices and QOL; and (2), illustrates the effects of changes in sociodemographics over time (individual attributes and changes of life events) on people's life choices and QOL. Third, from a long-term viewpoint, it: (1) clarifies biographical interdependences; and (2) demonstrates the changes in life choices and QOL in response to changes in people's life choices over the course of their lives.

2.2 Literature Review

2.2.1 Definition and Measurement of Quality of Life

Beginning in the 1960s, the question of quality of life (QOL) arose because the social costs of economic growth became more and more apparent to the public, especially environmental damage and the loss of future resources. Moreover, doubts grew about whether increasing the GDP would increase people's QOL (Tang 2007). Therefore, social scientists paid increasing attention to the QOL (Sirgy et al. 2000; George 2006), as did urban studies researchers (Khalil 2012; De Vos et al. 2013; Serag El Din et al. 2013). However, defining QOL is difficult, because it is a subjective experience that depends upon one's perceptions and feelings. There are over 100 definitions and models of QOL, but in recent years scholars have agreed that it is a multidimensional and interactive construct encompassing many aspects of people's lives and environments (Schalock 1996). Diener and Suh (1997) suggested that QOL is based on the experience of individuals. If a person experiences her/his life as good and desirable, it is assumed to be so, and factors such as feelings of joy, pleasure, contentment, and life satisfaction are paramount. Obviously, this definition of the QOL is most closely associated with the subjective well-being (SWB) tradition in the behavioral sciences. Andereck et al. (2007) and Uysal et al. (2012) have said that QOL refers to one's satisfaction with life and feelings of contentment or fulfillment with one's experiences in the world. It is concerned with how people view (or what they feel about) their lives. Similar situations and circumstances may be perceived differently by different people (Taylor and Bogdan 1990). QOL is a multifaceted and complicated concept. It is defined as a constellation of components that consists of three dimensions: positive, negative, and future expectations (Glatzer 2012). Future expectations are emphasized as a component of QOL because when someone experiences a bad situation, it matters whether that person is optimistic about the future or sees no way out.

To date, social indicators and subjective wellbeing (SWB) based approaches have been used to measure the QOL. Social indicators are societal measures that reflect people's objective circumstances in a given cultural or geographic unit. The hallmark of social indicators is that they are based on objective, quantitative

statistics rather than on individuals' subjective perceptions of their social environment. Indicators such as infant mortality, doctors per capita, longevity, rape rates, homicide rates, and police per capita can be assessed to measure QOL. Nevertheless, objective indicators do not tell us how individuals perceive and experience their lives, whereas subjective evaluations define the experience of life more precisely. SWB refers to how people experience their whole lives, as well as specific life domains, and it includes both cognitive judgments and affective reactions (Diener 1984; Myers and Diener 1995). Concepts encompassed by SWB include positive and negative affects, happiness, and life satisfaction (Gilbert and Abdullah 2004). Happiness has been defined as transitory moods of "gaiety and elation" that people feel about their current state of affairs (Campbell 1976). Happiness is an affective mood or state (Bowling 1995), whereas life satisfaction refers to a cognitive sense of satisfaction with life (Kahn and Juster 2002; Diener 2000). Happiness occurs over shorter time frames and can be assessed via self-reported feelings or emotions during an interval or activity episode. Life satisfaction is a cognitive evaluation of a longer period of time (Diener and Suh 1997; Diener 2009). Both affect and judgments of satisfaction represent people's evaluations of their lives and circumstances.

More specifically, happiness has usually been measured with a question such as, "Taken all together, how happy would you say you are?" (Easterlin 2001; Veenhoven 2012). On a 10-point scale in which ten represents maximum happiness, one represents maximum unhappiness, and five represents neutrality, the median response was slightly over seven and the mean response not much lower (Myers and Diener 1996). As Veenhoven (2012) has noted, people may also derive happiness from a specific life domain (e.g., a happy marriage or a good job). Veenhoven (2012) found that there is only limited evidence about how different decisions affect happiness. He suggested that studies of the effects of time and monetary choices on happiness should be research priorities, and Zimmermann (2014) concurred. Dutt (2008) argued that happiness does not depend on consumption and income alone, but on many other things. People usually spend their income and time managing various types of life choices, such as education, housing, vehicles, tourism and leisure activities, and daily shopping. In addition, life satisfaction is a cognitive measure of QOL (Kahn and Juster 2002). It is widely accepted that life satisfaction can be measured saying, "Now I want to ask you about your life as a whole. How satisfied are you with your life as a whole these days?" This question from the 1976 national survey of the quality of American life (Campbell 1976) is typical of those that have been asked in many subsequent surveys. Typically, a five-point scale ranging from completely satisfied to completely dissatisfied is used. Measures of overall satisfaction with life allow respondents to weigh each life domain according to their own standards to form an evaluation of their satisfaction (Diener et al. 1985). Moreover, life satisfaction is jointly determined by context-specific factors in life domains. Some measures are simple summations or averages of domain-specific satisfaction scores, whereas others use weighting procedures in which responses to the direct questions about overall life satisfaction are dominant (Campbell 1976). Individuals judge different aspects of

life more importantly than others and so it is important to understand which life domains contribute to life satisfaction. These questions depend upon the value an individual attaches to different experiences in life or the values they attach to various life domains (Sirgy 2010). However, how the domains interrelate, and which domains contribute most to overall life satisfaction, is unclear (Dolnicar et al. 2012).

2.2.2 Life Choices and Quality of Life

For individuals, the scientific understanding of quality of life (QOL) can guide important decisions in life, such as where and how to live and how to travel (Diener and Suh 1997). First, given the complex structural system of people's QOL, it is better to clarify how the life decisions made in different life domains affect people's QOL. Research from the life domain approach indicates that QOL is associated with various life domains, including residence, leisure and recreation, employment, health, social life, finance, education and learning, and family life (Knox 1975). The life domain approach maintains that satisfaction with each life domain determines overall well-being (Campbell 1976, 1981). These and other studies on life domain satisfaction suggest that satisfaction with health, family, and finance are the most important factors for overall life satisfaction (Cummins 1996; Salvatore and Munoz Sastre 2001; Van Praag et al. 2003). An earlier cross-sectional study by Cantril (1965) also indicates that economic factors, as well as health and family, rank highly among people's personal concerns. In an investigation of the livelihoods and well-being of low-income populations in Recife, Brazil, Maia et al. (2016) showed that the restricted mobility and activity patterns of citizens in these low-income communities influences or interacts with their QOL outcomes such as wealth, health, and well-being. Other research has confirmed that transportation planning and policy can play a role in enhancing people's future life chances. Specifically, with respect to the residential life domain, Wang and Li (2004) found that the residential satisfaction of young adults is influenced by individual local identity, financial capability, residence type, and an environment index based on comfort, convenience, and health. They also showed that housing ownership is central to residential satisfaction, based on a study in Beijing, China.

Cao (2016) adapted Campbell's model to examine the relationship between neighborhood characteristics and life satisfaction through perceptions and residential satisfaction and concluded that land use mix has both positive and negative impacts on life satisfaction, but the overall effect is insignificant. Both high density and poor street connectivity are detrimental to life satisfaction, but street connectivity is much more influential than density. To enhance life satisfaction, planners should limit neighborhoods with poor connectivity and implement strategies to promote positive responses to land use mix. As for the leisure or recreational domain, Brajša-Žganec et al. (2011) found that engaging in important leisure activities contributes to QOL, but the pattern of leisure activities

varies somewhat by age and gender. Chen et al. (2016) examined the relationship between holiday recreational experiences and life satisfaction, as mediated by tourism satisfaction, for a sample of 777 respondents in the United States. They found that individuals who were able to control what they wanted to do, felt relaxed and detached from work, and had new and challenging experiences during a vacation were more likely to be satisfied with their holiday experiences and their lives in general. Uysal et al. (2016) made substantial contributions to the literature and provided guidance for future research on QOL and well-being in tourism. They pointed out that tourism experiences and activities have a significant effect on both tourists' overall life satisfaction and well-being of residents in tourist areas. That is, tourists' experiences and tourism activities tend to contribute to positive affect in a variety of life domains such as family life, social life, leisure life, cultural life, among others.

With respect to the financial domain, Clark et al. (2008) provided a good literature review of the effect of income on QOL, and they concluded that the relationship is generally positive. Headey et al. (2008) demonstrated that household income allocation is a stronger predictor of life satisfaction than household income alone. As for social life, Diener and Seligman (2002) found that social relationships are a major distinguishing factor in college students' happiness; the happiest students tend to have strong relationships with friends, family, and partners. Transportation-related social exclusion is increasingly recognized as having a significant impact upon QOL, especially for people who live in the rural areas (McDonagh 2006; Lamont et al. 2013). Cambir and Vasile (2015) described the state of art in the field of social inclusion in relation with the QOL and its material dimension and identified the main areas of Romania where national policies and strategies should be tailored to improve QOL. Lei et al. (2015) found that increased social participation among older adults in urban communities in China had a positive effect on various dimensions of health-related QOL. There is a need for policies that improve the integration of community-level public resources to encourage frequent social interaction among older adults and to promote health and social care as a whole.

Turning to family life, Campbell (1976) found that satisfaction with family life is a strong and significant predictor of overall QOL. With respect to employment, Zhao and Lu (2010) claimed that there is an urgent need to explore the determinants of workers' commuting time, as the reduced accessibility of jobs has had a serious negative effect on the quality of urban life, particularly in the megacities of China. Their analysis showed that the interaction of housing availability, the market system, and the *Hukou* system has a significant impact on individual commuting time, and by extension, on QOL. Alexopoulos et al. (2014) confirmed that higher levels of stress and longer work hours are related to job satisfaction and workers' QOL, although the magnitude of these associations varies depending upon age and gender. In the health domain, the role of the built environment in facilitating physical activity is well recognized. In a longitudinal study of "home zone" style changes designed to make residential streets more "livable" by reducing the dominance of vehicular traffic and creating shared spaces, Curl

et al. (2015) examined broader self-reported behavioral (e.g., activity levels and perceptions), health, and quality of life outcomes. Among participants who were 65 or older, those in the intervention found it significantly easier to walk on the street near their home. Tsai et al. (2016) examined the cross-sectional and longitudinal association between sleep and health-related quality of life in pregnant women in Taiwan. They found that adequate sleep is essential for women at all stages of pregnancy and that improving the quantity and quality of nocturnal sleep in early gestation was especially important for an optimal health-related quality of life later in pregnancy. In the educational or learning domain, González et al. (2016) confirmed the motivational value and effectiveness of a gamification-training program that can prevent childhood obesity by using motor games and active videogames developed for overweight children aged 8–12. The outcomes included biometric variables, learning healthy habits, and experience with the intervention, and the results were highly satisfactory.

2.2.3 Behavioral Interdependencies of Life Choices

The interdependencies of life choices have not been satisfactorily explored, even though it is possible to identify studies that have examined several life choice variables. There is a large literature that investigates leisure related behavior and other life choices. Uysal et al. (2016) showed that tourists' experiences and tourism activities have positive effects in a variety of life domains, such as family life, social life, leisure life, and cultural life. Wilson et al. (2016) confirmed that participation in physical leisure activities, workload, and work environment all impact work-related fatigue. Tercan (2015) examined the relationship between leisure participation with one's family, family assessment, and life satisfaction among students at Akdeniz University and found that it is very important to understand students' family lives, as they develop leisure participation habits based on family life.

There is a great deal of literature on relationships between health-related behavior and other life choices. Fichera and Savage (2015) reported that there is a close relation between income and health improvement. They found that a 10 % increase in income is associated with a 0.02 (BMI: Body Mass Index) reduction in the number of illnesses in Tanzania. Based on a multilevel regression analysis of 1768 women living in the Paris metropolitan area, Vallée et al. (2010) discovered that the administrative characteristics of a neighborhood could promote or discourage the health-related behaviors of people whose daily activities are concentrated in the neighborhood. They confirmed the combined effects of activity space and neighborhood of residence on participation in preventive health-care activities.

Current theoretical models propose that work characteristics can influence health directly or indirectly via the work–family interface (Michel et al. 2009, 2011). Work–family conflict is a key construct that links the labor market and job quality to parents, family life, and children's home environments (Strazdins

et al. 2013). For mothers and fathers, work–family conflict has been associated with poorer physical and mental health outcomes, poorer QOL, low job satisfaction and commitment, and high job turnover (Allen et al. 2000; Nomaguchi et al. 2005). Studies that have examined the early stages of the family life cycle have reported that work–family conflict is associated with poorer parental mental health and poorer parent–child interactions to a degree that measurably affects children's mental health (Cooklin et al. 2014, 2015a). Cooklin et al. (2015b) found that long and inflexible work hours, night shift work, job insecurity, a lack of autonomy, and more children in the household were associated with increased work–family conflict, and this was in turn associated with increased distress. In a survey of 3243 fathers of infants (aged 6–12 months) in Australia, job security, autonomy, and having a more prestigious occupation were positively associated with work–family enrichment and better mental health. With respect to social behavior and other life choices, Milner et al. (2016) reported that there is a strong direct effect of social support on mental health and that it differs between employed and unemployed persons. The availability of good social support buffers the mental health impact of unemployment considerably. Improvements in social support for the unemployed may reduce the mental health impacts of job loss. Given the well-established benefits of social support for mental health, studies have begun to explore how access to social support may be shaped by the residential context in which people live. Keene et al. (2013) used multilevel data from the Chicago Community Adult Health Survey to investigate the relationships between an individual's length of residence and measures of social integration, as well as the extent to which these relationships are moderated by neighborhood poverty. They found that the relationship between length of residence and some measures of social integration are stronger in poor neighborhoods than in ones that are more affluent. These findings suggest that long-term residence may contribute positively to well-being in low-income communities because residents have access to social resources that are likely to be health promoting. Most of the evidence indicates that various life choices are interdependent, and we need to understand the internal mechanism of interdependences to see how they contribute to QOL improvement.

2.2.4 Dynamics of Life Choices and Quality of Life

Transportation researchers have followed trends in other disciplines and started paying increased attention to subjectively experienced well-being and how this relates to travel behavior from a dynamic/life course perspective. It is well-known that travel behavior is both constrained and enabled by life events (Sharmeen et al. 2014; Oakil 2015), life cycle stages (Higgins et al. 1994; Lee and Goulias 2014), life course (Scheiner 2014; SchoenduIet al. 2015), longer-term choices regarding lifestyle (Ritsema van Eck et al. 2005), residential location (Van Acker et al. 2010; van Acker 2015), and so on, and all of these aspects are closely related to well-being (De Vos et al. 2013). Many typical life events tend to cluster at certain stages

in the life course, and they may have negative consequences for well-being if they do not occur at the usual age (McLanahan and Sorensen 1985). For instance, family formation (household structure change) usually occurs in young adulthood, whereas exit from the labor market is typically experienced towards the end of the life course. In a recent study, Powdthavee (2009) found that people who became severely disabled eventually returned to their pre-disability levels of satisfaction in various domains of life, with the exception of satisfaction with health and income, which remained significantly lower than before the onset of disability. Research by Plagnol and Scott (2011) offered further support for the idea that it is important for future research on QOL to take a life course perspective, as changes in the conceptualization of QOL may be linked to life course events. They found that entering a partnership and retirement have the largest effects on QOL. Sharmeen et al. (2014) found that in the year following the birth of a first child, travel behavior (such as car acquisition) and residential choices (such as living area) are independent. This means that policies aimed at reducing car use by changing housing situations may not be successful, as car ownership is affected by life choices other than changes in residential situation. In such cases, more detailed and longitudinal data are required. Scheiner (2014) noted that some key events, including the birth of a child, job participation, and changes in residential choices, have significant effects on travel mode choices. Abou-Zeid et al. (2012) reported that well-being is shaped by residential attributes and the dimensions of activities and trips, such as types of activities, duration of activities, persons with whom they are undertaken, and travel mode used. However, as Plagnol and Scott (2011) have said, we cannot completely rule out reverse causality, because it is possible people's QOL influences which events they experience. For instance, someone who believes in the importance of family is probably more likely to enter a long-term partnership and have children than someone who considers their career to be more important. Negative feelings such as stress can lead to immediate adjustments in people's activity and travel patterns and can have a spillover effect on subsequent travel behavior, as well as on choice of residential location. These reverse effects suggest that people may decide to change their residential location, dispose of or acquire vehicles, or reconfigure their mobility and activity patterns in order to improve their QOL. Hence, it is important to consider the multiple time scales implicated in the relationships between travel behavior, residential choices, and QOL, as QOL is temporally complex and has short-term and long-term dimensions.

