Gap-theoretical analyses of residential satisfaction and intention to move

Gap-Theoretical Analyses of Residential Satisfaction and Intention to Move

PROEFSCHRIFT

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穷则独善其身，达则兼济天下

献给所有我爱及爱我的人

Acknowledgements

Now that I start writing this acknowledgement, all the memories from the past four years of my PhD life become vivid again. When I look back at the time when I came to Eindhoven, it feels like yesterday. I still clearly remember the day I got a reply from Harry Timmermans accepting me to join his group. Unlike many other PhDs who joined this group for his big name, before I contacted Harry, I only read some of his work. I had the rough idea that Harry works on a myriad of topics using quantitative methods. I decided to send out my application letter after reading his Tue profile. It was written that he is doing work related with culture. As I am always interested in cultural conflicts, I thought this might match my research interests. As everyone knows, Harry replies emails very fast with the minimum number of words. Within one hour after sending my application, I got his reply: yes. At that time, I realised that maybe I should more carefully read some of his papers. While reading those papers, I felt like I was fooled by the Tue website: Harry does not do any work directly related with culture and his work has many complicated equations! I was struggling for some time whether I should become his PhD student, because I only conducted qualitative research. I had not studied math for over nine years and I knew nothing about modelling! Even though Harry thought it would not be a problem when I discussed these concerns with him, I was still quite worried. Even until the time I had to come to the Netherlands, I felt anxious. At that time, I had doubts about the power of quantitative methods, I doubted about the work I was going to do and I doubted about my future life.

The day I arrived in Eindhoven, Holland welcomed me with the typical Dutch weather, cold, unstoppable rain and wind. The sky was so dark and full of clouds, exactly as my emotion. Everything was closed and there was almost no one on the streets. I doubted my decision: is this the country I am going to live for the next four years?

Now four years have already passed. I would say it was one of the best decisions I have made in my life to come here. During the past exciting four years, I realised that a PhD study is full of surprises. I realised that quantitative analysis can be interesting and attractive. I realised that I have the potential to finish the unknown work if I work hard on it and I realised that the Netherlands and Dutch weather can also be lovely and beautiful. Although I did encounter many problems in the past four

years, sometimes felt bewildered, sometimes felt too stressful and had insomnia. Overall, I walked through those difficulties and enjoyed the work and life.

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During this PhD study, another important task I conducted is travelling. Thanks to the good location of the Netherlands and helpful people all around the world, I visited almost all countries in Europe, and some in the Middle East and Africa. Due to all problems I encountered, I grew up as a person. Thanks to all the people willing to provide help when I was stuck on the road, which convinced me that urban and transportation planning is required to improve individuals' life all around the world.

Pursuing a PhD degree in an unfamiliar country is a tough journey. Due to the cultural differences and the distance from home, one can easily feel lonely. There are so many times I feel that life is hard to carry on, so many times I continue working while wiping my tears, so many times I went back home late in the evening along empty roads from Vertigo with the company of heavy rain and strong winds. During this lonely journey, I feel grateful for the support of my parents. They supported me whenever needed, always listened to my worries and comforted me. Although sometimes they were also quite worried whether I can graduate or not, I know they will always be my strongest backing no matter what I decide to do. Last but not least, thanks to my boyfriend Sarvesh and my friends (Nan, Nenad, Nikhil, Yi and Wenjie) to escort me during this lonely journey. All in all, thanks to this tough and excited PhD journey, with all the hardness and happiness, I enjoyed!

Eindhoven, October, 2017

Summary

Gap-Theoretical Analyses of Residential Satisfaction and Intention to Move

This PhD thesis analyses residential satisfaction and intention to move house in historical blocks in selected Chinese cities from a gap-theoretical perspective. Existing studies have mainly explained residential satisfaction as a function of residential attributes and social demographics. Specifically, housing, neighbourhood and accessibility attributes have been used as determinants of residential satisfaction and mobility. However, these studies largely neglected the aspiration of individuals. They ignored the fact that individuals may have different aspiration levels about their living environment. In this thesis, we assume that the gap between individuals' aspiration and their experienced situation may be correlated with residential satisfaction and moving propensity. Although gap theory regarding aspiration has been introduced in the housing literature for several decades, the concept is still in need of a more precise definition, operationalization and an examination of the functional form between aspiration, residential gap and residential satisfaction. Moreover, the studies on residential satisfaction and mobility adopting gap theory have mainly been concerned with single causal relationship either between residential gap and satisfaction or between residential gap and residential mobility. A more integrated approach analysing the direct and indirect relationships between residential attributes, gap, satisfaction and intention to move house is largely missing.

Therefore, using gap theory, this PhD research project develops a comprehensive theoretical framework regarding social-demographic information, aspiration, residential gap, residential satisfaction and intention to move to analyse both the direct and indirect relationships between these concepts. Different types of models are used to analyse the complex relationships within the developed theoretical framework. Considering the nature of dependent variable, single interrelationships are estimated using regression and discrete choice models. A gap index was built as the ratio between aspiration and reality as the foundation of these statistical analyses. Using a best subset regression analysis, the influence of the gap between aspiration and reality on residential satisfaction is examined for different residential dimensions. The

contribution of all the dimensional satisfactions on overall residential satisfaction is also analysed. Then, a mixed logit model is used to analyse the relationship between social demographics, residential satisfaction and intention to move. Finally, a path model is estimated involving all direct and indirect relationships between all the key concepts.

To estimate these models, data of a sample of 384 respondents were used. The data were collected using a spatially stratified sample in historical blocks in two Chinese cities. The renovated historical blocks were chosen because these blocks provide variations for analysing aspiration, residential satisfaction and moving intention. As residents living there encounter different opportunities and constraints during different stages of renovation, their aspiration and satisfaction levels may vary between the renovation stages. For each of the classified dimensions of residential satisfaction, a set of residential attributes was identified. For each of these attributes, respondents were invited to articulate their aspiration level, their perceived current situation and satisfaction. These data were complemented with data on personal and household information and the intention to move.

The estimation results of the models lead to the following conclusions. First, residential satisfaction is found significantly influenced by the gap index. It means that as the residential gap increases, residential satisfaction decreases. Furthermore, most dimensional satisfactions are found to significantly influence overall residential satisfaction. Second, residential satisfaction is significantly and negatively influenced related to the intention to move house. Lower satisfaction is associated with a higher intention to move house. No taste difference was identified between residents living in blocks that belong to different renovation stages, while a significant impact of interaction of residential satisfaction and renovation stage on moving intention is observed. Third, residential satisfaction plays a mediating role between residential gap and moving intention, so the moving intention is first directly driven by satisfaction and further driven by gap between aspiration and reality.

Besides the standard linear models, two newly formulated model specifications were explored. First, considering the limitations of our gap index and existing gap models, three nonlinear, asymmetric gap-satisfaction models were developed based on gap theory. By comparing the newly formulated models and the existing ones, findings indicate that the nonlinear asymmetric models perform better than the traditional linear models. Second, a latent class path model was proposed to identify unobserved heterogeneity within the integrated model. The model results captured unobserved

heterogeneity between groups of residents during the decision making process. Class membership is identified based on household characteristics.

The contribution of this study is the estimation of an integrated framework, which analyses residential satisfaction and intention to move based on the concept of residential gap. In addition, nonlinear, asymmetric and non-truncated specifications of gap theory are introduced as an alternative to current linear symmetric gap-satisfaction models. Finally, a latent class path model of residential satisfaction and intention to move house is proposed to identify unobserved heterogeneity among residents.

Contents

List of figures

List of tables

1

Introduction

1.1 Background and motivation

Most adults have at least experienced once a residential move in their lifetime. From a behavioural perspective, residential mobility consists of three stages: intention to move, the selection of the dwelling and location, and the real move (Speare, Goldstein, & Frey, 1975). The intention to move refers to the first phase of the residential mobility process in which an individual or household develops the idea to relocate. It triggers a process of mentally or actually exploring the housing market and searching for a house. Depending on the urgency of moving, the ease of finding a house that satisfies the needs, aspirations of the individual or household and the budget fits, this search process may take a short or long time. If the search is successful, the intention to move is translated into the selection of a new housing, with a particular aspired profile. Conversely, if too much effort has been spent unsuccessfully, the intention to move house may gradually disappear, implying that the household has to adjust its aspiration level according to their current living situation. Once the new house has been selected, it is followed by the actual move, in which households physically move from their old to the newly selected house.

This thesis focuses primarily on the intention to move. This first phase may be activated by various triggers, including life cycle events, and change of job across a distance that necessitates moving house. The focus of this thesis, however, concerns residential gap and residential satisfaction induced intention to move. Residential satisfaction is viewed as a function of the concept of residential gap, which expresses the degree of deviation between residential aspirations of the living condition and the real situation that people experience. Residential gap is assumed negatively correlated

with residential satisfaction. In turn, ceteris paribus, lower satisfaction is assumed correlated with a higher intention to move house.

Finding determinants of residential satisfaction and intention to move house has a long history in urban planning and housing research. Residential attributes (e.g., housing, neighbourhood and accessibility attributes), lifecycle events and social-demographics have all been analysed for their relationships with residential satisfaction and intention to move. Although gap theory has played a role in this literature, its influence on residential satisfaction and intention to move house has not been systematically explored. Moreover, empirical examination of the influence of residential gap on residential satisfaction has been limited. In addition, the complex relationships between socio-demographics, residential gap, satisfaction and intention to move have rarely been investigated.

The aim of this thesis, therefore, is to examine the relationships between individual or household characteristics, aspirations, residential gap, satisfaction and intention to move. This study is based on satisfaction and gap theory, arguing that the increase in the gap between aspiration and reality will lead to a lower satisfaction and an increase in the intention to move house, subject to budget constraints. Structured from a bottom-up perspective, this study focuses on the behaviours and intentions of individuals, while the influence of the macro background is selectively taken into consideration.

These relationships are examined in the context of renovated historical blocks in selected Chinese cities. Although there is a plethora of residential literature about residential satisfaction and mobility in urban areas in general, residential studies focusing on historical blocks are still very limited in number. Historical blocks are the areas where historical or cultural buildings are concentrated and exhibit the characteristics and style of a certain historical period. These blocks have experienced several rounds of renovation, which provide the variability for examining the relationship between aspiration, residential gap and residential satisfaction. Residents living in such blocks face more complicated situations compared with inhabitants from other urban areas. Specifically, on one hand, their houses are not in good technical condition, which may generate a bigger gap between the residents' aspirations and perceived reality and lower the satisfaction. On the other hand, these houses have a high cultural value and are normally located in the centre of the city, implying they possess very good access to public transportation and facilities, which increases residential satisfaction. However, the low percentage of property rights and low

education level of residents imply it is hard for them to act on their preference. At the same time, different levels of renovations that these blocks experienced also increase the variation of residential opinions. Therefore, historical blocks provide an interesting background for the analysis of aspirations, residential gap and satisfaction.

Results of this study can help understanding the reasons behind low residential satisfaction and moving intention in historical blocks and be used to provide prioritised suggestions to governments to improve the living conditions of residents. The relevance of such research goes beyond the specifics of historical blocks. We see these blocks as increasing exemplars of regenerated neighbourhoods across megacities in which residential satisfaction changes during the regeneration process and residents face constraints. Furthermore, most findings are not unique to the selected historical blocks but might be relevant for other countries and cities as well.

The contribution of this study is to propose an integrated theoretical framework for the analysis of residential satisfaction and intention to move house, using gap theory. All these relationships between the above-mentioned key concepts are examined using different statistical models. In addition, two technical explorations are conducted as an extension of the substantive part of this study. First, a latent class path model of residential satisfaction is proposed in this study. Second, nonlinear asymmetric specifications of gap theory are suggested as a novel update of current linear gap-satisfaction models in residential studies.

1.2 Research questions

To achieve the aim of this study, the main research question is to identify the relationships between residents' aspirations, their residential gap, satisfaction and intention to move. This main research question can be decomposed into several sub-questions:

1. How does the gap between aspiration and perceived reality influence residential satisfaction? What are the weights of the attributes underlying the gaps on residential satisfaction? Does the gap model perform better than the conventional assessment of residential satisfaction? Which dimension of residential satisfaction affects overall satisfaction most? Are the determinants of satisfaction in renovated historical blocks different from other urban areas?
2. To what extent do residential satisfaction and social-demographics impact the intention to move house? Is there any taste variation between residents

in their propensity of moving? Can any joint effect of residential satisfaction and social-demographic information be identified?

3. Does the residential gap indirectly influence the intention to move through the mediation of residential satisfaction? To what extent and how can we build an integrated model of social-demographics, gap between aspiration and reality, residential satisfaction and intention to move to capture the direct and indirect relationships between each other? Are the determinants of the intention to move in renovated historical blocks the same as in other urban areas?

From a methodological point of view, the following research questions will be addressed:

4. Is there any heterogeneity between individuals in their moving intentions and how can we identify the different decision making processes in an integrated model of residential gap, satisfaction and intention to move using advanced latent class path models?
5. Should the relationship between residential gap and satisfaction be characterised as a linear (symmetric) or a nonlinear asymmetric function? Do the existing gap models best represent the gap-satisfaction relationship? What is the best model to represent this relationship and to what extent do these relationships vary between attributes?

1.3 Organisation of the thesis

Chapter 1 provides an overview of the thesis. The motivation for the thesis, its theoretical background, its contribution and a description of the empirical field of study are introduced. The aim of the study and the central research questions are outlined. This chapter ends with a discussion of the structure of the thesis. As the introduction mentioned, the key concepts of this study include social-demographics, aspiration, reality, gap, residential satisfaction and intention to move.

Chapter 2 shifts the focus of attention to the body of knowledge that is used in this study. This chapter begins with a review of the literature regarding residential gap. Next, studies of residential satisfaction and mobility are summarised. Finally, a summary of all these concepts and relationships is provided, and the research void is defined.

After identifying the research void, Chapter 3 constructs the theoretical framework of this thesis. Before introducing the framework, a short introduction of the

underlying theories regarding residential satisfaction and mobility is given. Then, the key concepts used in this thesis are explained. Next, the causal relationship between residential gap and satisfaction is elaborated, which is followed by the discussion of relationships between all the key concepts. In the end, the complete theoretical framework is built and elaborated in detail, incorporating the essential residential concepts and their interdependencies.

The data collection is described in Chapter 4. Based on our theoretical framework, a questionnaire was designed. It collects data about aspiration, perceived reality, satisfaction with the current living situation and the intention to move. According to classical studies, housing, neighbourhood and accessibility are identified as three main reasons of move. Detailing these three dimensions, the structure of this questionnaire is divided into six parts, namely housing, living environment, historical atmosphere and tourism, neighbourhood bonding, work and economic situation. As the detailed design of the questionnaire is based on these six dimensions, each block asks questions about the key concepts of the framework. Personal and household characteristics are included in the questionnaire as a separate section. After explaining questionnaire design, this Chapter discusses the selected study areas and sample recruitment. Finally, sample characteristics are reported.

Chapters 5 to 7 are the core chapters of this thesis. In these chapters, the results of all analyses about the single and multiple causal relationships included in our conceptual framework are reported. Chapter 5 discusses the relationship between residential gap and satisfaction. Rather than adopting the traditional assessment of residential satisfaction in terms of residential attributes directly, the influence of the gap between aspiration and perceived reality on satisfaction is estimated. A best subset regression model is used to analyse data from six residential dimensions. The model results are compared with the traditional assessment. Furthermore, the contribution of all the dimensional satisfactions to overall residential satisfaction is estimated.

Chapter 6 explores how residential satisfaction influences the intention to move house, controlling for social-demographics. As different people are assumed to have different taste during the decision making process, taste variation between individuals is identified. At the same time, the interactions between attributes are examined. To include both taste variation and interaction, a mixed logit model is adopted.

After analysing the influence of residential gap on satisfaction and residential satisfaction on the intention to move, Chapter 7 considers all these three concepts at the same time and estimates a simultaneous model that includes both the direct and

indirect relationships between residential gap, satisfaction and intention to move. Social-demographics are also included as indicators. The path model is used to analyse the complex relationships between all key concepts.

These core chapters draw a complete map of the relationships between all the key concepts. A variety of methods is used. For the most part, these methods are well-known and have been widely applied in residential satisfaction research. In relation to gap theory, these methods have some limitations. The next two chapters, therefore, explore more advanced models.

Chapter 8 explores variations in the specification of the gap-model. The gap model discussed in Chapter 4 is based on two assumptions: (i) the measure of the gap between aspiration and perceived reality is symmetric around the reference point that aspiration equals to reality and truncated for wide deviations; (ii) the relationship between the gap and satisfaction is linear. Because both assumptions may be invalid, three nonlinear asymmetric gap models without truncation are proposed, and their empirical performance is compared against the conventional models.

Based on the conceptual model built in previous chapter 7, Chapter 9 takes the heterogeneity issue into consideration. It estimates a latent class path model. To the best of our knowledge, this is the first time such a model is proposed and applied in the study of residential satisfaction and mobility.

The last chapter summarises the main findings of this research project, discusses their implications for housing and urban policy and outlines avenues of future research.

2

Literature review

2.1 Introduction

Identifying determinants of residential satisfaction has been of interest to a myriad of scholars. Most of these studies have focused on attributes of houses, neighbourhoods (primarily in terms of physical attributes, but also in social attributes) and locations, relative to work, school, and other activity locations and nodes in transportation networks. Residential satisfaction has also been found influenced by residential mobility, apart from being a determinant of housing mobility. For instance, the previous moving experience may influence current residential satisfaction and future moving decisions.

These studies mainly consist of two types: the direct assessment of attributes and the examination of complicated relationships influencing residential mobility. The first type of studies focuses on single causal relationships between residential mobility and other sets of attributes. In this seminal work, which can be traced back to the 1950s, individual and/or household characteristics, residential attributes and residential satisfaction are usually identified as determinants of residential mobility. From the 1970s, the second type of studies has become popular, reflecting the availability of structural equation and path modelling. These models allow estimating the complex direct and indirect relationships between socio-demographics, residential attributes, residential satisfaction and residential mobility. In these relationships, residential satisfaction is usually analysed as the mediator variable.

This chapter is organised as follows. First, we will discuss the literature on gap theory and similar theories. Next, we will provide an overview of the residential satisfaction literature. Then, studies regarding residential mobility will be presented.

2.2 Residential gap

Although several other scholars already used the term aspiration before (Campbell, Converse, & Rodgers, 1976; Michelson, 1977), gap theory is generally attributed to Galster (1987), who introduced gap theory in the study of residential satisfaction. Galster argued that residential satisfaction should be measured in terms of the gap between the actual environment and the aspired environment. Although later this concept was adopted by several scholars to study residential satisfaction (e.g., Tang, 2012), the operationalization of the concept has remained relatively straightforward and has not been subjected to much critical assessment.

In addition to the concept of gap, several other similar concepts have been used in housing studies. For example, mismatch (Jansen, 2014), discrepancy (Handal, Barling, & Morrissy, 1981), housing deficit (Sulaiman & Yahaya, 1987) and stress are related concepts, although they vary in detail. Among these concepts, stress has been used most frequently. Wolpert (1965) was the first to use stress-threshold theory, which states that an individual's aspiration is defined by accumulated needs, and if aspiration is significantly different from immediate utility (current needs), individuals will consider moving house. This difference was labelled as stress. Dynamically, the natural deterioration of housing quality and rising aspirations resulting from particular economic or demographic events may increase the degree of stress. Once it exceeds a certain threshold, according to this theory, people start searching for alternative housing, and will move house when they find a stress-reducing and affordable house.

Brown and Moore (1970) further conceptualised migration as a response to stress between the collective needs of the household and the characteristics of their living environment. Basically, his concept of stress is similar to the notion of gap, while the notion of collective needs is similar, but not necessarily identical to aspirations in the sense that aspirations may exceed pure needs. Later, Speare (1974) built the first model connecting aspiration and satisfaction, but he chose to use the term dissatisfaction rather than stress and did not measure stress explicitly. Using Speare's model, Lu (1999) and Barcus (2004) included additional neighbourhood and social-demographic attributes, arguing that satisfaction depends on many different aspirations. Huff (1978), Brummell (1979, 1981) and Phipps (1984, 1989) added the concept of resistance to this theory by examining the joint influence of resistance and stress on residential mobility. The notion of resistance emphasises the fact that change (residential move) involves a lot of effort and costs, and therefore people may postpone the search process or even never act on their desire to search for another house.

However, the introduction of resistance still did not explicitly explain how stress influences residential satisfaction while the relationships between stress, aspiration and residential satisfaction remained conceptual.

After Phipps, scholars' interests turned to life course theory (Rossi, 1955) and the application of gap theory faded. In fact, by assuming that aspirations change over the life course, the integration of these theoretical frameworks would constitute a powerful theoretical framework. Thus, although gap and other similar theories have been part of housing satisfaction and mobility research since 1965, the question how aspiration is related to gap and how gap theory can be used to measure housing satisfaction has remained relevant and deserves further investigation. Because readers may associate the concept of stress with the notion of a psychological disposition, we prefer to use the concept of residential gap.

2.3 Residential satisfaction

Identifying determinants of residential satisfaction has attracted substantial interest from scholars since the 1980s onwards (e.g., Galster & Hesser, 1981; Lu, 1999; Molin & Timmermans, 2003). Multiple determinants of residential satisfaction (Amole, 2009) have been identified. Often, these determinants have been grouped into housing, neighbourhood and accessibility dimensions (Clark, 1982, 1983). Among these, housing and neighbourhood attributes have been found most important, although importance varies between social-demographic groups (e.g., Molin & Timmermans, 2003; He & Yang, 2011; Grigolon, et al., 2014; Addo, 2016; Ren & Folmer, 2016; Azimi & Esmaeilzadeh, 2017). As the potential effects of neighbourhood characteristics on behaviour have a long history in social science (Briggs, 1997), it is not surprising that neighbourhood effects especially drew increasingly more attention in residential studies. Specifically, the assessment of variables related to the neighbourhood shifted from measuring few neighbourhood attributes (Lu, 1999) to comprehensive analyses, including both physical and social aspects (Parkes, et al., 2002). Recently, neighbourhood characteristics are considered to include a set of morphological and functional characteristics, but social composition is sometimes also included. For instance, He and Yang (2011), Huang and Du (2015) and Ren (2016) found that community facilities exert a strong influence on residential satisfaction. Social factors such as crime and ethnical composition have also been identified as influential factors (e.g., Parkes, 2002 & Clark, 2015).

Besides neighbourhood, tenure (e.g., Molin & Timmermans, 2003; Elsinga & Hoekstra, 2005; Diaz-Serrano, 2009; Hu, 2013; Huang et al., 2015) and age of residents (e.g., James, 2008; Waziri, et al., 2014; Grigolon, et al., 2014) are common variables in the analysis of housing satisfaction. Home ownership status has been found to have a strong positive effect on satisfaction in the sense that owning the house will provide a higher satisfaction than renting the property (Diaz-Serrano, 2009; Mohit, et al., 2010; Ibem & Aduwo, 2013; Hu, 2013). Also, older people tend to be more satisfied with their housing (Waziri, et al., 2014). On the one hand, it may reflect that older people with higher accumulated wealth had longer time and a bigger budget, ceteris paribus, to find a living environment that better meets their aspirations; on the other hand, it is well known that older people tend to give higher satisfaction ratings, regardless of the topic of interest.

Although a myriad of factors have been analysed as the determinants of residential satisfaction, early research mainly assessed the direct effects of the influential factors on residential satisfaction. It means that such studies, implicitly or explicitly, have assumed that people with the same socio-demographic profile will derive the same satisfaction from particular housing attributes or characteristics of the neighbourhood. In reality, however, different people may have different levels of aspiration, which may lead to varying satisfaction, even for the same attribute values or levels. An increasing mismatch between aspirations and the daily experienced real situation may result in lower satisfaction. Thus, change in residents' satisfaction may not only be caused by attributes of the house and the environment, but may also reflect a change in aspiration levels. However, the number of studies about the relationship between aspiration and residential satisfaction is limited.

Residential satisfaction has also been analysed as an intervening variable to explain residential mobility. Speare (1974) first used satisfaction as a mediator between individual and residential variables and residential mobility, including the propensity to move and the real move. He concluded that social-demographic characteristics influence both types of moves through satisfaction. This finding was later confirmed by Oh (2003) and Diaz-Serrano (2010). By analysing the data from 12 countries, Diaz-Serrano (2010) confirmed that, in the majority of the selected countries, the mediating effect of residential satisfaction on mobility is very strong. Deane (1990), who expanded Speare's model by adding adjustment as the mediation between satisfaction and intention to move, also found a strong impact on the intention to move. In contrast, Landale and Guest (1985) conducted a similar analysis, but found that residential satisfaction has

little influence on mobility as a mediator variable of social-demographics, although it directly and strongly influences thoughts of moving house. The mediating effect of residential satisfaction was also not supported by Liao (2004). Residents' aspirations were not taken into consideration.

By studying the causality between residential satisfaction and mobility, scholars also found that the residential history will affect current residential satisfaction, in spite of the fact that those studies are based on different scales of relocation (Barcus, 2004; Lu, 2002; Posthumus et al., 2014).

Turning from the general residential satisfaction literature to studies on historical blocks, it should be emphasised that the number of studies on residential satisfaction in renovated historical blocks is still very limited (Temelová & Dvořáková, 2012), although there is a large body of knowledge about satisfaction regarding residential mobility in other urban areas (Baker, 2002; Kleinhans, 2003; Meerts, et al., 2011; Posthumus, et al., 2014). Both qualitative (Meerts, et al., 2011) and quantitative methods (Posthumus, et al., 2014) have been used to study inhabitants' residential satisfaction and identify different determinants in other urban areas. Specifically, policy influence is considered significant in Meerts' study, while Posthumus et al. (2014) signal out economic factors. To the best of our knowledge, no prior studies have investigated residential satisfaction in historical blocks.

Focusing on residential satisfaction research in China, even though the recently emerging flow of studies examined determinants of residential satisfaction of low-income residents in urban areas in different cities (Li & Chen, 2011; Chen, et al., 2013; Li & Wu, 2013; Tao, et al., 2014; Huang, et al., 2015b), the number of studies is small. Most followed the Western tradition. Li and Wu (2013) found that factors underlying residential satisfaction differ between cities. Results showed that, overall, housing attributes (e.g., size, property rights), attributes of the neighbourhood and facilities tend to have a major impact on residential satisfaction.

2.4 Residential mobility

Residential mobility has a long history in urban planning and housing research. As mobility is important in understanding residential preferences and behaviour, the question how families move began to attract the interest of scholars since the middle of the 1950s. In the 1980s and 1990s, identifying variables that influence residential mobility became a popular topic of research. Even though recent years have witnessed a decrease in the analyses of residential mobility due to the shift of interest to

international immigration (Coulter, Ham, Findlay, & Coulter, 2013), residential mobility remains a significant topic to discuss, especially in developing countries.

Initially, Clark (1983) defined the housing, neighbourhood and accessibility as three main reasons for voluntary residential mobility. Boehm (1986) and Lee (1994) found that neighbourhood variables play an significant role in predicting mobility. Clark (2003, 2006a) checked the influence of neighbourhood satisfaction and stated that people who like their neighbourhood are less likely to move out. In another paper, (Clark et al., 2006), further addressed the trade up in housing and neighbourhood quality and found people often try to improve both through move. Kan (2007) used social capital to replace the neighbourhood and found it has a negative effect on residential mobility.

Since Rossi (1955), tenure has always been included in analyses of residential mobility. It was found to have a salient effect on residential mobility as raised by Clark (2003), Van der Vlist (2002), Coolen, Boelhouwer, & Van Driel (2002) and Lu (2002). Baker (2002) soon added that homeowners are more satisfied with their housing and community characteristics than tenants, and are thus less likely to move. Huang (2006) found that homeowners are less likely to move than renters. Besides tenure, length of stay has been subjected to analyses using months as an independent variable in residential mobility studies. Studies have found varying effects. McGinnis (1968) concluded that increasing length of stay will decrease the propensity to move. However, Ioannides (1987) asserted that length of stay will affect mobility jointly with tenure status. Onaka (1983) also found length of stay does not have a consistent effect on mobility. Only for young couples without children, a negative effect could be observed.

Residential mobility is also considered to be the function of lifecycle events (Mulder & Hooimeijer, 2002). Different events happening in an individual's life are potentially triggering the need of moving house. Rossi (1955) mentioned that life cycle is placed at the top of the list of reasons of residential mobility. Clark (1983) argued that lifecycle is a more important determinant compared with cost, tenure, etc. Two years later, Courgeau (1985) used a retrospective survey and found that the birth of the first child has a significant effect on increasing mobility rates. He also pointed out that divorce has a significant effect mainly for women, while the influence of marriage changes over time. Later, Clark (2003), Feijten (2007) and Rabe (2010) confirmed the importance of lifecycle for couples in explaining residential mobility.

Change of job can also be regarded as a lifecycle event, which potentially leads to residential mobility. Many scholars found the positive link between job change and

moving house (van Ommeren et al., 2000; Clark & Davies Withers, 1999). By analysing job change, Böheim (2002) found that in the UK unemployed people are more likely to move than employees, while Diaz-Serrano (2010) argued that the influence of job change depends on the country where respondents live.

Besides tenure, age and gender have been considered in most residential mobility studies. All studies indicate that residents are less likely to move with increasing age, while the effect of gender varies. Moreover, education has been shown to affect mobility significantly (e.g., Wu, 2006; Green, 2014; Kim et al., 2015). Specifically, Wu (2006) found that education shows a significant positive effect on both the intention to move and actual moves. Later, Green (2014) and Kim (2015) confirmed this finding.

The direct relation between residential satisfaction and residential mobility also attracted a lot of attention in housing research. A significant influence of residential satisfaction (or dissatisfaction) on the intention to move was found by many scholars (e.g., Clark & Onaka, 1983; Kearns & Parkes, 2003; Oh, 2003; Kwon & Beamish, 2013; Kim et al., 2015). Speare (1975) applied path analysis to study the influence of residential satisfaction on intention to move. His model was confirmed by Landale (1985) and showed that satisfaction is a strong predictor of the intention to move and the thought of moving will influence the real move. Earhart (1996) and Oh (2003) argued that residential satisfaction influences the intention to move house, jointly with other variables such as feelings of home attachment and social bonding. Kearns (2003) and Kwon (2013) also found that dissatisfaction increases the intention to move. Diaz-Serrano (2010) used panel data collected from 12 countries and found that residential satisfaction triggers real moves. The non-perfect relationship between intention to move and real move may be explained by the fact that the wish to move may not always be realised due to a lack of resources and/or market conditions. The high transition costs and the effort involved may lead to postponing or change of plans to move house. Another factor may be that demographic or economic factors may change an individual's or household's housing needs, implying that an existing intention to move house is not transformed into actual residential mobility.

Residential mobility has also been a topic of interest among Chinese scholars during the last decade (e.g., Li, 2003; Wu, 2006; Huang & Deng, 2006; Fang, 2006; Li, 2004; Hui & Yu, 2009; Huang et al., 2014; He, 2015). However, Chinese findings are inconsistent with Western results. Fang (2006) found that in contrast to the Western literature, lower residential satisfaction also causes a higher intention to move house,

but will not lead to more real moves. Li (2004) found that life course, including marriage and childbirth, is not influential for residential mobility, which is different from findings in the Western world. Even for tenure status, Li (2003) and Wu (2006) concluded it does not necessarily drive residential mobility. The main reason for this discrepancy may be that Chinese are faced with stronger constraints and hence have less opportunities to act on their preferences and intentions.

The influence of the special Chinese hukou system (Chinese residence ID) on mobility was analysed by Huang (2014). He found that it only has effects in more-developed municipalities. Huang and Deng (2006) found that changes in housing supply and housing qualification trigger residential mobility in Chinese cities, while He (2015) asserted that the intention to move house is generated by a combined effect of various factors.

Although plenty of Chinese studies tried to identify the determinants of residential mobility, few scholars have examined the relationship between residential satisfaction and residential mobility. For example, using data from inner-city Beijing, Fang (2006) indicated that low satisfaction leads to high moving intention. Tao (2014), examining migrant workers living in Shenzhen, found that mobility preferences influence residential satisfaction. To the best of our knowledge, research about historical blocks has not addressed this relationship yet.

When focusing on historical blocks, Chinese scholars have studied housing mainly from the macro-level perspective. Although much less forced relocation can be observed after 2007, local government is still blamed as the main cause of social problems and residential mobility (Jin, 2005; He & Deng, 2014). Physical protection of historical blocks is another topic that has triggered the interest of Chinese scholars (Lin & Ruan, 2006; Chen, et al., 2009). Even though recent years have witnessed an increasing number of studies about public participation, they stay at the community level and are still not concerned with individuals (e.g., Zheng & Yang, 2005; Zhong & Kou, 2015). Little research has been devoted to the residents' perspective.

2.5 Conclusions and discussion

This chapter summarised the existing literature regarding gap, residential satisfaction, residential mobility and complicated relationships between them as well as social-demographics and residential attributes. We have provided evidences from the international literature that although the concepts of gap and stress have played a role in the literature, attempts to systematically measure the gap between aspirations and

the actual housing situation, to include them in the analysis and to examine its relationship with residential satisfaction and mobility have been limited. Therefore, in this thesis, we will explore how residential gap influences residential satisfaction.

Residential mobility and satisfaction have been found influenced by residential attributes and social demographic information. Residential satisfaction was also identified as the mediator between residential attributes and mobility. Accumulated evidence in housing studies, particularly concerned with developed economies, suggests that residential satisfaction is systematically but not perfectly related to the intention to move house and the ultimate housing mobility decision. The literature differs in the sense that some authors have assumed a direct relationship whereas others have assumed an indirect relationship in which residential satisfaction is used as an intervening variable.

The literature review indicates that even though a plethora of literature has identified the determinants of residential satisfaction and mobility, studies examining the complicated relationships between social-demographics, gap of aspiration and perceived current situation, residential satisfaction and intention to move is still lacking. Thus, constructing an integrated conceptual framework to comprehensively study the single and multiple relations between the above-mentioned groups of attributes will be discussed in this thesis.

Relative to the abundant literature in developed countries, the literature on housing satisfaction and residential mobility in emerging economies, such as China, is modest at best. The literature focusing on residential preferences, satisfaction and mobility in historical blocks from individual perspective is really scarce. Considering this lack of interest is in flagrant contrast with the importance and relevance of this topic in that various constraints influence the relationship between residential satisfaction and intention to move, the empirical work of this thesis will focus on the renovated historical blocks in China.

3

Theoretical framework

3.1 Introduction

The aim of this PHD study is to examine the relationships between individual or household characteristics, aspiration, residential gap, satisfaction and intention to move. As literature review indicated, the number of studies that examined these interrelationships using full operationalisations of residential gap theory are very limited and completely lacking in the Chinese context. Meanwhile, although residential attributes have been directly analysed as the determinants of residential satisfaction or mobility for a long time, the comprehensive relationships between individual's aspiration, residential satisfaction and intention to move have been largely neglected. Following classical gap theory, we assume that residential satisfaction is not determined by the actual values of housing and neighbourhood attributes per se, but rather by a function of the discrepancy between the aspired and perceived attributes. The gap may impact residential satisfaction. A decrease of residential satisfaction may lead to the intention of moving house. The detailed causal relationships between these concepts will be examined in this chapter and the structure of this PhD study will be outlined.

In this chapter, first, the basic theories and concepts used in this study, namely aspiration, perceived reality and residential gap will be discussed. Then, it will describe how aspiration and perceived reality influence residential gap, which is followed by a discussion of relationships between gap, residential satisfaction and intention to move. Finally, after presenting the theoretical framework, conclusions will be drawn based on the framework.

3.2 Background theories

Regarding the literature review, this PhD study is based on two fundamental theories,

namely satisfaction theory and gap theory. In terms of satisfaction theory, as Simon (1959) argued, the motivation of behaviour stems from satisfaction, rather than maximizing utility. In that sense, satisfaction may be different from utility maximisation theory. Simon indicated that humans are satisficing animals rather than totally rational ones that drive their activities on the basis of maximising their utility. They are motivated and perform their behaviours based on meeting certain aspiration levels, rather than being a maximising animal. Therefore, using utility maximization theory to examine the influence of satisfaction on intention to move may be less appropriate, although it has been applied frequently in the literature. In this research project, satisfaction theory is adopted to study residential moving intention.

Gap theory is another theoretical foundation of this study. As the previous chapter indicated, gap theory states that the gap between the perceived environment and the aspired environment influences residential satisfaction. As the gap increases, people will become more dissatisfied. Although most studies on residential mobility and satisfaction directly assessed the influence of residential attributes, gap theory constitutes an alternative.

3.3 Concepts

The basic concepts used in this study include aspiration, perceived reality and residential gap. Aspiration, in a residential choice context, refers to the profile of housing attributes that people desire to experience within some time horizon. As individuals have different backgrounds, their aspiration may vary. Perceived reality is the perceived value or the level of attributes of the house and its neighbourhood. The concept is used because individuals do not necessarily have perfect information about the objective reality. Moreover, people state their satisfaction based on their perception of the environment.

The aspiration and reality both consist of two parts: one is macro background and the other is micro situation. Considering the special Chinese political system, the macro level is about the broader Chinese context caused by government policies (Gong, Boelhouwer, & de Haan, 2014), time change or cultural transformation. It cannot be controlled by inhabitants and sometimes does not influence people's thoughts directly. Considering the relevance to residential satisfaction and intention to move, the macro level pertains to three aspects of change: macro-economic, social and spatial. Macro-economic change is mainly about economic investment from the government in the historical blocks. In terms of social change, it is defined as community-organised

activities and community management. Those activities will strength or weaken the social bonding between inhabitants and the neighbourhood, which may also change residents' aspiration. The spatial change refers to the physical change happening in the community and nearby facilities that might play an essential role in influencing inhabitants' views about their living conditions.

The micro level is related to individuals. People can directly feel and react to those changes. Here we only consider those elements that impact inhabitants' satisfaction and moving intention under historical block renovation. The micro level can be also divided into micro-economic change, social change and spatial change. Micro-economic change is related to the money that people might gain or spend on housing. For social change, neighbourhood relationships and self-organised activities within the community will be included. Finally, spatial change is concerned with physical conditions of the house.

The third concept, residential gap, refers to the mismatch between aspiration and perceived reality. Residential gap increases with an increasing discrepancy between perceived reality and aspiration. The gap may increase either because the perception of the residential environment deteriorates, or because aspiration increases, or both. The latter is often triggered by life events such as the birth of a baby, or a substantial increase of income. Lowering perceived reality is often related to a deteriorating housing quality, but it may also be based on comparison of newer housing. In renovated historical blocks, the unsuccessful renovation may also decrease the perceived reality.

3.4 Gap and satisfaction

Critical for the positioning of this study is that most studies on residential satisfaction focused on the direct assessment of the relation between attributes of the house and neighbourhood and satisfaction. The aim of these studies was to quantify the nature and strength of actual attribute levels (number of bedrooms, tenure, etc.) on the degree of residential satisfaction.

However, although the actual attributes of housing and neighbourhoods may generate different degrees of satisfaction, prior research that directly assessed the effect of residential variables on satisfaction has ignored that the contribution of attributes may depend on the aspiration levels of individuals. The degree of satisfaction about a certain attribute level likely differs between individuals with the same socio-demographic profile who have different aspirations related to that attribute. Our

contention, driving the conceptualisation and focus of the current study, is that residential satisfaction is influenced by articulated aspirations that may or may not be realised in the actual attribute levels as perceived by the individuals.

Housing aspirations change in response to lifecycle, economic prosperity, housing supply and market conditions. At the same time, supply and resource constraints imply that people may not always be able to realise their aspirations. Consequently, under the influence of spatial, social and economic factors, there may be a mismatch between housing aspirations and the reality people face on a daily basis. As the aspiration and perceived reality vary with individual and household characteristics, this mismatch between aspiration and reality is also influenced by social-demographic information. As gap theory indicates, this mismatch may also influence residential satisfaction. As the gap increases, the satisfaction level decreases. If this mismatch is substantial or grows through life-course events, and when it exceeds a certain threshold, people may consider to move house.

3.5 Residential gap, residential satisfaction and intention to move

Housing is a basic need of individuals and households. As satisfaction theory indicates, residents may intend to take actions to deal with the low satisfaction level that is induced by a large residential gap. As residential satisfaction is negatively influenced by the gap between aspiration and perceived reality, they may feel dissatisfied if the reality residents face does not meet their aspirations.

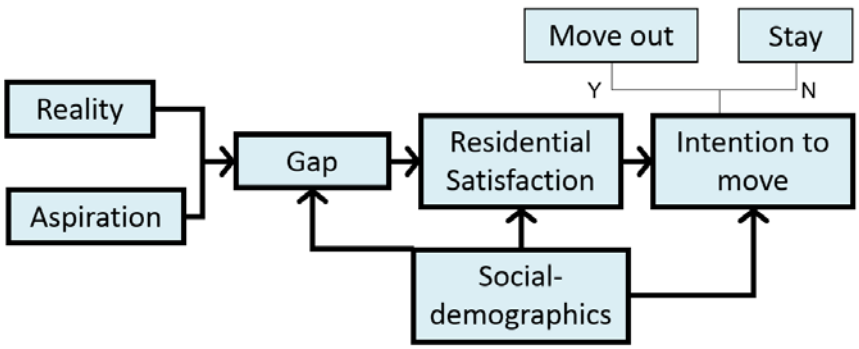


Figure 3.1 Conceptual framework

Under these circumstances, residents may try to improve the current situation or lower their (unrealistic) aspirations to reduce the mismatch and feel more satisfied. However, if the current situation continues to deteriorate, or their aspiration cannot be further controlled, they may have a low satisfaction level and develop the intention to move, subject to the constraints they face. Once an opportunity occurs, they will relocate (Hooimeijer & Oskamp, 1996).

As current residential studies mainly focus on the single causal relationships between residential gap, residential satisfaction and residential mobility, this study follows this trend to examine these single relationships first and further examine the direct and indirect relationships between these attributes. Thus, this study using residential satisfaction as an intervening variable is not confined to one specific quantitative relationship, but takes into account logically more complicated direct and indirect relationships. While the single relationships are usually estimated using ordinary linear regression or discrete choice models, path and structural equation models will be included as the dominant models to analyse the complex relationships.

The theoretical framework of this study includes all the causal relationships mentioned in this chapter, namely direct and indirect relationships between social demographics, residential gap, residential satisfaction and intention to move. These conceptual causal relationships can be represented with Figure 3.1. In this framework, both the single and complicated relationships are included. The single relationships consist of the relationship between residential satisfaction and gap, and between residential satisfaction and intention to move. The indirect relationship assumes that the gap between aspiration and perceived reality will lead to a change in residential satisfaction and further influences the intention to move. As individuals may have different aspirations, social-demographic information is also considered in this framework and used as a predictor to examine its direct or indirect influence on residential gap, satisfaction and the intention to move. Considering the Chinese context, policy influence is also considered.

3.6 Conclusions

This chapter presented the conceptual framework of this PhD study. Before presenting the key concepts, the chapter first briefly introduced two fundamental theories underlying this thesis from literature: satisfaction theory and gap theory. Among all key concepts of this thesis, residential gap is the core concept. Following classical gap theory, residential gap is defined as the mismatch between aspiration (i.e. the desired

attribute levels) and reality (i.e. the perceived current situation). Both the aspiration and the perceived reality are influenced by the macro background and micro situation that can be divided into spatial, social and economic changes.

The conceptual framework embeds single and multiple relationships between the key concepts. The single relationships include the relation between gap and satisfaction, and the relation between satisfaction and intention to move. The multiple relationships refer to the direct and indirect relationships between all key concepts. Considering the literature, the influence of social-demographic information and policy is also considered in this conceptual framework.

4

Data collection

4.1 Introduction

The data related to the different concepts presented in previous chapters needs to be collected. Different from the majority of residential studies that directly used residential attributes as independent variables, this study focuses on the influence of residents' aspirations. Moreover, rather than using the objective attributes of the house and its neighbourhood, residents' perception of these attributes is used because we assume that people make decisions on the basis of their perceptions. Note that for some attributes, such as the number of rooms, perceptions will likely be equal to the objective reality, but residents may have incomplete and imperfect knowledge about other attributes. Data about aspirations and perceived reality of residents need to be collected to estimate the residential gap.

As the theoretical framework identified that spatial, social and economic changes are three aspects to influence residential gap and satisfaction, the design of questionnaire is based on these aspects. Specifically, the structure of measurement is divided into six dimensions, including housing, living environment, tourism and historical atmosphere, neighbourhood, work and economic dimensions.

As mentioned before, renovated historical blocks provide a natural setting to investigate these relationships. Although there are some difficulties to gather data from these blocks considering the low educational degrees and relatively older age of their residents, renovated historical blocks were chosen as empirical examples as the different stages of renovation can provide the various data regarding our framework. Also, the constraints and benefits faced by residents offer an interesting background for aspiration, satisfaction and mobility research.

In this chapter, the design of the questionnaire will be systematically explained. After discussing the selection of study areas in 4.3, we will discuss sample selection. Before the distribution of the questionnaire, a pilot test was conducted. Finally, the statistical properties of the sample will be reported.

4.2 Questionnaire design

In line with the classical stream of Western research (Clark, 1982, 1983), residential satisfaction is formed by integrating satisfaction related to the following domains: housing, neighbourhood and accessibility. However, in this traditional classification, every domain is the concoction of different dimensions of related attributes. The housing domain involves physical conditions and economic attributes of the house. The neighbourhood domain consists of both physical and social attributes of neighbourhoods, while work and relative location variables are mixed in the accessibility domain.

In order to compare aspiration and reality within these specific dimensions, we organised the measurement of aspiration and reality into six dimensions, by elaborating the traditional classification. Figure 4.1 visualises how these dimensions relate to the overall conceptual framework and the commonly used distinction between housing, neighbourhood and accessibility.

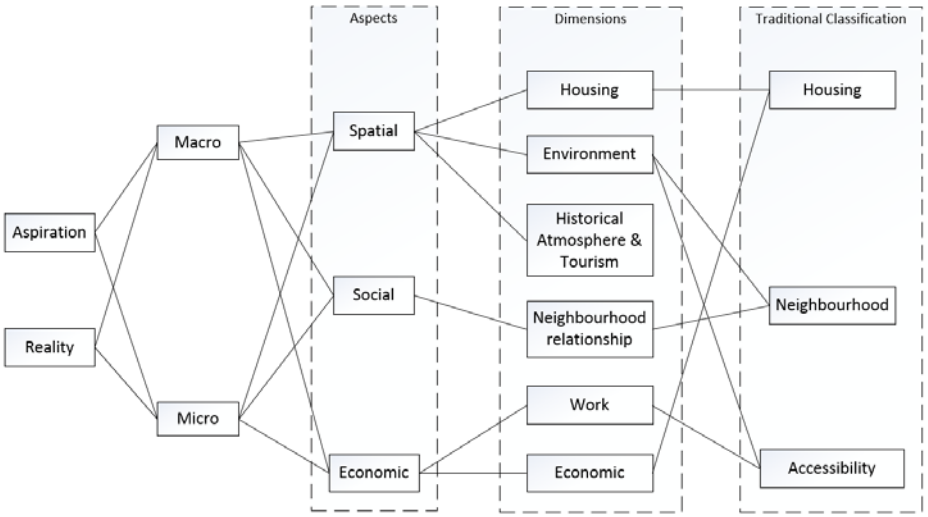


Figure 4.1 The reorganization of classifications of residential attributes

The application of our conceptual framework requires data about (i) individual aspirations related to a set of attributes of the house and neighbourhood, (ii) perceived current values or levels of these attributes, (iii) measurements of satisfaction of attributes and dimensions, (iv) the intention to move house and (v) a set of personal and household characteristics. To collect these data, the following steps in the process of designing the questionnaire were made.

First, the attributes influencing residential satisfaction were elicited. Often, researchers derive the list of attributes from literature research. A possible disadvantage is a lack of creativity, implying that only attributes that have been used before will be identified. To avoid this possible issue, we first listed for each dimension the attributes deemed relevant considering the Chinese background and then checked this list against the findings of the literature review. Having selected the attributes, it was decided whether attributes should be measured continuously or categorically, and in the latter case which categories to define.

Second, we decided how to systematically measure aspirations, perceived reality and satisfaction. In this context, it should be realised that such measurements depend on respondents retrieving information from their memory, processing and understanding the nature and purpose of the task and then making judgmental inferences and expressing these in terms of the scale use. To keep the consistency, these measurements were obtained in a coherent way. We first ask respondents to indicate their perception of the current situation with respect to a particular attribute. In case of continuous variables, they were invited to specify their perceived value for the attribute. In case of categorical variables, they were required to choose one category for the attribute.

Next, using the same format, they were invited to express their aspiration level or value of the attribute. The wording for the concept of aspiration was such that respondents were invited to express their ideal situation. Finally, they were invited to express their degree of satisfaction with this attribute. These triples of questions were repeated for all attributes. At the end of every dimension, respondents were required to express their total satisfaction with this dimension.

Third, in the remaining sections of questionnaire, respondents were asked to provide information about their socio-demographic profile, overall residential satisfaction and their intention to move house. A final section prompted them to identify past changes and what they did to deal with certain laws. Table 4.1 gives an overview of the

variables included in the survey. Political influence is included due to the fact that renovation of historical blocks is usually organised by local governments in China. As crime and ethnic issue are not problems for historical blocks, they are not included in the attributes in spite of their influence found on residential satisfaction in literature. Although life course is found to have significant impact on residential mobility, it is not considered in this thesis, as it requires the collection of longitudinal data.

In the questionnaire design, we deliberately decided not to ask respondents to subjectively assess the gap between aspiration and perceived reality directly. We feel that "unobtrusive" measurement of the concept, without making respondents explicitly be aware of the concept, provides much stronger evidence of the effects of gaps on residential satisfaction than direct assessments.

Table 4.1 Variables expressing the different dimensions

Dimension	Housing	Environment	Historical atmosphere and tourism	Neighbourhood relationship	Work	Economic
Variable	Cities	Cities	Cities	Cities	Cities	Cities
	Floor	Distance to primary school	Historical building	Frequency of meeting neighbours	Commuting time	House price increase
	Size	Distance to retail shops	Historical environment	Known neighbour NO.	Job Type	Rent increase
	Proximity to main road	Distance to shopping mall	Disturb from tourists	Familiar neighbour NO.	Change of job	Family income
	Bedroom NO.	Distance to health centre	Benefits from tourists	Familiar new neighbour NO.		Opening family business
	Non-shared kitchen and bathroom	Distance to recreation	Fight with shop owner	Frequency of community activities		
	Technical quality	Distance to metro stop	Store NO.	Frequency of self-organised activities		
	Property rights	Bus stop NO.	Store type	Frequency of management		
	Governmental repairing	Infrastructure type		Management type		
	Preservation rules	Green type		Disturb from neighbours		
		Walkability		Safety		

Note: NO. refers to the number of individuals or facilities.

4.3 Study area

In order to better understand residential satisfaction in renovated historical blocks, we collected data on residential satisfaction in 8 historical blocks in two cities in China. The term historical block and district refer to those areas in Chinese cities, where historical or cultural buildings gather, and characterise the architectural style of a certain historical period[1]. Most of these blocks are located in the centre of Chinese cities, and consequently tend to have very good public transportation connections. The renovation of these historical blocks started in the 1980s as the deteriorating quality of their buildings, due to a lack of proper repair, demanded substantial restoration efforts. From 2000 onwards, triggered by financial support from local governments, renovation became a popular planning strategy in China. As local governments orchestrated these renovations, residents were usually excluded from the decision-making process underlying renovation planning. Therefore, little attention was paid to residents' preferences and satisfaction.