2.3 Life-Oriented Behavioral Surveys: Cross-sectional, Panel, and Life History Surveys

In addition to long life expectancy (Coulmas et al. 2008), Japan is also known for its relatively traditional, rigid social structures with predetermined life courses and career paths (Sugimoto 2010), and especially the narrow wealth gap. These stable features suggest that an emphasis on the quality of life is more evident in Japan

than in other societies (Inoguchi and Fujii 2009). Moreover, in order to capture the various behavioral interdependencies of life choices, especially from cross-sectional, dynamic, and long-term viewpoints, different time-series data sets are needed. Therefore, we conducted three Web-based surveys that covered all of the major cities in Japan, two life choice surveys in 2010 and 2014, and a life history survey in 2010.

2.3.1 The 2010 Web-Based Life Choice Survey

Considering the diversity and complexity of life choices, Zhang et al. (2011) conducted a Web-based life choice survey in Japan in January 2010 with the help of an Internet survey company that had more than 1.4 million registered panels at the time of survey. Respondents were randomly selected from the registered panels by considering the distributions of age, gender, and residential areas (here, referred to prefectures) across all of Japan. Zhang et al. (2011) argued that a Web-based survey is the most effective way to control the sample composition, which can be hard to achieve by other methods. However, we cannot deny that there are some sample selection biases. Nevertheless, considering that the Internet usage rate in Japan reached 75.5 % in 2010, the Internet might be an acceptable medium for conducting such a survey. A total of 2188 respondents participated in the survey, and 2178 provided valid answers for this study. The survey solicited very detailed information about individual's different life domains, including questions that asked about:

(1) Residence: location (zip code), length of stay, price (rental fee or purchase price), type, number of stories in the building, living area, number of rooms, distance to daily facilities, etc.
(2) Family budgets: income and expenditures.
(3) Health: subjective health condition, accidents and illnesses, amount of sleep, frequency and times of different types of physical exercise, and distance to places for physical exercise.
(4) Neighborhood: frequency of neighborhood communication and participation in community activities.
(5) Education and learning: academic degree, learning frequency and duration each time, distance, and major travel modes to different types of learning facilities.
(6) Job: location of workplace, commuting mode, job type, working days and hours per day, start and end time for a normal working day, paid holidays allowed and number of holidays actually taken, and number of years working.
(7) Family life: in-home and out-of-home time spent with family members on weekdays and weekends, frequency of communication with relatives, and care giving to preschool children and elderly or disabled family members.

(8) Leisure and recreation: discretionary time on weekdays and weekends, use of leisure time at different facilities (activity duration, frequency, distance to place, travel party (travel accompany during a trip such as relatives or friends), and major travel mode, tourism (domestic and overseas, frequency, travel party, and expenditure), and Internet usage (time and frequency).

A summary of the data characteristics is shown in Table 2.1. We expected decisions in the above domains to be interdependent. One can see that travel behavior such as possession of a driver's license, vehicle ownership (number and types of vehicles), and main travel mode are cross-domain behaviors. Furthermore, life satisfaction and happiness were also included to measure people's subjective QOL overall and in each domain, together with household attributes (numbers of preschool children, dependent students, and elderly members) and attributes of each

Table 2.1 Summary of characteristics of life choices survey data in 2010

Individual characteristics	Percentage	Individual characteristics	Percentage
Gender		*Household composition*	
Male	49.68	1 member	10.84
Female	50.32	2 members	28.83
Age		3 members	24.88
<15 years old	1.97	>3 members	35.45
15–17 years old	2.02	*Car ownership*	
18–34 years old	22.73	Have more than one car	26.91
35–64 years old	61.48	Have a private car	53.44
>64 years old	11.80	Have no car	19.65
Occupation		*Main travel mode*	
Employed	49.36	Cycling/walking	35.67
Part-time job	11.02	Public transit	23.51
Housewife	20.71	Car	36.64
Student	8.72	Others	4.18
Unemployed	10.19	*Health condition*	
Education level		Good	77.55
Having a bachelor degree	63.50	Not good	22.45
Having not a bachelor degree	36.50	*Life satisfaction*	
Marital status		Satisfied	57.07
Married	69.83	Neutral	32.87
Single	30.17	Dissatisfied	10.06
Household income		*Happiness*	
<2 million yen/year	7.76	9–10 point	13.22
2–6 million yen/year	46.46	6–8 point	51.56
>6 million yen/year	45.78	0–5 point	35.22

member (age, gender, marital status, relationship with household head, ownership of mobile phones, personal computer, etc.). For life satisfaction, respondents indicated on a 5-point scale how satisfied they were with their life as a whole and in each life domain (1 = very dissatisfied to 5 = very satisfied). For happiness, respondents indicated on a 11-point scale how happy they were currently (0 = very unhappy to 10 = very happy). For affective experience, the respondents assigned percentages to several moods (bad mood, low mood, pleasant mood, and very good mood) totaling to 100 % in each of the following domains: employment, social life, family life, and leisure and recreation. Based on these survey data, we found a bimodal distribution for happiness in Japan, with one peak at the center of the scale (5) and another at 7–8 (where 0 = very unhappy and 10 = very happy). The average happiness score was 6.37 (Fig. 2.1). The life satisfaction distribution is shown in Fig. 2.2.

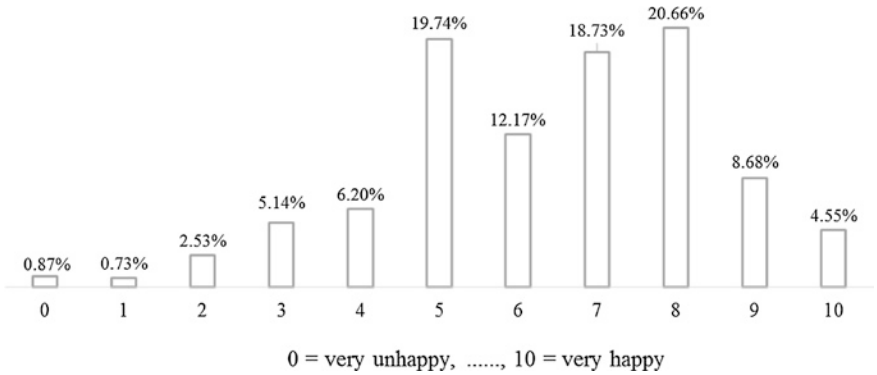

Fig. 2.1 Happiness scores

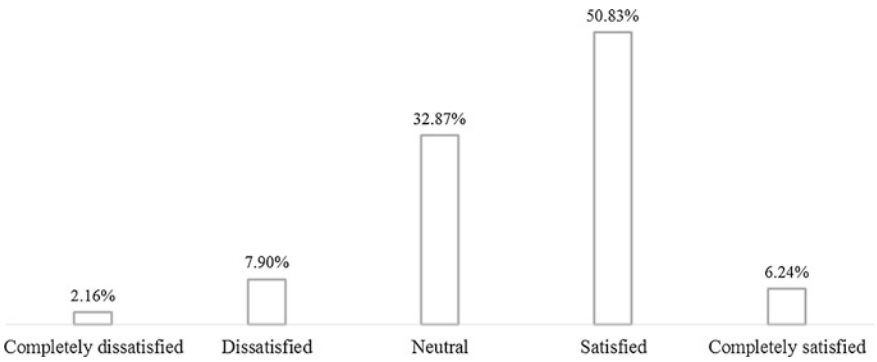

Fig. 2.2 Life satisfaction scores

2.3.2 The 2014 Web-Based Life Choice Survey

Zhang et al. (2014) conducted another life choice survey in January, 2014. Nine hundred respondents between 15 and 88 years old participated in the survey, and there were panel data for 422 participants who had responded to both the 2010 and the 2014 life choice surveys. The change rates for main life events and QOL indicators between 2010 and 2014 are shown in Fig. 2.3.

2.3.3 A Life History Survey

To disentangle behavioral interdependencies using a life course perspective, longitudinal data are required. Instead of a time-consuming panel survey, we used a retrospective approach that asked respondents to recall past mobility information. Using the same survey company mentioned above, this Internet-based life story survey was carried out in November 2010 in the major cities in Japan. Of the 6940 registered panels contacted, 1400 questionnaires were collected for which representative age, gender, and residential distributions across Japan are guaranteed. The response rate was 20.2 %. The survey focuses on four life events over the life course: residential mobility, household structure mobility, employment/education mobility, and car ownership mobility. Before answering detailed information about each type of mobility, respondents first indicated instances when their mobility changed, including the exact timing of relevant events (their age when the event occurred). To facilitate the reporting of detailed information, a simplified matrix showing these timings is presented in a separate window. Detailed information about each episode for each type of mobility is reported as follows:

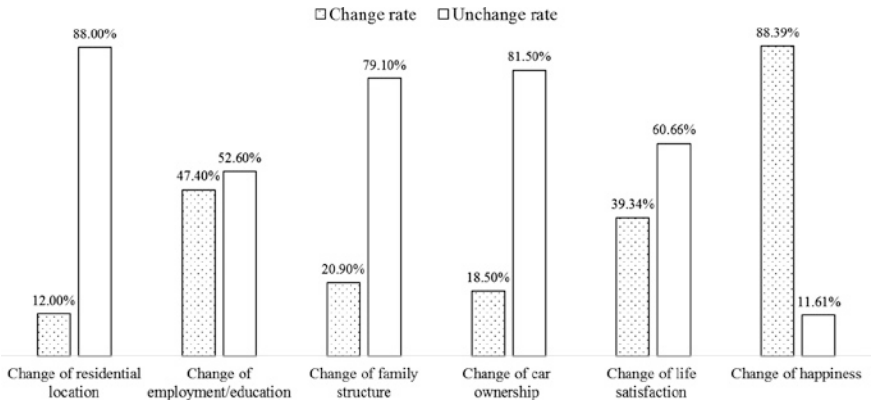

Fig. 2.3 The change rate of main life events based on panel data between 2010 and 2014

(1) Residential mobility: relocation place, income, residence property, and access (distance) to various facilities, including railways, bus stops, primary, junior, and high schools, hospitals, parks, supermarkets, and city hall, for each episode.
(2) Household structure mobility: household size, information about each household member for each episode, including age, gender, and relationship to householder.
(3) Employment/education mobility: job category, commute time to job/school, access to job/school, and travel mode for each episode.
(4) Car ownership mobility: number of cars, main user, car efficiency, purpose, and frequency of use for each episode.

In addition to the above information, QOL related variables (happiness and life satisfaction) were examined, and respondents were asked to report how confident they felt (11-point scale) about their answers to some major question items (e.g., access to facilities) with continuous values. Such confidence ratings can be used to reflect the reliability of the reported information as well as the quality of the retrospective survey. The data showed that the average confidence level varied from 7–9 across different cohorts (on the 11-point scale, 0 = not confident at all and 10 = completely confident), suggesting acceptable quality for the survey data. Figure 2.4 displays the mobility timing of residential location, car ownership,

Fig. 2.4 Timing of mobilities in residential, household structure, employment/education, and car ownership

household structure, and employment/education over the life course in 5-year intervals. Obviously, there is a peak period of residential mobility between 20 and 35 years of age, and similar curves can be seen for the other three types of mobility.

2.4 Cross-sectional Analysis

2.4.1 Methodology

Considering the numerous life choice variables in this study, there are likely to be many correlations among them and more nonlinear relationships between these variables and QOL related variables, and these relationships must be treated properly. That is, a logical methodology will allow for consistent conclusions. Zhang (2014) has stated that there are interdependencies across the above eight life domains, and thus we must quantify such interdependencies in this analysis. To this end, we proposed an integrated approach employing a data mining method called Exhaustive Chi-squared Automatic Interaction Detector (CHAID) to clarify the kinds of life choice variables that have impacts on the target decisions (e.g., residence property, and QOL indicators). We also used a Bayesian Belief Network (BBN) approach to quantify the influence of the various variables. The results from the Exhaustive CHAID approach were used to build the network structure for the QOL indicators and life choices variables in the BBN approach.

2.4.1.1 Exhaustive CHAID Approach

Data mining is an analytical tool for exploring large datasets to identify consistent interdependencies among variables. CHAID, a decision tree technique based on adjusted significance testing, is one of the most popular methods used in science and business for prediction, classification, and detection (Kass 1980). It uses the available data to automatically build a series of "if–then" rules in the form of a decision tree. The tree begins with one root (parent) node for a target variable that contains all of the observations in the sample, and it grows to accommodate subgroups that are segmented based on predictors at various branch levels until the tree converges (based on stopping criteria). However, a CHAID analysis may not find the optimal split for a predictor variable. Exhaustive CHAID was developed to remedy this issue by continuing to merge categories of the predictor variables until only two super categories are left that have the strongest associations with the target variable. Thus, once a set of predictors is given for a target variable, the Exhaustive CHAID approach will automatically derive the best combination of predictors for the target variable. Thus, the arbitrary influences of analysts can be eliminated. However, the Exhaustive CHAID approach can only be used to clarify

which life choice variables influence target variables (e.g., QOL indicators); it cannot quantify the degree/size of influence.

2.4.1.2 Bayesian Belief Network (BBN) Approach

The Bayesian Belief Network (Janssens et al. 2006; Verhoeven et al. 2007; Takamiya et al. 2010; Verhoeven 2010) approach is based on probabilistic causation (the occurrence of a cause increases the probability of an effect). It is useful for observing and analyzing complex and unstable systems for decision making and reasoning under uncertainty. Moreover, it is suitable for analyzing nonlinear relationships and evaluating the impacts of changes when updating modeled situations.

Recently, some researchers have employed the BBN approach in transportation behavior research. Janssens et al. (2006) examined and confirmed the value of BBN to manage the complexity of travel mode choice problems. The BBN approach is valuable for visualizing the multidimensional nature of complex decisions, and thus it is potentially valuable for modeling complex decisions. Takamiya et al. (2010) showed the effectiveness of the BBN approach for modeling travel behavior based on dependency zones and trip characteristics, where zones are characterized by the important facilities for trip makers. Verhoeven et al. (2007) verified the feasibility of BBNs to capture the direct and indirect effects of life trajectory events on the dynamics of activity travel patterns in general and travel mode choices in particular.

BBN structures are directed acyclic graphs (DAG). As there are no cycles, a BBN structure consists of a set of nodes and directed arcs. The nodes represent variables and the arcs represent directed causal influences between the nodes. An arc connects a parent node (Y) to a child node (X). A child node is dependent on its parent node, but it is conditionally independent of other nodes. The conditional probability P (Y|X), showing how a given parent node Y can influence the probability distribution over its child node X, is calculated using Bayes' Theorem:

$$P(Y/X) = \frac{P(Y/X)P(Y)}{P(X)} \tag{2.1}$$

where, P (X|Y) is the conditional probability of X given Y, and P(X) and P(Y) are the probabilities of nodes X and Y, respectively.

BBN is not a perfect approach, as it still has some weaknesses (Mittal 2007). First, it cannot differentiate between a causal relationship and a spurious relationship, because causal relationships cannot be ascertained from statistical data alone. Therefore, it cannot provide theoretical explanations for modeling results. Another limitation is that BBNs do not differentiate between a latent construct and its measures (observed variables). Because this study has clear assumptions about the interdependencies among residential choice variables, travel behavior variables, and QOL related variables, and BBN is just being used to test those assumptions, the first weakness of BBNs is not relevant in this study. As for the

second weakness of BBNs, our analysis does not need latent variables, and thus the second weakness is not relevant either. To use the BBN model, structure learning must first be performed to construct a network structure based on causal relationships derived from the observed data. We obtained the model structure based on repeated trial and error runs to check the improvement of the model. Once the network structure is established, parameter learning is implemented to determine the prior conditional probability tables (CPT) for each node in the network. Fortunately, CPT can be calculated automatically by means of probabilistic inference algorithms that are included in the Bayesian network-enabled software. We used the Netica Application, which can handle continuous and discrete variables simultaneously. Discrete variables can be divided into different states (i.e., high, medium, and low), and continuous variables can be automatically converted to discrete quantities before any probabilistic inferences are made. Brief details of the variables included in the analysis are shown in Table 2.1. The resulting BBN structure was obtained after repeated testing, calibrating, and validating.

Netica uses standard scoring rules to evaluate the classification accuracy of BBNs, including logarithmic loss, quadratic loss, and spherical payoff (Morgan et al. 1990). Values of spherical payoff, the most useful index, vary between 0 and 1, with 1 being best model performance. The logarithmic loss values are calculated using the natural log, between 0 and infinity inclusive, with values close to 0 indicating the best performance. Quadratic loss values are between 0 and 2, with 0 being best.