The selected blocks were Ciqikou, Shancheng alley and Zhongshan 4th Road historical block in Chongqing and Julu Road, Shanyin Road, Laochengxiang, Yuyuan Road and Bugaoli historical block in Shanghai. All these blocks can be considered as representative of historical blocks in China. Chongqing and Shanghai were chosen as examples of "first-tier" Chinese cities that consist of the largest mega-cities, exhibiting strong political and economic influence on other Chinese cities. Both two cities have a yearly GDP of over 1000 billion, and experience strong GDP growth (> 7%). Chongqing is located in the Western part of China, while Shanghai is located in the Eastern part. Currently, eight historical areas remain in Chongqing and 14 in Shanghai.

Considering the ratio of remaining historical areas, three cases were chosen in Chongqing and five in Shanghai. The eight blocks were randomly chosen from all remaining 22 (8+14) historical areas and they are representative of all these historical blocks (Figure 4.2). Considering that these blocks have experienced different degrees of renovation, they can be grouped into three renovation stages: Shancheng alley and Laochengxiang are still at the early stage of renovation as few rounds of small renovations took place before and very few local residents moved out. Ciqikou, Julu Road, Shanyin Road and Yuyuan Road blocks are at the middle renovation stage, with at least one round of major renovation. Although they currently do not face any renewal, potentially they may have more renovations in the future. Another 2 blocks,

[1] Ministry of Construction of the People's Republic of China, May 1985

Zhongshan 4th Road and Bugaoli, are already at the late renovation stage: they went through several rounds of renovation with a large share of inhabitants replaced. New large scale renovation is not expected soon.

All selected historical blocks are located in the downtown of the cities. Consequently, they tend to have very good transportation connections. In term of size, the blocks in Shanghai are smaller than those in Chongqing, due to the different local administration divisions. In Shanghai, the blocks vary from 0.03 to 0.15 km^2, while in Chongqing they range from 0.1 to 0.5 km^2. Furthermore, the blocks differ in population size, varied between 2000 and 14000 inhabitants (Table 4.2).

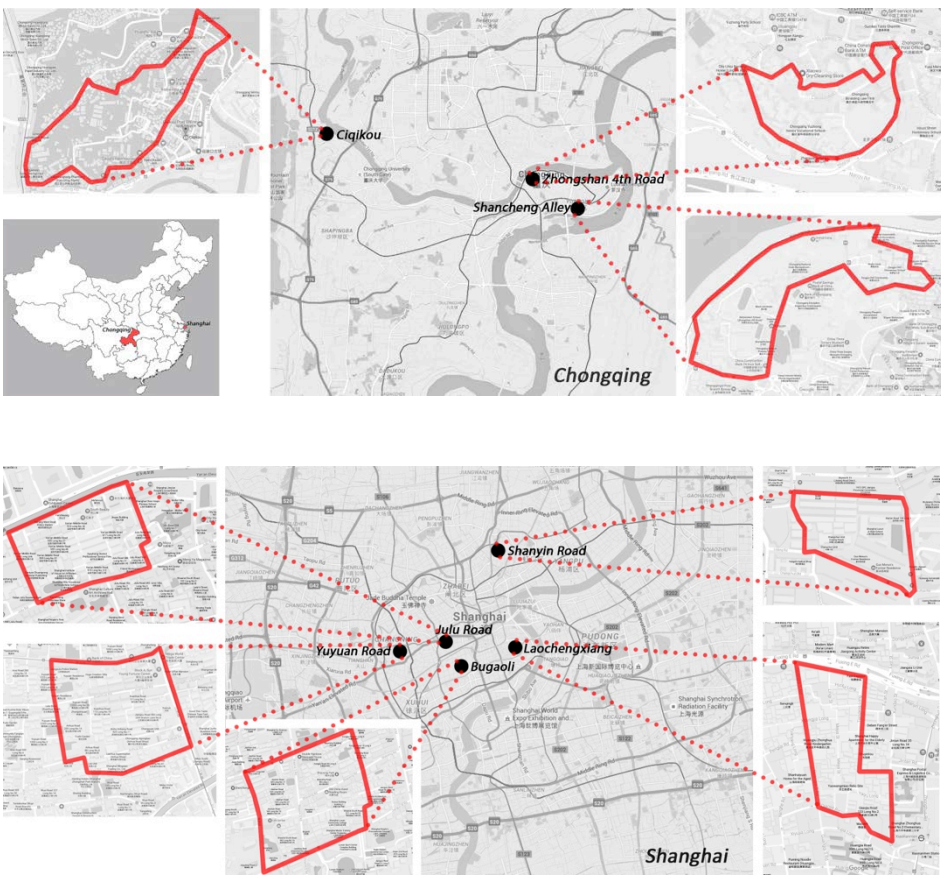


Figure 4.2 The location and scale of two cities and the eight historical blocks

Table 4.2 General situation of the eight blocks

City	Block Name	Areas	Population	Location
Chongqing	Ciqikou	0.3km^2	2710	Ciqikou historical area
	Shancheng alley	0.11 km^2	13850	Shancheng alley historical area
	Zhongshan 4th Road	0.53 km^2	Around 8000	Zhongshan 4th Road historical area
Shanghai	Julu Road	0.162 km^2	4616	Nanjing Western Road historical area
	Shanyin Road	0.027 km^2	2048	Shanyin Road historical area
	Laochengxiang	0.039km^2	4381	Laochengxiang historical area
	Yuyuan Road	0.080km^2	Around 5000	Yuyuan Road historical area
	Bugaoli	0.065 km^2	2634	Hengshan Road- Fuxing Road historical area

Note: the detailed population cannot be provided in some blocks.

4.4 Sample selection

A leading principle underlying sample selection is to create sufficient variability in housing and neighbourhood variables. Lack of variability means less opportunity to identify the functional form between residential gap and satisfaction. Because neighbourhood and accessibility are included as attributes, logically we decided to select more blocks/neighbourhoods. A second consideration was that the plan of analysis included both an analysis at the individual level and the possibility for more aggregate analyses at the level of the block. It means that we needed multiple respondents in the same block. Therefore, 50 respondents were recruited per block.

Before the formal survey, a pilot test was conducted to improve the clarity, validity and layout of the questionnaire. 20 respondents were randomly selected from renovated historical blocks in Chongqing and each of them were assigned to a trained interviewer during the survey. Interviewers were requested to explain each question to the interviewees, and record their answers and complaints. After the test, the interviewers were required to report the easily misunderstood questions, difficulties, suggestions to improve the questionnaire and the time spent. Based on these reports, the questions that were hard to understand were modified, the questions that were misunderstood were rephrased, the questions that respondents were reluctant to answer were changed or removed. These feedbacks during the pilot test not only

helped improve the questionnaire, but also provided the interviewers experience and skills to process the final survey more efficiently.

The formal data collection took place between April and June 2015. A spatially stratified random sampling method was used to select the respondents. Within the blocks, the sample was stratified with respect to age as this was the only available information. More specifically, only the proportion of people older, respectively younger than 60 was available from local government. In some blocks, the residents' home could not be entered directly. In this case, the local government was contacted to mediate the recruitment of respondents. All visits were made at randomly chosen times on randomly selected days. As indicated, 50 questionnaires were distributed in every block. With the support from local authorities, the questionnaire distribution went on quite smoothly. Ultimately, 384 valid questionnaires were completed, representing a high response rate of 96 per cent.

Considering the relatively low education level and high age of respondents in historical blocks, all questionnaires were administered on a face-to-face basis, using a trained interviewer. All questions were explained by the interviewer to ensure that the questions were correctly understood to avoid missing data as much as possible.

In general, the quality of the data seems good. However, although we tried to explain the contents of the questionnaire during the interview and create trust, some respondents were reluctant to answer some specific questions. Especially, some data were missing for questions concerning house price/rent and income, either because respondents did not know the facts or they avoided providing information about their private life. In order to respect their choice, we excluded these data and treated them as missing data in the analysis.

In addition to the questionnaires, at least 3 semi-structured interviews were held with randomly chosen respondents in every block. In total, 36 interviews were recorded. These interview data are not directly used in the present thesis, but make up relevant complementary material for the interpretation of model results.

4.5 Sample characteristics

The average age of the respondents is 55 and a relatively high percentage (43.8%) of the respondents is 60 or older (Figure 4.3), which means residents have a relative high age. Table 4.3 shows that more than half of the residents (55.7%) wish to stay in the current neighbourhood.

The table shows the descriptive information about the social demographic data. The statistical results indicate the share of female respondents (51.3%) is slightly higher than the share of males (48.7%). The descriptive statistics show that not only a relatively large share of the residents is aged, they also have slightly lower education levels (79.7% has only high school or a lower degree) compared with the average city population (75%[2]). Over half of the families does not need to support their children (56.8%) and/or parents (63.3%). Even though some people have moved between different blocks before, 89% live in the same city from their childhood holding the local Chinese ID, Hukou (Huang et al., 2014), while very few come from another city (6.3%) or village (4.7%). Furthermore, 69.8% of the respondents has lived in their current block for more than 20 years. 52.4% of the households earns a monthly family income lower than 5000 yuan (around 714 euros), while only 2.9% has a family income higher than 20000 yuan (around 2857 euros). 52.3% of respondents do not have job or are retired. 57.3% respondents rent a house either from the private, company or government, while 40.4% owned a house.

As for the stage of renovation, 25.3% of respondents are still at the early stage of renovation and only underwent a few rounds of small renovations before and might encounter larger scale renovation later; very few natives have moved out until now. 51.6% of the respondents are at the middle stage of renovation, which means they have already experienced at least one around of large-scale renovation. There are no immediate plans of further renovation; nothing will change much in the short run, but these blocks still have the potential of renewal again in the future. Another 23.2% of respondents are already at a late stage of renovation. They have experienced several rounds of renovation and will not have huge scale renovation soon. A large percentage of local residents has already been replaced.

The statistics regarding aspiration, gap and satisfaction for each variable and the dimensional satisfaction are summarised in Table 4.5, 4.6 and 4.7. The detailed categories of each categorical variable are listed in Table 4.4. As the three tables show, the data indicate that variance exists between individuals. As respondents tend to express the highest aspiration level about some mandatory residential items, such as safety and not being disturbed by neighbours, almost no variance was found in these variables and they were therefore excluded from the table.

[2] http://www.stats.gov.cn/tjsj/pcsj/rkpc/6rp/indexce.htm

Table 4.3 Description of mobility data and social-demographic data (N=384)

Variable category	Variable	Category	Frequency (%)
Mobility data	Intention to move	Move	44.3
		Stay	55.7
Social-demographic data	Gender	Male	48.7
		Female	51.3
	Family composition	live alone	12.2
		with partner	30.2
		with children/with parents/with others	24.0
		with partner+ children+ parents/with partner+ children	33.6
	Number of raising children	0	56.8
		1	37.8
		2 and over	5.5
	Supporting elderly	Yes	36.7
		No	63.3
	Education Level	Junior high school and under	45.1
		Senior high school	34.6
		Junior college and over	20.4
	Hukou	This city	89.0
		Other city	6.3
		Village	4.7
	Length of stay	20 years and under	35.4
		21-40 years	34.1
		41-60 years	20.1
		Over 60 years	10.4
	Family Income	<2000 yuan	7.6
		2000-5000 yuan	44.8
		5000-20000 yuan	44.8
		>20000 yuan	2.9
	Job	Yes	47.7
		No(including retired)	52.3
	Tenure	Rent	57.3
		Bought	40.4
		Shared rights with government	2.3
	Renovation Stage	Early stage of renovation	25.3
		Middle stage of renovation	51.6
		Late stage of renovation	23.2

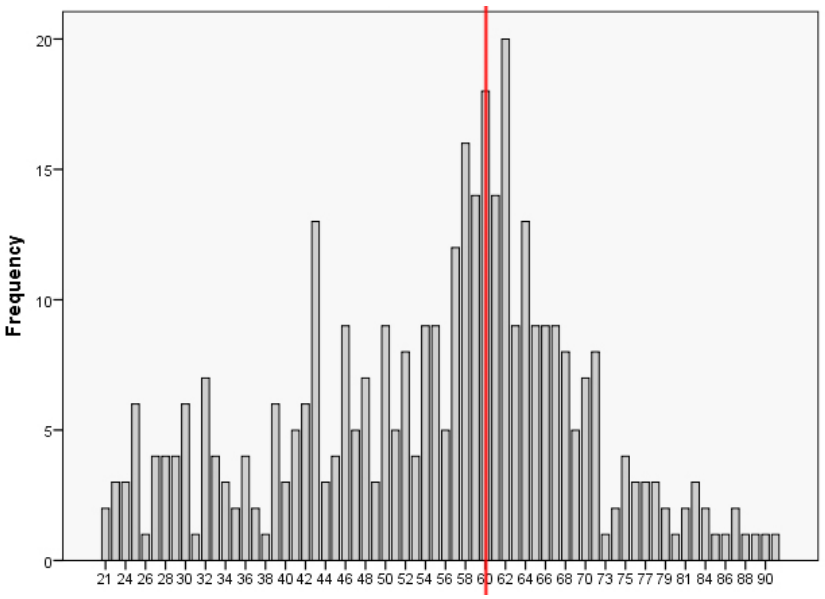


Figure 4.3 Age frequency

4.6 Conclusions

Based on our theoretical framework, the design of questionnaire discussed in this chapter captures the links between aspiration, reality, residential satisfaction and intention to move. Different from previous studies that only required the residential data of the current situation, this data collection also collected the aspiration and satisfaction for every attribute. Also, considering residents cannot get the fully information, subjective perception of every attribute was collected rather than objective measurement. Besides the core part of the questionnaire, data regarding individual and households characteristics was also gathered. Furthermore, in order to understand these key concepts, data was collected from six residential dimensions.

In order to gather the data with some variance, data were collected from eight randomly selected historical blocks in two Chinese cities from April to June 2015. A pilot test was done before the formal distribution of questionnaires to improve the design of questionnaire and sufficiency of interviewers. The final response rate was relatively high with 384 questionnaires being collected in total. The data quality was satisfactory and statistical analysis manifested a certain variance.

Table 4.4 Categories of categorical variables

Variable	Categories
Proximity to Main Road	The house is located next to the main road
	The house is located away from the main road
Non-shared Kitchen Bathroom	The house has both non-shared bathroom and kitchen
	The house has only non-shared bathroom
	The house has only non-shared kitchen
	The house has neither non-shared bathroom nor kitchen
Technical Quality	The house has good technical quality (sturdy, no cracks, good roof, good ventilation and comfortable to live in)
	The house has poor technical quality
Governmental Repairing	Government helps to repair the exterior facade of the house
	Government does not help to repair the exterior facade of the house
	Do not know
Green1	There are roadside trees within 600m distance(10mins walking distance) or not
Green2	There is big city park within 600m distance(10mins walking distance) or not
Green3	There is small community park within 600m distance(10mins walking distance) or not
Green4	There is common playground within 600m distance(10mins walking distance) or not
Green5	There is no green environment within 600m distance(10mins walking distance)
Historical building	Live in historical building or not
Historical environment	Live in historical environment or modern environment
Disturb from Tourists	Noise
	Be taken photos by the tourists
	Be watched by the tourists
	Tourists enter my house
	Other disturbs from tourists
	No disturb from tourists
Benefits from Tourists	Open shops for tourists
	Rent room to tourists
	Obtain information from tourists

	Make friends with tourists
	Other benefits
	No benefits
Fight with Owner	Had quarrels and fighting with the shop owners in community
	Had quarrels
	Had fighting
	No quarrels and fighting
Store type 1	The community has food shops (restaurant or cafe or bar) or not
Store type 2	The community has retail shops (clothes, bags, accessories, books, gifts, specials) or not
Store type 3	The community has entertainment stores or not
Store type 4	The community has supermarket or not
Management Type	Meetings
	Planning consultant
	Join social organisations
	Other neighbourhood management
	No neighbourhood management
Disturb	Noise
	Be watched by neighbours
	Neighbours occupied the open space
	Neighbours threw trashes everywhere
	Other disturbs from neighbours
	No disturbs from neighbours
Job type	State-owned companies
	Collective-owned companies
	Governmental organisation
	Educational, medical or scientific research organisation
	Foreign company or joint companies
	Local private companies
	Self-employed
	Retired
	No job

Table 4.5 Descriptive statistics of aspiration

Housing dimension		Environment dimension		Historical atmosphere and tourism dimension		Neighbourhood relationship dimension		Work dimension		Economic dimension	
Floor	3.30 (3.064)	Distance of Primary School	456.66 (341.952)	Historical Building	1.760 (.427)	Frequency of Meeting Neighbour (weekly)	36.590 (44.939)	Commuting Time(min)	18.211 (19.652)	Rent Increase(yuan)	3.629 (13.927)
Size(m^2)	66.08 (29.110)	Distance of Retail Shop (m)	350.39 (315.21)	Historical Environment	1.670 (.472)	Known Neighbour NO.	48.31 (63.345)	Job Type	6.090 (2.460)	Family Income (yuan)	6.250 (1.376)
Proximity to Main Road	1.62 (.485)	Distance of Mall(m)	1052.14 (651.61)	Benefits from Tourists 2	.050 (.217)	Familiar neighbour NO.	9.22 (13.274)			Opening Family business	1.78 (.417)
Bedroom NO.	2.21 (.636)	Distance of Health Centre	709.04 (557.316)	Benefits from Tourists 3	.040 (.206)	Familiar New Neighbours NO.	1.640 (4.009)				
Non-shared Kitchen Bathroom	1.05 (.358)	Distance of Recreation	721.48 (1790.82)	Benefits from Tourists 4	.050 (.222)	Frequency of Community Activities	30.08 (56.135)				
Governmental Repairing	1.32 (.687)	Distance of Metro Stop	876.38 (560.393)	Benefits from Tourists 6	.800 (.401)	Frequency of Self-organised Activities	32.05 (72.965)				
		Number of Bus Stop	1.85 (.375)	Store NO.	1.880 (.889)	Frequency of Management (yearly)	15.050 (23.665)				
		Green2	.630 (.485)	Store Types 1	.760 (.426)	Management Type5	.370 (.484)				
		Green3	.770 (.424)	Store Types 3	.570 (.496)						
				Store Types 4	.710 (.456)						

Note: The numbers outside the parentheses are mean, while numbers in the parentheses are standard deviation.

Table 4.6 Descriptive statistics of residential satisfaction

Housing dimension		Environment dimension		Historical atmosphere and tourism dimension		Neighbourhood relationship dimension		Work dimension		Economic dimension	
Floor	4.39 (1.380)	Distance of Primary School	5.04 (.975)	Historical Building	3.99 (1.216)	Frequency of Meeting Neighbour	4.96 (.837)	Commuting Time	4.91 (1.155)	Rent Increase	4.97 (1.200)
Size	3.58 (1.456)	Distance of Retail Shop	4.94 (1.176)	Historical Environment	4.09 (1.414)	Known Neighbour NO.	4.92 (.909)	Job Type	4.79 (.908)	Family Income	4.03 (1.087)
Proximity to Main Road	4.56 (1.218)	Distance of Mall	4.13 (1.312)	Disturb from Tourists	4.49 (1.012)	Familiar neighbour NO.	4.96 (.915)			Opening Family business	4.40 (.906)
Bedroom NO.	3.77 (1.422)	Distance of Health Centre	4.83 (1.217)	Benefits from Tourists	4.43 (.863)	Familiar New Neighbours NO.	4.43 (.903)				
Non-shared Kitchen Bathroom	3.96 (1.598)	Distance of Recreation	4.57 (1.057)	Fight with Owner	4.73 (.945)	Frequency of Community Activities	4.40 (1.042)				
Technical Quality	3.56 (1.483)	Distance of Metro Stop	5.17 (1.099)	Store NO.	4.42 (1.089)	Frequency of Self-organised Activities	4.49 (.999)				
Governmental Repairing	4.23 (1.258)	Number of Bus Stop	5.18 (1.119)	Number of Stores	4.42 (1.089)	Frequency of Management	4.29 (1.048)				
		Infrastructure1	4.48 (1.657)	Store Types	4.19 (1.073)	Management Type	4.26 (1.065)				
		Infrastructure2	4.80 (1.269)			Disturb	4.22 (1.355)				

Infrastructure3	2.87 (2.220)	Safety	4.70 (1.218)
Infrastructure5	4.45 (1.417)		
Infrastructure7	4.35 (2.010)		
Green	(4.09 (1.244)		
Walkability	4.45 (1.044)		

Note: The numbers outside the parentheses are mean, while numbers in the parentheses are standard deviation.

Table 4.7 Descriptive statistics of residential gap and related total satisfaction for this dimension

Housing dimension		Environment dimension		Historical atmosphere and tourism dimension		Neighbourhood relationship dimension		Work dimension		Economic dimension	
Satisfaction	3.91 (1.238)	Satisfaction	4.380 (1.087)	Satisfaction	4.076	Satisfaction	4.906 (0.769)	Satisfaction	4.640 (.840)	Satisfaction	4.090 (.928)
City	-.26 (.967)	Distance of Primary School	.892 (.293)	Historical Building	-.080 (.998)	Frequency of Meeting Neighbour	.925 (.191)	Commuting Time	.801 (.382)	Rent Increase	.780 (.625)
Floor	.77 (.638)	Distance of Retail Shop	.806 (.382)	Historical Environment	-.330 (.944)	Known Neighbour NO.	.911 (.207)	Job Type	.770 (.644)	Family Income	.665 (.283)
Size	.607 (.286)	Distance of Mall	.559 (.459)	Disturb from Tourists 1	.650 (.760)	Familiar neighbour NO.	.912 (.226)			Opening Family business	.72 (.696)

Proximity to Main Road	.040 (.917)	Distance of Health Centre	.794 (.384)	Disturb from Tourists 4	.910 (.423)	Familiar New Neighbours NO.	.862 (.326)
Bedroom NO.	.696 (.254)	Distance of Recreation	.751 (.412)	Disturb from Tourists 5	.910 (.423)	Frequency of Community Activities	.768 (.390)
Non-shared Kitchen Bathroom	.060 (1.000)	Distance of Metro Stop	.888 (.298)	Benefits from Tourists 2	.920 (.388)	Frequency of Self-organised Activities	.802 (.378)
Technical Quality	-.050 (1.000)	Number of Bus Stop	.934 (.191)	Benefits from Tourists 3	.950 (.303)	Frequency of Management	.714 (.436)
Governmental Repairing	.310 (.953)	Infrastructure1	.600 (.802)	Benefits from Tourists 4	.940 (.348)	Management Type5	.540 (.842)
		Infrastructure2	.920 (.388)	Benefits from Tourists 6	.730 (.680)	Disturb1	.330 (.944)
		Infrastructure3	-.340 (.942)	Fight with Owner	.940 (.334)	Disturb2	.970 (.227)
		Infrastructure5	.840 (.546)	Store NO.	.797 (.348)	Disturb3	.590 (.810)
		Infrastructure7	.570 (.821)	Store Types 1	.560 (.831)	Disturb4	.340 (.940)
		Green2	.340 (.940)	Store Types 3	.340 (.940)	Disturb5	.910 (.423)
		Green3	.000 (1.001)			Safety	.380 (.926)
		Walkability	.270 (.964)	Store Types 4	-.180 (.985)		

Note: The numbers outside the parentheses are mean, while numbers in the parentheses are standard deviation.

5

Residential Gap and Satisfaction

5.1 Introduction

The study of residential satisfaction in renovated historical blocks in Chinese cities has largely been neglected in the urban planning and housing literature, despite the relevance of the topic. Since the emergence of behavioural geography, a consistently increasing number of studies have analysed residential preferences and satisfaction. The relevance of these studies is two-fold. First, these studies have significantly contributed to the development of behavioural geography, introducing concepts about human choice and decision making and advancing various models of satisfaction, preference formation and discrete choice behaviour. Second, results of these studies have a tremendous applied significance as they provide insights into the relative importance of the various housing and neighbourhood attributes on residential satisfaction and mobility. Although residential satisfaction is often analysed in developed countries where housing development plans tended to rely on such analyses and models, in developing countries where traditionally urban planning authorities play a key role in guiding and controlling housing markets, residential satisfaction has been largely neglected. More recently, the role of public participation has somewhat increased and consequently insight into residential satisfaction is increasing. In turn, this has triggered academic attention.

This chapter intends to fill this gap in the urban planning and housing literature by analysing the relationship between residents' aspirations and residential satisfaction in historical blocks in selected Chinese cities. Following our framework, we assume that residential satisfaction is a function of the gap between aspiration and experienced reality (i.e. the aspired, ideal attribute level and the actual experienced attribute level).

The aim of this chapter is to identify the relative contribution of various attributes from above-identified six dimensions on residential satisfaction in selected historical blocks in China. Best subset regression analysis (Hofmann, Gatu, & Kontoghiorghes, 2007) is used to analyse the data. The current perceived situation (perceived reality) is compared to the desired situation (aspiration) and expressed as an index. The resulting variables are then regressed against satisfaction to identify the relative contribution of each discrepancy between aspiration and reality to satisfaction with respect to a particular dimension. The performance of this gap-satisfaction model is compared with traditional residential satisfaction assessments directly using residential attributes as independent variables. Finally, the influence of the degree of satisfaction with different dimensions of the residents' living environment on overall residential satisfaction is analysed.

Thus, this chapter makes two contributions to the international literature. First, it adds evidence on residential satisfaction in historical blocks in Chinese studies. Second, due to its specific operationalization of theoretical concepts and choice of analysis, it contributes to the existing literature on gap-theoretical approaches in housing satisfaction research.

The remainder of this chapter is structured as follows: the next section will describe the formulation of gap model and the method that will be used. Then, the followed section will present the results of model estimation. Finally, the last section will draw conclusions based on the analysis, provide policy implications and discuss the limitations.

5.2 Formulation of gap model

As indicated, satisfaction is assumed a function of the discrepancy between aspiration and reality. Different from prior work defining the gap as a difference function, we define the gap as the ratio of aspiration and reality. Using the ratio as opposed to the difference has the appealing property that the influence of the same absolute difference becomes smaller as aspiration becomes higher to reflect the notion that the gap is less important under those conditions. Any deviation from the stated aspiration level or value is supposed to lead to a lower satisfaction. In case of continuous attributes, gap is not necessarily monotonically increasing or decreasing with increasing ratio between reality and aspiration, because respondents may have some optimal point in mind. For instance, less or more than the ideal/aspired number of bedrooms may both create burden for residents and thus lead to a lower than

maximum satisfaction. Let *i* be an index for individuals and *k*=1,2,...,*K* be an index for an attribute. We then defined the gap related to continuous attribute *k* for individual *i* as:

$$g_{ik} = \max(0, 1 - |R_{ik} - A_{ik}|/A_{ik})$$

where g_{ik} represents the gap index of individual *i* for attribute *k*. R_{ik} indicates reality (the actual value of attribute *k* that individual *i* experiences), while A_{ik} is the aspired value of attribute *k* for individual *i*. Note that as the gap between aspiration and reality becomes smaller, proportional to aspiration level, $|R_{ik} - A_{ik}|/A_{ik}$ is approaching 0 and therefore the gap index approaches 1. Thus, as the mismatch decreases, the gap index increases. In contrast, as the discrepancy between aspired and real situation grows, the gap index decreases. At first glance, this may seem counterintuitive. The reason for this transformation is that we intend to keep the direction of the gap index of continuous variable consistent with the categorical variables. For categorical variables, the match between aspiration and reality is measured. A value of 1 for the gap index indicates that reality matches aspiration and hence there is no gap between them. Thus, by applying this transformation, all indices will go in the same direction: a larger gap index refers to a smaller gap, leading to higher satisfaction as the conceptual framework assumes.

When aspiration is much higher than reality, the gap index approaches zero and the gap reaches its maximum. There are few situations that reality exceeds two times the aspiration, for instance, few residents intend to have a much smaller house after divorce. In that case, the gap index was truncated at zero, as indicated by the equation. Alternatively, we could have used a non-linear expression, but because this may cause potential technical problems in later analysis, this alternative was not adopted.

Using the ratio, as opposed to the difference, means that we assume people are more sensitive to the absolute differences between reality and aspirations when their aspirations are relatively low, and less sensitive when aspirations are high.

As discussed, the aim of the analysis is to identify the contribution of the gap for the residential attributes to residential satisfaction. As a basic model, we assumed a linear additive model. That is, satisfaction ratings are assumed to increase linearly with increasing values of the gap index. In addition, we assume that residential satisfaction is the result of trade-offs between the gaps of the various attributes. A smaller gap index for a particular attribute may be (partly) compensated by higher indices for one or more other attributes. More complicated specifications can be

chosen, but we leave this for future research. Note that the linear additive satisfaction function has been used in the literature in the vast majority of studies.

As evidenced by the literature review, most prior studies have used ordinary or step-wise regression analysis to estimate the (significant) effects of the selected explanatory variable on satisfaction (e.g., Mohit & Azim, 2012; Ibem & Aduwo, 2013; Li & Wu, 2013; Mohit & Adel Mahfoud, 2015; Ghasrodashti et al., 2017). Stepwise regression analysis adds or deletes a variable in each step based on t-statistics. This procedure may end in local optima and hence may be sub-optimal in some cases. For that reason, we used best subset regression analysis instead to estimate the assumed linear relationship between satisfaction and the defined gaps between aspiration and perceived reality. Best subset regression is a particular form of regression analysis, which explores different subsets of explanatory variables in terms of model fit, and provides the possibility to select the best subset of explanatory variables that generates the highest R squared to find the best model. The best fit of the model can be chosen based on the biggest adjusted R squared and the smallest square root of the mean squared error. Compared to the complete model with all variables, using a subset of variables instead of a complete set has the advantage of estimating the regression coefficients and predicting future responses with smaller variance.

To assess whether socio-demographics influence residential satisfaction and whether interactions of residential attributes and socio-demographics significantly influence residential satisfaction, these variables were added to the regression analysis. The model results indicate that most social-demographic variables as well as the interactions are insignificant. As the tables including interactions are too long to list, they are not included in the thesis. Table 5.1 shows the regression results with the influence of social-demographics. The results indicate that gender and renting house significantly influence some domain satisfactions. In the parsimonious model, only gender is found to be influential for living environmental satisfaction. Thus, in the next section, we will mainly focus on the interpretation of the significant interaction effects and influence of gap index on dimensional satisfaction.

We assume that the satisfactions pertaining to particular dimensions are integrated to arrive at overall residential satisfaction. Hence, the best subset regression analysis focusing on the various dimensions are followed by an analysis of how overall residential satisfaction is influenced by satisfaction related to various dimensions. Different dimensional satisfactions are regressed against overall residential satisfaction to identify their contribution. The multicollinearity of variables

in every dimension was tested by the variance inflation factor (VIF). Results of all VIF test are smaller than 1.88 and most are smaller than 1.5, which means that no serious multicollinearity exists between those variables.

5.3 Results

In order to compare the performance of this gap model with the traditional direct assessment of residential satisfaction, best-subset regressions were conducted respectively by using gap and residential attributes as independent variables for each of the above-mentioned six dimensions underlying residential satisfaction in renovated historical blocks. As the comparison results about R-squared and adjusted R-squared shown in Table 5.2, the gap-satisfaction models outperform the classic regression model in which satisfaction is a function of objective attribute levels and values of the respondents. F-statistics showed that the differences in explained variance between the models were statistically significant at conventional levels.

The estimated parameters of the gap-satisfaction model are shown in Table 5.2. In all six regression models, residential satisfaction for a particular dimension is the dependent variable, while the independent variables are the residential gap indices for different constituent attributes. Every column in Table 5.3 shows the coefficients of one dimension. Besides the gap index, city was added as an independent variable, allowing to check city differences. For most dimensions, this variable was not significant.

As expected, the estimation results for housing satisfaction show that the estimated coefficients are positive and therefore in anticipated direction. The lower the gap, proportional to the aspiration, the higher the value for the gap index and the higher the satisfaction, which is consistent with our framework. Except the gap index for the number of bedrooms, the estimated coefficients of all other explanatory variables are statistically significant at conventional levels. Results indicate that the gap indices for technical quality (0.344) and size of the house (0.269) are the most important variables influencing housing satisfaction. It is reasonable that compared with other urban areas, the quality of most housing in historical blocks is lower and the house size is smaller, which is indicated by the results of the survey and the interviews. For instance, many respondents mentioned that increasing housing quality and size are most important for them. “I am unsatisfied with my house…I have lived in this shanty for several decades, of course I want to live in a better house, everyone wants to live in a house of good quality. ” “My house is too small…

Table 5.1 Regression results of six dimensions considering the influence of social-demographics

Housing dimension		Environment dimension		Historical atmosphere and tourism dimension		Neighbourhood relationship dimension		Work dimension		Economic dimension	
Constant	3.184***	Constant	3.591***	Constant	4.076***	Constant	4.127***	Constant	4.083***	Constant	2.869***
Gender	.036		.117**		.010		.021		-.133*		.012
Age	-.043		.012		.008		-.031		-.022		.116
Rent house	-.114		-.174*		.108		.037		-.098		.025
Own house	.059		.075		-.072		-.034		.058		.038
Elderly or not	.016		-.051		-.054		.021		-.021		.053
Education less than junior high school	.032		-.004		.008		-.009		-.040		-.101
Education of senior high school	-.055		-.055		-.032		.011		-.040		-.086
Hukou of this city	-.040		-.069		-.024		-.064		-.027		-.045
Hukou of another city	-.031		-.054		-.035		.058		.092		.154**
Length of stay	.035		.073		.002		.091		.138		.002
City	.068		-.085		-.018		.082		.054		-.039
Size	.270***	Distance to Retail Shop	.073	Historical Building	.118**	Frequency of Meeting Neighbour	.037	Commuting Time	.207***	Rent Increase	.162***

Proximity to Main Road	.116***	Distance to Mall	.098**	Historical Environment	.133***	Familiar New Neighbours NO.	.015	Job Type	.311***	Family Income	.334***
Bedroom NO.	.065	Infrastructure1	.121**	Disturb from Tourists 1	.128**	Frequency of joining Management	.109*				
Non-shared Kitchen Bathroom	.150***	Infrastructure2	.097**	Disturb from Tourists 4	-.052	Management Type5	-.047				
Technical Quality	.330***	Infrastructure3	.084	Disturb from Tourists 5	.045	Disturb1	.075				
Governmental Repairing	.149***	Infrastructure5	.050	Benefits from Tourists 2	-.066	Disturb2	.070				
		Infrastructure7	.203***	Benefits from Tourists 3	-.055	Disturb3	.060				
		Green2	.037	Benefits from Tourists 4	-.116**	Disturb4	.105*				
		Green3	.083*	Benefits from Tourists 6	.112**	Disturb5	.103**				
		Walkability	.307***	Fight with Owner	.094*	Safety	.229***				
				Store NO.	.197***						
				Store Types 1	.090*						
				Store Types 3	.066						
				Store Types 4	.082*						

R^2=0.481, N=384 Calculated missing value=0	R^2=0.404, N=384, Calculated missing value=23	R^2=0.200, N=384 Calculated missing value=0	R^2=0.159, N=384 Calculated missing value=0	R^2=0.184, N=384, Calculated missing value=0	R^2=0.212, N=384, Calculated missing value=0

Note: 1. The numbers in the parentheses are standard errors. 2. ***P<0.01 **P<0.05 *P<0.1

Table 5.2 Comparison of R-squared between two regressions

	Housing dimension	Environmental dimension	Historical atmosphere and tourism dimension	Neighbourhood relationship dimension	Work dimension	Economic dimension
Gap influences satisfaction(without the influence of social-demographics	0.461(0.453)	0.373(0.355)	0.200(0.170)	0.157(0.134)	0.148(0.139)	0.161(0.153)
Residential attributes influence satisfaction	0.417(0.403)	0.358(0.338)	0.136(0.106)	0.154(0.131)	0.080(0.034)	0.033(0.024)

Note: The numbers outside the parentheses are R-squared, while numbers in the parentheses are adjusted R-squared.

Table 5.3 Regression results of six dimensions

Housing dimension		Environment dimension		Historical atmosphere and tourism dimension		Neighbourhood relationship dimension		Work dimension		Economic dimension	
Constant	2.919***	Constant	3.344***	Constant	4.076***	Constant	4.199***	Constant	4.132***	Constant	3.237***
City	.095 (.052)**	Gender	.003 (.073)	Historical Building	.118 (.041)**	Frequency of Meeting Neighbour	.056 (.197)	Commuting Time	.181 (.167)**	Rent Increase	.182 (.088)***
Size	.269 (.223)***	Gender× Distance to Mall	.136 (.100)**	Historical Environment	.132 (.045)***	Familiar New Neighbours NO.	-.091 (.116)*	Job Type	.289 (.083)***	Family Income	.342 (.190)***
Proximity to Main Road	.117 (.052)***	Distance to Retail Shop	.071 (.127)	Disturb from Tourists 1	.122 (.057)**	Frequency of joining Management	.121 (.101)**				
Bedroom NO.	.061 (.232)	Distance to Mall	.107 (.104)**	Disturb from Tourists 4	-.060 (.102)	Management Type5	-.062 (.052)				
Non-shared Kitchen Bathroom	.158 (.055)***	Infrastructure1	.105 (.062)**	Disturb from Tourists 5	.052 (.096)	Disturb1	.073 (.045)				
Technical Quality	.344 (.051)***	Infrastructure2	.113 (.119)***	Benefits from Tourists 2	-.056 (.112)	Disturb2	.069 (.162)				
Government	.128		.065	Benefits	-.067	Disturb3	.065				

al Repairing	(.051)***	Infrastructure3	(.052)	from Tourists 3	(.137)		(.053)				
		Infrastructure5	.067 (.086)	Benefits from Tourists 4	-.112 (.127)**	Disturb4	.129 (.046)**				
		Infrastructure7	.220 (.060)***	Benefits from Tourists 6	.123 (.068)**	Disturb5	.105 (.088)**				
		Green2	.037 (.051)	Fight with Owner	.096 (.125)*	Safety	.220 (.041)***				
		Green3	.080 (.049)*	Store NO.	.210 (.121)***						
		Walkability	.317 (.052)***	Store Types 1	.098 (.049)**						
				Store Types 3	.067 (.044)						
				Store Types 4	.081 (.041)*						
R^2=0.469, N=384 Calculated missing value=0		R^2=0.391, N=384, Calculated missing value=23		R^2=0.200, N=384 Calculated missing value=0		R^2=0.157, N=384 Calculated missing value=0		R^2=0.148, N=384, Calculated missing value=0		R^2=0.161, N=384, Calculated missing value=0	

Note: 1. The numbers in the parentheses are standard errors. 2. ***P<0.01 **P<0.05 *P<0.1

you can already see all of it from the entrance. My son grows up; it is very inconvenient for us to live in one room. He is such a big boy... Now I have to give my bed to my son and sleep on the floor".

The gap indices of bathroom and kitchen (0.158) and repair help from government (0.128) also significantly impact housing satisfaction. Different from previous studies about non-historical urban areas (Lu, 2002; Diaz-Serrano, 2009), the gap index for property rights was found to be insignificant in historical blocks. Inhabitants in these blocks are not interested in lowering the gap regarding tenure status and this variable is therefore excluded from the best subset regression model.

The city variable is found significant only for the housing dimension. Its positive sign indicates that, on average, residents from historical blocks in Chongqing report a higher housing satisfaction than those from Shanghai, but there is not much difference between those two cities on other dimensions. The overall model fit regarding housing satisfaction is good as indicated, by an R squared value of 0.469.

Regarding the environmental dimension, the model fit is lower than that for housing (0.391). Although gender is found statistically insignificant, the interaction between gender and distance to shopping mall significantly influences environmental satisfaction. Its positive sign indicates that for residents who have same gap index for distance to shopping mall, males tend to have higher satisfaction about the living environment than females. The positive signs of all gap index coefficients indicate that the smaller the gap between aspiration and reality, proportional to the aspiration level, the higher residential satisfaction. The estimated parameters for variables, including distance to retail shops, infrastructure 3 (road benches), infrastructure 5 (sewer pipes) and green 2 (big city park) are insignificant. The gap index for walkability is the most influential for environmental satisfaction in historical blocks as the attribute has the highest beta (0.317). It may be indicative of limited action spaces and mobility convenience for people living in the selected historical blocks, emphasizing the importance of a friendly walking environment. As expected, the gap index for the infrastructure system is also found significant for environmental satisfaction. The availability of gas pipes (infrastructure 7) is more important (0.220) for increasing environmental satisfaction than other infrastructure. However, none of the gap indices for distances to public facilities have significantly influence on the environmental satisfaction.

In case of the dimension of historical atmosphere and tourism, over half of the estimated parameters is statistically significant. Although 4 out of 14 parameters

display a negative sign, most of these are insignificant. Only the beta of index for becoming friends with tourists (Benefits from tourists 4) contributes significantly and negatively. However, when we conduct a separate linear regression between this variable and its own satisfaction rather than total satisfaction of this group of variables, the direction of the sign turned out to be positive. It means that this variable might be influenced by other variables in the regression with historical satisfaction. Thus, as current conditions describing this dimension approximates residents' aspirations, inhabitants are more satisfied, which is still consistent with our framework. The gap index for the number of stores (0.210) influences residential satisfaction more than that for the other variables, but the differences between different variables are small. The best subset regression predicting the satisfaction with historical atmosphere and tourism has a relatively low goodness of model fit (R^2=0.20).

The next dimension is neighbourhood relationship. The explanatory power of the regression analysis is lower than that for the other dimension as indicated by an R-squared of 0.157. The estimated coefficients of the gap indices for number of familiar new neighbours, frequency of joining management, throwing trash everywhere (disturb 4), other disturbs (disturb 5) and safety are statistically significant. Higher satisfaction is caused by a higher gap index (smaller gap) for most variables, except for the number of familiar new neighbours and for joining community management (management type 5). However, we found that the parameter of the gap index for management type 5 is statistically insignificant and the beta for number of familiar new neighbours illustrates a positive sign for a regression with its own satisfaction separately. Therefore, these findings support our theoretical framework. Consistent with the results of the interviews, a bigger gap index for safety is most influential for higher neighbourhood satisfaction (0.220). Other attributes are relatively less important.

Finally, all coefficients have the anticipated sign in the regression analysis of work (R^2=0.148) and economic factors (R^2=0.161). It suggests that the more reality reaches the aspiration level, proportional to aspiration, the higher the satisfaction. All estimated parameters are significant. Furthermore, results illustrate that the gap index for job type (0.289) has a bigger impact on the satisfaction level of inhabitants than the index for commuting time (0.181). For the economic variables, the gap index for family income influences the economic satisfaction more than the gap index for rent. Even though many respondents showed great interest in setting up family business in the blocks with the help of unique historical features, they also admit this

is not a priority. “After I have a better house, I will consider opening a small shop.” This variable therefore was excluded in the model.

As for the contribution of satisfaction for the different dimensions to overall residential satisfaction, the model fit is very good, R^2=0.659 (Table 5.4). Results show that satisfaction for housing, environment, neighbourhood and the economic dimension are statistically significant and contribute most to the variability in overall residential satisfaction. The signs of all coefficients are positive, indicating as expected that an increasing satisfaction with the various dimensions will lead to a higher overall residential satisfaction. The physical condition of housing is the most important dimension influencing overall residential satisfaction (0.521), followed by satisfaction with the environment (0.229). The economic dimension also contributes significantly (0.146) while the neighbourhood dimension is much less influential (0.136). Work satisfaction is the least influential predictor for the overall residential satisfaction (0.010).

5.4 Conclusions and discussion

The aim of this chapter was to examine the determinants of residential satisfaction in renovated historical blocks in selected Chinese cities from the perspective of residents. Whereas plenty of previous residential research has typically analysed the direct relationship between attributes and satisfaction, following the classical gap

Table 5.4 Regression results for overall residential satisfaction

Model	Standardised Coefficients	Std. Error	t-value	Sig.
Constant	-.680**	.309	-2.201	.028
Satisfaction of Housing	.521***	.038	12.439	.000
Satisfaction of Environment	.229***	.043	5.284	.000
Satisfaction of Historical atmosphere and tourism	.033	.052	.837	.403
Satisfaction of Neighbourhood	.136***	.055	3.577	.001
Satisfaction of work	.010	.051	.267	.790
Satisfaction of Economy	.146***	.043	3.921	.000

Note: 1. R^2= 0.659, N=384, Missing values=23

2. ***P<0.01 **P<0.05 *P<0.1

concept, our conceptual framework assumes that satisfaction is a function of the ratio of the difference between aspiration and reality, proportional to aspiration level. The use of this ratio indicates that a higher gap index means that experienced reality differs less from the aspiration level. The results of best subset regression analysis provide support for this contention. Virtually all estimated coefficients are in anticipated direction and the strength of the relationships are moderately strong, which is expected for this kind of analysis, considering the substantial heterogeneity in satisfaction and underlying aspirations. Unexpected signs are either not significant or caused by strong correlations between attributes. The results confirm that residential satisfaction is not just a direct function of attributes of the residential situation, but also a function of the gap between aspiration and reality. The smaller the gap, proportional to aspiration level, the higher the gap index and the higher the level of satisfaction. Note that this conceptualization may solve the puzzle raised by previous scholars about why residents living in public housing are more likely to feel satisfied than those having better housing (Lu, 1999). Based on previous literature directly assessing the influence of residential attributes on satisfaction, a worse housing condition will lead to lower residential satisfaction. However, residents experiencing poor housing conditions may also have lower aspirations about their house, which means they may have a smaller gap between aspiration and reality compared with residents who live in better houses. As our findings indicate, a smaller gap between aspiration and reality will lead to higher satisfaction, hence it is possible that inhabitants living in public housing are more satisfied than those living in better houses.

The results of best subset regression indicate that the housing dimension has the best fitting model while the work dimension shows the lowest fit. For attributes related to dwelling, a higher gap index in technical quality and house size are of key concern for inhabitants, which is consistent with the previous direct assessment of residential satisfaction where quality and size are regarded as the most important (Howley, 2010). In contrast, a higher index of the number of bedrooms is of least interest to inhabitants. Satisfaction rating differs only significantly between the two cities for the housing dimension. It means that residential satisfaction in historical blocks does not differ much between the selected cities, which is different from average urban areas according to Li and Wu (2013). Regarding environmental attributes, a higher gap index for walking convenience is considered needed most while the index for proximity to big city park is least significant to increase the satisfaction, which might be because, compared with other urban areas, those blocks

are located in the centre of the city and already possess good accessibility to city parks. Males are found to have higher environmental satisfaction compared to females when they have similar gap index for distance to shopping mall. As for the tourism dimension, a higher gap index of the number of stores is of concern to most residents, while the index for disturbance from tourists is least important to them.

Regarding the neighbourhood dimension, the index for safety is considered the most important issue for the inhabitants, which is inconsistent with previous studies (Cutter, 1982; Buys & Miller, 2012). This might be because compared to other urban areas, historical blocks are open communities that everyone can enter and theft is a common problem. For the work attributes, both a higher gap index of profession and reducing commuting time are essential for higher satisfaction. The gap index of rent and family income are also influential for economic satisfaction of residents.

Overall residential satisfaction is found to be significantly influenced by satisfaction for the housing, environmental, neighbourhood and economic dimensions. The housing attributes are found most influential, which is consistent with some previous studies in China which are not confined to historical blocks (Ren & Folmer, 2017). It means that the primary residential requirements of inhabitants living in historical blocks may be similar to those living in other urban areas. Environmental satisfaction also contributes substantially to overall residential satisfaction while job satisfaction contributes the least. Neighbourhood satisfaction is found to be much less influential than other physical dimensions, which is different from findings of other urban areas. It might be because good neighbourhood bonding already exists in these historical blocks.

Due to special Chinese context, the model results also found that government policy influences residential satisfaction in renovated historical blocks to some extent. Even though the residents do not care about the preservation regulations, they do want more repair support from government. Many residents mentioned in the interview that governmental repair really improved the condition of the historical block although not sufficient. Smaller gaps (bigger gap index) in infrastructures are found more important than the distance to facilities and city parks, which indicates that for those blocks, more governmental funding is expected to improve infrastructures compared with the accessibility of facilities and parks. For the management of the community, residents do not favour more types of community management, regardless of aspiration level. Even some respondents mentioned that

it is of no use to join any management, which is different from many scholars' claim that residents are enthusiastic about attending community management meetings (Wang, 2006; Xiang & Wang, 2012; Huang & Du, 2015). The reason might be lack of trust between local government and residents (Ye & Peng, 2010; Ma, 2011; He, 2014). Therefore, besides improving infrastructures and walkability, local authorities can also involve more residents into the renovation, which could increase the communication and cooperation between government and residents, and further build more trust for further collaboration to improve the living conditions together.

Even though the relationship between aspiration and residential satisfaction has been analysed in this chapter, there is still some room for future improvement. For instance, some scholars may argue that the relationship between residential satisfaction and gap between aspiration and reality might be nonlinear without truncation. We will explore a nonlinear non-truncated satisfaction model in a later chapter.

6

Residential Satisfaction and Intention to Move

6.1 Introduction

The intention to move is found influenced by a plethora of variables. This chapter will answer the second research question by analysing how social-demographic variables and residential satisfaction jointly influence residential mobility intentions, which is consistent with the mainstream residential mobility studies that concentrate on the propensity to move (Kestens, 2004). All six dimensions of residential satisfaction are considered in this analysis. The social-demographics include both individual and household characteristics. The social-demographic variables found previously to influence residential mobility are included in this model, namely: gender, age, family composition, number of raising children, supporting elderly or not, education level, hukou status, the length of stay (how long residents have lived in this house), family income and job. Considering that the renovation stage may also impact moving intention, this attribute is also included. To explore the heterogeneity of moving intention between residents, a multinomial logit model and a mixed logit model are compared. A set of social-demographic attributes is selected as the random parameters. The interactions between residential satisfaction and social-demographic information are also examined.

The remainder of this chapter is structured as follows: the introduction section is followed by a description of the method. Then, the results of analysis will be presented and results will be discussed. Based on the results, some conclusions will be drawn in the last section.

6.2 Method and results

A mixed logit model was used to estimate the influence of residential satisfaction and social-demographic characteristics on residential mobility. By specifying the random parameters in the mixed logit model, unobserved heterogeneity between individuals can be captured. As different renovation stages changed the living environment for residents, they are assumed to affect residents' thoughts about housing individually and used as random parameters to estimate taste variation between residents in renovated historical blocks. Also, in order to check the influence of renovation stages on satisfaction, interactions between those two groups of variables were estimated. All categorical attributes were effect coded.

To explore the existence of taste variation, the mixed logit model was compared with the multinomial logit model. Results of two models are listed in Table 6.1. Compared with the multinomial logit model (Rho squared= 0.221), the mixed logit model resulted in a slightly better fit (Rho squared= 0.228). It suggests that the sample of respondents is rather homogeneous and that much of the taste variation is already captured by the observed socio-demographics, although as we will see soon, even most of the socio-demographic variables are not significant. Because by and large, the estimates of the models are consistent, mainly the results of mixed logit model are interpreted in detail.