2.4.2 Behavioral Interdependencies of Life Choices

The primary source data for this study come from the 2010 Internet-based life choice survey, which recruited respondents residing in various cities across Japan (Zhang et al. 2011). We expected decisions about the above domains to be interdependent. In the popular activity-based approach, it is argued that travel demand is derived from activity participation. In the life-oriented approach, it is argued that travel demand is derived from life decisions. Similar arguments have been made for residential behavior. Residential and travel behavior are interdependent, as well as being interdependent with other life domains. In this study, we used 99 explanatory variables (including 85 life choice variables and 14 land use attributes), as shown in Table 2.2.

Setting the decision tree to a maximum level of 10 for each target variable (e.g., happiness indicator, each life choice) leads to the best decision tree in the Exhaustive CHAID approach, and it adopts all of the above predictors. This is true for the Exhaustive CHAID approach using the Answer Tree software, which treats the 85 life choice variables as inputs (predictors) to each target choice variable. To quantify influence on the QOL indicators, we estimated the BBN model. The network structure between the target variables (QOL indicators) and its factors was built using the results of the Exhaustive CHAID, after controlling for the

Table 2.2 Explanatory variables

Land use attributes	**Employment domain**
Distance to railway station (km)	Occupation: officer; civil servant; merchant; part-time job; housewife; non-employee; others
Distance to bus stop (km)	Job type: technical professional; management; salesman; service staff; agriculture; others
Distance to city hall (km)	Commute mode[a]
Distance to community center (km)	Working hours per day (paid)
Distance to post office (km)	Vacation actually taken (days/year)
Distance to hospital (km)	Duration of tenure (years)
Distance to supermarket (km)	Monthly workdays (days)
Distance to Kindergarten (km)	**Health domain**
Distance to elementary school (km)	Sleep time
Distance to secondary school (km)	Frequency of contact sports
Distance to high school (km)	Frequency of non-contact sports
Distance to cinema/theatre (km)	Frequency of gentle sports
Distance to sports facility (km)	Duration of contact sports (minutes)
Distance to park (km)	Duration of non-contact sports (minutes)
Residence domain	Duration of gentle sports (minutes)
Residence duration (years)	**Family life domain**
Living area (m^2)	Indoor time use on weekday
Housing type: attached house; terrace house; apartment; others	Outdoor time use on weekday
Number of stories of residential building	Indoor time use on non-weekday
The floor where respondents lived	Outdoor time use on non-weekday
Number of rooms	Household composition
Residence property (own = 1; rent = 0)	Frequency of having dinner with family
Main travel mode[a]	Frequency of contact with relatives
Vehicle ownership (number of vehicles)	
Finance domain	**Leisure and recreation domain**
Household annual income: 1: < 1, 2: 1–2, 3: 2–3, 4: 3–4, 5: 4–5, 6: 5–6, 7: 6–7, 8: 7–8, 9: 8–9, 10: 9–10, 11:10–15, 12: > 15 million yen	Frequency of going to cinema and theatre
Percentage of food expenditure	Frequency of going to sports facilities
Percentage of housing expenditure	Frequency of going to amusement parks
Percentage of energy expenditure	Frequency of going to entertainment places
Percentage of furniture expenditure	Frequency of going to racing facilities
Percentage of clothes expenditure	Travel party[c] to cinema and theatre
Percentage of healthcare expenditure	Travel party[c] to sports facilities
Percentage of transport expenditure	Travel party[c] to amusement parks
Percentage of education expenditure	Travel party[c] to entertainment places
Percentage of leisure expenditure	Travel party[c] to racing facilities
Percentage of saving	Travel mode to cinema and theatre[a]
Percentage of other expenditure	Travel mode to sports facilities[a]
	Travel mode to amusement parks[a]
	Travel mode to entertainment places[a]
	Travel mode to racing facilities[a]
	Duration at cinema and theatre (minutes)
	Duration at sports facilities (minutes)
	Duration at amusement parks (minutes)
	Duration at entertainment places (minutes)
	Duration at racing facilities (minutes)
	Leisure frequency
	Tourism frequency
	Frequency of going home for a visit
	Leisure expenditure (yen/year)
	Tourism expenditure (yen/year)
	Expenditure on going home for a visit (yen/year)
	Internet usage frequency (use every day = 1,0)
	Internet usage time (minutes/day)

(continued)

Table 2.2 (continued)

Learning and education domain
Education level (bachelor = 1,0)
Frequency of language learning
Frequency of knowledge learning
Frequency of hobby learning
Frequency of job training
Duration of language learning (minutes)
Duration of knowledge learning (minutes)
Duration of hobby learning (minutes)
Duration of job training (minutes)
Travel mode for language learning[a]
Travel mode for knowledge learning[a]
Travel mode for hobby learning[a]
Travel mode for job training[a]
Neighborhood domain
Frequency of neighborhood communication[b]
Participation in community activities[b]

Note
[a]Travel mode or main travel mode or commute mode: car; walking; public transit; others
[b]Frequency of neighborhood communication/community activities: often; sometimes; rare
[c]Travel party: alone; family member; colleague/classmate; acquaintance; friend; others

effects of land use attributes. The results from Exhaustive CHAID are shown in Tables 2.3, 2.4, 2.5, 2.6, 2.7, 2.8 and 2.9, and the results of the BBN are shown in Tables 2.10 and 2.11. The BBN estimation (with predictors derived from the Exhaustive CHAID) shows the variance reduction (VR) calculated in parentheses after each predictor. Variance reduction is the expected reduction in the variance of a target node because of the introduction of an input node. In this sense, VR can be used to evaluate the degree of influence of each predictor on the target variable. In Tables 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10 and 2.11, the first column shows the indicators of various life choices, including travel behavior and residential choices, and the second and last columns show the predictors for each indicator. The value in parentheses after each target variable in Tables 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10 and 2.11 is the accuracy of the decision tree split, which ranged between 60 and 86 %, suggesting that the Exhaustive CHAID approach achieved acceptable accuracy. The classification accuracy of the BBN that was estimated using Netica software was evaluated based on standard scoring rules, including logarithmic loss, quadratic loss, and spherical payoff (Morgan et al. 1990). Spherical payoff values, the most useful index, vary from 0 to 1, with 1 indicating the best model performance. The logarithmic loss values are calculated using the natural log, between 0 and infinity (inclusive), where a smaller value suggests better performance. Quadratic loss values range from 0 to 2, with 0 being the best. For our model structure, the spherical payoff was 0.9091, the logarithmic loss was 0.53, and the quadratic loss was 0.6842. All of these values indicate that the BBN model performs well.

Given the results in Table 2.10, it is clear that income (i.e., household annual income) influences happiness, but this is only true with respect to happiness and

Table 2.3 Significant factors influencing the variables in residence life

Target variables	Predictors
Residence duration (82.6 %)	Percentage of housing expenditure, household annual income, distance to nearest park, duration at amusement park, distance to nearest hospital, percentage of furniture expenditure, household composition, frequency of going to cinema and theatre, percentage of education expenditure, residence property, distance to city hall
Living area (66.4 %)	Residence property, number of rooms, residence duration, frequency of neighbor communication, percentage of transport expenditure, house type, tourism expenditure, household composition, travel party to amusement park, percentage of clothes expenditure, main travel mode, job type, vehicle ownership, percentage of education expenditure, travel mode to entertainment places
Housing type (84.6 %)	Number of stories of residential building, residence property, number of rooms, living area, tourism frequency, distance to nearest kindergarten, travel mode for language learning, distance to nearest secondary school, travel party to cinema and theatre, duration of gentle sports, frequency of neighbor communication
Number of stories of residential building (91.70 %)	The floor lived, house type, distance to railway station, percentage of food expenditure, percentage of furniture expenditure, household annual income, percentage of transport expenditure, household composition, residence property, distance to supermarket, distance to city hall, distance to nearest elementary school
The floor where lived (71.90 %)	Number of stories of residential building, residence property, frequency of gentle sports, percentage of furniture expenditure, sleep time, residence duration, frequency of contact with relatives, frequency of neighbor communication, travel mode to entertainment places, distance to nearest kindergarten, travel party to cinema and theatre, frequency of going to sports facilities, travel mode to cinema and theatre, percentage of education expenditure, distance to city hall, distance to supermarket
Number of rooms (75.70 %)	Living area, outdoor time use on non-weekday, number of stories of residential building, education level, percentage of transport expenditure, residence duration, vehicle ownership, distance to supermarket, percentage of education expenditure, house type, frequency of contact with relatives, percentage of energy expenditure, household composition, frequency of neighbor communication

(continued)

Table 2.3 (continued)

Target variables	Predictors
Residence property (88.10 %)	House type, residence duration, living area, distance to railway station, number of rooms, number of stories of residential building, travel mode to amusement park, percentage of transport expenditure, distance to nearest elementary school
Main travel mode (70.90 %)	Commute mode, indoor time use on weekday, travel mode to sports facilities, vehicle ownership, frequency of having dinner with family, education level, occupation, travel mode to cinema and theatre, percentage of education expenditure, travel mode to entertainment places, household annual income
Vehicle ownership (62.20 %)	Household composition, main travel mode, house type, travel mode to amusement park, living area, percentage of furniture expenditure, percentage of saving, duration of tenure, household annual income, number of rooms, duration of non-contact sports, expenditure on going home for a visit, distance to nearest post office, frequency of neighbor communication, number of stories of residential building, percentage of transport expenditure

Note The value in the parenthesis after each target variable shows the accuracy of decision tree split based on the Exhaustive CHAID approach (100 % means a perfect representation)

the mildly pleasant mood produced by leisure activities. However, it was not the most influential factor. In the case of happiness, the variable with the greatest influence was the percentage of saving (i.e., income saved), with a VR of 30.80 %, which is about three times higher than that of income (VR = 10.76 %). As for the mildly pleasant mood produced by leisure activities, time spent at racing facilities was estimated to be the most influential factor (VR = 34.19 %), followed by income (VR = 24.19 %). For the land use attributes, distance to a park (7.93 %) played a dominant role in happiness. For the other life choice variables, only occupation and the length/frequency of job training were associated with several happiness indicators. Occupation was the most important variable in explaining all three types of mood assessed for working on the job. The length of job training influenced the mildly pleasant mood produced by leisure activities, and the frequency of job training influenced the good mood produced by leisure activities. However, both of these variables had less influence than did the consumption variables. For example, the VR values for the length and frequency of job training were 2.32 and 2.03 %, respectively, which is just 6.79 and 6.21 % of the VR values of the most influential factors.

Education-related life choice variables were associated only with being in a bad mood during one's job, family life, and neighborhood communication. The percentage of income spent on education and a person's education level were the top factors influencing bad moods during family life and neighborhood

Table 2.4 Significant factors influencing the variables in finance life

Dependent variables	Predictors
Household annual income (52.80 %)	Household composition, living area, number of rooms, percentage of saving, percentage of furniture expenditure, tourism expenditure, percentage of housing expenditure, residence duration, travel party to cinema and theatre, duration of tenure, distance to nearest kindergarten, distance to nearest post office, tourism frequency
Percentage of food expenditure (34.30 %)	Percentage of energy expenditure, percentage of saving, distance to nearest high school, living area, percentage of housing expenditure, distance to city hall, distance to railway station, percentage of clothes expenditure, percentage of leisure expenditure, frequency of neighbor communication, household annual income
Percentage of housing expenditure (28.20 %)	Percentage of transport expenditure, percentage of healthcare expenditure, residence property, vehicle ownership, percentage of furniture expenditure, distance to nearest supermarket, house type, frequency of contact with relatives, percentage of clothes expenditure, percentage of food expenditure, residence duration, percentage of saving, distance to nearest post office
Percentage of energy expenditure (45.60 %)	Percentage of transport expenditure, percentage of furniture expenditure, percentage of healthcare expenditure, house type, distance to railway station, duration of tenure, distance to supermarket, number of stories of residential building, percentage of leisure expenditure, household annual income, residence duration, percentage of housing expenditure
Percentage of furniture expenditure (54.40 %)	Percentage of clothes expenditure, percentage of transport expenditure, distance to nearest hospital, distance to nearest kindergarten, number of stories of residential building, percentage of energy expenditure, percentage of education expenditure, percentage of food expenditure, indoor time use on weekday, distance to nearest bus stop, the floor lived, percentage of leisure expenditure, residence property, residence duration, distance to nearest post office
Percentage of clothes expenditure (52.80 %)	Percentage of furniture expenditure, percentage of transport expenditure, distance to nearest hospital, vehicle ownership, distance to nearest secondary school, percentage of housing expenditure, percentage of healthcare expenditure, the floor lived, occupation, percentage of leisure expenditure, percentage of food expenditure, distance to nearest park, frequency of hobby learning, number of number of stories of residential building of residential building, percentage of energy expenditure, percentage of education expenditure

(continued)

Table 2.4 (continued)

Dependent variables	Predictors
Percentage of healthcare expenditure (42.30 %)	Percentage of transport expenditure, percentage of clothes expenditure, percentage of housing expenditure, vehicle ownership, percentage of food expenditure, indoor time use on non-weekday, household composition, percentage of education expenditure, leisure frequency
Percentage of transport expenditure (46.20 %)	Percentage of healthcare expenditure, percentage of energy expenditure, education level, percentage of clothes expenditure, percentage of education expenditure, travel party to cinema and theatre, percentage of furniture expenditure, frequency of contact with relatives, distance to nearest bus stop, distance to nearest park, frequency of neighbor communication, outdoor time use on non-weekday, distance to nearest high school, distance to nearest kindergarten
Percentage of education expenditure (49.70 %)	Percentage of transport expenditure, household composition, duration of hobby learning, residence duration, number of rooms, percentage of food expenditure, percentage of furniture expenditure, residence property, distance to nearest bus stop, frequency of neighbor communication
Percentage of leisure expenditure (43.70 %)	Percentage of transport expenditure, percentage of clothes expenditure, percentage of food expenditure, distance to nearest park, residence duration, distance to nearest kindergarten, percentage of education expenditure, distance to nearest bus stop, percentage of housing expenditure, residence property, commute mode
Percentage of saving (35.80 %)	Percentage of leisure expenditure, percentage of transport expenditure, percentage of housing expenditure, percentage of food expenditure, percentage of furniture expenditure, household annual income, house type

Note The value in the parenthesis after each target variable shows the accuracy of decision tree split based on the Exhaustive CHAID approach (100 % means a perfect representation)

communication, whereas education level was the third most influential variable on bad moods during one's job. Thus, in this study, education only contributed to negative affective experiences.