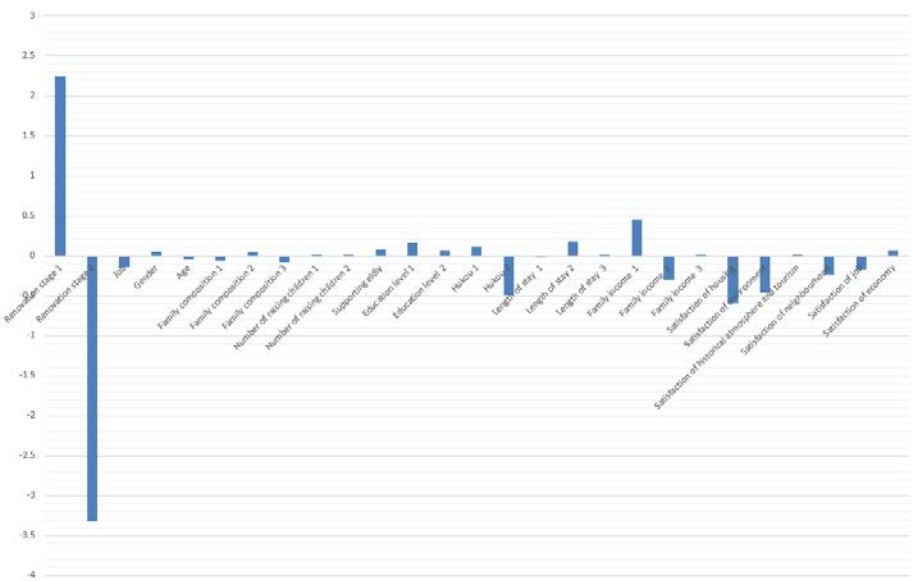


Figure 6.1 Utilities of main effect variables

Table 6.1 Results of multinomial logit model and mixed logit model

Variables	Coefficient for ML	Coefficient for MNL
Constant	7.720***	7.713***
Early Renovation stage	2.241	2.245
Middle Renovation stage	-3.319**	-3.318**
Job or Not	-0.145	-0.145
Gender	0.051	0.051
Age	-.035**	-.035**
Family composition 1 (live alone)	-0.058	-0.058
Family composition 2 (live with partner)	0.039	0.039
Family composition 3 (live with children or parents or other relatives)	-0.084	-0.084
Number of raising children 1	0.003	0.003
Number of raising children 2	0.012	0.012
Supporting eldly	0.078	0.078
Education level 1 (low)	0.164	0.164
Education level 2 (middle)	0.058	0.058
Hukou 1 (this city)	0.119	0.118
Hukou 2 (other city)	-0.490	-0.489
Length of stay 1	-0.024	-0.024
Length of stay 2	0.180	0.180
Length of stay 3	0.006	0.006
Family income 1 (<2000 yuan)	0.448	0.447
Family income 2 (2000-5000 yuan)	-0.297	-0.297
Family income 3 (5000-20000 yuan)	0.012	0.012
Renovation stage 1 × Satisfaction of housing	-0.137	-0.137
Renovation stage 1 × Satisfaction of environment	-0.151	-0.151
Renovation stage 1 ×Satisfaction of historical atmosphere and tourism	0.207	0.207
Renovation stage 1 × Satisfaction of neighbourhood	-.599*	-.599*
Renovation stage 1 × Satisfaction of economy	0.381	0.380
Renovation stage 2 × Satisfaction of housing	0.099	0.099
Renovation stage 2 ×Satisfaction of environment	0.156	0.156
Renovation stage 2 ×Satisfaction of historical atmosphere and tourism	0.107	0.107
Renovation stage 2 × Satisfaction of neighbourhood	.429*	.429*
Renovation stage 2 × Satisfaction of economy	-0.142	-0.142
Satisfaction of housing	-.595***	-.594***
Satisfaction of environment	-.453**	-.452**
Satisfaction of historical atmosphere and tourism	0.005	0.005
Satisfaction of neighbourhood	-0.241	-0.241
Satisfaction of job	-0.179	-0.179
Satisfaction of economy	0.062	0.062
Random parameters	Standard deviation	
Early Renovation stage (Renovation stage 1)	0.013	
Middle Renovation stage (Renovation stage 2)	0.081	

Note: 1. Rho squared= 0.221 for MNL, while Rho squared= 0.228 for ML.

2. ***P<0.01 **P<0.05 *P<0.1

An examination of Table 6.1 shows that the estimated constant is positive and significant. It illustrates that the probability of intention to move house is larger than the intention not to move in historical blocks. Results also indicate that stage 2 (middle renovation stage), age, housing satisfaction and satisfaction with the environment, interactions between renovation stages and satisfaction of neighbourhood are statistically significant (Figure 6.1). As the middle stage of renovation is found to be influential for residential mobility (-3.319), compared with people from other renovation stages, residents living in historical blocks during middle renovation stage are less likely to move. As the renovation continues, the intention to move increases at the early and late stages. This may suggest that renovation from government more or less changed both the tangible and intangible living environment. This quantitative result was confirmed during our qualitative interviews in which residents mentioned that after a few rounds of renovation, they do find their living conditions improved. So they were happy about their houses and less interested in moving out. However, because the historical buildings were partly made from wood and needs constant repairs, a few rounds of small-scale renovation cannot stop the trend of deterioration. Therefore, after some time, in spite of more rounds of renovation, residents were more inclined to move as they think the renovation cannot solve the fundamental problems, such as housing structure and house size. Age also significantly impacts the mobility intention (-0.035). Its negative sign shows that the older the residents, the lower the intention to move house.

As for the various satisfaction variables, housing satisfaction is the most important variable influencing residential mobility compared with other satisfaction variables (-0.594). Its negative impact suggests that lower housing satisfaction leads to a higher intention to move, which is consistent with previous research (e.g., Kearns and Parkes, 2003; Oh, 2003). Following housing satisfaction, satisfaction with the living environment also significantly influences the mobility intention (-0.453). The negative coefficient also indicates that the higher environmental satisfaction, the lower the propensity to move. Similarly, neighbourhood satisfaction and job satisfaction have a negative sign, showing that the intention to move house decreases with increasing satisfaction with neighbourhoods and jobs. Historical and economic satisfaction show an unexpected positive sign; however none of them are statistically significant. In this context, it should also be emphasised that all satisfaction variables are strongly intercorrelated. If we examine the single correlations, results indicate that historical satisfaction and economic satisfaction are negatively correlated with the intention to move house as we would expect. Thus,

the negative signs in the logit model are likely due to the correlations among the satisfaction variables.

Although renovation stages are assumed to display taste variation, the standard deviation of these random parameters are statistically insignificant. It means residents living in historical blocks at same renovation stages do not exhibit significant differences in their propensity to move house. However, estimates of interaction between renovation stage and satisfaction variables suggest that the neighbourhood satisfaction significantly interacts with several renovation stages. Specifically, with same neighbourhood satisfaction, residents living in blocks of early renovation stage (-0.599) have a lower inclination to move compared with those from blocks of later renovation stages (0.429), which is different from coefficients of sole renovation stages. A likely explanation is that social bonding was destroyed during renovation as more neighbours were replaced. The same trend is found in the interaction with environmental satisfaction. Similarly, lower housing satisfaction is found may decrease the (base) intention to move in early renovation stage. As historical and economic satisfaction exhibit unexpected signs and are insignificant statistically, their interaction effects will not be interpreted.

Regarding other social-demographic variables, although the results suggest that they are statistically insignificant, which may be due to the relatively small sample size, some trends can still be observed. The negative sign of having a job indicates that people who have a job are less likely to move out compared with those retired or having no job. It might be because people with a job are more stable than those without a job. Some respondents mentioned in the interviews that they cannot move because their work places are nearby and it would be inconvenient for their commuting if they would relocate. Gender positively influences residential mobility, which means that males have a higher intention to move compared with females. The changing signs of family composition indicate that residents who live alone and live with children or parents or other relatives are less interested in moving compared with residents living with a partner or extended family. The result is consistent with researches focusing on life course in which marriage will lead to higher moving intention (Clark & Huang, 2003; Feijten & van Ham, 2007; Rabe & Taylor, 2010). Similarly, supporting more elderly at home will also induce a higher mobility intention. In terms of length of stay, residents who live less than 20 years and longer than 60 years in historical blocks are less likely to move. Although tenure has been studied intensively in residential mobility research, it is not involved in this

analysis as the model indicated singular when tenure is included, which might be due to its high correlation with other variables.

Higher education level shows a negative effect on the intension to move in the sense that residents with a higher education level have a lower inclination to relocate. Residents holding hukou of the current city and village have higher moving intention compared with those holding hukou of other cities, which was confirmed in the interviews that residents holding hukou from other cities are more reluctant to move as they have less expectations about change. Families with the lowest income are more interested in moving than families having other levels of income, which might be because some respondents with low family income mentioned that they intend to get high compensation from government because of the relocation to improve their economic situation.

6.3 Conclusions

The aim of this chapter was to systematically understand residential satisfaction and social-demographic characteristics as determinants impacting residential mobility. The results of the mixed and multinomial logit model indicate that residential satisfaction is an important determinant of residential mobility, which is consistent with previous research (e.g., Kwon & Beamish, 2013). Among the social-demographic attributes, renovation stage and age are found to significantly influence mobility intention.

Most satisfaction variables have a negative impact on residential mobility. It means when a certain dimension of satisfaction increases, the intention to move decreases. Housing satisfaction is found to be the most influential compared with other satisfaction variables. As for social-demographic characteristics, length of stay is found not to affect mobility consistently, which is consistent with Onaka (1983), but because of distinct reasons. Another variable, age, negatively influences the intention to move, which confirms earlier findings (Earhart & Weber, 1996; Clark & Huang, 2003). Holding the Chinese ID, hukou, of other city may also reduce the propensity to move compared with those having local hukou. Consistent with previous Western studies (Clark & Huang, 2003; Feijten & van Ham, 2007), people living with a partner or extended family are more likely to move compared with those living alone or with few relatives, which is, however, inconsistent with finding from other urban areas in Shanghai (Li & Song, 2009).

The results of this chapter also revealed that there is no difference in residents' taste regarding renovation stage. Residents living in blocks of the same renovation stages have similar preference contributing to the mobility intention. However, the joint effects of renovation stage and neighbourhood satisfaction are influential in the propensity to move. For residents having the same neighbourhood satisfaction, those who live in early renovation stage are less likely to move out. This negative coefficient is different from the positive influence of early renovation stage on moving intention, which might be because increasing number of local residents are replaced as the renovation continues. As renovation stage and its interaction with neighbourhood satisfaction influence residential mobility significantly, how to improve the renovation to create better house condition and living environment, and reduce deterioration of social fabric for the residents are worthy of consideration by policy makers. Although this chapter provides some insights into the impact of social-demographic characteristics and residential satisfaction on intended residential move, the investigation about the complex influence between residential gap, residential satisfaction and mobility still remains. It will be examined in the next chapter.

7

Integrated Model of Intention to Move

7.1 Introduction

Considering that existing studies mainly focus on the single relationships between residential gaps, satisfaction and intention to move, this chapter attempts to combine these concepts into an integrated analysis. Instead of a two-step analysis between concepts, we formulate and estimate an integrated path model that allows the estimation of the direct and indirect effects between personal and household characteristics, housing and neighbourhood characteristics, residential satisfaction and the intention to move house. In this integrated model, the direct influence of residential satisfaction and social-demographics on the intention to move and the direct impact of social-demographic variables on the residential gap will be included. Also, the indirect relationships between these concepts will be tested. Because the main aim of this analysis is to identify the influence on moving intention, estimation of the relationship between social-demographics and residential satisfaction will not be included.

In this chapter, only data of two dimensions will be used. Although housing, neighbourhood and accessibility were identified as the three main reasons of voluntary move, a large number of scholars found that housing attributes have more influence on residential satisfaction and mobility compared with the other two groups of variables (e.g., Dieleman & Mulder, 2002; Molin & Timmermans, 2003; Li, 2003; Dane et al., 2014; Fattah et al., 2015; Addo, 2016; Ren & Folmer, 2016). Most housing attributes used in previous studies relate to the house itself. To get a more comprehensive understanding of factors influencing residential satisfaction, we include a wider set of factors into our model. More specifically, both housing and environmental attributes are included in this analysis.

The social-demographic variables used in this chapter are the commonly used ones in studies of residential mobility, including age, gender, tenure, length of stay, supporting elderly, education and type of job. However, considering the specific Chinese context, the special household registration system (hukou in Chinese) and the stage of renovation are also included.

In the following sections, the sample statistics regarding the subset of sample will be presented first, followed by a discussion of the method used for this analysis. Then, the results will be presented in detail, and compared with the findings from other urban areas. Limitation and future work will be illustrated in the last section.

7.2 Sample statistics

Although 384 valid questionnaires were completed in the survey. Due to the missing data in one question, only data from 375 questionnaires was used in this and following analysis. The subsample statistics is as follows: As shown in Table 7.1, over half of the respondents has the intention to stay, while 44.5% would like to move. As shown in Table 7.2, females and males are almost equally distributed (49.1% vs. 50.9% for male and female). 11.7% of residents live alone, while 34.1% live with an extended family. Over half of the families do not need to support elderly (62.9%). Regarding education level, results show that 79.8% (45.1% +35.7%) of the respondents possess a degree lower than high school. Most respondents have hukou from the current city (89.1%), while only few come from other cities or villages (10.9%). In addition, 48% respondents have jobs while others are retired or do not have jobs. 64.5% (34.6%+19.5%+10.4%) of the respondents was born in the historical blocks or has lived there for over 20 years, and therefore may have some emotional attachment to their neighbourhood. As for renovation stages, over half of the respondents come from blocks in the middle renovation stage (51.2%), while the percentage of respondents from blocks at an early or late stage of renovation is more or less similar. Finally, 56.8% of the respondents rent houses from privates, government or companies compared with 40.8% having the property rights. Only 2.4% of the respondents living in the historical blocks share property rights with government.

In order to reduce the number of estimated variables, all multiple categories were merged into binary categories. Renovation stage was divided into “early renovation stage” and “later renovation stage”. Rent refers to rent the house or not. Family composition includes “living alone” and “living with other relatives”, education

level was merged into having at least college degree or not. Hukou contains “hukou of this city” and “hukou of other city or village”. In the analysis, age and length of stay are used as continuous rather than categorical variables.

Table 7.1 Description of mobility data (N=375)

Variable	Category	N	Frequency (%)
Intention to Move	Move	167	44.5
	Stay	208	55.5

Table 7.2 Description of social-demographic data (N=375)

Variable	Category	Frequency (%)
Gender	Male	49.1
	Female	50.9
Family composition	live alone	11.7
	with partner	30.4
	with children/with parents/with others	23.7
	with partner+ children+ parents/with partner+ children	34.1
Supporting elderly	Yes	37.1
	No	62.9
Education Level	Junior high school and under	45.1
	Senior high school	34.7
	Junior college and over	20.3
Hukou	This city	89.1
	Other city	6.4
	Village	4.5
Job	Yes	48.0
	No	52.0
Length of stay	20 years and under	35.5
	21-40 years	34.6
	41-60 years	19.5
	Over 60 years	10.4
Renovation Stage	Early stage of renovation	25.6
	Middle stage of renovation	51.2
	Late stage of renovation	23.2
Tenure	Rent	56.8
	Bought	40.8
	Shared right with government	2.4

7.3 Analysis and results

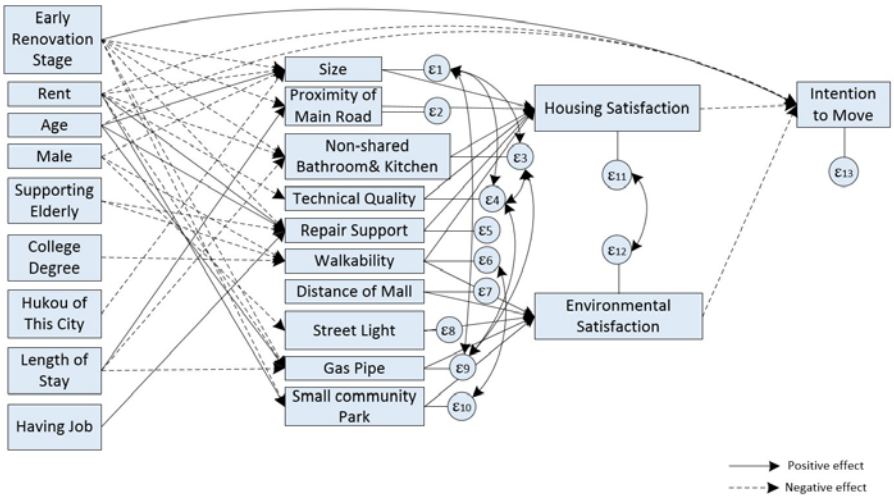


Figure 7.1 Results of path analysis

7.3.1 Analysis

We assume that the scales used to measure satisfaction have interval properties. Some scholars may argue the scale is ordinal. It certainly has ordinal properties, but it goes beyond a simple ordinal scale. This is the reason why we assume we are dealing with an interval scale, being in line with the majority of studies using such scales (Speare, 1974; Morris et al., 1976; Molin & Timmermans, 2003; Liao, 2004; Diaz-Serrano & Stoyanova, 2010). It allows us to apply a wider spectrum of statistical models. In particular, to understand the complex relationships between intention to move, residential satisfaction, residential gap and social demographics, a path model was estimated to analyse the data. Path analysis can be used to measure both the direct and indirect causal relationships between several groups of variables. Regression is the inherent measurement of this model that tests the existence of causal relationships. A series of regressions is considered simultaneously during estimation. Different from structural equation modelling having latent variables, all variables in path analysis are observable. In this sense, a path model is a special case of a structural equation model that has only a structural model, but no measurement model (Williams, 2015).

7.3.2 Results

Table 7.3 and Figure 7.1 show the results of the estimated path model. The x^2/df

Table 7.3 Results of causal relationships

Determinants of Intention to move		Determinants of Residential Satisfaction			
Intention to move		Satisfaction of Housing		Satisfaction of Environment	
Satisfaction of Housing	-0.439***	Size	0.301***	Distance to Mall	0.159***
	(0.062)		(0.057)		(0.050)
Satisfaction of Environment	-0.138**	Proximity of Main Road	0.195***	Street light	0.224***
	(0.064)		(0.066)		(0.072)
Early Renovation Stage	0.160***	Non-shared Kitchen & Bathroom	0.188***	Gas Pipe	0.502***
	(0.060)		(0.067)		(0.043)
Rent	-0.162***	Technical Quality	0.453***	Small Community Park	0.139***
	(0.058)		(0.052)		(0.053)
Age	-0.230***	Governmental Repair Support	0.218***	Walkability	0.457***
	(0.078)		(0.069)		(0.047)
		Walkability	0.315***		
			(0.058)		

Determinants of Residential Gap					
Size		Proximity of Main Road		Non-shared Kitchen& Bathroom	
Early Renovation Stage	-0.300***	Early Renovation Stage	-0.337***	Early Renovation Stage	-0.318***
	(0.046)		(0.056)		(0.054)
Rent	-0.225***	Length of Stay	0.150*	Rent	-0.484***
	(0.049)		(0.078)		(0.051)
Male	-0.135**			Length of Stay	-0.189***
	(0.055)				(0.069)
Age	0.199***				
	(0.076)				
Hukou of This City	-0.149***				
	(0.054)				
Technical Quality		Governmental Repair Support		Street light	
Rent	-0.206***	Early Renovation Stage	-0.128**	Male	-0.280*
	(0.065)		(0.060)		(0.159)
		Rent	0.263***		
			(0.060)		
		Age	0.279***		
			(0.089)		
		Supporting Elderly	-0.175**		
			(0.069)		
		Having Job	0.167**		
			(0.085)		

Gas Pipe		Small Community Park		Walkability	
Early Renovation Stage	-0.662***	Early Renovation Stage	-0.223***	Male	-0.186**
	(0.039)		(0.061)		(0.067)
Rent	-0.241***	Rent	0.243***	Supporting Elderly	-0.151**
	(0.066)		(0.063)		(0.072)
Age	0.248***			College degree	-0.145**
	(0.092)				(0.072)
Length of Stay	-0.171**				
	(0.087)				

Note: 1. The numbers in the parentheses are standard errors.
2. ***P<0.01 **P<0.05 *P<0.1

equals 1.88, which is smaller than 3, the commonly used threshold. CFI = 0.920, TLI=0.890 and RMSEA < 0.05, which means the goodness-of-fit of the final model is good. Note that all parameters reported in Table 7.3 are the standardised coefficients. The first box of the first row of the table indicates the influence of the two selected dimensions of residential satisfaction and social-demographics on the intention to move. Coefficients in the following two boxes in the first row refer to the contribution of the various gap indices between aspiration and reality to housing and environmental satisfaction respectively. All other boxes explain the effects of social-demographics on residential gap.

The results of the estimated path model confirm our conceptual model. The gap between aspiration and reality influences residential satisfaction and further influences the intention to move house. The social-demographic variables have varying impacts on residential gap and mobility.

The moving intention in historical blocks is significantly influenced by both housing and environmental satisfaction. Their negative impacts indicate that lower satisfaction will lead to a higher moving propensity. The effect of housing satisfaction (-0.439) influences the intention to move more than the satisfaction about the environment (-0.138), which is also confirmed in the interviews. Three physical and social-demographic variables (rent, age and early renovation stage) significantly influence the intention to move. The negative sign of rent indicates that residents who rent a house have a lower intention to move compared with those possessing part or full property rights. Older residents and residents living in blocks at later stages of renovation are also less likely to move.

Regarding the influence of gap on residential satisfaction, as found in Chapter 5, the positive and significant signs of all residential gap variables confirm again that, when the gap between aspiration and reality decreases, proportional to aspiration level, residential satisfaction increases. For housing satisfaction, the results indicate that the gap index for technical quality is the most influential variable (0.453), followed by walkability (0.315) and house size (0.301). Considering houses in historical blocks are relatively small compared to those in other urban areas and some respondents are even living in a house as big as 10 square metres with children, the importance of house size is understandable. The gap indices related to non-shared kitchen and bathroom (0.188) and repair support from government (0.218) are also statistically significant.

As for the effect of the gap indices on environmental satisfaction, the gap index for infrastructure such as gas pipe (0.502) and walkability in the community (0.457) influences environmental satisfaction more compared with the gap indices for other environmental variables. Gap indices for distance to the shopping mall, having a small community park and streetlights are important attributes influencing environmental satisfaction.

The following boxes demonstrate that different social-demographical profiles have significant and varying effects on residential gaps. Here, only the significant social-demographic effects are reported in Table 7.3. Renting (-0.225) and early renovation stage (-0.300) negatively affect the gap index of house size, which means residents who rent a house or live in blocks at early renovation stages have a smaller gap index (i.e. proportional to their aspiration level, they tend to experience a bigger gap between aspiration and reality) about house size. Similarly, males (-0.135) and younger people (0.199) seem to also have a smaller gap index for house size compared to females and the elderly. A smaller gap index for house size is also found for residents who own city hukou in those blocks, which indicates that residents with city hukou have a bigger gap between their aspiration and current situation about size of the house.

The gap index of proximity to the main road is significantly influenced by early renovation stage (-0.337), which means residents living in blocks that are at an early stage of renovation are more likely to have a smaller gap index compared to those living in blocks that have gone through more rounds of renovation. Living in those blocks for a shorter time also indicates a smaller gap index about the proximity to the main road (0.150). Different from the gap index of proximity to the main road,

longer time of residence leads to a smaller index (bigger gap) regarding non-shared kitchen and bathroom. This might be because residents' aspirations increase as more households have a non-shared kitchen and bathroom, but their living situation remains same. Residents who rent houses (-0.484) or live in blocks that are at an early stage of renovation (-0.318) are more likely to have a smaller gap index for kitchen and bathroom. As for technical quality, only tenure turns out to be significant, indicating that respondents who rent houses have a bigger gap index compared to house owners.

In terms of repair support from government, different from the effects on other residential gaps, renters have a higher gap index (0.263), which might be because they do not have the property rights, and hence renovation is not of much interest to them. Older residents show a bigger gap index of their aspirations and reality, while families with elderly have a smaller gap index for repair support, which may be due to their higher financial load. Residents with jobs have a higher gap index for renovation support from government, which might be because they have less financial burden.

As expected, the gap index for gas pipes is larger for older residents than for younger people (0.248). For inhabitants living in blocks at the early renovation stage, a smaller gap index for gas pipe is found. Similar to older residents, those who own a house (-0.241) or live in the area for a short time (-0.171) are more likely to have a larger gap index for gas pipes as the negative sign indicates.

For small community park, residents from blocks at the early renovation stage or house owners have a smaller gap index compared with those living in blocks at a later renovation stage or renters. Males (-0.186) and residents with a college degree (-0.145) have a smaller gap index for walkability compared with females and people with a lower education degree. As expected, families with elderly show a smaller gap index for walkability, which means families with elderly experience a bigger gap between their aspiration and reality for the convenient and friendly pedestrian environment (walkability) within their community (-0.151).

The residual covariances between variables of residential gap are found to be significant as shown in Table 7.4. The residual covariances are not fixed at zero in the path model to identify the residual correlations between variables. As there is no logical causal relationship between these variables, the residual covariance found may be attributable to the potential hidden variables, like personal preferences and housing characteristics.

Table 7.4 Results of residual relationships

Non-shared Kitchen& Bathroom		Satisfaction of Environment	
Size	0.452***	Satisfaction of Housing	0.385***
	(0.056)		(0.124)
Technical Quality		Gas Pipe	
Size	0.368***	Size	0.440***
	(0.057)		(0.064)
Non-shared Kitchen& Bathroom	0.428***	Non-shared Kitchen& Bathroom	0.499***
	(0.076)		(0.086)
Gas Pipe	0.370***		
	(0.088)		
Walkability			
Small Community park	0.214**		
	(0.084)		

Note: 1. The numbers in the parentheses are standard errors.

2. ***p<0.01 **p<0.05 *p<0.1

7.4 Conclusions and discussion

This chapter represents an attempt to systematically analyse the direct and indirect relationships between moving propensity, residential satisfaction, residential gap and social-demographics underlying the gap-theoretical framework. The integrated causal relations between these variables are confirmed and residual correlations between the variables of residential gap are identified. The results again confirm our assumption that residential satisfaction will not only be influenced by the value of attributes, but also the gap between residents' aspiration levels and the current situation.

The results of the path analysis indicate that the intention to move house is directly driven by residential satisfaction and further indirectly driven by residential gap. Housing and environmental satisfaction both strongly influence moving intention. Among them, housing satisfaction is the most influential variable, which is in line with the findings for other urban areas where housing variables are most significant (Grigolon, et al., 2014; Ren & Folmer, 2016; Ghasrodashti, Majedi & Paydar, 2017). Besides residential satisfaction, social-demographics were found to directly influence the intention to move, which is different from Speare's (1974) conclusion that social-demographics only affect residential preference by mediation of residential satisfaction. Older residents were found less likely to move compared with the young, which is consistent with previous studies (Kim et al., 2015; Wu,

2006; Clark & Huang, 2003). This means that age has a similar impact on residential mobility in both historical blocks and other urban areas. In contrast, residents who own a house or live in blocks of early renovation stage are more inclined to move, which is consistent with finding from Huang (2006). It might be because of the potential high profit that house owners can get from selling or renting their houses that are usually located in the centre of city.