The residence-related life choice variables were found to influence eight happiness indicators, six of which were positive affects (a mildly pleasant mood during leisure activities and neighborhood communication, and a good mood during leisure activities, family life, one's job, and neighborhood communication) and two that were negative affects (a bad mood during one's job and neighborhood communication). Three residence-related life choice variables were influential: residence property, living area, and length of residence. Residence property and length of residence had mixed effects on affective experience—that is, they were associated with both positive and negative affects. In contrast, living area

Table 2.5 Significant factors influencing the variables in Education/Learning life

Dependent variables	Predictors
Education level (71.20 %)	Commute mode, household annual income, travel mode for hobby learning, established holiday, frequency of having dinner with family, occupation, number of rooms, job type, residence duration, frequency of contact with relatives, frequency of hobby learning, health condition, sleep time
Frequency of language learning (98.40 %)	Duration of language learning, frequency knowledge learning, percentage of healthcare expenditure, duration of job training, travel mode to racing facilities
Frequency knowledge learning (97.90 %)	Duration of knowledge learning, frequency of language learning, percentage of transport expenditure, travel mode to racing facilities, frequency of going to sports facilities, frequency of hobby learning, frequency of job training
Frequency of hobby learning (96.60 %)	Duration of hobby learning, frequency of job training, indoor time use on weekday, duration at amusement park, distance to city hall, working hours, frequency of neighbor communication
Frequency of job training (96.80 %)	Duration of job training, travel mode for job training, frequency of language learning, commute mode, education level, duration of non-contact sports, percentage of energy expenditure, frequency of hobby learning, sleep time, frequency of neighbor communication, health condition
Travel mode for language learning (92.70 %)	Travel mode for knowledge learning, frequency of language learning, distance to nearest bus stop, occupation, travel mode to cinema and theatre, duration of language learning
Travel mode for knowledge learning (91.60 %)	Travel mode for language learning, duration of knowledge learning, travel mode for hobby learning
Travel mode for hobby learning (86.00 %)	Travel mode for knowledge learning, duration of hobby learning, travel mode for job training, vehicle ownership, travel mode to cinema and theatre
Travel mode for job training (84.80 %)	Duration of job training, travel mode for knowledge learning, residence duration, duration of tenure, duration of gentle sports, main travel mode, commute mode
Duration of language learning (94.20 %)	Frequency of language learning, duration of knowledge learning, frequency of gentle sports, frequency of having dinner with family

(continued)

Table 2.5 (continued)

Dependent variables	Predictors
Duration of knowledge learning (92.60 %)	Frequency knowledge learning, duration of hobby learning, percentage of healthcare expenditure
Duration of hobby learning (83.20 %)	Frequency of hobby learning, duration of knowledge learning, travel mode for hobby learning, duration of job training, duration of contact sport, distance to nearest bus stop
Duration of job training (77.90 %)	Frequency of job training, travel mode for job training, duration of hobby learning, living area, household annual income, working hours, frequency knowledge learning, occupation, frequency of neighbor communication

Note The value in the parenthesis after each target variable shows the accuracy of decision tree split based on the Exhaustive CHAID approach (100 % means a perfect representation)

Table 2.6 Significant factors influencing the variables in employment life

Dependent variables	Predictors
Occupation (69.90 %)	Established holiday, workdays, frequency of contact with relatives, house type, living area, working hours, frequency of neighbor communication, education level, distance to nearest secondary school, duration of tenure
Job type (41.60 %)	Occupation, education level, household annual income, established holiday, expenditure on going home for a visit, travel party to amusement park, frequency of hobby learning, frequency of neighbor communication, commute mode
Commute mode (75.40 %)	Main travel mode, occupation, travel mode for job training, established holiday, distance to nearest park, household annual income
Duration of tenure (48.90 %)	Occupation, established holiday, distance to nearest hospital, household annual income, vacation actually taken
Monthly workdays (60.00 %)	Occupation, vacation actually taken, working hours, frequency of hobby learning, travel mode to cinema and theatre
Vacation actually taken (67.90 %)	Established holiday, workdays, frequency of going to cinema and theatre, household composition, residence property
Established holiday (73.20 %)	Vacation actually taken, occupation, distance to nearest elementary school, sleep time, frequency of going to entertainment places, duration of tenure, internet usage frequency, frequency of hobby learning
Working hours per day (51.10 %)	Occupation, workdays, frequency of having dinner with family

Note The value in the parenthesis after each target variable shows the accuracy of decision tree split based on the Exhaustive CHAID approach (100 % means a perfect representation)

Table 2.7 Significant factors influencing the variables in family and social life

Dependent variables	Predictors
Indoor time use on weekday (36.00 %)	Indoor time use on non-weekday, residence property, frequency of having dinner with family, frequency of neighbor communication, working hours, job type, vacation actually taken, outdoor time use on weekday, residence duration, occupation, sleep time, workdays
Outdoor time use on weekday (72.50 %)	Indoor time use on weekday, outdoor time use on non-weekday, travel mode to cinema and theatre, duration of tenure, frequency of neighbor communication, sleep time, indoor time use on non-weekday
Indoor time use on non-weekday (36.00 %)	Indoor time use on weekday, residence property, outdoor time use on non-weekday, education level, distance to nearest secondary school, commute mode, workdays, sleep time, frequency of neighbor communication, outdoor time use on weekday
Outdoor time use on non-weekday (46.30 %)	Indoor time use on non-weekday, outdoor time use on weekday, leisure frequency, duration at amusement park, residence duration, frequency of going to amusement park, percentage of housing expenditure
Frequency of having dinner with family (63.90 %)	Indoor time use on weekday, living area, main travel mode, established holiday, sleep time, frequency of contact with relatives, frequency of neighbor communication, house type, travel party to cinema and theatre, education level, number of rooms, vehicle ownership, travel party to sports facilities, number of stories of residential building, health condition
Household composition (51.4 %)	Indoor time use on non-weekday, residence property, health condition, percentage of education expenditure, vehicle ownership, frequency of neighbor communication, number of rooms
Frequency of contact with relatives (25.80 %)	Frequency of neighbor communication, travel mode to amusement park, living area, tourism frequency, commute mode, leisure frequency, number of rooms, frequency of going home for a visit, frequency of going to entertainment places, education level, frequency of going to amusement park, percentage of leisure expenditure, sleep time
Frequency of neighborhood communication (77.50 %)	Frequency of neighbor communication, distance to nearest high school, working hours, occupation, household composition, sleep time, percentage of saving, residence duration, commute mode, duration of non-contact sports, frequency of having dinner with family

(continued)

Table 2.7 (continued)

Dependent variables	Predictors
Participation in community activities (79.00 %)	Frequency of neighbor communication, residence property, duration at sports facilities, frequency knowledge learning, health condition, distance to supermarket, education level, distance to nearest hospital, frequency of contact with relatives, frequency of going to sports facilities, percentage of education expenditure, living area, household composition, percentage of energy expenditure, number of stories of residential building, travel party to amusement park

Note The value in the parenthesis after each target variable shows the accuracy of decision tree split based on the exhaustive CHAID approach (100 % means a perfect representation)

Table 2.8 Significant factors influencing the variables in health life

Target variables	Predictors
Sleep Time (61.20 %)	Working hours, occupation, commute mode, outdoor time use on weekday, frequency of hobby learning, frequency of gentle sports, internet usage frequency, education level
Frequency of contact sports (87.10 %)	Duration of contact sport, frequency of non-contact sports, commute mode, education level, frequency of neighbor communication
Frequency of non-contact sports (78.80 %)	Duration of non-contact sports, frequency of contact sports, frequency of going to amusement park, frequency of going to sports facilities, frequency of contact with relatives, frequency of gentle sports, frequency of job training
Frequency of gentle sports (62.60 %)	Duration of gentle sports, frequency of non-contact sports, percentage of transport expenditure, percentage of saving, duration of contact sport, sleep time, travel party to entertainment places, commute mode, percentage of housing expenditure
Duration of contact sport (87.60 %)	Frequency of contact sports, duration at sports facilities, duration at cinema and theatre, travel mode for job training
Duration of non-contact sports (81.70 %)	Frequency of non-contact sports, duration at sports facilities, duration at cinema and theatre
Duration of gentle sports (67.80 %)	Frequency of gentle sports, percentage of leisure expenditure, duration of non-contact sports, residence property, percentage of energy expenditure

Note The value in the parenthesis after each target variable shows the accuracy of decision tree split based on the exhaustive CHAID approach (100 % means a perfect representation)

Table 2.9 Significant factors influencing the variables in leisure/recreation life

Target variables	Predictors
Frequency of going to cinema and theatre (61.10 %)	Travel party to cinema and theatre, frequency of going to sports facilities, travel party to amusement park, travel mode to sports facilities, distance to nearest secondary school, frequency of neighbor communication, frequency of going to amusement park, travel mode to cinema and theatre, frequency of gentle sports, travel party to racing facilities, tourism expenditure
Frequency of going to sports facilities (75.80 %)	Duration at sports facilities, travel party to sports facilities, travel mode to amusement park, travel mode to amusement park, frequency of going to entertainment places, frequency of non-contact sports, duration of non-contact sports, frequency of going to amusement park
Frequency of going to amusement parks (61.80 %)	Duration at amusement park, travel party to amusement park, frequency of going to entertainment places, duration of knowledge learning, travel mode to cinema and theatre, number of rooms, frequency of going to cinema and theatre, frequency of gentle sports, travel mode to amusement park, travel mode to amusement park, frequency of neighbor communication
Frequency of going to entertainment places (72.50 %)	Duration at entertainment places, travel party to entertainment places, travel party to amusement park, frequency of going to sports facilities, frequency of having dinner with family, duration at amusement park, education level, leisure expenditure, duration of job training, frequency of going to amusement park, percentage of education expenditure
Frequency of going to racing facilities (93.60 %)	Duration at racing facilities, frequency of going to entertainment places, frequency of having dinner with family, travel mode to sports facilities
Travel mode to cinema and theatre (75.50 %)	Travel party to cinema and theatre, travel mode to entertainment places, travel mode to amusement park, residence property, frequency of neighbor communication, main travel mode, vehicle ownership, travel mode to sports facilities, frequency of hobby learning, frequency of going to cinema and theatre
Travel mode to sports facilities (82.70 %)	Duration at sports facilities, travel mode to racing facilities, travel mode to amusement park, travel party to amusement park, the floor lived, travel mode to cinema and theatre, main travel mode

(continued)

Table 2.9 (continued)

Target variables	Predictors
Travel mode to amusement parks (82.10 %)	Duration at amusement park, travel mode to entertainment places, distance to nearest secondary school, travel party to amusement park, travel party to sports facilities, duration at cinema and theatre, frequency of gentle sports, travel mode to sports facilities, travel mode to cinema and theatre, commute mode
Travel mode to entertainment places (82.50 %)	Travel party to entertainment places, travel mode to cinema and theatre, main travel mode, travel mode to amusement park, duration at entertainment places, travel mode to racing facilities, expenditure on going home for a visit
Travel mode to racing facilities (86.50 %)	Frequency of going to racing facilities, travel mode to sports facilities, travel mode to entertainment places, travel party to racing facilities, duration at sports facilities, frequency of neighbor communication
Duration at cinema and theatre (71.70 %)	Frequency of going to cinema and theatre, duration of non-contact sports, travel mode to cinema and theatre, travel party to cinema and theatre, duration at sports facilities, distance to railway station, distance to nearest elementary school, health condition, tourism expenditure
Duration at sports facilities (77.70 %)	Frequency of going to sports facilities, travel party to sports facilities, duration at cinema and theatre, travel mode to sports facilities, duration at entertainment places, vacation actually taken, duration at amusement park
Duration at amusement parks (76.70 %)	Travel mode to amusement park, frequency of going to amusement park, distance to city hall, frequency of going to cinema and theatre, travel party to sports facilities, residence duration, travel party to amusement park, duration at sports facilities, occupation, education level, percentage of education expenditure, travel mode to sports facilities
Duration at entertainment places (77.40 %)	Frequency of going to entertainment places, travel party to entertainment places, duration of gentle sports, travel mode to entertainment places, occupation, education level, percentage of transport expenditure
Duration at racing facilities (98.30 %)	Frequency of going to racing facilities, travel mode to racing facilities, duration at cinema and theatre, number of stories of residential building, distance to railway station, duration at entertainment places, frequency of neighbor communication

(continued)

Table 2.9 (continued)

Target variables	Predictors
Travel party to cinema and theatre (76.80 %)	Frequency of going to cinema and theatre, indoor time use on non-weekday, travel party to amusement park, living area, travel mode to cinema and theatre, duration of non-contact sports, frequency of hobby learning, travel party to entertainment places, outdoor time use on non-weekday, occupation
Travel party to sports facilities (80.70 %)	Frequency of going to sports facilities, travel party to racing facilities, duration at sports facilities, travel mode to sports facilities, frequency of having dinner with family, travel party to amusement park, percentage of transport expenditure, travel party to cinema and theatre
Travel party to amusement parks (81.60 %)	Frequency of going to amusement park, travel party to cinema and theatre, travel mode to cinema and theatre, travel party to racing facilities, travel mode to amusement park, frequency of going to entertainment places, indoor time use on weekday, travel mode to racing facilities, travel party to entertainment places, duration of tenure
Travel party to entertainment places (79.30 %)	Frequency of going to entertainment places, travel party to cinema and theatre, outdoor time use on non-weekday, travel party to amusement park, travel party to racing facilities, travel mode to entertainment places, duration at sports facilities, duration of gentle sports, duration at entertainment places
Travel party to racing facilities (93.20 %)	Frequency of going to racing facilities, travel party to entertainment places, travel party to sports facilities, duration at entertainment places, travel mode to sports facilities, frequency of hobby learning, travel mode to entertainment places, duration of knowledge learning, travel party to amusement park
Internet usage frequency (85.6 %)	Internet usage time, education level, outdoor time use on weekday, duration at amusement park, frequency of contact with relatives, percentage of transport expenditure, leisure frequency, frequency of hobby learning, frequency of going to entertainment places
Internet usage time (32.40 %)	Internet usage frequency, travel mode to entertainment places, health condition, education level, travel party to cinema and theatre, indoor time use on weekday, duration of job training, duration at cinema and theatre, percentage of education expenditure, frequency of neighbor communication, vehicle ownership, frequency of neighbor communication, frequency of contact with relatives, percentage of clothes expenditure, residence property

(continued)

Table 2.9 (continued)

Target variables	Predictors
Leisure frequency (37.50 %)	Tourism frequency, travel mode to amusement park, frequency of going to amusement park, duration of job training, percentage of leisure expenditure, travel mode to amusement park, indoor time use on non-weekday, outdoor time use on non-weekday, duration of non-contact sports, sleep time
Tourism frequency (61.60 %)	Tourism expenditure, occupation, frequency of having dinner with family, outdoor time use on weekday, frequency of hobby learning, frequency of job training, leisure frequency, percentage of furniture expenditure
Frequency of going home for a visit (70.30 %)	Expenditure on going home for a visit, number of stories of residential building, percentage of energy expenditure, occupation, distance to nearest elementary school, leisure frequency, residence property, sleep time, distance to nearest park
Leisure expenditure (78.40 %)	Tourism expenditure, duration at amusement park, percentage of leisure expenditure, frequency of contact with relatives, percentage of education expenditure, travel mode to amusement park, living area, travel party to sports facilities, household annual income, household composition, frequency of neighbor communication, outdoor time use on non-weekday, house type
Tourism expenditure (70.50 %)	Travel party to amusement park, education level, duration of knowledge learning, indoor time use on non-weekday, frequency of gentle sports, household annual income, frequency of contact with relatives, household composition, established holiday, sleep time, frequency of having dinner with family, travel party to cinema and theatre, frequency of going to amusement park
Expenditure on going home for a visit (68.50 %)	Residence duration, distance to city hall, distance to nearest park, percentage of saving, duration at amusement park, duration of gentle sports, distance to nearest elementary school, travel mode to amusement park, frequency of neighbor communication, education level, frequency of job training, occupation, frequency of contact with relatives, percentage of furniture expenditure, frequency of neighbor communication, sleep time

Note The value in the parenthesis after each target variable shows the accuracy of decision tree split based on the Exhaustive CHAID approach (100 % means a perfect representation)

Table 2.10 Significant factors influencing happiness

Target variables	Predictors
Happiness (79.2 %)	(1) Percentage of saving (30.80 %), (2) travel party to amusement parks (12.78 %), (3) household annual income (10.76 %), (4) tourism frequency (8.73 %), (5) distance to park (7.93 %), (6) duration of gentle sports (5.12 %), (7) frequency of contact with relatives (0.11 %), (8) frequency of neighborhood communication (0.07 %), (9) percentage of leisure expenditure (0.02 %)
Bad mood during leisure activities (71.3 %)	(1) Indoor time use on weekday (18.25 %), (2) frequency of contact with relatives (11.92 %), (3) percentage of leisure expenditure (10.61 %)
Mildly pleasant mood during leisure activities (69.4 %)	(1) Duration at racing facilities (34.19 %), (2) household annual income (24.19 %), (3) frequency of neighborhood communication (14.19 %), (4) main travel mode (11.76 %), (5) leisure expenditure (8.99 %), (6) residence property(7.93 %), (7) outdoor time use on holiday (5.701 %), (8) percentage of clothes expenditure (4.39 %), (9) duration of job training (2.32 %), (10) distance to bus stop (2.02 %)
Good mood during leisure activities (86.2 %)	(1) Duration at cinema and theatre (32.68 %), (2) percentage of transport expenditure (20.48 %), (3) residence property (10.40 %), (4) duration of language learning (8.30 %), (5) internet usage time (5.08 %), (6) frequency of job training (2.03 %)
Bad mood during family life (75.5 %)	(1) Percentage of education expenditure (4.32 %), (2) travel party to amusement parks (3.71 %), (3) percentage of transport expenditure (2.25 %), (4) percentage of food expenditure (1.16 %), (5) distance to city hall (1.08 %)
Mildly pleasant mood during family life (63.1 %)	(1) Indoor time use on holiday (12.75 %), (2) leisure expenditure (12.50 %), (3) duration of hobby learning (10.33 %), (4) distance to railway station (9.87 %), (5) frequency of contact with relatives (1.58 %), (6) duration of contact sports (1.03 %), (7) frequency of neighborhood communication (0.08 %), (8) duration at cinema and theatre (0.03 %)
Good mood during family life (66.3 %)	(1) Travel party to amusement parks (12.22 %), (2) tourism frequency (12.01 %), (3) percentage of healthcare expenditure (0.71 %), (4) indoor time use on holiday (0.10 %), (5) living area (0.004 %)
Bad mood during job (63.5 %)	(1) Occupation (8.20 %), (2) indoor time use on weekday (5.37 %), (3) education level (1.93 %), (4) vacation taken (1.13 %), (5) residence property (0.10 %), (6) distance to supermarket (0.08 %), (6) frequency of going to cinema and theatre (0.003 %)
Mildly pleasant mood during job (62.5 %)	(1) Occupation (7.60 %), (2) frequency of gentle sports (4.47 %), (3) duration at amusement parks (0.44 %), (4) percentage of others expenditure (0.23 %), (5) frequency of going to cinema and theatre (0.17 %), (6) frequency of neighborhood communication (0.14 %)
Good mood during job (61.1 %)	(1) Occupation (3.21 %), (2) distance to city hall (3.00 %), (3) distance to railway station (2.78 %), (4) frequency of going to cinema and theatre (2.60 %), (5) internet usage time (2.40 %), (6) residence duration (0.17 %), (7) vacation taken (0.14 %)