As expected, residential satisfaction is positively influenced by the gap index between aspiration and reality, which means an increase of the gap index (i.e. a decrease of gap, proportional to aspiration level) will lead to higher satisfaction. For housing satisfaction, gap indices of technical quality and house size are most important among the housing attributes while the location of house is of less importance. Although house quality and size have also been found significant in studies about other urban areas (Li & Wu, 2013; Huang et al., 2014; Huang et al., 2015), they are found to be especially important in renovated historical blocks, which is reasonable as interviewers indicated that houses in those historical blocks are always in a worse condition and have much smaller size compared with the ones in other urban areas.

Regarding the environmental dimension, the gap indices for walking convenience and infrastructure are of most concern to residents, while the gap index for community parks is of least concern, which is rarely found in previous findings of other urban areas. As those historical blocks are located in the centre of city and not far away from city parks, therefore it might be the reason that they are not interested in community parks. However, infrastructures in those communities are not fully equipped and worse than other urban areas, so they might attract more attention from residents. Meanwhile, the gap indices for house size, non-shared kitchen and bathroom, technical quality, gas pipe, walkability and community parks are found to have residual covariance between pairs of variables that might be induced by some common hidden factors in the measurement of satisfaction and moving intention.

Regarding the influence of social-demographics on the gap between aspiration and reality, residents living in blocks at the early renovation stage have a smaller gap index (i.e. a bigger gap of aspiration and reality, proportional to aspiration level) about most aspects of housing and environment compared with those living in blocks of later stages. Renters value more improvements in house size, quality, non-shared kitchen, bathroom and gas pipe, but care less about

governmental repair and small community parks, which might be because renters are easier to move and do not need to shoulder the responsibility of deterioration of house. Therefore, they are less concerned about the renovation and leisure space compared with house owners. Given the aspiration level, older inhabitants have lower gap for residential elements, such as house size and gas pipe, than the younger inhabitants. They also tend to express lower gap for governmental repair support, which means they are less concerned about repair support. Males are more interested in the improvement of house size, streetlights and surrounding walkability or have to reduce their aspirations compared with females. Longer residence decreases the gap index for gas pipe and non-shared kitchen and bathroom, but increases the gap index for proximity to the main road. Residents with hukou of the current city also express a smaller gap index about house size. Given the aspiration level, families supporting elderly have greater interest in more renovation support and better walkability, which is similar for families living in the other urban areas (Patterson & Chapman, 2004). Other social-demographics such as education degree are found to have less impact on the residential gap.

Although residents living in renovated historical blocks face more constraints and complicated situations compared with those living in other urban areas, results from the path model suggest that these two groups of residents have similar interests. For instance, both consider housing satisfaction as the most significant factor influencing the intention to move, and the moving intention decreases as the age of resident increases in both groups. However, some particularity regarding moving propensity of residents in renovated historical blocks still exists. For instance, governmental repair support is found to be significant in these blocks as house quality is worse and residents have a lower income compared with other urban areas. The improvement of infrastructure is more significant for residents in historical blocks as they have worse infrastructure than residents of other urban areas. Although house quality and size have also been found significant in other urban areas, they are considered particularly important in historical blocks because relatively the house quality is worse and house size is much smaller.

This chapter sheds lights into the complicated relationships between residential gap, satisfaction and intention to move, there is still room for possible improvement and extension. Our measure of gap assumes that the effects of deviations from the aspiration level on satisfaction are symmetric. However, one may hypothesise that (perceptually and cognitively) the gap is larger if reality is lower than aspiration compared to reality exceeding aspiration. Because any measure that

has this property likely involves nonlinear forms and hence increases the complexity of analyses, and may require methodological advances, in this and previous chapters we only consider the current formulation. Thus, the following chapter will further explore this limitation and propose some methodological solutions.

8

Nonlinear Asymmetric Gap-Satisfaction Model

8.1 Introduction

In the previous three core chapters, the single and multiple relationships between all the key concepts have been examined. The following two chapters will shift the focus to a methodological perspective and explore advanced modelling technologies regarding residential satisfaction and the intention to move. Specifically, a nonlinear asymmetric gap-satisfaction model will be formulated in this chapter, while the heterogeneity issue will be investigated in the next chapter.

Since gap theory was introduced in housing studies, different operationalisations have been proposed and used. They share the notion that residential gap is defined as a function of the discrepancy between aspiration and reality. Some of these studies, however, lack the measurement of aspirations and/or the perceived environment and as such cannot be viewed as studies that truly operationalised the concept of residential gap. Some researchers tried to include the notion of stress by making assumptions regarding the objective variables (Clark & Huang, 2003; Coulter, Van Ham & Feijten, 2012; Coulter, 2013; Clark & Coulter, 2015). For example, Clark (1992) developed an index of room stress by making assumptions as opposed to measuring the needs or aspirations of households. Particularly, the stress is calculated in terms of the number of actual rooms divided by the number of required rooms. The latter is assumed as "two rooms are allocated for each head of household with or without a spouse. Then, one room is added for each additional married couple or single person aged 18 or over; one room is added for every two boys under 18 and one room for every two girls under 18. If the number of children in the household is an odd number, then the numbers are rounded up. If there is an odd number of girls and an odd number of boys, then those under 10 years of age are paired regardless of sex" (W. A. V. Clark, 1992). Thus,

although this measure of stress is adopted in plenty of studies (Clark & Huang, 2003; Clark & Ledwith, 2006; Coulter et al., 2012; Coulter, 2013; Clark & Coulter, 2015), it should not be regarded as a valid measure of the concept residential gap.

In most studies that measure aspirations, gap has typically been operationalised as the difference between aspiration and experience (Brummell, 1979; Phipps, 1989; Tang, 2012). Moreover, most studies have assumed a linear relationship between gap and satisfaction. The linear relationship implies that the marginal effect of a positive discrepancy between aspiration and experience is the same as the effect of an equivalent negative discrepancy. However, such linear operationalisations may be very inadequate in explaining the relationship between satisfaction and gap. Pointing at the principle of diminishing marginal utility, Galster (1987) argued that the marginal effect of a gap on residential satisfaction is monotonically decreasing with a decreasing gap. It means that the assumption of a linear relationship between residential satisfaction and gap would not be the best specification. In addition, some studies assumed symmetry around the point of a zero gap. However, asymmetry around the point of a zero gap may be more realistic considering that the marginal effects on satisfaction are likely to vary for situations that aspiration is lower and higher than reality. The gap model raised in chapter 5 is linear, symmetric and truncated, and these limitations need further exploration.

Thus, in this chapter, we introduce a different framework for operational decisions of residential gap theory compared with chapter 5, and discuss some alternative options. We systematically compare the empirical performance of the alternative specifications with our previous gap model and gap models from literature, using the data of residential satisfaction. The main contribution of this chapter to the literature on residential satisfaction, therefore, is to provide a more proper representation of the relationship between residential gap and satisfaction.

The remainder of this chapter is structured as follows: first, the general model formulation underlying the relationships between aspiration, reality, gap and residential satisfaction in the existing literature will be summarised. Second, the relevant literature about gap models, gap theory and other similar concepts will be further discussed. After the discussion of the limitations of the linear symmetric gap ratio model raised in chapter 5, the newly proposed models will be presented. Then, the data used for this chapter will be explained, followed by the interpretation of results and analyses. Finally, the chapter will be concluded in combination with some discussions.

8.2 Problem statement

Consider a residential environment *j*, which in this study is assumed to consist of a house, the physical neighbourhood environment, and neighbourhood bonding. The current environment can be characterised in terms of a bundle of attributes R_{ik}, where $k = 1,2,\dots,K$ represents the *kth* attribute. Potentially, we can represent the current environment/reality on a subjective or objective basis. Objective evaluation in this context means that reality is expressed in terms of its physical measurement, while subjective evaluation means reality is expressed in terms of perception. As different individuals i may experience the same physical environment in different ways, R_{ik} is replaced with R_{ijk}.

Let A_{ik} denotes the aspiration of individual *i* for attribute *k*. Gap theory assumes that individuals may have a certain gap for each attribute *k*, denoted as G_{ijk}. The gap is influenced by both the current (perceived) situation and the individual's/household's own aspiration. This gap is then an attribute-specific function of the experienced and aspired levels or value:

$$G_{ijk} = f_k\left(R_{ijk}, A_{ik}\right), \forall k, k \in [1, K] \quad (1)$$

Assume individuals derive a certain degree of satisfaction for each attribute *k*, in environment *j*, denoted as S_{ijk}. Because residential satisfaction is a function of the gap between aspiration and reality, the gap can be transformed into satisfaction for each attribute *k* through a function g_i:

$$S_{ijk} = g_i\left(\, G_{ijk}\right) \quad (2)$$

Substituting equation 1 into 2, we have:

$$S_{ijk} = g_i(f_k\left(R_{ijk}, A_{ik}\right)), \forall k, k \in [1, K] \quad (3)$$

Thus, this formulation of satisfaction as a function of the gap between aspirations and experienced reality requires two operational decisions: the concept of gap as reflected in f_k, and the relationship between gap intensity and degree of satisfaction, represented by g_i. In the next section, we will discuss the literature along these lines.

8.3 Literature review

The conceptual framework introduced in the previous section sets the stage to position previous research. Particularly, the two functions f_k and g_i allow the identification of

the operational decisions made in prior studies. We will use these two functions as the basis of our literature review.

Table 8.1 provides an overview of the measurement of gap and similar concepts such as stress, discrepancy (Handal et al., 1981), Mismatch (Jansen, 2014), disequilibrium (Hanushek & Quigley, 1978; Onaka & Clark, 1983) and housing deficit (Sulaiman & Yahaya, 1987; Morris et al., 1976). As shown in Table 8.1, f_k has been mainly specified as a function of difference. For instance, Tang (2012) measured residential gap as the difference between reality and aspiration. Phipps (1989) measured the stress between desired and experienced utility using the difference function. Most of these difference formulations subtracted aspiration from reality, while a few of them used the absolute difference between reality and aspiration (Hanushek & Quigley, 1978; Handal et al., 1981; Phipps, 1989). This may look like a minor issue, but the difference formulation implies that the more reality exceeds aspiration, the higher satisfaction, while the absolute difference inherently assumes the existence of an ideal point. Satisfaction decreases if reality deviates from aspiration in both directions.

Besides the formulation using difference, the ratio between reality and aspiration has also been used to represent the gap concept. The studies using ratio formulations often do not represent the ratio of the perceived physical and aspired physical attributes of the same house and/or neighbourhood. For instance, Campbell et al., (1976) used ratios to measure the gap between aspiration and reality, in which reality was measured regarding the current house and neighbourhood while aspiration was measured regarding other aspired houses and neighbourhoods. In other cases where an explanatory variable is arbitrarily created to represent the gap, the concept of gap is not well represented. For instance, Galster (1987) used the ratio of the number of rooms to the number of residents in a house.

Table 8.1 also provides an overview of the different measurements of reality, including the objective and subjective measures. As the table shows, most studies have used subjective measurement, which means that gap was measured based on residents' interpretation (perception) of their living environment rather than in terms of direct physical measurements.

As for the second operational decision, function g_i, the choice of statistical models depends primarily on the (assumed) measurement level of the satisfaction scale. Rating scales have been used in most studies to measure satisfaction. In most studies, it has been assumed that rating scales have interval properties. In contrast, other researchers (e.g., Tao et al., 2014; Huang & Du, 2015; Abe & Kato, 2017) argued these

scales only have ordinal properties. Consequently, in those cases where interval properties have been assumed, linear regression analysis has been a popular approach. The use of linear regression indicates that the relationship between satisfaction and gap (g_i) is assumed to be linear. It means that the contribution of a unit difference in the gap function is assumed to result in the same, proportional change in satisfaction. Table 8.1 shows that the linear function was used by many scholars to express the relationship between gap and residential satisfaction (e.g., Jansen, 2014, Jiang et al., 2017). Wu (2008), using a path model, also assumed a linear relationship between gap and satisfaction.

However, the linear shape of the dominant satisfaction model has not escaped criticism. Galster (1987) stated that the relationship between satisfaction and aspiration should be curvilinear. He argued for a nonlinear model because satisfaction is bounded by a certain maximum level but not by a minimum level. A reality far away from aspiration may result in a very low satisfaction, while reality approximating aspiration will lead to a stable maximum satisfaction. Furthermore, and in our opinion more convincing, he pointed at the law of diminishing marginal utility, and argued that increments in residential satisfaction becomes increasingly smaller as the gap decreases. Once satisfaction exceeds a certain point, the satisfaction will remain stable and not continue to increase. Therefore, it is reasonable that a nonlinear function may be more convincible to capture the relationship. Unfortunately, as listed in Table 8.1, studies using nonlinear functions to analyse the impact of gap on residential satisfaction are very limited (e.g., Galster, 1987).

This nonlinear relationship is assumed in studies of residential mobility in which a logistic function was used to analyse choice probabilities (e.g., Hanushek, 1978; Phipps, 1984, 1989; Coulter, 2012, 2013). The gap function itself was linear and the nonlinearity stems from the logistic mapping of satisfaction into choice probabilities. For instance, the nested logit model was used by Onaka (1983) to analyse the influence of disequilibrium on moving probability. In the logit/logistic case the utility function itself is typically a linear additive function. Only the mapping of the utility function into choice probabilities is nonlinear, which was driven by the desire to derive a closed form expression. Particularly in the early years of the development of discrete choice models, with a lack of computing power, the challenge of the researchers was to find assumptions about the error terms of the utility or satisfaction function that would result in a closed form, easy to estimate choice model. The solution found was to assume that

the error terms are independently and identically distributed. This logically led to the logistic form.

Chapter 5 suggested a linear ratio gap-satisfaction model. Residential gap is represented in terms of the following equation:

$$G_{ik} = \max(0, 1 - \frac{|R_{ik} - A_{ik}|}{A_{ik}}) \quad (4)$$

The equation indicates that when perceived reality (R_{ik}) approaches aspiration (A_{ik}), the gap index (G_{ik}) approximates to 1 and the gap becomes the smallest. The index was truncated at zero when reality exceeds two times the aspiration. This formulation assumes that the effect of a given difference between reality and aspiration is smaller if aspiration is higher. Taking the number of rooms in a house as an example, if the difference between reality and aspiration is 1 room, this index would indicate the gap is smaller if the aspiration is 6 rooms compared to 3 rooms. Thus, this gap index expresses the ratio of the gap and aspiration to be sensitive to the value of the aspiration.

Similar to the majority of studies on residential satisfaction, the relationship between gap and residential satisfaction was assumed to be linear as follows:

$$S_{ik} = \lambda + \theta * G_{ik} \quad (5)$$

where S_{ik} denotes the residential satisfaction of individual *i* for each attribute *k*. λ is the intercept, θ is the slope of the linear relationship between gap and residential satisfaction.

Although this model has some interesting features and can be easily applied within the general framework, the assumption of the constant marginal effects of deviations from the aspiration level on satisfaction may not be valid. Generally, a perceived reality, which is higher or lower than aspiration, may lead to different marginal changes in residential satisfaction. Therefore, the linear nature of this gap-satisfaction model is potentially too rigorous and needs flexibility, although this limitation applies to all linear specifications of g_i.

Second, the relationship between gap and satisfaction is assumed to be symmetric. Therefore, increment in satisfaction is invariant for the same deviations from aspirations because the same positive and negative difference results in the same change of satisfaction. This may be a strong assumption because residents could have different sensitivities to out- and underperformance of aspiration.

Third, the truncation may not be an elegant way to deal with extreme cases. The index becomes truncated when reality exceeds two times the aspiration. Potentially, respondents may indicate a high difference between aspiration and perceived reality. In that case, the index will become smaller than zero, losing its property of being an index, so the value was truncated at zero. However, although this situation may happen in a few cases particularly with attributes having a high range, as the difference between aspiration and reality increases, residential satisfaction may continue to decrease or slowly approach stable rather than suddenly become stable from a certain point as assumed in this linear gap ratio model. The specification of a continuous shape for the gap-satisfaction model without truncation requires more exploration.

In summary, by using the difference and ratio formulations respectively to represent the gap between aspiration and reality, this chapter develops nonlinear, asymmetric and non-truncated gap-satisfaction models to examine the relationship between residential gap and satisfaction. The aim of this chapter is to compare the performance of new formulations against the ones used in exiting studies and our gap model raised in chapter 5 to represent gap theory.

8.4 Model formulation

Considering that individuals may not necessarily have full and perfect information about the environment, in this study, reality is measured as the perceived reality. We consider two specifications of f_k in this chapter. The first most intuitive specification defines f_k as the difference between aspiration (A_{ik}) and perceived reality (R_{ijk}), which was adopted in most studies. To incorporate the assumption of an ideal point, gap is represented using the absolute difference rather than the simple difference used in most residential literature:

$$G_{ijk} = |R_{ijk} - A_{ik}| \tag{6}$$

The second operational decision concerns the specification of relative difference. Gap is defined as the ratio of the difference between aspiration (A_{ik}) and reality (R_{ijk}) to the aspiration level, see as below:

$$G_{ijk} = \frac{|R_{ijk} - A_{ik}|}{A_{ik}} \tag{7}$$

This specification assumes that the same difference between aspiration and perceived reality has a smaller effect if aspiration is high.

Table 8.1 Overview of gap models

Concept	Authors	Year	Country	Objective or Subjective Measure of reality	Measure of gap	Dependent variable	Relation between gap & satisfaction/mobility	Model for gap & satisfaction/mobility	Empirical study	Sample size	Time of data
Gap	Campbell	1976	USA	Subjective	Difference, Ratio	Residential satisfaction	Linear, asymmetric	Linear regression	Yes	285	
	Galster	1987	USA	Objective	Ratio	Residential satisfaction	Nonlinear, asymmetric	Polynominal regression	Yes	434	Jul-Oct 1980
	Tang	2012	China	Subjective	Difference	Gap	No analysis		No		
	Jiang	2017	China	Subjective	Ratio	Residential satisfaction	Linear, symmetric	Linear regression	Yes	384	Apr-Jun 2015
Stress	Speare	1975	USA	Subjective	Difference	Probability of moving	Linear, asymmetric	Linear function	No		
	Phipps and Carter	1984	USA	Subjective	(Absolute) Difference	Probability of moving	Nonlinear, asymmetric	Logistic regression	Yes	103	1982
	Phipps	1989	USA	Subjective	Absolute difference	Probability of moving	Nonlinear, asymmetric	Logistic regression	Yes	2,700	1980-1986
	Brummell	1979	Canada	Subjective	Difference	Stress	No analysis		No		

	Brummell	1981	Canada	Subjective	Difference	Residential stress	No analysis		Yes	45	
Disequilibrium	Goodman	1976	USA	Objective	Difference	Intention to move	Nonlinear, asymmetric	Multiple classification analysis	Yes	5,000	1969-1971
	Quigley and Weinberg	1977	USA	Subjective	Difference	Equilibrium	No analysis		No		
	Hanushek and Quigley	1978	USA	Subjective	Absolute difference	Probability of moving	Nonlinear, asymmetric	Logistic function, Probit function	Yes	HADE data	
	Onaka and Clark	1983	USA	Subjective	Difference	Probability of moving	Nonlinear, asymmetric	Nested logit model	Yes	75,666	1973-1975
Housing deficit	Sulaiman and Yahaya	1987	Malaysia	Objective	Difference		No analysis		No		
	Morris	1976	USA	Subjective	Difference	Intention to move	Linear, asymmetric	Path model	Yes	405	1971
Discrepancy	Handal	1981	USA	Subjective	Absolute difference	Residential satisfaction	Linear, asymmetric	Classification and regression trees	Yes	120	
	Wu	2008	China	Subjective	Difference	Residential satisfaction	Linear, asymmetric	Path model	Yes	330	1999
Mismatch	Jansen	2014	NL	Subjective	Difference	Residential satisfaction	Linear, asymmetric	Linear regression	Yes	3,107	2012

Three specifications of g_i (i.e. relationship between gap and satisfaction) are considered in this chapter. Considering diminishing marginal utility, the increment of residential satisfaction may be different at different aspiration levels, indicating a nonlinear gap-satisfaction relationship. Moreover, the marginal change of satisfaction around the optimal point and within the region of large mismatch might vary between individuals and attributes. If residents are sensitive to the change of gap when perceived reality approaches aspiration around the optimal point, the marginal effect of satisfaction would increase until achieving the maximum satisfaction, otherwise the marginal satisfaction would decrease. If residents are sensitive to the change in gap where aspiration is substantially different from reality, the marginal satisfaction would keep on increasing while reality moving far away from aspiration, otherwise the marginal effect of satisfaction would decrease until satisfaction becomes stable. Thus, three patterns of change of residential satisfaction can be summarised regarding the different combinations of residents' sensitivity to the change of gap.

To model these three patterns specifically, in this chapter, we consider three specifications of the gap-satisfaction relationship, including exponential, inverse exponential and logistic formulations. The difference between these formulations is related to the sensitivity to the change of gap. The first specification, the exponential formulation reflects three requirements. Firstly, we assume that the marginal satisfaction is a monotonically increasing function with the decrease of gap until the optimal point. Secondly, the satisfaction should asymptotically approximate the minimum of the satisfaction scale with increasing residential gap when reality is substantially different from aspiration. Thirdly, by capturing the connotation that the marginal decrease in satisfaction when the perceived reality outperforms aspiration may not be same as that when the perceived reality underperforms aspiration by the same amount, the functional relationship should be asymmetric. Thus, the following exponential functional form is suggested:

$$S_{ijk} = \theta * \exp(-|\alpha - I| * \beta * G_{ijk}) \quad (8)$$

where, I is an instrumental variable. I = 1 if $R_{ijk} \leq A_{ik}$, and I = 0 otherwise, $\alpha \in [0,1]$.

Here, the absolute difference between two parameters, $|\alpha - I|$, is used to deal with the symmetry issue in previous gap models. Previous models typically assumed that the effects of deviations from aspiration on satisfaction are symmetric, which may not be true in reality. Lower or higher aspiration relative to reality may not always lead to the same amount of decrease in residential satisfaction. To examine the asymmetric

property, because of different values of I, the absolute difference between α and / can generate different slopes for the situations when aspiration is higher or lower than reality.

Figure 8.1 represents the relationships between residential satisfaction and gap based on difference and ratio measurements for the first specification. It can be seen that, for both measurements, when α equals 0.5, satisfaction increases or decreases at the same amount no matter when aspiration is higher or lower than reality. When α is between 0 and 0.5, the increment in satisfaction is higher for the situation that aspiration exceeds reality. In contrast, when α is higher than 0.5, the increment is smaller. In extreme cases where α equals 0 or 1, satisfaction becomes constant for the situation that aspiration is lower than reality or reality is lower than aspiration, respectively.

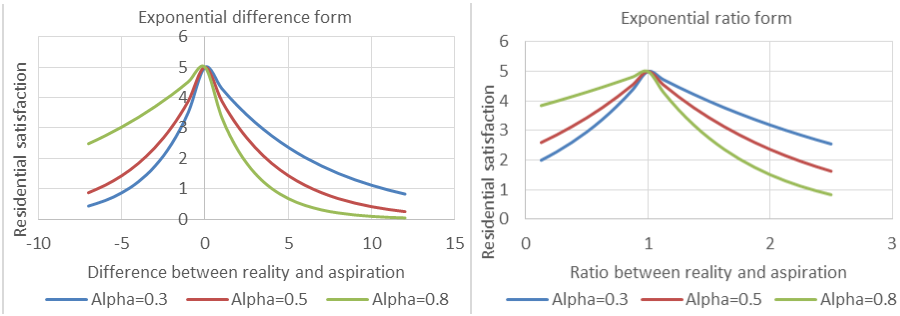


Figure 8.1 Difference and ratio forms of gap-satisfaction models while fixing beta=0.5, theta=5.

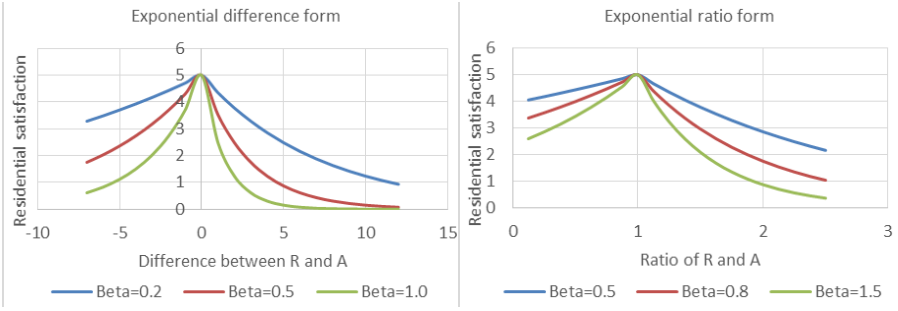


Figure 8.2 Difference and ratio forms of gap-satisfaction models while fixing alpha=0.3, theta=5.

Residential satisfaction (S_{ijk}) is expressed as a nonlinear function of residential gap. A smaller gap between reality and aspiration will lead to a higher residential satisfaction. The exponential function in equation (8) represents the nonlinear nature where the multiplication of $|\alpha - I|$ and β determines the slope of the curve of the gap-satisfaction equation. As shown in Figure 8.2, given $|\alpha - I|$, as β increases, the shape of equation becomes steeper for both the situations when aspiration is higher and lower than reality.

θ defines the maximum satisfaction which occurs when the gap is zero. In the case that $G_{ik} = 0, S_{ijk} = \theta * \exp(0) = \theta$. For the gap difference model, this maximum satisfaction is reached when $R_{ik} - A_{ik} = 0$, while for ratio model, the highest satisfaction is reached when $R_{ik}/A_{ik} = 1$. Moreover, θ also influences the slope of gap-satisfaction model together with α, I and β. As θ increases, the highest residential satisfaction that residents can achieve for this attribute increases and the shape of curve becomes steeper, which means that for the same amount of change in gap, the unit increment in residential satisfaction increases.