(continued)

Table 2.10 (continued)

Target variables	Predictors
Bad mood during social communication (63.3 %)	(1) Education level (30.34 %), (2) percentage of education expenditure (15.20 %), (3) outdoor time use on holiday (10.20 %), (4) travel party to cinema and theatre (9.19 %), (5) internet usage frequency (7.12 %), (6) internet usage time (2.32 %), (7) frequency of neighborhood communication (0.03 %), (8) residence duration (0.002 %)
Mildly pleasant mood during social communication (63.4 %)	(1) Frequency of neighborhood communication (18.98 %), (2) tourism frequency (9.37 %), (3) residence property (1.24 %), (4) percentage of food expenditure (1.06 %), (10) distance to bus stop (1.02 %)
Good mood during social communication (60.4 %)	(1) Frequency of neighborhood communication (21.28 %), (2) indoor time use on holiday (15.27 %), (3) frequency of going to entertainment places (3.03 %), (4) distance to high school (1.97 %), (5) frequency of gentle sports (1.02 %), (6) travel party to amusement parks (0.94 %), (7) travel party to entertainment places (0.02 %), (8) residence duration (0.009 %)

Note
The value in the parenthesis after each target variable shows the accuracy of decision tree split based on the Exhaustive CHAID approach, and the value in the parenthesis after each predictor is the variance reduction (VR) calculated from the BNN model

was associated only with a positive affect (being in a good mood in one's family life). Unfortunately, none of the residence-related variables influenced overall life happiness.

Happiness indicators were influenced by various other life choice variables. Regarding happiness as a whole, as mentioned above, the most influential life choice variable was the percentage of saving (VR = 30.80 %), whereas travel party to amusement parks was the next most influential variable (VR = 12.78 %), even stronger than income. In other words, investment in one's future is most important for enhancing people's current overall happiness level. For the four targeted life domains (jobs, family life, the neighborhood, and leisure and recreation), saving was less relevant for happiness. For experiences of a mildly pleasant mood during leisure activities, income was the second most influential factor, followed by the frequency of neighborhood communication.

Apart from income and the percentage of saving, happiness was clearly influenced by spending money to maintain an active lifestyle, including tourism and leisure activities, sports and entertainment, contact with relatives, and communication within the neighborhood. Active lifestyle was related to experiencing a positive affect in some life domains, but it was associated with a negative affect in others. Thus, the effects of active life related choices on happiness were mixed.

Table 2.11 Significant factors influencing life satisfaction

Dependent variables	Predictors
Life satisfaction (72.9 %)	(1) Vehicle ownership (28.5 %), (2) main travel mode (21.1 %), (3) occupation (19.13 %), (4) outdoor time use on non-weekday (12.56 %), (5) distance to bus stop (4.4 %), (6) commute mode (2.7 %), (7) frequency of going to cinema and theatre (1.92 %), (8) distance to railway station (0.9 %), (9) distance to sports facilities (0.551 %), (10) distance to city hall (0.49 %), (11) distance to park (0.389 %)
Satisfaction with residence (73.5 %)	(1) Main travel mode (33.3 %), (2) distance to kindergarten (11.8 %), (3) distance to secondary school (10.4 %), (4) vehicle ownership (11.03 %), (5) distance to station (1.27 %), (6) distance to bus stop (0.82 %), (7) travel mode to cinema and theatre (0.23 %), (8) internet usage time (0.21 %), (9) monthly workdays (0.18 %), (10) distance to city hall (0.08 %), (11) frequency of neighborhood communication (0.06 %)
Satisfaction with finance (68.9 %)	(1) Percentage of saving (30.9 %), (2) frequency of going to cinema and theatre (15.4 %), (3) vehicle ownership (9.74 %), (4) occupation (8.95 %), (5) main travel mode (2.11 %), (6) distance to railway station (1.83 %)
Satisfaction with health (75.6)	(1) Travel mode to sports facilities (23.8 %), (2) frequency to sports facilities (19.4 %), (3) commute mode (1.28 %), (4) occupation (1.02 %), (5) main travel mode (0.54 %)
Satisfaction with social (80.9 %)	(1) Frequency of neighborhood communication (28.1 %), (2) travel mode to park (23.6 %), (3) frequency to park (20.3 %), (4) travel mode to sports facilities (18.7 %), (5) distance to park (3.49 %), (6) distance to sports facilities (2.34 %), (7) occupation (1.12 %)
Satisfaction with education/learning (71.2 %)	(1) Outdoor time use on non-weekday (20.34 %), (2) distance to community center (10.44 %), (3) percentage of education expenditure (9.12 %), (4) monthly workdays (5.67 %), (5) distance to high school (3.12 %), (6) distance to kindergarten (1.63 %), (7) vehicle ownership (1.11 %)
Satisfaction with job (82.1 %)	(1) Vehicle ownership (10.4 %), (2) tourism frequency (7.61 %), (3) commute mode (5.59 %), (4) distance to station (4.32 %), (5) distance to bus stop (4.20 %), (6) job type (1.01 %)
Satisfaction with family life (82.3 %)	(1) Indoor time use on weekday (26.8 %), (2) main travel mode (12.90 %), (3) frequency of going to cinema and theatre (1.92 %), (4) vehicle ownership (0.78 %); (5) frequency to park (0.51 %), (6) frequency to sports center (0.045 %)
Satisfaction with leisure/recreation (65.3 %)	(1) Outdoor time use on non-weekday (30.3 %), (2) distance to park (15.04 %), (3) distance to station (12.52 %), (4) main travel mode (6.23 %), (5) distance to sports facilities (5.01 %), (6) frequency of contact with relatives (3.12 %), (7) frequency to park (0.51 %)

Note

The value in the parenthesis after each target variable shows the accuracy of decision tree split based on the Exhaustive CHAID approach, and the value in the parenthesis after each predictor is the variance reduction (VR) calculated from the BNN model

Of the 13 happiness indicators, the frequency of neighborhood communication influenced seven indicators (including positive and negative affective experiences), suggesting the importance of communicating with one's neighbors for happiness. The frequency of neighborhood communication had the greatest influence on experiences of positive moods (mildly pleasant and good moods) during neighborhood communication.

With respect to the influence of expenditures on happiness, besides bad and good moods during one's job and being in a good mood during neighborhood communication, expenditure variables influenced all the other happiness indicators, either negatively or positively. Leisure expenditure influenced happiness and the affective experience during leisure activities and family life, but with mixed effects. Transportation expenditure was associated not only with being in a good mood during leisure activities but also with being in a bad mood during family life. Food expenditure was related to both positive and negative affective experiences (good mood during neighborhood communication; bad mood during family life). Expenditure on clothes was only associated with positive affect (a mildly pleasant mood during leisure activities). Expenditure on health care was associated with being in a good mood during family life. Several of the expenditure variables were equally influential. The two most influential expenditure variables were the effect of the percentage of saving on overall life happiness, and the effect of the percentage of income spent on education on bad moods during family life. The next most influential expenditure variables were the effect of the percentage of income spent on leisure on bad moods during leisure activities, the effect of the percentage of income spent on transportation on good moods during leisure activities, and the effect of the percentage of income spent on education on bad moods during neighborhood communication. Tied for the third most influential expenditure variables were the effect of leisure expenditure on mildly pleasant moods during family life, and the effect of the percentage of income spent on health care on good moods during family life.

For the life choice variables, sports contributed to positive affects, whereas Internet usage and visiting amusement parks, cinemas, and the theater had mixed effects on affective experience. Indoor time use on a weekday was only related to two negative experiences: bad moods during leisure activities and during one's job. However, indoor time use during a holiday was associated with three types of positive affective experiences: mildly pleasant moods during family life, and good moods during family life, and neighborhood communication. Given that working hours and monthly working days did not significantly influence any of the 13 happiness indicators, whereas leisure- and tourism-related variables did, these results may imply that one's current work–life balance does not matter for happiness, but the use of one's free time outside of work definitely does.

Table 2.11 shows how QOL (in terms of life satisfaction) is affected by land use attributes, residential choices, travel behavior, and other life choices. First, land use attributes such as accessibility and travel behavior had a dominant role in life satisfaction. Specifically, vehicle ownership was the most influential factor (28.5 %), followed by main travel mode (21.1 %), and the distance to a railway station (0.9 %) also played a prominent role in life satisfaction. Second, the satisfaction with residence domain was mainly affected by main travel mode (33.3 %) and the distance to kindergarten (11.8 %). This reveals the strong association between closeness to childcare facilities and life satisfaction. Additionally, access to a railway station had a significant effect on satisfaction with finance, and access to a community center was important for the satisfaction with education and learning domain. This suggests that community centers (with museums, planetarium, and so on) in Japan are beneficial for those who would like to increase their knowledge, and that they generate greater enthusiasm for learning. Closeness to parks and railway stations have a positive influence on the life satisfaction in the leisure and recreation domain. This reveals that transit/leisure oriented environments are essential for participation in leisure activities.

2.4.3 Summary

This section of the chapter systematically examined various behavioral interdependencies across a broad set of life domains. Both the Exhaustive CHAID approach and the Bayesian Belief Network approach were shown to be the promising tools for quantifying the complex behavioral interdependencies between life choices and the quality of life. We used life choice survey data collected from residents in various Japanese cities in 2010. These data were originally collected for the life-oriented approach. The life-oriented analysis provides a foundation for this study. The findings are summarized below.

First, we confirmed that the life choices (decisions) that are relevant to various life domains are interdependent. For each life choice, the results showed other life choices as relevant predictors.

Second, we successfully captured the effects of different kinds of life choices on people's quality of life and quantified those effects. Some interesting findings include:

- Family life activities, leisure activities, and social activities are important for happiness and life satisfaction.
- Saving is the most important factor for enhancing people's happiness, whereas vehicle ownership is the primary factor for improving people's life satisfaction.
- Usage of one's free time outside of work increases happiness, but land use attributes and travel behavior play a vital role in life satisfaction.
- The effects of different types of expenditures and residence-related life choices on happiness and life satisfaction are mixed. However, most residence-related

and leisure-, social-, and family life-related life choice variables were related to positive affective experiences.
- Only the distance to the nearest park influenced people's happiness, whereas distance to bus stops, railway stations, sports facilities, and the city center influenced people's life satisfaction.

Finally, these results have valuable policy implications. We found that people who choose to live closer to the daily facilities of life (public railway stations, bus stops, city center, school, and so on) tend to have pleasant moods in each life domain. That is, geographic scales matter to levels of happiness and life satisfaction, reflecting the strong positive associations between: closeness to the city center and more employment opportunities; convenient transit and more trips; and closeness to school and higher education and enthusiasm for learning. People with more leisure activity opportunities have more positive social feelings and are more satisfied with most life domains.

2.5 Panel Analysis

2.5.1 Methodology

A Structural Equation Model (SEM) was developed for this study. Structural equation modeling is a very powerful tool and it is increasingly being used in travel behavior research (Golob 2003). A complete SEM consists of two components: the structural component and the measurement component. These components are defined by three sets of equations: structural equations, measurement equations for endogenous variables, and measurement equations for exogenous variables. This study includes both of the components and thus uses a full SEM model. Several measures are used to assess the goodness-of-fit of a SEM. However, in most cases, these measures do not agree (Fabrigar et al. 2010). Some take parsimony into account and others do not, and thus fit indices can be divided into general goodness of fit indices and parsimony fit indices. Roughly speaking, the first category of indices shows whether the model fits the data better than any other model. Parsimony fit indices address the possibility that the model may only be fitting the noise in the data and that it may not be representative of the wider population. Chi-square is an essential statistic to report, as are the Root Mean Square Error of Approximation (RMSEA) and the associated p-value (Hooper et al. 2008). Given the sensitivity of chi-square to model misspecification, the Standardized Root Mean square Residual (SRMR) is also reported. For a good fit, the value of SRMR should be less than 0.05, although values up to 0.08 are considered acceptable (Hooper et al. 2008). The RMSEA value should be less than 0.05 to indicate a good fit (Golob 2003). Given the complexity of the model for this study, we assessed the model fit of both of the aforementioned indices.

2.5.2 Model Estimation

2.5.2.1 Data

This analysis used data from a two-wave panel (2010 and 2014) Web-based survey with 422 respondents from major cities of different population sizes in Japan. The survey contained numerous life choice variables covering relevant travel behavior and eight life domains. The selected sociodemographic variables included personal and household characteristics, as shown in Table 2.12. The results indicate that males were slightly overrepresented in both samples, and most of the respondents were middle-aged, from 35 to 54 years old. In addition, the percentage of respondents with jobs, higher education degrees, and high household annual incomes increased, to varying degrees, from 2010 to 2014.

2.5.2.2 Conceptual Framework and Explanatory Variables

We used a structural equation model to represent the dynamics of life choices (including residential choices, and travel behavior) and QOL, after controlling for

Table 2.12 The sample characteristics of the two-wave panel survey data in 2010 and 2014

Variables (value)		Sample size: 422 persons	
		2010 (%)	2014 (%)
Gender	Male	56.64	56.64
	Female	43.36	43.36
Age	0–17	0.95	0.00
	18–34	18.72	10.90
	35–54	56.87	56.16
	55–64	10.66	15.17
	≥65	12.80	17.77
Education level	With bachelor degree or over	52.13	71.33
	No bachelor degree	47.87	28.67
Household annual income (Unit: million Yen)	Low (<200)	6.40	7.11
	Medium (200–599)	49.05	47.39
	High (≥600)	44.55	45.50
Employment status	With full/part-time job	69.67	71.56
	Housewife/students/no job	30.33	28.44
Household structure	Single	18.48	19.67
	Two members	27.01	26.54
	Three members	21.80	20.38
	Four members or more	32.69	33.41

the effects of changes in sociodemographics (in addition to age and gender, mainly the changes in key life events) over time. The proposed structural model takes state dependence of all life choices into account. Overall, we assumed that present residential choices, travel behavior, other life choices, and QOL are influenced by decisions made in the past. In particular, in addition to the effects of changes in sociodemographics over time, we assumed that current residential choices (travel behavior) are not only affected by previous corresponding residential choices but also by previous travel behavior and other life choices. We further assumed that other current life choices are not only influenced by current residential choices, travel behavior, and changes in sociodemographics but also by past residential choices, travel behavior, and other corresponding choices. Most importantly, we anticipated that the present QOL (and the effects of changes in sociodemographics produced by present and past life choices) would be simultaneously boosted by previous QOL. The conceptual framework is presented in Fig. 2.5.