The second specification of g_i is formulated as an inverse exponential function. This specification also has three properties. Firstly, the marginal effect of satisfaction is assumed to monotonically decrease with the decreasing gap until the optimal point. It means individuals are less sensitive about the change in gap when reality approaches aspiration compared with the first specification. Secondly, the marginal satisfaction is assumed to continuously increase with the increase of gap when aspiration is substantially different from current situation. In this specification, residential satisfaction is assumed not bounded by a low level regarding to Galster (1987). The third requirement is the same with that in the exponential function. Thus, an inverse exponential function is proposed:

$$S_{ijk} = \theta - \exp(|\alpha - I| * \beta * G_{ijk}) \quad (9)$$

where I has the same property as the instrumental variable in Equation 5. I equals 1 if $R_{ijk} \leq A_{ik}$, and 0 otherwise, and $\alpha \in [0,1]$.

Other parameters in the second specification have similar characteristics to the parameters in the first specification (Figure 8.3 and 8.4). $|\alpha - I|$ defines the asymmetric property of the function. As alpha increases in the inverse exponential function, the unit increment in satisfaction decreases when aspiration exceeds reality and increases when aspiration is lower than reality. The multiplication of $|\alpha - I|$ and β decides the slope of

the curve. Given $|\alpha - I|$, as β increases, the slope of the whole equation increases. Similar to the first specification, θ defines the maximum satisfaction.

The third specification of g_i is suggested as a logistic function:

$$S_{ijk} = \frac{\theta}{1+\exp[|\alpha - I| * \beta * G_{ijk} - \gamma]} \quad (10)$$

where I has the same property as in Equation 8. I = 1 if $R_{ijk} \leq A_{ik}$, and I = 0 otherwise, $\alpha \in [0,1]$.

The logistic function assumes that the marginal effect of the satisfaction decreases with the decreasing gap until the optimal point. Then, beyond the inflection point of the curve, the marginal effect again becomes increasingly smaller and ultimately approximates zero as the increase of gap (Figure 8.5 and 8.6).

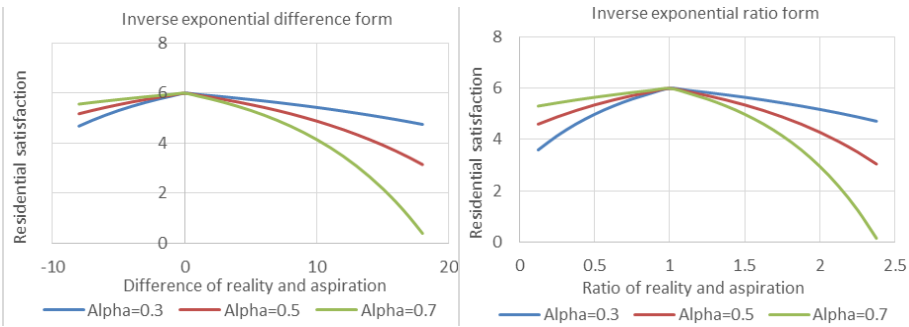


Figure 8.3 Difference and ratio forms of gap-satisfaction models while fixing beta=0.15, theta=7.

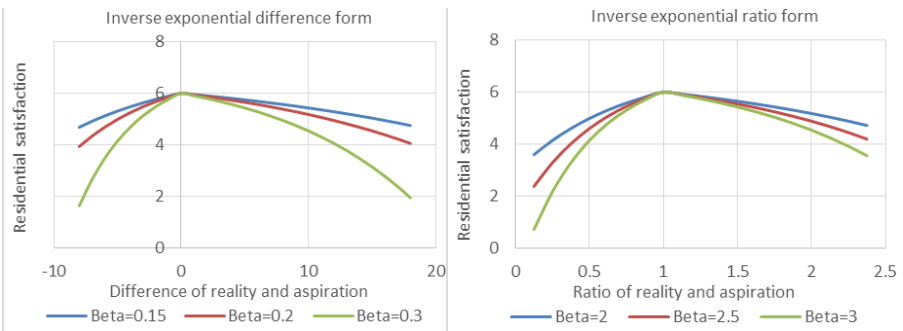


Figure 8.4 Difference and ratio forms of gap-satisfaction models while fixing alpha=0.3, theta=7.

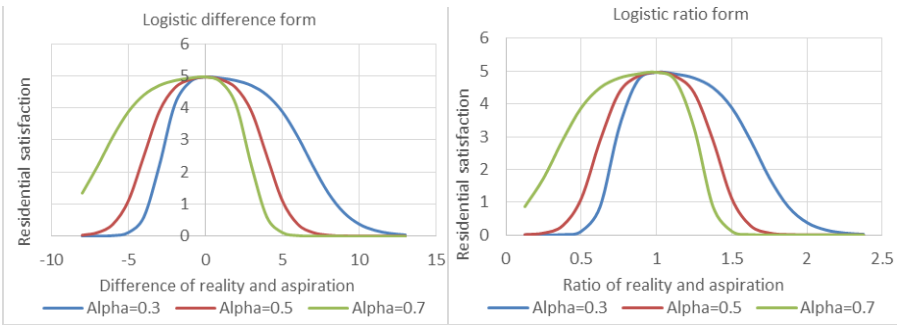


Figure 8.5 Difference and ratio forms of gap-satisfaction models while fixing beta=2.5, theta=5 and gamma=5.

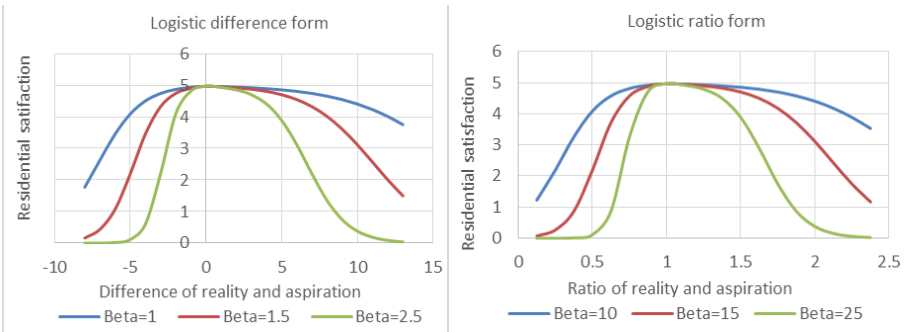


Figure 8.6 Difference and ratio forms of gap-satisfaction models while fixing alpha=0.3, theta=5 and gamma=5.

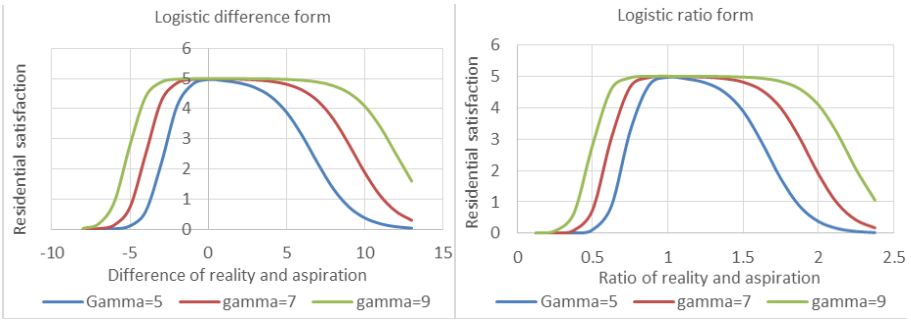


Figure 8.7 Difference and ratio forms of gap-satisfaction models while fixing alpha =0.3, beta=2.5 and theta=5.

Besides the common parameters, the logistic specification uses parameter γ to define the scale of the function for both the difference and ratio measurements (Figure 8.7). When γ increases, the shape of the function becomes wider, which means that for the same amount of change in the gap index approaching the optimal point, the unit increment in satisfaction decreases and individuals become less sensitive about the change in the gap around the optimal point.

8.5 Data

This chapter uses data from three dimensions: house, living environment and neighbourhood. Only continuous attributes from these three dimensions are considered in this analysis. Specifically, the housing dimension contained three attributes: located floor of the house, size of the house and number of bedrooms. As the environmental dimension is the combination of different aspects of relative location or accessibility and the provision of services in the neighbourhood, the living environmental dimension consisted of nine attributes: distance to primary school, distance to retail shop, distance to shopping mall, distance to health centre, distance to recreation facilities, distance to metro stations, number of bus stops, number of retail shops in the community and commuting time. Seven attributes composed the neighbourhood dimension, including frequency of meeting neighbours (per week), number of known neighbours, number of familiar neighbours, number of known new neighbours, frequency of community activities, frequency of self-organised activities and frequency of joining community management. Except for the attribute of meeting neighbours, all the other questions related to frequency is measured on an annual basis. As the data regarding the green environment (e.g., the community park and city park) was collected as categorical data, it is excluded from this analysis.

The sample size adopted in this chapter is same as chapter 5 and 6. Data from 384 respondents are used in this analysis.

8.6 Results

As discussed before, the difference and ratio forms of the exponential, inverse exponential and logistic gap models will be compared to examine the performance of different formulations. Nonlinear, asymmetric and non-truncated features are examined by comparing the performance of previous gap-satisfaction models with the models proposed in this chapter, including the exponential difference model (equation 6, 8), the exponential ratio model (equation 7, 8), the inverse exponential difference model

(equation 6, 9), the inverse exponential ratio model (equation 7, 9), the logistic difference model (equation 6, 10) and the logistic ratio model (equation 7, 10). Here, the previous gap-satisfaction models include our previous linear gap ratio model from chapter 5 (equation 4, 5) and the traditional linear gap difference model that consists for both the linear difference and linear absolute difference models from the literature.

In total, nine models are compared in terms of goodness-of-fit indicators R squared and adjusted R squared values. Results of these models defining the house, living environment and neighbourhood dimensions are listed in Table 8.2. Overall, the nonlinear models outperform the linear models. Among the linear models, our previous linear ratio gap model performs better than the traditional linear (absolute) difference models. For the housing dimension, the nonlinear asymmetric gap ratio models, including both the exponential and logistic ratio models, show the best performance compared with other models. All models in this dimension have a good model fit (R^2> 0.350). It means that the relationship between residential gap and satisfaction is nonlinear, asymmetric without truncation for housing attributes and the gap between aspiration and reality can be best represented with a ratio equation so that given the aspiration level, as the gap between reality and aspiration increases, the residential satisfaction decreases. The model of number of bedrooms has a better fit for the logistic ratio gap model, while the models of other two attributes, floor location and size of house observe a better performance for the exponential ratio model. It means that residents living in renovated historical blocks are relatively more sensitive to the change of gap for floor location and house size compared to bedroom number when reality is close to aspiration.

For the living environmental dimension, except for the model of distance to primary school, all models achieve a reasonable fit (R^2>0.222) with exponential models. The exponential difference gap model has the best performance for most attributes except for the number of stores where the best performance is observed from the exponential ratio model. Only the models of distance to primary school and distance to shopping mall achieve their best fit with the linear ratio gap model, although the model fit for the former model is relatively low. These results indicate that, for most environmental attributes, the relationship between residential satisfaction and gap is nonlinear and asymmetric and residents in historical blocks are sensitive about the change in gap when reality is close to aspiration for environmental attributes.

Table 8.2 Results of R-squared and adjusted R-squared

	Housing dimension						Living environmental dimension													
	Floor		Size		Bedroom NO.		Distance of Primary School		Distance of Retail Shop		Distance of Mall		Distance of Health Centre		Distance of Recreation		Distance of Metro Station		Bus Stop NO.	
	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2
Linear difference	.086	.083	.379	.377	.450	.449	.109	.106	.248	.245	.255	.253	.210	.207	.004	.001	.187	.185	.005	.002
Linear absolute difference	.171	.169	.379	.377	.400	.399	.112	.109	.277	.275	.299	.297	.233	.231	.172	.170	.192	.190	.224	.222
Linear ratio	.316	.314	.492	.490	.469	.468	**.123**	**.120**	.301	.299	**.412**	**.411**	.310	.308	.204	.201	.212	.210	.249	.247
Exponential difference	.204	.201	.426	.425	.470	.468	.116	.114	**.332**	**.331**	.360	.359	**.317**	**.315**	**.222**	**.220**	**.222**	**.220**	**.255**	**.253**
Exponential ratio	**.350**	**.349**	**.506**	**.505**	.490	.489	.091	.089	.243	.241	.201	.199	.254	.252	.146	.143	.127	.125	.238	.236
Logistic difference	.199	.197	.423	.422	.469	.468	.113	.111	.323	.321	.355	.353	.311	.309	.163	.161	.201	.199	.254	.252
Logistic ratio	.344	.342	.501	.499	**.495**	**.494**	.089	.086	.237	.235	.190	.188	.249	.247	.137	.135	.124	.121	.236	.234
Inverse exponential difference	.122	.120	.294	.292	.382	.380	.096	.093	.181	.178	.199	.197	.200	.198	.105	.102	.101	.098	.239	.237
Inverse exponential Ratio	.307	.305	.442	.441	.484	.483	.066	.063	.096	.094	.082	.080	.117	.114	.114	.112	.072	.069	.224	.222

					Neighbourhood dimension													
	Commuting Time		Store NO.		Frequency of Meeting neighbours		Known neighbour NO.		Familiar neighbour NO.		New Neighbour NO.		Frequency of Community Activities		Frequency of Self-organised Activities		Frequency of Joining Management	
	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2	R^2	Adj. R^2
Linear difference	.319	.315	.011	.008	.008	.005	.003	.001	.008	.005	.006	.003	.111	.109	.046	.043	.153	.151
Linear absolute difference	.393	.389	.224	.222	.002	.001	.020	.018	.007	.004	.040	.037	.088	.085	.047	.044	.131	.128
Linear ratio	.396	.393	.264	.262	.102	.100	.140	.138	.114	.112	.029	.026	.240	.238	.121	.118	.233	.231
Exponential difference	**.415**	**.412**	.247	.245	.043	.041	.023	.021	.009	.007	**.063**	**.061**	.156	.154	.050	.048	.234	.232
Exponential ratio	.318	.314	**.265**	**.263**	**.112**	**.110**	.154	.152	.119	.116	.031	.029	.246	.245	.128	.126	**.235**	**.233**
Logistic difference	.413	.410	.247	.245	.042	.039	.023	.020	.009	.006	.062	.060	.155	.152	.050	.047	.222	.220
Logistic ratio	.311	.307	.262	.260	.109	.107	.158	.156	**.133**	**.131**	.027	.024	**.247**	**.246**	**.134**	**.131**	.215	.213
Inverse exponential difference	.306	.302	.205	.203	.041	.038	.015	.012	.005	.002	.003	.003	.006	.006	.044	.041	.107	.104
Inverse exponential Ratio	.084	.079	.223	.221	.107	.105	**.159**	**.157**	.131	.128	.030	.028	.246	.245	.131	.129	.228	.226

The goodness-of-fit for most models in the neighbourhood dimension is less than 0.2. Only the models for frequency of community activities and frequency of joining community management have a reasonable model fit (R^2> 0.235) and they are best described with the nonlinear asymmetric gap ratio model. The satisfaction with more attributes associated with the neighbourhood dimension is best predicted by the logistic gap ratio model compared with the other two dimensions, including the number of familiar neighbours, the frequency of community activity and the frequency of self-organised activities, which indicates that residents are less sensitive to changes in gap around the reference point for neighbourhood attributes. The number of known neighbours is the only attribute best described by the inverse exponential ratio model with a relatively low goodness-of-fit.

The coefficients of the best model for each attribute and relevant graph are summarised in Table 8.3. All estimated parameters are statistically significant at the 1% probability level and all parameters have the same sign. As the model formulation indicated, the smaller gap between aspiration and current situation, the higher satisfaction. When aspiration meets reality, predicted satisfaction is highest.

Different housing attributes have different combinations of parameters. Specifically, an alpha lower than 0.5 for the located floor of the house indicates a higher increase in residential satisfaction for the same amount of change in gap, when reality is lower than aspiration. It also means that residents are less sensitive to underperformance than outperformance of aspiration, which confirms our assumption. The attribute “size of the house” also has an alpha lower than 0.5. But compared with other attributes, the graph of this attribute mainly contains the situation that reality is lower than aspiration. The attribute “number of bedrooms” has an alpha lower than 0.5 and a small value for gamma. As gamma is small, the graph shows that residents are only slightly less sensitive to a change in gap when reality approaches aspiration compared with other housing attributes. The estimated maximum satisfaction for all housing attributes is over 5.

As for environmental attributes, the attribute “number of bus stops within 1000 metres” is the only environmental attribute with an alpha higher than 0.5, which means that the change in satisfaction is larger when the perceived distance is longer than the aspiration compared to the situation that the perceived distance is shorter than the aspired distance. The graph shows residents’ satisfaction might remain constant from the situation that reality exceeds two times aspiration for distance to shopping mall. The attributes “distance to retail shops” and “distance to metro station” both indicate a very

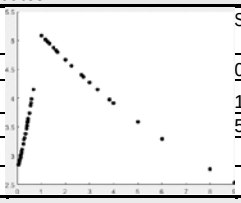
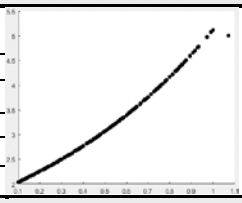
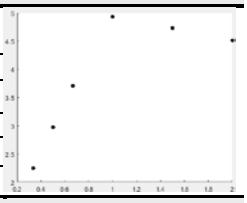
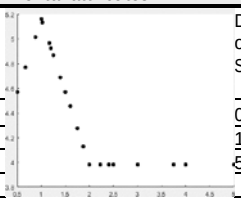
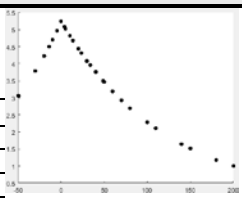
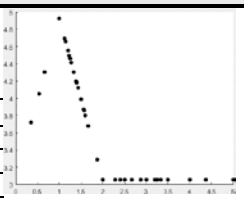
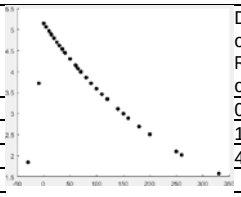
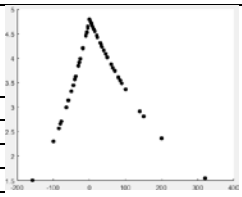
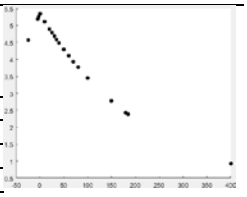
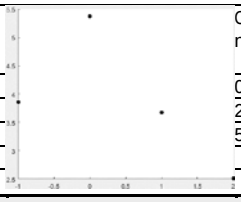
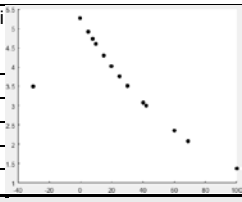
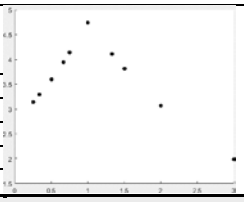
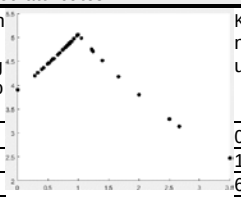
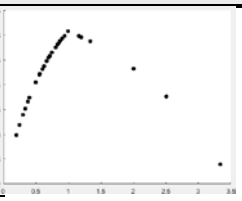
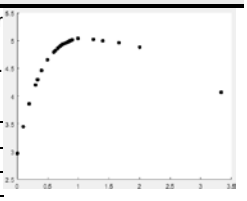
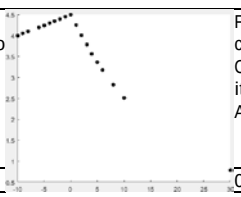
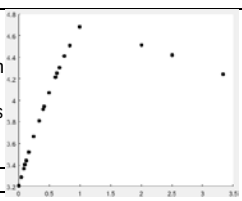
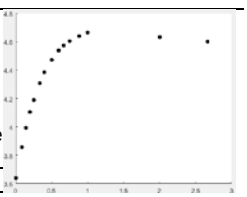
low predicted satisfaction level (around score 1) when the current distance is much longer than the aspiration, but both are predicted to have a high satisfaction level (theta is around score 5.3) when aspiration meets reality. Although the estimated highest and lowest satisfaction levels vary between different attributes, environmental dimension tends to display higher estimated maximum satisfaction than other two dimensions.

For neighbourhood attributes, only the models for frequency of community activities and frequency of management participation have a reasonable model fit. One attribute has an alpha lower than 0.5, while another has the alpha higher than 0.5. Both models lead to a similar prediction of the highest and lowest satisfaction level. The graph of frequency of joining management does not contain the situation that reality exceeds aspiration and only limited amount of residents got the highest satisfaction level, which probably means residents expect to get more involved in community management.

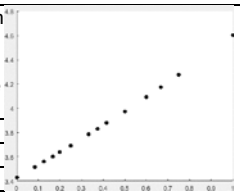
8.7 Conclusions and discussion

During the long history of residential gap studies, the vast majority of prior studies have operationalised the gap as a function of difference between aspiration and perceived reality and have assumed that satisfaction is a linear function of the gap. This chapter is based on the contention that these operationalisations may be too rigorous. Rather, it seems plausible that residential satisfaction is a nonlinear function of residential gap in the sense that the marginal effect of the gap may change along the degree of discrepancy between aspiration and reality. This argument is in line with Galster (1987). Furthermore, we argue that the mapping function of gap on satisfaction may be asymmetric for the situations that aspiration exceeds or below reality. The reason could be that residents have different sensitivities to outperformance and underperformance of aspiration. Then, we argue that the relationship between residential gap and satisfaction should be continuous rather than truncated. Finally, we argue that the gap between aspiration and reality may also depend on the aspiration level besides the generally used difference formulation. The same discrepancy will be perceived higher if the aspiration is already low. To capture this property, a gap ratio specification is suggested.

Table 8.3 Results of parameters and graphs

Housing attributes								
	Floor			Size			Bedroom NO.	
α	0.124			0.240			0.115	
β	0.702			1.347			3.246	
θ	5.088			5.117			6.211	
γ							1.351	
λ								
Living environmental attributes								
	Distance of Primary School			Distance of Retail Shop			Distance of Mall	
α				0.435				
β				1.906				
θ	1.179			5.239			1.872	
γ								
λ	3.982						3.055	
	Distance of Health Centre			Distance of Recreation			Distance of Metro Station	
α	0.093			0.325			0.413	
β	3.867			1.090			1.055	
θ	5.149			4.791			5.346	
γ								
λ								
	Bus Stop NO.			Commuting Time			Store NO.	
α	0.535			0.497			0.442	
β	0.712			2.704			0.987	
θ	5.376			5.264			4.744	
γ								
λ								
Neighbourhood attributes								
	Frequency of Meeting neighbour			Known neighbour NO.			Familiar neighbour NO.	
α	0.524			0.283			0.241	
β	0.546			19.702			5.283	
θ	5.061			6.074			5.109	
γ							4.337	
λ								
	New Neighbour NO.			Frequency of Community Activities			Frequency of Self-organised Activities	
α	0.831			0.140			0.134	
β	0.701			1.707			3.991	
θ	4.499			5.426			4.707	
γ				1.836			4.684	
λ								

	Frequency of joining Management
α	0.687
β	9.378
θ	4.602
γ	
λ	



To account for these ideas, several nonlinear, asymmetric and non-truncated gap-satisfaction models based on the difference and ratio formulations are specified. The various model specifications are compared in terms of their goodness of fit. The relationship between aspiration, gap and residential satisfaction is found to be best represented by different gap-satisfaction models for different dimensional attributes. Nonlinear relationships are found between most attributes of residential gap and satisfaction rather than the linear relationship assumed in previous literature. For housing attributes, exponential and logistic ratio models can best represent their gap-satisfaction relationships, while exponential difference models best represent the gap-satisfaction relationship for environmental attributes. As for the neighbourhood attributes, only two gap models indicate a good model fit and both relationships are best described by nonlinear ratio models. The relatively low model fit in the neighbourhood dimension might be because residential satisfaction in renovated historical blocks is not significantly influenced by neighbourhood attributes as residents have very good neighbourhood bonding in these blocks so that they do not expect higher aspirations than the current situation. Overall, results of the empirical estimations indicate that generally the nonlinear, asymmetric gap models without truncation outperform the traditional linear gap model and our previous linear symmetric gap model with truncation.

The exponential function is found to better describe the gap-satisfaction relationship for renovated historical blocks compared with inverse exponential and logistic functions. The inverse exponential ratio model can only represent the gap-satisfaction relationship for one attribute (number of known neighbours) with a relatively low model fit, while the logistic gap ratio model can best describe the gap-satisfaction relationship for four attributes and only two of these models have good model fit (i.e., number of bedrooms and frequency of joining community activities). None of the inverse exponential difference models or logistic difference models show a high performance. These findings mean that residents living in renovated historical

blocks are sensitive about the change in gap around the optimal point for most residential attributes, except the bedroom number and frequency of joining community activities. Residents are indifferent about the change of satisfaction when the gap is large enough for most attributes except for the number of known neighbours. Compared with other models, the linear ratio model is found to only best describe the variable of distance to the shopping mall with a good model fit.

Different combinations of parameters are examined. Results show that the alpha for most residential attributes is lower than 0.5, which means the increment of satisfaction is lower for aspirations below reality than that for aspirations exceeding reality. It also indicates that residents are less sensitive to underperformance than to the outperformance of aspiration. Larger theta is mainly observed for accessibility attributes in the environmental dimension, which is reasonable in that higher estimated satisfaction might be manifested for accessibilities as the historical blocks are located in the city centre and have very good access to the public transportation and facilities. All the logistic gap models indicate a small gamma, which means the sensitivities of residents around the optimal point is not very low.

Among all attributes from the three dimensions, only two concern the situation that aspiration exceeds reality. The attributes of house size and frequency of joining management are expressed by a limited number of residents for the situation of a higher reality than aspiration. This is reasonable because most residents may be unsatisfied with their house size as houses in historical blocks are generally smaller compared with other urban areas. This result also indicates that inhabitants incline to attend more community management activities in those blocks. Therefore, the larger house size and more community management participations may need to be considered by the local authorities to improve the residential satisfaction in future renovations of historical blocks.