This analysis contributes to the literature examining the dynamics of life choices, including residential choices and travel behavior, which are essential to the representation of higher overall QOL. Specifically, as time goes on, the current QOL is expected to be shaped by the past QOL. In this study, QOL was measured by life satisfaction and happiness, and thus it was essential that we obtain data for both constructs. Specifically, for life satisfaction, we asked respondents to use a 5-point scale (1 = very dissatisfied to 5 = very satisfied) to show how satisfied they were with life as a whole and with each life domain. For happiness, we asked respondents how happy they are currently, with response options ranging from 0 to 10 (0 = very unhappy to 10 = very happy). Thus, there were more than 140 variables in all. Zhang et al. (2014) provides details of data content. For the analysis, we constructed a structural equation model with latent variables to capture the complicated interdependencies between QOL, residential choices, and travel

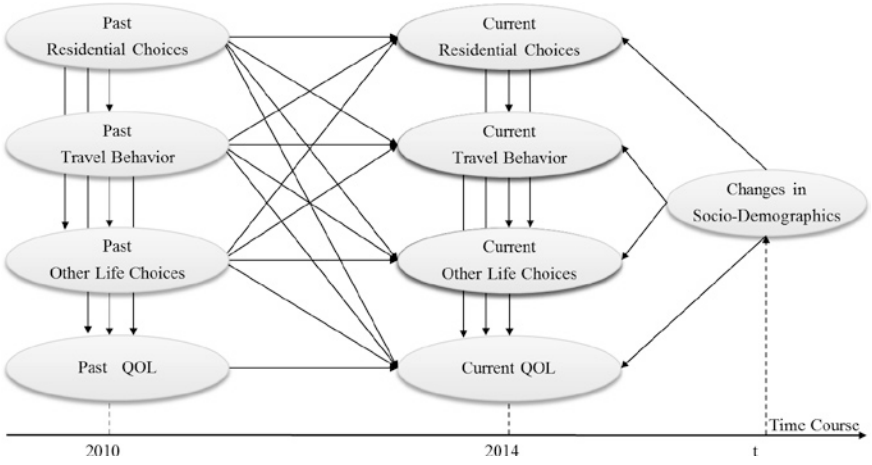

Fig. 2.5 The conceptual framework of panel data analysis between 2010 and 2014

behavior by explicitly incorporating the influence of other life choices over time. Based on the Chi-square test for life choice variables between 2010 and 2014, this analysis only used variables that differed significantly between 2010 and 2014 for the modeling. The Chi-square test results are shown in Table 2.13, and only statistically significant variables are presented and described.

Table 2.13 The Chi-square test results of the two-wave panel life choices variables in 2010 and 2014

Variables	Pearson Chi-square	Asymp. Sig. (2-sided)
Socio-demographics		
Education level (1: bachelor, 0: otherwise)	32.906	***
Employment status (1: employed, 0: otherwise[a])	0.365	**
Household annual income[b]	4.372	***
Household structure (number of family members)	4.968	***
Other life choices		
Percentage of household transport cost	18.254	**
Frequency of family meals weekly	36.772	***
Frequency of community activity participation	22.731	***
Time use in amusement park daily	12.787	**
Time use in doing gentle sports daily (e.g. golf)	16.823	**
Residential choices		
Distance from the city hall (city center) within 1 km (1: yes, 0: no)	1.639	*
Distance from nearest bus stop within 0.5 km (1: yes, 0: no)	2.511	**
Distance from nearest railway station within 1 km (1: yes, 0: no)	0.484	*
Residence duration (years you lived in the current house)	51.235	**
Residence type (living in the apartment = 1, 0[c])	0.801	*
Residence property (1: own, 0: otherwise)	1.708	**
Travel behavior		
Household vehicle ownership	3.484	**
Main travel mode is public transit (1: yes, 0: no)	1.914	**
Main travel mode is car (1: yes, 0: no)	0.324	*
Main travel mode is walking/cycling (1: yes, 0: no)	0.331	**

Note

[a]The value '0' refers to housewife, student, or the person without job

[b]Household annual income level: 1: < 1, 2: 1–2, 3: 2–3, 4: 3–4, 5: 4–5, 6: 5–6, 7: 6–7, 8: 7–8, 9: 8–9, 10: 9–10, 11:10–15, 12: > 15 (unit: 1 million Yen)

[c]The value '0' refers to the person living in the detached house or other types

*Significant at the 90 % level; **significant at the 95 % level; ***significant at the 99 % level

2.5.3 Dynamic Interdependencies of Life Choices

The maximum likelihood estimation procedure in the AMOS 20.0 software was used for the above structure equation model analysis. The estimated results are discussed in this section, including descriptions of the direct, indirect, and total effects of exogenous variables on endogenous variables. Table 2.14 shows the results of the interdependencies of sociodemographics, residential choices, travel behavior, other life choices, and quality of life (QOL) between 2010 and 2014. The goodness-of-fit measures reveal that the model is acceptable (GFI = 0.699, AGFI = 0.652, and RMSEA = 0.016). The parsimony indicator (PNFI = 0.556) also indicates that the models have modest applicability (Sharmeen et al. 2014). In Fig. 2.5, we assumed 29 direct effects among the latent variables, and 16 of the 29 direct effects were statistically significant. Corresponding to the insignificant direct effects, two indirect effects were significant. The estimated results consistently support our main assumed conceptual structure.

First, from a cross-sectional perspective, which offers insights into the direct and indirect effects on past QOL, the results indicate that past other life choices (−0.276) had a more prominent direct effect on QOL compared with past residential choices (0.158). Indirectly, the estimation indicated that past travel behavior (0.033) had a primary influence on past QOL, which suggests that the effect of travel behavior on QOL may be mediated by other life choices. This implies ignoring other life choices that are relevant to key life domains, such as health and leisure, and emphasizing that the straightforward impacts of transportation policies on QOL may not be fruitful, as QOL is affected by life choices other than changes in transportation situations. Second, from a longitudinal perspective, if we look at the significant direct and indirect effects over time, the results indicate that past QOL (0.826) has a substantial direct influence on current QOL, followed by past other life choices (−0.409), other current life choices (0.316), past travel behavior (−0.141), changes in sociodemographics (0.084), current residential choices (0.083), past residential choices (−0.045), and current travel behavior (0.031). There were also some statistically significant indirect effects, including for past residential choices (0.148) and past travel behavior (0.105). As these data show, past QOL contributes to current QOL, and they also show that other life choices play a prominent role in both past and current QOL. It may be that more and more residents are placing greater emphasis on leisure, social, family, and health oriented domains in order to enhance their overall QOL. The results show that life choices other than residential choices, travel behavior, and sociodemographics contribute to improvements in QOL over time. Thus, if we fail to examine life choices comprehensively and longitudinally, we may misunderstand how land use and transportation policies impact the QOL.

Table 2.14 Estimation results of cause-effect relationships based on structural equation model

Endogenous variables	Exogenous variables											
	Changes in socio-demographics			Past residential choices			Past travel behavior			Past other life choices		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Latent variables												
Past travel behavior				−0.051		−0.051						
Past other life choices				−0.004	0.006*	0.002*	0.12*		0.12*			
Current residential choices	−0.271*		−0.271*	0.114*	−0.01	0.104*	0.039	0.055*	0.094*	0.403*	0.023	0.426*
Current travel behavior	0.1	0.015	0.115	0.029	−0.037	−0.008	0.534*	−0.009	0.525*	0.1	−0.016	0.084
Current other life choices	−0.088	0.042	−0.046	0.029	−0.012	0.018	0.036	−0.088	−0.051	0.98*	−0.063	0.917*
Past QOL				0.158*	−0.003	0.155*	0.044	0.033*	0.078*	−0.276*		−0.276*
Current QOL	0.084*	−0.034	0.05*	−0.045*	0.148*	0.104*	−0.141*	0.105*	−0.036*	−0.409*	0.1	−0.309*
Changes in socio-demographics												
Age in 2014	−0.186*		−0.186*									
Gender in 2014	0.031		0.031									

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables											
	Changes in socio-demographics			Past residential choices			Past travel behavior			Past other life choices		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Changes of education level between 2010 and 2014 (Yes = 1, 0)	0.233*		0.233*									
Changes of household annual income between 2010 and 2014 (Yes = 1, 0)	0.717*		0.717*									
Changes of employment status between 2010 and 2014 (Yes = 1, 0)	0.207*		0.207*									

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables											
	Changes in socio-demographics			Past residential choices			Past travel behavior			Past other life choices		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Changes of household structure between 2010 and 2014 (Yes = 1, 0)	0.61*		0.61*									
Past residential choices												
Distance from the City Hall (city center) within 1 km in 2010				0.165*		0.165*						
Distance from nearest Bus Stop within 0.5 km in 2010				0.698*		0.698*						
Distance from nearest Railway Station within 1 km in 2010				0.275*		0.275*						

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables											
	Changes in socio-demographics			Past residential choices			Past travel behavior			Past other life choices		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Residence duration in 2010				0.024		0.024						
Residence type in 2010				0.718*		0.718*						
Tenure in 2010				0.767*		0.767*						
Past travel behavior												
Household vehicle ownership in 2010					−0.019	−0.019	0.382*		0.382*			
Main travel mode is walking/ cycling in 2010					0.047	0.047	-0.924*		−0.924*			
Main travel mode is public transit in 2010					−0.02	−0.02	−0.39*		−0.39*			

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables											
	Changes in socio-demographics			Past residential choices			Past travel behavior			Past other life choices		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Main travel mode is car in 2010					−0.034	−0.034	0.678*		0.678*			
Past other life choices												
Percentage of household transport cost in 2010					−0.016*	−0.016*		0.009*	0.009*	−0.075*		-0.075*
Frequency of family meals weekly in 2010					0.015*	0.015*		−0.027	−0.027	0.221*		0.221*
Time use in amusement park daily in 2010					0.023*	0.023*		0.02	0.02	0.169*		0.169*
Time use in doing sports daily in 2010					0.036	0.036		−0.007*	−0.007*	0.058		0.058
Frequency of community activity participation in 2010					0.001*	0.001*		−0.091*	−0.091*	0.754*		0.754*

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables											
	Changes in socio-demographics			Past residential choices			Past travel behavior			Past other life choices		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Current residential choices												
Distance from the city hall (city center) within 1 km in 2014		−0.068*	−0.068*		0.026*	0.026*		−0.024*	−0.024*		0.106*	0.106*
Distance from nearest bus stop within 0.5 km in 2014		−0.024*	−0.024*		0.009*	0.009*		−0.008*	−0.008*		0.038*	0.038*
Distance from nearest railway station within 1 km in 2014		−0.088*	−0.088*		0.034*	0.034*		−0.03*	−0.03*		0.138*	0.138*
Residence duration in 2014		0.12*	0.12*		−0.046	−0.046		0.042	0.042		0.188*	0.188*
Residence type in 2014		−0.191*	−0.191*		0.073*	0.073*		−0.066*	−0.066*		0.299*	0.299*

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables											
	Changes in socio-demographics			Past residential choices			Past travel behavior			Past other life choices		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Tenure in 2014		0.188*	0.188*		−0.072	−0.072		0.065*	0.065*		0.295*	0.295*
Current travel behavior												
Household vehicle ownership in 2014		0.032	0.032		−0.002	−0.002		0.147*	0.147*		0.024	0.024
Main travel mode is car in 2014		0.071	0.071		−0.005	−0.005		0.325*	0.325*		0.052	0.052
Main travel mode is public transit in 2014		0.048	0.048		−0.003	−0.003		−0.221*	−0.221*		0.035	0.035
Main travel mode is walking/cycling in 2014		−0.107	−0.107		0.007	0.007		−0.488*	−0.488*		−0.078	−0.078
Current other life choices												

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables											
	Changes in socio-demographics			Past residential choices			Past travel behavior			Past other life choices		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Percentage of household transport cost in 2014		0.005	0.005		−0.002	−0.002		0.005	0.005		−0.095*	−0.095*
Frequency of family meals weekly in 2014		0.004	0.004		−0.002	−0.002		0.005	0.005		−0.089	−0.089
Time Use in amusement park daily in 2014		0.009	0.009		−0.004	−0.004		0.01	0.01		0.186*	0.186*
Time Use in doing sports daily in 2014		0.007	0.007		−0.003	−0.003		0.02	0.02		0.239	0.239
Frequency of community activity participation in 2014		−0.04	−0.04		0.015	0.015		−0.045	−0.045		0.807*	0.807*
Past QOL												
Life satisfaction in 2010					0.128*	0.128*		0.064*	0.064*		−0.229*	−0.229*

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables											
	Changes in socio-demographics			Past residential choices			Past travel behavior			Past other life choices		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Happiness in 2010					0.122*	0.122*		0.061*	0.061*		−0.218*	−0.218*
Current QOL												
Life satisfaction in 2014		0.038*	0.038*		0.078*	0.078*		−0.027*	−0.027*		−0.233*	−0.233*
Happiness in 2014		0.041*	0.041*		0.084*	0.084*		−0.029*	−0.029*		−0.249*	−0.249*

Endogenous variables	Exogenous variables														
	Current residential choices			Current travel behavior			Current other life choices			Past QOL			Current QOL		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Latent variables															
Past travel behavior															
Past other life choices															
Current residential choices															
Current travel behavior	−0.054		−0.054												

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables														
	Current residential choices			Current travel behavior			Current other life choices			Past QOL			Current QOL		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Current other life choices	−0.142	−0.002	−0.144	0.03		0.03									
Past QOL															
Current QOL	0.083*	−0.047	0.036*	0.031*	0.009	0.04*	0.316*		0.316*	0.826*	0.002	0.829*			
Changes in socio-demographics															
Age in 2014															
Gender in 2014															
Changes of education level between 2010 and 2014 (Yes = 1, 0)															
Changes of household annual income between 2010 and 2014 (Yes = 1, 0)															

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables														
	Current residential choices			Current travel behavior			Current other life choices			Past QOL			Current QOL		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Changes of employment status between 2010 and 2014 (Yes = 1, 0)															
Changes of household structure between 2010 and 2014 (Yes = 1, 0)															
Past residential choices															
Distance from the City Hall (city center) within 1 km in 2010															
Distance from nearest Bus Stop within 0.5 km in 2010															
Distance from nearest Railway Station within 1 km in 2010															

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables														
	Current residential choices			Current travel behavior			Current other life choices			Past QOL			Current QOL		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Residence duration in 2010															
Residence type in 2010															
Tenure in 2010															
Past travel behavior															
Household vehicle ownership in 2010															
Main travel mode is walking/cycling in 2010															
Main travel mode is public transit in 2010															
Main travel mode is car in 2010															
Past other life choices															

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables														
	Current residential choices			Current travel behavior			Current other life choices			Past QOL			Current QOL		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Percentage of household transport cost in 2010															
Frequency of family meals weekly in 2010															
Time use in amusement park daily in 2010															
Time use in doing sports daily in 2010															
Frequency of community activity participation in 2010															
Current residential choices															
Distance from the city hall (city center) within 1 km in 2014	0.25*		0.25*												

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables														
	Current residential choices			Current travel behavior			Current other life choices			Past QOL			Current QOL		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Distance from nearest bus stop within 0.5 km in 2014	0.09		0.09												
Distance from nearest railway station within 1 km in 2014	0.324*		0.324*												
Residence duration in 2014	0.442*		0.442*												
Residence type in 2014	0.703*		0.703*												
Tenure in 2014	0.692*		0.692*												
Current travel behavior															
Household vehicle ownership in 2014		−0.015	−0.015	0.281		0.281									
Main travel mode is car in 2014		−0.033	−0.033	0.619*		0.619*									

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables														
	Current residential choices			Current travel behavior			Current other life choices			Past QOL			Current QOL		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Main travel mode is public transit in 2014		−0.023	−0.023	−0.421*		−0.421*									
Main travel mode is walking/cycling in 2014		0.05	0.05	−0.93*		−0.93*									
Current other life choices															
Percentage of household transport cost in 2014		0.015	0.015		−0.003	−0.003	−0.104		−0.104						
Frequency of family meals weekly in 2014		0.014	0.014		−0.003	−0.003	0.097*		0.097*						
Time Use in amusement park daily in 2014		0.029	0.029		−0.006	−0.006	0.202*		0.202*						
Time Use in doing sports daily in 2014		0.025	0.025		−0.002	−0.002	0.001*		0.001*						

(continued)

Table 2.14 (continued)

Endogenous variables	Exogenous variables														
	Current residential choices			Current travel behavior			Current other life choices			Past QOL			Current QOL		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Frequency of community activity participation in 2014		−0.126	−0.126		0.026	0.026	0.88		0.88						
Past QOL															
Life satisfaction in 2010										0.828*		0.828*			
Happiness in 2010										0.791*		0.791*			
Current QOL															
Life satisfaction in 2014		0.027*	0.027*		−0.03*	−0.03*		0.238*	0.238*		0.624*	0.624*	0.753*		0.753*
Happiness in 2014		0.029*	0.029*		−0.032*	−0.032*		0.255*	0.255*		0.668*	0.668*	0.806*		0.806*

*significant at the 95 % level

2.5.3.1 Changes in Sociodemographics and QOL

Examining the six indicators of the latent variable changes in sociodemographics, the results indicate that changes in sociodemographics mainly occurred for life events change variables such as household annual income (0.717), followed by household structure (0.61), education level (0.233), and employment status (0.207), as well as a current individual attributes such as age (−0.186). The results for the total effects show that changes in sociodemographics had considerable influences on current residential choices (−0.271) and current QOL (0.05). Specifically, based on the positive signs of the changes in sociodemographics on current QOL and the above sample characteristics, the results show that QOL is enhanced when people increase their education, dedicate themselves to one career, and change their household annual income and household structure, which means that a QOL-oriented lifestyle may trigger life events. However, because of model limitations and the data used here, we cannot offer specific statements about how changes to household structure (such as having a baby) or changes in household annual income can improve QOL. The results also indicate that people who experienced changes in education level, household annual income, employment status, and household structure preferred to live in rental apartments close to the city center with good access to transit rather than own a detached house. This type of residential choice helps to improve QOL changing life events. However, this trend decreases with age. This implies that, to some extent, key life event changes can help explain improvements in QOL. Thus, life domains and life events should be considered together, which is consistent with Scheiner (2014).

2.5.3.2 Residential Choices and QOL

Examining the six indicators of past residential choices at a single point in time, the residential choices are featured by people's preferences for housing attributes and residential location/environment characteristics. As Chen et al. (2008) have noted, trade-offs between housing qualities and property, activity opportunities, and transportation accessibility have long been recognized as fundamental considerations in the decision to move and the selection of a residence. Residential property (0.767) was an important factor in people's residential choices, followed by residence type (0.718) (apartment or detached house), and location/environment characteristics, such as having the nearest bus stop within 0.5 km (0.698), the nearest railway station within 1 km (0.275) and the city center within 1 km (0.165). This implies that high-density, transit-oriented residential environments are critical factors in people's residential location choices. The findings above differ slightly from those in 2014. Similarly, the present respondents' residential choices were largely characterized by preferences for housing attributes relative to preferences for residential location/environment. However, residence type (0.703) played a dominant role in residential choices, in addition to residential property (0.692), length of residence (0.442), nearest railway station within 1 km (0.324),

and distance to the city center within 1 km (0.25). In contrast, having the nearest bus stop within 0.5 km failed to influence residential choices. This implies that, compared with access to a bus stop, the current respondents cared more about access to railway stations.

If we examine the effects of the latent variable past residential choices, we can see that it has a significant direct effect on past QOL (0.158) and a significant indirect effect on past other life choices (0.006). With respect to the impact of residential choices on other life choices, the results indicate that living in one's own apartment, living close to the city center, railway stations, and bus stops, spending less on transportation, dining with family members more frequently, going to the amusement park, and greater participation in community activities had positive impacts on family life, leisure, and social life. These findings suggest that land use planning that emphasizes compactness and diversity enhances people's leisure and social and family lives, making residents more satisfied and happy. Thus, these findings also suggest that land use policies that try to improve QOL by changing housing situations or relocate residences may not be as beneficial to other life domains, such as leisure.

The latent variable current residential choices had a significant and direct effect on current QOL (0.083). Both in the past and currently, residents who live in a high-density or transit-oriented land use area, especially one with different kinds of facilities, feel more satisfied and are happier about their different life domains. Surprisingly, after controlling for the influence of other life choices over time, the consistent finding in the literature of an effect of residential choice on travel behavior was not observed in this study for past or current residential choices. This suggests that the influence of residential choices on travel behavior reported in the literature may be spurious because of the failure to control for other life choices. This re-confirms the importance of taking a life-oriented approach and suggests that more detailed and comprehensive research is required.

With respect to the impacts of past residential choices on current life choices and current QOL, we found that past residential choices had significant direct effects on current residential choices (0.114) and current QOL (0.045), and significant indirect effects on current QOL (0.303). Past residential choices did not have a significant effect on current travel behavior or other life choices. Considering the substantial total effect of past residential choices on current residential choices, we can surmise that as time passes, the respondents maintained their preferences for housing attributes and residential environments, possibly because of inertia. Most importantly, it is interesting to note that past residential choices exists the effect of future expectation on prospective QOL attainment. Having lived in high-density or transit-oriented land use areas in the past, residents still feel satisfied and happy in those same types of areas.

2.5.3.3 Travel Behavior and QOL

Of the four indicators of past travel behavior, main travel mode of walking/cycling (0.924) played a dominant role in characterizing the respondents' travel behavior,

followed by main travel mode by car (0.678), main travel mode by public transit (0.39) and household vehicle ownership (0.382). These findings are similar to those for the present, but they are slightly different because of the trivial effects of current household vehicle ownership. We found that car acquisition played an important role in the respondents' past travel mode choices. If we examine all the impacts of past travel behavior, it only had significant effects on past other life choices (0.12) and past QOL (0.078); it did not have an effect on past residential choices. We found that the respondents who owned more vehicles and took more trips by car allocated more household income to transportation costs. In contrast, the respondents who walked/cycled more and who used public transit more were more likely to participate in more community activities and health oriented sports activities, which in turn improve their QOL. This is consistent with findings about current travel behavior that walking/cycling more and using public transit more (particularly, driving less) make residents happier and more satisfied.

Past travel behavior had a significant influence on current travel behavior (0.525), but less of an influence on current residential choices (0.094) and current QOL (−0.036). With respect to the effects of past travel behavior on current residential choices, we found that the respondents who preferred car use to public transit or active transportation (walking and cycling) were happier and more satisfied if they owned detached houses and lived far away from the city center in areas of dispersed land use patterns that are convenient for driving. On the other hand, the respondents who liked to walk/cycle and use public transit were more satisfied and happier if they lived in the high-density and transit-oriented neighborhoods, even when renting an apartment. We also found that self-selection helps explain QOL, which is consistent with Cao and Ettema's (2014) findings. Transportation policies that try to directly enhance QOL by reducing car use and promoting public transit and active transit may not be efficient, as QOL may be affected by life choices other than changes in transportation conditions. Again, further investigation is required.

2.5.3.4 Other Life Choices and QOL

The five indicators of past other life choices were family life, social life, health, leisure and recreation, and finance. The distinguishing characteristics of this latent variable were aspects of the social life domain, such as frequency of participation in community activities (0.754), which varied with the current other life choices, which was, in turn, primarily characterized by the leisure related domain and activities such as time spent in amusement parks (0.202). If we examine all of the effects of past other life choices, we see that it played a significant role in current other life choices (0.917), current residential choices (0.426), current QOL (−0.309), and past QOL (−0.276). With respect to the impact of past other life choices on current other life choices, we found that respondents who spent more time in social life, health-related, and leisure activities in the past were more likely to do the same in the future, just as they spent less money on transportation both in

the past and present daily life, which may be because of inertia. As for the effect of past other life choices on current residential choices, we found that people who spent more time outdoor and less money on transportation in the past were more likely to move close to the city center and live in compact neighborhoods with accessible transit and a good walking environment. It may be that as time goes on, past life choices play a role in current life choices. Past other life choices also had an impact on the QOL indicators such that respondents who engaged in more social, leisure, and health-related activities in the past reported an improved current QOL. These results show that isolated land use and transport policies intended to improve people's QOL by changing housing situations and transportation conditions may not be effective, as QOL is broadly affected by other life choices rather than by changes in residential and travel factors.

2.5.4 Summary

Motivated by the variability of people's life choices over time, especially residential and employment changes, this section of the chapter examined changing life choices in the context of key life events. We examined changing life choices involving health, social life, education and learning, employment, family life, finance, and leisure and recreation domains jointly in order to shift the research focus from short-term behavioral analysis to midterm longitudinal analysis. We also extended the boundaries of the effects of changing life choices on QOL by incorporating the influence of key life events, which provides further insight into predicting people's prospective life decisions. To conduct this preliminary investigation of this complex system, we estimated a structural equation model based on panel data.

First, we examined a single point in time and found that other life choices have considerable effects on quality of life compared with the minor effects of residential choices and travel behavior. When examined over time, the results show that past and current other life choices played a dominant role in current quality of life relative to the slight influences of current and past residential choices, key life events, and the slight effect of current and past travel behavior. As such, ignoring other life choices that are relevant to people's key life domains (such as health and leisure) and key life events (such as changes in household structure) and only emphasizing the straightforward impacts of land use and transportation policies on quality of life may not be appropriate, because quality of life is greatly affected by other life choices—more so than by changes in residential and transportation situations. Second, we found that residents living in a high-density land use area (especially one with diverse facilities) or in a transit-oriented neighborhood feel more satisfied and happier with their lives. This finding indicates how land use patterns influence quality of life and provides insight into the worsening regional depopulation issue in Japan. Third, after controlling for the influence of other life choices over time, we failed to observe (both at a single point in time and over

time) the consistently reported influence of residential choices on travel behavior. This suggests that the observed influence of residential choices on travel behavior in the literature may be spurious, possibly because previous research has not accounted for other life choices and key life events.

2.6 Life History Analysis

Once a transportation system is built or a land-use policy is carried out, it influences people's travel behavior and their lives for a long time. Therefore, it is important for policy makers to understand people's travel behavior decisions and their lives over a long period. However, little is known about the interdependencies of life domains, especially over the life course (i.e., biographical interdependencies). To address this gap, this section of the chapter aims to clarify the biographical interdependencies of households in relation to residential and car ownership biographies by explicitly incorporating the influence of household structure and employment/education biographies. Biography can be defined based on a general concept of mobility that indicates a change in a life domain. In November 2010, we conducted a Web-based life history survey, and 1000 households in major cities in Japan provided valid data. We performed aggregate and Exhaustive CHAID analyses, focusing on the occurrence times of mobilities in each biography.

Biography refers to the course of a person's life, and in this study it is defined as a series of mobilities in each life domain over the life course, whereas mobility indicates a change occurring in each domain. Mobility defined in this way is similar to the concept of a life event. Especially in the literature on residential and travel behaviors, such life events mainly refer to changes in jobs, workplaces, or household members (and/or their status), and they have been used as an explanatory variables for residential and travel behaviors. However, in this study, such life events are treated as dependent variables. For the above reasons, mobility is used instead of life event in this study. Four types of biographies that use the concept of mobility are defined as follows:

(1) Residential biography: a series of residential mobilities caused by relocation over the life course. Details from the survey: residential location, income, house property, access (which here refers to distance) to various facilities (including railway stations, bus stops, primary, junior and high schools, hospitals, parks, supermarkets, city hall) in each episode.
(2) Household structure biography: a series of mobilities in the status of household members. Details from the survey: household size, information about each household member in each episode (including age, gender, relationship with the respondent).
(3) Employment/education biography: a series of mobilities in one's job and/or school. Details from the survey: job category, commute time to job/school, access to job/school, travel mode in each episode.

(4) Car ownership biography: a series of mobilities of car ownership as a tool for travel. This is a specific type of travel biography (and refers to mobility biography in the general literature on transportation) that may include season passes or prepaid IC cards for public transportation systems, ownership of bicycles, and major travel modes in daily life. Details from the survey: number of cars, primary user, car efficiency, purpose, and frequency of use in each episode.

The results indicate obvious two-way cause–effect relationships over the life course between residential and car ownership biographies, which were further influenced by household structure and employment/education biographies. In particular, in both the short term and the long term, state dependence and future expectations within and across life domains were clarified. We found that household structure and employment/education biographies had a greater impact on residential biography than on car ownership biography. Although residential biography was found to be more influential on car ownership biography, the other two biographies also played an important role in explaining the car ownership mobility decision. All of these findings suggest the necessity of developing a unified framework of intra-domain and inter-domain biographical interdependence models with flexible structures that capture the influences of state dependence and future expectations over different time scales in the life course. The findings are summarized further below.

First, focusing on the occurrence times of mobilities in each biography, this study revealed obvious two-way cause–effect relationships between residential and car ownership biographies that were further influenced by household structure and employment/education biographies in a complex way. Therefore, the viewpoint that residential and travel behaviors should not be treated independently of other life domains in the life course was confirmed. This finding suggests that it is necessary to develop integrated models to jointly describe changes in the above four domains over the life course.

Second, substantial state dependence and future expectations were identified to explain the occurrence and nonoccurrence of residential relocation and car ownership mobilities. Both short-term and long-term state dependence and future expectations were clarified. These findings emphasize the need to develop a unified framework of dynamic models that incorporate higher-order state dependence and future expectations within and across domains over different time scales over the life course.

Third, household structure and employment/education mobilities were found to have a greater impact on residential mobility (relocation) than on car ownership mobility. Although residential mobility was found to have a greater impact on car ownership mobility, mobilities in the other two biographies also played an important role in explaining the car ownership mobility decision. These results call attention to the joint analysis of residential and car ownership mobilities by explicitly linking them to household structure and employment/education mobilities based on better behaviorally oriented approaches.

2.7 Conclusions

Using survey data from multiple points in time in several Japanese cities, this chapter presented empirical evidence of the behavioral interdependencies of life choices at a single point in time, over a midterm period, and from a life history viewpoint. Using several statistical methods, this study successfully captured the interrelationships between different life choices. In addition, we examined the value of a life-oriented approach (Zhang 2014, 2015) by incorporating various life choice interdependencies into the analyses. The findings suggest that it is necessary to describe the changes in life choices comprehensively, especially with respect to specific social issues.

First, we used cross-sectional data and an Exhaustive CHAID approach to identify predictors for life choices. In addition, we quantified the effects of life choices, including residential choices and travel behavior, on the quality of life (measured by happiness and life satisfaction indicators). We were able to identify which life choices affect people's life decisions and their quality of life.

Second, using a structural equation model based on midterm longitudinal data, we examined the changes in life choices after controlling for the effects of key life events over time. The results indicate that current life choices can be influenced by past life choices.

Third, from a life history viewpoint (using data from a Web-based retrospective life story survey in Japan), we made an additional attempt to represent biographical interdependencies among residential mobility, household structure mobility, employment/education mobility, and car ownership mobility. This analysis revealed obvious two-way cause–effect relationships between residential and car ownership biographies that were further influenced by household structure and employment/education biographies in a complex way. These results suggest that it is necessary to develop integrated models that jointly describe changes in these four domains over the life course.

Several important research issues should also be noted. First, the quality of life differs greatly at specific stages of the life course, especially in response to changes in residential location and employment. Additional longitudinal data should be collected and time series analyses should be conducted. Second, more advanced choice models should be built to jointly represent residential choices, travel behavior, and other life choices, as well as quality of life, in order to incorporate decision-making mechanisms into the analysis. Third, the effects of land use and transportation policies on the quality of life should be re-evaluated based on the conceptual framework proposed in this study and the future development of better choice models. Finally, to arrive at more comprehensive conclusions, more case studies should be conducted—not only in developed countries but also in developing countries, which are experiencing more dynamic changes economically, socially, and culturally.

References

Abou-Zeid M, Witter R, Bierlaire M, Kaufmann V, Ben-Akiva M (2012) Happiness travel mode switching: findings from a Swiss public transportation experiment. Transp Policy 19(1):93–104

Alexopoulos EC, Palatsidi V, Tigani X, Darviri C (2014) Exploring stress levels, job satisfaction, and quality of life in a sample of police officers in Greece. Saf Health Work 5(4):210–215

Allen TD, Herst DE, Bruck CS, Sutton M (2000) Consequences associated with work–to–family conflict: a review agenda for future research. J Occup Health Psychol 5(2):278

Andereck KL, Valentine KM, Vogt CA, Knopf RC (2007) A cross–cultural analysis of tourism and quality of life perceptions. J Sustain Tourism 15(5):483–502

Bowling A (1995) Measuring disease: a review of disease–specific quality of life measurement scales. Open University Press

Brajša-Žganec A, Merkaš M, Šverko I (2011) Quality of life and leisure activities: how do leisure activities contribute to subjective well–being? Soc Indic Res 102(1):81–91

Cambir A, Vasile V (2015) Material dimension of life quality social inclusion. Procedia Econ Finan 32:932–939

Campbell A (1976) Subjective measures of well–being. Am Psychol 31(2):117–124

Campbell A (1981) The sense of well–being in America: recent patterns and trends. McGraw-Hill

Cantril H (1965) The pattern of human concerns. Rutgers University Press, New Brunswick

Cao X (2016) How does neighborhood design affect life satisfaction? Evidence from twin cities. Travel Behav Soc 5:68–76

Cao X, Ettema D (2014) Satisfaction with travel and residential self-selection: how do preferences moderate the impact of the Hiawatha light rail transit line? J Transp Land Use 7(3):93–108

Cao X, Mokhtarian PL, Handy S (2013) Examining the impacts of residential self–selection on travel behavior: a focus on empirical findings. Transp Rev 29(3):359–395

Chen J, Chen C, Timmermans HJP (2008) Accessibility trade–offs in household residential location choice decisions. Transp Res Rec 2077(1):71–79

Chen CC, Huang WJ, Petrick JF (2016) Holiday recovery experiences tourism satisfaction life satisfaction–is there a relationship? Tour Manag 53:140–147

Clark AE, Frijters P, Shields MA (2008) Relative income, happiness, and utility: an explanation for the Easterlin paradox and other puzzles. J Econ Lit 46(1):95–144

Cooklin AR, Westrupp EM, Strazdins L, Giallo R, Martin A, Nicholson JM (2014) Fathers at work work–family conflict, work–family enrichment and parenting in an Australian cohort. J Family Issues. doi:10.1177/0192513X14553054

Cooklin AR, Westrupp EM, Strazdins L, Giallo R, Martin A, Nicholson JM (2015a) Mothers' work–family conflict and enrichment: associations with parenting quality and couple relationship. Child Care Health Dev 41(2):266–277

Cooklin AR, Giallo R, Strazdins L, Martin A, Leach LS, Nicholson JM (2015b) What matters for working fathers? Job characteristics work–family conflict enrichment fathers' postpartum mental health in an Australian cohort. Soc Sci Med 146:214–222

Coulmas F, Conrad H, Vogt G, Schad–Seifert A (2008) The demographic challenge: a handbook about Japan. Brill

Cummins RA (1996) The domains of life satisfaction: An attempt to order chaos. Soc Indic Res 38:303–328

Curl A, Thompson CW, Aspinall P (2015) The effectiveness of 'shared space' residential street interventions on self–reported activity levels and quality of life for older people. Landscape Urban Plann 139:117–125

De Holler AE, Staatsen BA (2003) Health environment and quality of life: An epidemiological perspective on urban development. Landscape Urban Plann 65(1):53–62

De Vos J (2015) The influence of land use and mobility policy on travel behavior: a comparative case study of Flanders and the Netherlands. J Transp Land Use 8(1):171–190

De Vos J, Schwanen T, van Acker V, Witlox F (2013) Travel subjective well–being: a focus on findings methods and future research needs. Transp Rev 33(4):421–442
Delmelle EC, Haslauer E, Prinz T (2013) Social satisfaction commuting neighborhoods. J Transp Geogr 30:110–116
Diener E (1984) Subjective well–being. Psychol Bull 95(3):542–575
Diener E (2000) Subjective well–being: the science of happiness and a proposal for a national index. Am Psychol 55(1):34–43
Diener E (2009) The science of well–being: the collected works of Ed Diener. Social indicators research series 37. Springer Science Business Media, Springer Netherlands
Diener E, Seligman ME (2002) Very happy people. Psychol Sci 13(1):81–84
Diener E, Suh E (1997) Measuring quality of life: economic social subjective indicators. Soc Indic Res 40(1–2):189–216
Diener ED, Emmons RA, Larsen RJ, Griffin S (1985) The satisfaction with life scale. J Pers Assess 49(1):71–75
Dolnicar S, Yanamram V, Cliff K (2012) The contribution of vacations to quality of life. Ann Tourism Res 39(1):59–83
Dutt AK (2008) The dependence effect consumption on happiness: Galbraith revisited. Rev Polit Econ 20(4):527–550
Easterlin RA (2001) Income and happiness: towards a unified theory. Econ J 111(473):465–484
El Din HS, Shalaby A, Farouh HE, Elariane SA (2013) Principles of urban quality of life for a neighborhood. HBRC J 9(1):86–92
Ettema D, Gärling T, Olsson LE, Friman M (2010) Out–of–home activities daily travel and subjective well–being. Transp Res Part A: Policy Pract 44(9):723–732
Fabrigar LR, Porter RD, Norris ME (2010) Some things you should know about structural equation modeling but never thought to ask. J Consum Psychol 20(2):221–225
Fichera E, Savage D (2015) Income and health in Tanzania: an instrumental variable approach. World Dev 66:500–515
Frisvold D, Golberstein E (2011) School quality and the education–health relationship: evidence from Blacks in segregated schools. J Health Econ 30(6):1232–1245
George L (2006) Perceived quality of life. In: Linstock R, George L (eds), Handbook of aging and the social sciences, The 6th Edition. Burlington, MA: Academic Press.
Gilbert D, Abdullah J (2004) Holiday taking and the sense of well–being. Ann Tourism Res 31(1):103–121
Glatzer W (2012) Cross–national comparisons of quality of life in developed nations including the impact of globalization. In: Land KC, Michalos AC, Sirgy MJ (eds) Handbook of social indicators and quality of life research. Springer, Netherlands, pp 381–398
Golob TF (2003) Structural equation modeling for travel behavior research. Transp Res Part B: Methodol 37(1):1–25
González CS, Gómez N, Navarro V, Cairós M, Quirce C, Toledo P, Marrero-Gordillo N (2016) Learning healthy lifestyles through active videogames motor games and the gamification of educational activities. Comput Hum Behav 55:529–551
Greenhaus JH, Collins KM, Shaw JD (2003) The relation between work–family balance and quality of life. J Vocat Behav 63(3):510–531
Headey B, Muffels R, Wooden M (2008) Money does not buy happiness: or does it? A reassessment based on the combined effects of wealth income and consumption. Soc Indic Res 87(1):65–82
Heal LW, Chadsey-Rusch J (1985) The lifestyle satisfaction scale: assessing individuals' satisfaction with residence, community setting, and associated services. Appl Res Mental Retard 6(4):475–490
Higgins C, Duxbury L, Lee C (1994) Impact of life–cycle stage and gender on the ability to balance work and family responsibilities. Fam Relat 43(2):144–150
Honold J, Beyer R, Lakes T, ver Meer E (2012) Multiple environmental burdens and neighborhood–related health of city residents. J Environ Psychol 32(4):305–317

Hooper D, Coughlan J, Mullen M (2008) Structural equation modelling: guidelines for determining model fit. Electron J Bus Res Methods 6(1):53–60
Huang Q, Sverke M (2007) Women's occupational career patterns over 27 years: relations to family of original life careers and wellness. J Vocat Behav 70(2):369–397
Inoguchi T, Fujii S (2009) The quality of life in Japan. Soc Indic Res 92(2):227–262
Janssens D, Wets G, Brijs T, Vanhoof K, Arentze T, Timmermans H (2006) Integrating Bayesian networks and decision trees in a sequential rule–based transportation model. Eur J Oper Res 175(1):16–34
Kahn RL, Juster FT (2002) Well-being: concepts and measures. J Soc Issues 58(4):627–644
Kaplan GA, Shema SJ, Leite CMA (2008) Socioeconomic determinants of psychological well–being: the role of income, income change and income sources during the course of 29 years. Ann Epidemiol 18(7):531–537
Kass G (1980) An exploratory technique for investigating large quantities of categorical data. Appl Stat 29(2):119–127
Keene D, Bader M, Ailshire J (2013) Length of residence and social integration: the contingent effects of neighborhood poverty. Health Place 21:171–178
Khalil HAEE (2012) Enhancing quality of life through strategic urban planning. Sustain Cities Soc 5:77–86
Knox PL (1975) Social well-being: a spatial perspective. Oxford University Press, Oxford
Lamont D, Kenyon S, Lyons G (2013) Dyslexia and mobility–related social exclusion: the role of travel information provision. J Transp Geogr 26:147–157
Lee JH, Goulias KG (2014) Examining differences and commonalities of life cycle stages indaily contacts and activity–travel time allocation. Compendium of papers CD-ROM, The93rd annual meeting of transportation research board. Washington, D.C., 12–16 Jan
Lei P, Xu L, Nwaru BI, Long Q, Wu Z (2015) Social networks and health-related quality of life among Chinese old adults in urban areas: results from 4th national household health survey. Public health 131:27–39
Leung L, Lee PS (2005) Multiple determinants of life quality: the roles of internet activities use of new media social support and leisure activities. Telematics Inform 22(3):161–180
Lin JH, Wong JY, Ho CH (2013) Promoting frontline employees' quality of life: Leisure benefit systems and work–to–leisure conflicts. Tour Manag 36:178–187
Lotfi S, Solaimani K (2009) An assessment of urban quality of life by using analytic hierarchy process approach (case study: comparative study of quality of life in the North of Iran). J Soc Sci 5(2):123–133
Maia ML, Lucas K, Marinho G, Santos E, de Lima JH (2016) Access to the Brazilian City—from the perspectives of low-income residents in Recife. J Transp Geogr (in press)
McDonagh J (2006) Transport policy instruments and transport–related social exclusion in rural Republic of Irel. J Transp Geogr 14(5):355–366
McLanahan SS, Sorensen AB (1985) Life course dynamics: trajectories and transitions 1968–1980. In Elder GH (ed) Life events and psychological well–being over the life course. Cornell University Press, Ithaca, pp 217–238
Michel JS, Mitchelson JK, Kotrba LM, LeBreton JM, Baltes BB (2009) A comparative test of work–family conflict models and critical examination of work–family linkages. J Vocat Behav 74(2):199–218
Michel JS, Kotrba LM, Mitchelson JK, Clark MA, Baltes BB (2011) Antecedents of work–family conflict: a meta–analytic review. J Organ Behav 32(5):689–725
Milner A, Krnjacki L, Butterworth P, LaMontagne AD (2016) The role of social support in protecting mental health when employed and unemployed: a longitudinal fixed–effects analysis using 12 annual waves of the HILDA cohort. Soc Sci Med 153:20–26
Mittal A (2007) Bayesian network technologies: applications and graphical models. IGI Global
Morgan MG, Henrion M, Small M (1990) Uncertainty: a guide to dealing with uncertainty in quantitative risk and policy analysis. Cambridge University Press, New York
Myers DG, Diener E (1995) Who is happy? Psychol Sci 6(1):10–19

Myers DG, Diener E (1996) The pursuit of happiness. Sci Am 274(5):70–72
Nomaguchi KM, Milkie MA, Bianchi SM (2005) Time strains and psychological well–being: do dual–earner mothers and fathers differ? J Fam Issues 26(6):756–792
Nordbakke S, Schwanen T (2013) Wellbeing and mobility: a theoretical framework and literature review focusing on older people. Mobilities 9(1):104–129
Oakil ATM (2015) Securing or sacrificing access to a car: Gender difference in the effects of life events. Travel Behav Soc 3:1–7
Plagnol AC, Scott J (2011) What matters for well–being: individual perceptions of quality of life before and after important life events. Appl Res Qual Life 6(2):115–137
Powdthavee N (2009) What happens to people before and after disability? Focusing effects lead effects and adaptation in different areas of life. Soc Sci Med 69(12):1834–1844
Ritsema van Eck J, Burghouwt G, Dijst M (2005) Lifestyles spatial configurations and quality of life in daily travel: an explorative simulation study. J Transp Geogr 13(2):123–134
Salvatore N, Munoz Sastre MT (2001) Appraisal of life; "area" versus "dimension" conceptualizations. Soc Indic Res 53(3):229–255
Schalock RL (1996) Reconsidering the conceptualization and measurement of quality of life. Qual Life 1(9):123–139
Scheiner J (2014) Gendered key events in the life course: effects on changes in travel mode choice over time. J Transp Geogr 37:47–60
Schoenduwe R, Mueller MG, Peters A, Lanzendorf M (2015) Analysing mobility biographies with the life course calendar: a retrospective survey methodology for longitudinal data collection. J Transp Geogr 42:98–109
Sharmeen F, Arentze T, Timmermans H (2014) An analysis of the dynamics of activity and travel needs in response to social network evolution and life–cycle events: a structural equation model. Transp Res Part A 59:159–171
Sirgy M (2010) Toward a quality–of–life theory of leisure travel satisfaction. J Travel Res 49:246–260
Sirgy M, Rahtz DR, Cicic M, Underwood R (2000) A method for assessing residents' satisfaction with community–based services: a quality–of–life perspective. Soc Indic Res 49(3):279–316
Strazdins L, OBrien LV, Lucas N, Rodgers B (2013) Combining work and family: rewards or risks or children's mental health? Soc Sci Med 87:99–107
Sturm R, Cohen DA (2004) Suburban sprawl and physical and mental health. Public Health 118(7):488–496
Sugimoto Y (2010) Introduction to Japanese society. Cambridge University Press
Takamiya M, Yamamoto K, Watanabe T (2010) Modeling and estimation of travel behaviors using Bayesian network. Intell Decis Technol 4(4):297–305
Tang TLP (2007) Income and quality of life: does the love of money make a difference? J Bus Ethics 72(4):375–393
Taylor SJ, Bogdan R (1990) Quality of life and the individual's perspective. In: Schalock RL (ed), Quality of life: perspectives and issues. American Association of Mental Retardation, Washington, pp 27–40
Tefft N (2012) Mental health and employment: the SAD story. Econ Human Biol 10(3):242–255
Tercan E (2015) An examination of leisure participation family assessment and life satisfaction in university students. Procedia-Soc Behav Sci 186:58–63
Tsai SY, Lee PL, Lin JW, Lee CN (2016) Cross–sectional and longitudinal associations between sleep and health–related quality of life in pregnant women: a prospective observational study. Int J Nurs Stud 56:45–53
Uysal M, Perdue R, Sirgy MJ (2012) Handbook of tourism and quality–of–life research: enhancing the lives of tourists and residents of host communities. Springer Science and Business Media
Uysal M, Sirgy MJ, Woo E, Kim HL (2016) Quality of life and well–being research in tourism. Tour Manag 53:244–261

Vallée J, Cadot E, Grillo F, Parizot I, Chauvin P (2010) The combined effects of activity space and neighbourhood of residence on participation in preventive health–care activities: the case of cervical screening in the Paris metropolitan area (France). Health Place 16(5):838–852

Van Acker V (2015) Defining, measuring, and using the lifestyle concept in modal choice research. Transp Res Rec 2495:74–82

Van Acker V, Van Wee B, Witlox F (2010) When transport geography meets social psychology: toward a conceptual model of travel behavior. Transp Rev 30(2):219–240

Van Praag BM, Frijters P, Ferrer-i-Carbonell A (2003) The anatomy of subjective well-being. J Econ Behav Organ 51(1):29–49

Veenhoven R (2012) Evidence based pursuit of happiness: what should we know, do we know and can we get to know? EHERO white paper Available: https://personal.eur.nl/veenhoven/Pub2010s/2012j-full.pdf. Accessed 1 Jul 2016

Verhoeven M (2010) Modelling life trajectories and mode choice using bayesian belief networks. Doctoral dissertation, Eindhoven University of Technology, The Netherlands

Verhoeven M, Arentze TA, Timmermans HJP, Van der Waerden PJHJ (2007) Examining temporal effects of lifecycle events on transport mode choice decision. Int J Urban Sci 11(1):1–13

Wang D, Li SM (2004) Housing preferences in a transitional housing system: the case of Beijing China. Environ Plann A 36(1):69–88

Wilson I, McDermott H, Munir F (2016) The role of working hours work environment and physical leisure activity on the need for recovery following a day's work among UK white–water raft guides: a within–subjects multilevel approach. Psychol Sport Exerc 23:123–131

Winters JV (2011) Human capital higher education institutions quality of life. Reg Sci Urban Econ 41(5):446–454

Zhang J (2009) Subjective well–being and activity–travel behavior analysis: applying day reconstruction method to explore affective experience during travel. In: Proceedings of the 14th international conference of Hong Kong Society for transportation studies, Hong Kong, 10–12 Dec, (2), pp 439–449 (Invited paper)

Zhang J (2014) Revisiting residential self–selection issues: a life–oriented approach. J Transp Land Use 7(3):29–45

Zhang J (2015) The life-oriented approach and travel behavior research. A discussion paper for the Workshop "life-oriented approach for transportation studies" at the 14th international conference on travel behaviour research, Windsor, UK, July 19–23

Zhang J, Tsuchiya Y, Fujiwara A, Chikaraishi M (2011) Citizens' life decisions and behavior survey: proposal and application to the evaluation of quality of life. In: Proceedings of infrastructure planning 43 (CD–ROM) (in Japanese)

Zhang J, Yu B, Chikaraishi M (2014) Interdependences between household residential and car ownership behavior: a life history analysis. J Transp Geogr 34:165–174

Zhao P, Lu B (2010) Exploring job accessibility in the transformation context: an institutionalist approach and its application in Beijing. J Transp Geogr 18(3):393–401

Zimmermann S (2014) The pursuit of subjective well–being through specific consumption choice. Available at SSRN: http://ssrn.com/abstract=2484660 or http://dx.doi.org/10.2139/ssrn.2484660