This chapter focuses on the nonlinear asymmetric relationship between residential satisfaction and the gap of aspiration and reality. Several types of nonlinear asymmetric relationships are found and the sensitivity around the optimal point is identified for the historical areas. Gap model raised in chapter 5 is improved to better represent the gap theory. As only housing, environmental and neighbourhood dimensions are included in this chapter, future studies may investigate additional dimensions, such as economic attributes.

9

Heterogeneous Path Model for Intention to Move

9.1 Introduction

In chapter 7, an integrated model was estimated to examine the complex relationships between all key concepts. In particular, a path model was used to estimate the various direct and indirect relationships between the key concepts. This model assumed that the estimated coefficients apply to all respondents. Hence, except for the observed heterogeneity, the model does not account for any differences between respondents as far as the examined relationships. In this chapter, we investigate this issue.

In particular, we will develop a heterogeneous latent class path model (LCP) to analyse the integrated relationships between the key concepts in this chapter. The intention to move house is influenced by residential satisfaction, which in turn is influenced by the gap between aspiration (desired situation) and reality (perceived current situation). To specify heterogeneity, the latent class path model is developed as a latent segmentation approach to specify the heterogeneity between residents in terms of the structure of the relationships between these observable variables that influence residential choices.

The aim of this chapter therefore is to formulate such an integrated model that examines the direct and indirect relationships between intention to move, residential satisfaction, residential gap and social-demographic characteristics, and further identifies the distinct decision patterns between different groups of individuals. This model will be estimated using the same data set with the chapter 7. To the best of our knowledge, this is the first study applying this approach in residential satisfaction and residential mobility research.

The remainder of the chapter is structured as follows: the next section will review some prior research on residential satisfaction and mobility from a methodological perspective. Then, a conceptual model will be proposed and the formulation of the LCP will be explained. The fourth section will interpret the results of the model estimation. The last section will draw some conclusions with a discussion of model findings about the intention to move in renovated historical blocks in China.

9.2 Literature review

In this literature review, our focus of attention will be on the issue how heterogeneity was taken into account in prior studies on residential satisfaction and residential choice behaviour. In fact, the conclusion of the literature research is that most existing studies have implicitly or explicitly assumed that the estimated parameters apply equally to every individual (with the same socio-demographic profile), indicating that unobserved heterogeneity was not taken into account. In part, this finding can be explained by the fact that the issue of unobserved heterogeneity was an unknown issue when research on residential satisfaction and choice was high on the research agenda. Only recently, with the development of models accounting for unobserved heterogeneity, this issue has been studied in residential choice behaviour.

Mixed logit models that estimate individual taste variation by identifying random parameters have attracted more attention. For example, Dane et al. (2014) studied how housing and work attributes, e.g. life cycle events and social-demographics, influence moving intentions using a binary mixed logit model. It was found that a high degree of heterogeneity in the intention to move house exists between people with lower education degrees.

Besides mixed logit models, the heterogeneity between residents has been examined using latent class analysis. For example, Burholt (1999) identified five groups of the elderly regarding their moving distance and individual characteristics using longitudinal data. Later, Ettema (2010) used the latent class discrete choice model to estimate the residential preferences of telecommuters on moving houses. Recently, the interest in examining unobserved heterogeneity in choice behaviour is increasing in housing location choice studies (Walker & Li, 2007; Liao et al., 2014; Olaru et al., 2011; Smith & Olaru, 2013). Different latent classes, each with a specific utility function, are identified. Class membership is typically predicted as a function of individual characteristics.

However, all these examples only concern simple models examining single relationships. To the best of our knowledge, prior housing studies have not addressed unobserved heterogeneity between individuals in complex structural equation models or path models. There is no reason to ignore this issue. In the process underlying the residential mobility decision, the reasons behind moving intention may vary for residents from different background. Different groups of residents may consider the same attributes having various importance while generating the moving intention. Thus, it is worthwhile to identify latent classes in the residential decision making process and simultaneously capture the different causal structures of direct and indirect relationships. This study sets out to explore that option.

9.3 Conceptual framework and model formulation

9.3.1 Conceptual framework

Same with the chapter 7, this chapter will analyse both the direct and indirect relationships between residential gap, satisfaction and intention to move. To specify the heterogeneity, a latent class variable is also included in the model. The class membership is assumed to be identified by social demographic information (Figure 9.1).

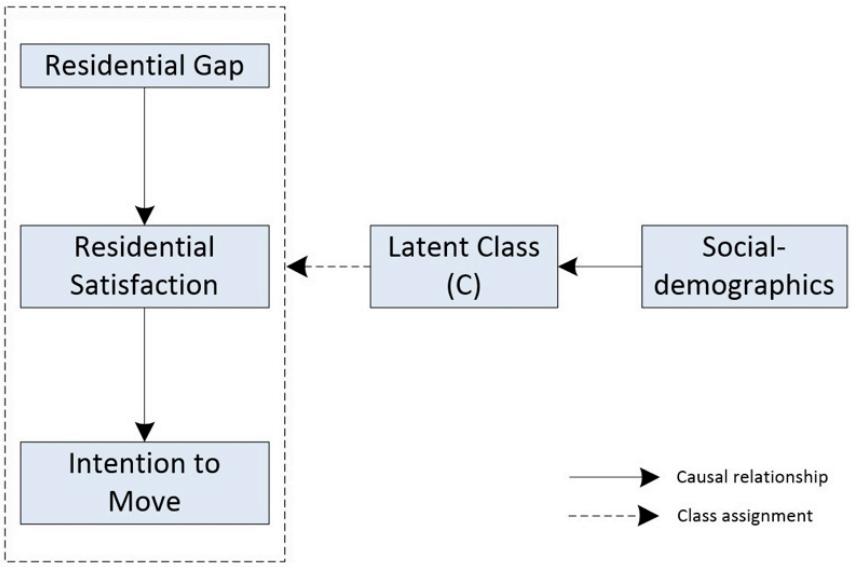


Figure 9.1 Conceptual model

In reality, different groups of residents may have different residential mobility preferences and the preferences are influenced by their own individual backgrounds. Moreover, residents may face different constraints while trying to act on their preferences and achieve their aspirations. In this chapter, the heterogeneity between residents is captured by specifying the latent classes in terms of residents' aspiration, residential satisfaction and moving intention. The class membership is treated as a function of social-demographic information which refers to common attributes from previous literatures regarding satisfaction or mobility. Specifically, personal and household characteristics, like gender (Kim et al., 2015), supporting elderly or not (W. A. V. Clark & Davies Withers, 1999), tenure (Lu, 2002; Huang & Deng, 2006) and education (Liao, 2004; Green, 2014) are chosen. Moreover, because the renovation condition of historical blocks may affect residents' thoughts, renovation stage is also included in this study to identify class membership.

It should be noted that this chapter uses the same data set with chapter 7, mainly focusing on the physical aspect of houses. To get a relative comprehensive understanding about the influence of physical factors, both attributes for house itself and attributes regarding the housing surroundings are considered. Therefore, housing and living environmental attributes are included as the empirical data.

9.3.2 Model formulation

To explain the modelling approach, the concept of gap plays a key role. Considering the complexity of latent class path model, the simpler residential gap formulated in chapter 5 is adopted in this chapter. The residential gap is defined in terms of the ratio gap index (g_{ik}) between aspiration (A_{ik}) and reality (R_{ik}), a lower gap index refers to a bigger gap between aspiration and reality.

Basically, the latent class path model is a path model with mixture structures where the latent categorical variable is incorporated to identify the latent classes that individuals belong to. Different from the continuous latent variables used in general structure equation models, a discrete latent variable is used in latent class models to capture the unobserved heterogeneity. It assumes that a certain number of latent classes result in the conditional independence of different outcomes. By keeping the homogeneity within each class, the interdependency relationships between variables across classes are different. The model can be treated as a member of the general finite mixture model. More details regarding the general model definition can be found in (Muthen & Shedden, 1999) and (Bengt O. Muthén, 2002).

Assume there are C latent classes or groups, in the current study, the overall probability of individual *i* having the intention to move *y*, $P_i(y)$, is then the summed product of the probability of moving intention of individual *i* given latent class *c* (c_i =1,2, ..., C), $P(y|c_i = c)$, and the probability of individual i belonging to certain class *c* giving influential variable $\boldsymbol{z}_i$, namely $P(c_i = c|\boldsymbol{z}_i)$ (Jahanshahi & Jin, 2016). Thus, the unconditional probability of individual *i* having the intention to move is:

$$P_i(y) = \sum_{c=1}^{C} P(c_i = c|\boldsymbol{z}_i) \cdot P(y|c_i = c) \quad (1)$$

where *y* is the categorical dependent variable, intention to move. *c* is the latent class categorical variable. $\boldsymbol{z}_i$ is a vector of variables that influences the class membership probability.

The class membership that an individual *i* belongs to class *c* is considered a function of social demographics of individual *i*, which can be formulated through a multinomial logistic function:

$$P(c_i = c|\boldsymbol{z}_i) = \frac{e^{\alpha_c + \boldsymbol{\gamma}_c \boldsymbol{z}_i}}{\sum_{c=1}^{C} e^{\alpha_c + \boldsymbol{\gamma}_c \boldsymbol{z}_i}} \quad (2)$$

where $\boldsymbol{\gamma}_c$ is a vector of slope parameters. $\boldsymbol{z}_i$ is a vector of the social-demographic information of individuals and/or households.

Because latent class path models are composed of both a latent class specification and a path analysis, it can estimate the direct and indirect causal relationships and, at the same time, identify the heterogeneity between individuals through group classification. In the part of path model, different from the typical path model that consists of a set of solely linear regressions, this path model is composed of linear regression and binary logit models. Following the majority of prior studies, residential satisfaction is measured as interval scales (Temelová & Dvořáková, 2012; Mohit & Adel Mahfoud, 2015; Addo, 2016), while intention to move is considered to be a nominal dependent variable (Clark, 2013; Clark & Maas 2015; Clark & Coulter, 2015). Specifically, in this chapter, the intention to move is treated as a binary variable, referring to intention to move and not move. So the linear regression in the path model explains the causal relationship between residential gap and residential satisfaction while the binary logit model represents the influence of residential satisfaction on intention to move. As heterogeneity exists between individuals, the difference in preferences is identified through the classification of individuals. Here, the latent classes are determined based on the underlying structural relationships within path model, and the class membership is identified regarding social-demographic characteristics.

Based on the structural dependency presented in Figure 9.1, within each class *c*, the relationship between satisfaction and residential gap is assumed to be linear:

$$s_{in} = \theta_{0c} + \sum_{k=1}^{K} \theta_{ck} g_{ik} + \varepsilon_n \quad (3)$$

where s_{in} is the satisfaction of individual *i* on attribute *n* (*n*=1,2,...,*N*). g_{ik} is the residential gap of individual *i* for attribute *k*. θ_{0c} and θ_{ck} are parameters to be estimated. ε_n is a normally distributed error term.

As the dependent variable "intention to move" is categorical, the probability of the intention to stay ($y_i = 0$) and the intention to move ($y_i = 1$) regarding individual *i* in each class can be expressed using a dichotomous probability function:

$$P_i(y|c_i = c) = \begin{cases} \frac{1}{1+e^{\beta_{0c}+\sum_{n=1}^{N}\beta_{cn}s_{in}}} & , y_i = 0 \\ \frac{1}{1+e^{-(\beta_{0c}+\sum_{n=1}^{N}\beta_{cn}s_{in})}} & , y_i = 1 \end{cases} \quad (4)$$

Here, $P_i(y|c_i = c)$ refers to the probability of intention to move for individual *i* given class *c*. β_{0c} and β_{cn} are parameters to be estimated.

To estimate the LCP model, a maximum-likelihood estimation procedure incorporating the Expectation-Maximization (EM) algorithm is needed because of the estimation of latent class variables. The EM algorithm is especially suitable for estimation problems that involves latent variables or missing data (Dempster, Laird, & Rubin, 1977). In general, EM algorithm implements an iterative and transition calculation between the steps of expectation (E) and maximization (M) until the convergence condition is matched.

In the LCP model presented in Figure 9.1, the expectation of the complete log-likelihood depends on all observed variables in the path model. Thus, it can be expressed by a posterior probability using Bayesian theory (B.O. Muthén, 2004):

$$P_{ic} = P(c_i = c|\boldsymbol{y}_i, \boldsymbol{s}_i, \boldsymbol{g}_i, \boldsymbol{z}_i) = \frac{P(c_i=c|\boldsymbol{z}_i)P(\boldsymbol{s}_i|\boldsymbol{c}_i,\boldsymbol{g}_i)P(\boldsymbol{y}_i|\boldsymbol{c}_i,\boldsymbol{s}_i)}{P(\boldsymbol{y}_i,\boldsymbol{s}_i|\boldsymbol{g}_i)} \quad (5)$$

where P_{ic} refers to the posterior probability of individual *i* belonging to class *c* (B.O. Muthén, 2000).

Because of the inherent dependency between variables of *y, s, g* in the path model, the latent class *c* and social-demographics (*z*), the expectation is based on the relationships between all variables, including the relationship between $\boldsymbol{c}$ and $\boldsymbol{z}$, $\boldsymbol{s}$ and $\boldsymbol{c}, \boldsymbol{g}$, $\boldsymbol{y}$ and $\boldsymbol{c}, \boldsymbol{s}$. Considering the mechanism of EM algorithm, the expectation of log likelihood should be the sum of all the interdependencies within the path model

(Muthen & Shedden, 1999; Gupta & Chen, 2010). Therefore, the expectation of the log likelihood is the expectation of the sum of following three log likelihood functions:

$$E\{log\ L(c_i = c|\boldsymbol{z}_i) + log\ L(\boldsymbol{s}_i|\boldsymbol{c}_i, \boldsymbol{g}_i) + log\ L(\boldsymbol{y}_i|\boldsymbol{c}_i, \boldsymbol{s}_i)\} \quad (6)$$

Using probability expression, equation (6) becomes:

$$E\left\{log \prod_{i=1}^{I} P(c_i = c|\boldsymbol{z}_i) + log \prod_{i=1}^{I} P(\boldsymbol{s}_i|\boldsymbol{c}_i, \boldsymbol{g}_i) + log \prod_{i=1}^{I} P(\boldsymbol{y}_i|\ \boldsymbol{c}_i, \boldsymbol{s}_i)\right\}$$

$$= E\left\{\sum_{i=1}^{I} log\ P(c_i = c|\boldsymbol{z}_i) + \sum_{i=1}^{I} log\ P(\boldsymbol{s}_i|\boldsymbol{c}_i, \boldsymbol{g}_i) + \sum_{i=1}^{I} log\ P(\boldsymbol{y}_i|\ \boldsymbol{c}_i, \boldsymbol{s}_i)\right\}$$

$$= E\left\{\sum_{i=1}^{I} [log\ P(c_i = c|\boldsymbol{z}_i) + log\ P(\boldsymbol{s}_i|\boldsymbol{c}_i, \boldsymbol{g}_i) + log\ P(\boldsymbol{y}_i|\ \boldsymbol{c}_i, \boldsymbol{s}_i)]\right\} \quad (7)$$

Because the expectation of the sum of three relations in Equation (7) is equivalent to the sum of the expectation of each element, we can address the expectation of each element separately. For $\boldsymbol{c}$ related to $\boldsymbol{z}$, the maximization of expectation is:

$$E\left\{\sum_{i=1}^{I} [log\ P(c_i = c|\boldsymbol{z}_i)]\right\} = \sum_{i=1}^{I} \sum_{c=1}^{C} P_{ic}\ log\ P(c_i = c|\boldsymbol{z}_i) \quad (8)$$

Considering that s is a continuous variable, the expectation for $\boldsymbol{s}$ related to $\boldsymbol{c}, \boldsymbol{g}$ is:

$$E\left\{\sum_{i=1}^{I} [log\ P(\boldsymbol{s}_i|\boldsymbol{c}_i, \boldsymbol{g}_i)]\right\}$$

$$= E\left\{\sum_{i=1}^{I} \sum_{c=1}^{C} c_i\ log\ P(\boldsymbol{s}_i|\boldsymbol{g}_i)\right\} = \sum_{i=1}^{I} \sum_{c=1}^{C} P_{ic}\ log\ P(\boldsymbol{s}_i|\boldsymbol{g}_i)_c \quad (9)$$

Considering that y is a categorical variable, the expectation for $\boldsymbol{y}$ related to $\boldsymbol{c}, \boldsymbol{s}$ is:

$$E\left\{\sum_{i=1}^{I} [log\ P(\boldsymbol{y}_i|\ \boldsymbol{c}_i, \boldsymbol{s}_i)]\right\}$$

$$= \sum_{i=1}^{I} \sum_{c=1}^{C} P_{ic}\ [log\ P(y_i = 0|\boldsymbol{c}_i, \boldsymbol{s}_i) + log\ P(y_i = 1|\boldsymbol{c}_i, \boldsymbol{s}_i) \quad (10)$$

9.4 Results

This section presents the results of the latent class path model that was estimated using Mplus. Because determining the optimal number of classes is important in latent class analysis, models with two classes and three classes were tested. Results are shown in Table 9.1. Comparing all criteria, despite the same BLRT (Bootstrap likelihood ratio test), the model with two classes has a lower Bayesian Information Criterion (BIC), lower Vuong-Lo-Mendell-Rubin test (VLMR) and a higher entropy, higher Akaike's Information Criterion (AIC). As Nylund (2007) indicated that AIC may not be a good indicator for class enumeration in latent class analysis (LCA) with categorical outcomes, while BIC normally performs better in an LCA Monte Carlo study than AIC, leading to that BIC is a more reliable criteria to determine the optimal number of classes. The VLMR is significant for the two-class model and insignificant for the three-class model, which suggests that the two-class model is better than single class model and two classes are already sufficient so that three classes are not needed. As an important criterion in LCA, entropy evaluates the quality of each class that is represented by the data. Empirically, entropy over 0.8 is preferred (Carragher, Adamson, Bunting, & McCann, 2009). Therefore, with a higher entropy and lower BIC and VLMR, the model with two classes is adopted.

The results of the two-class path model are shown in Figure 9.2 and Table 9.2. It is found that the impacts of housing and living environmental satisfaction on the intention to move house are significant in class 2 and insignificant in class 1, indicating that respondents in class 1, are not influenced by neither housing nor living environmental satisfaction. It means that the moving intention of class 1 may be influenced by other dimensional satisfaction. This is probably because of the variations in the social-demographic background of residents. The housing satisfaction in class 2 (-0.718) has a bigger influence on the intention to move than living environmental satisfaction (-0.584). The negative signs indicate that lower housing satisfaction or living environmental satisfaction will lead to higher intention to move, which is as expected.

Table 9.1 Comparison of results between different classes.

Number of class	AIC	BIC	Entropy	VLMR	BLRT
2 classes	2390.362	2551.366	0.810	0.09	0.00
3 classes	2342.733	2597.983	0.759	0.43	0.00

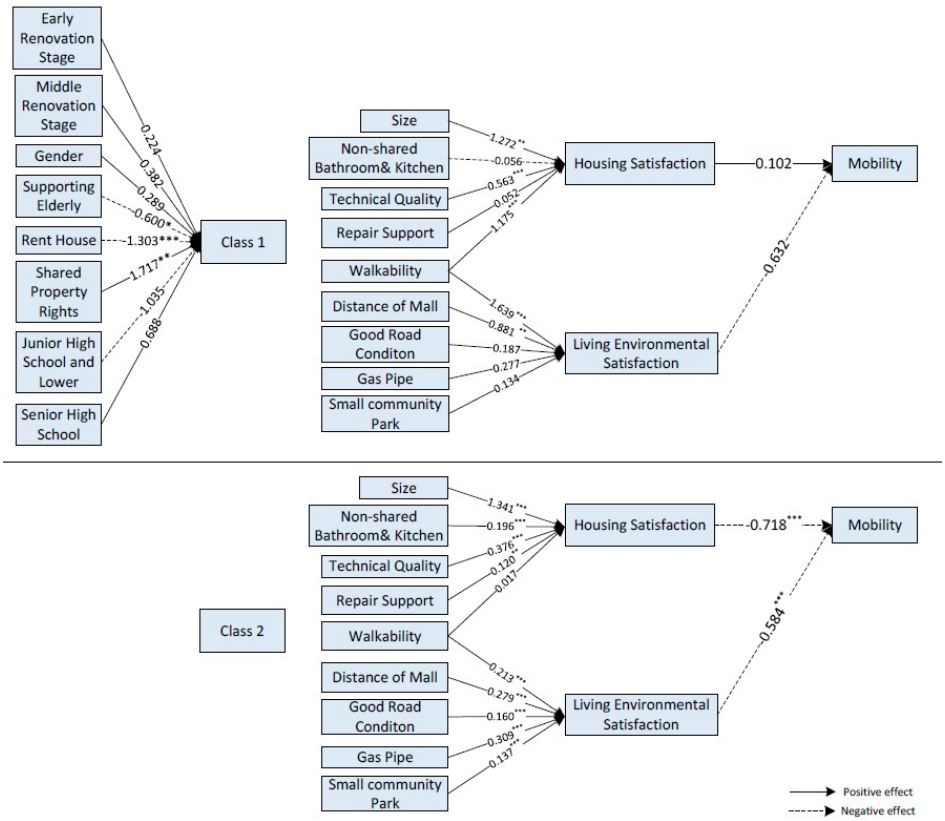


Figure 9.2 Results of latent class path model

Table 9.2 Comparison of detailed results from two classes.

Dependent variable	Determinants	Class 1	Class 2
Intention to move	Housing satisfaction	0.102	-0.718***
	Living environmental satisfaction	-0.632	-0.584***
Housing satisfaction	Size	1.272**	1.341***
	Non-shared kitchen and bathroom	-0.056	0.196***
	Technical quality	0.563***	0.376***
	Government repair support	0.052	0.12**
	Walkability	1.175***	0.017
Living environmental satisfaction	Distance of mall	0.881**	0.279***
	Good road condition	0.187	0.16***
	Gas pipe	0.277	0.309***
	Small community park	0.134	0.137***
	Walkability	1.639***	0.213***

Note: ***P<0.01 **P<0.05 *P<0.1

Table 9.3 Results of class membership.

Social-demographic variables	Class 1	Class 2
Early renovation stage	0.224	-0.224
Middle renovation stage	0.382	-0.382
Gender	0.289	-0.289
Supporting Elderly	-0.600*	0.600*
Rent house	-1.303***	1.303***
Shared property rights	1.717**	-1.717**
Junior high school and lower	-1.035	1.035
Senior high school	0.688	-0.688

Note: ***P<0.01 **P<0.05 *P<0.1

In both classes, all residential gap indices have positive impacts on residential satisfaction except for the one that is insignificant (non-shared bathroom & kitchen in class 1), which coincides with the assumption that residents feel more satisfied when reality approaches their aspiration. The smaller the gap index, the larger the gap and the lower the residential satisfaction. In class 1, the gap index for house size (1.272) influences residents' housing satisfaction the most, followed by the gap index for technical quality (0.563) and walkability (1.175). This means the residential satisfaction for residents in class 1 is mainly influenced by the house size. In case of the satisfaction on environment, only the coefficients of walkability (1.639) and distance of shopping mall (0.881) are statistically significant, in which the effect of walkability is almost doubled relative to that of distance to shopping mall. This indicates that the living environment with better walkability can significantly increase people's satisfaction. It should be noted that the gap index of walkability has a significant effect on both housing and residential satisfaction in class 1.

In class 2, all gap variables except for walkability exert significant and positive effects on housing satisfaction, which means residential gap will increase the residential satisfaction. Among all gap indices, the house size is again the most influential variable, while the repair support from government is the least important variable. Not like the residents in class 1 who consider only walkability and distance to shopping mall important, all gap indices in the dimension of living environmental satisfaction are significant in class 2, which means residents in class 2 also care about other aspects regarding facilities and infrastructures, e.g. good road condition, gas pipe and small community park.

To better understand class differences, class membership is measured using social-demographic information. Results in Table 9.3 show that the estimates of

supporting elderly, rent house and shared property rights are statistically significant. The coefficient of renting house equals to -1.303 for class 1, which means that the probability of respondents belonging to latent class 1 is affected significantly by shared property rights with government and not renting houses, while probability of residents in class 2 is significantly influenced by own or rent houses. The coefficient of supporting elderly is negative (-0.600) for class 1, which indicates that the probability that residents supporting elderly belong to class 2 is higher than the probability they belong to class 1. Note that the probability that respondents belong to class 1 is 11%, while the probability is 89% they belong to class 2.

9.5 Conclusions and discussion

Although a large number of studies have enhanced our knowledge about residential mobility, there is lack of attention to the unobserved heterogeneity between residents. Differences in residential preference and mobility have been largely explained in terms of observed socio-demographic profiles, while the number of studies on the effects of unobserved heterogeneity is dramatically small and has been mainly confined to studies on residential location choice. It seems that the heterogeneity between different groups of residents underlying integrated models has not been addressed yet in the literature.

Thus, this chapter proposes a latent class path model to explore the differences in residential decision structure, depicted in the direct and indirect interdependencies between intention to move, residential satisfaction regarding the house and living environment and residential gap, in which residential satisfaction is viewed as a function of the discrepancy between aspiration and perceived reality. The model specifies class membership as a function of social-demographic characteristics. Using data collected from eight historical blocks in two selected Chinese cities, the proposed latent class path model was estimated. As demonstrated, the model is capable of identifying heterogeneity and interdependency between different variables in a comprehensive way.

Results show that a clear difference exists between two groups of residents in residential mobility when taking into account the level of aspiration and residential satisfaction. The intention to move house is significantly influenced by housing and living environmental satisfaction for residents in class 2, but not in class 1. For residents in class 1, their moving intention may be influenced by residential satisfaction of other dimensions that is not considered in this study. Being consistent with residential studies in other urban areas (e.g., Ren & Folmer, 2016; Ghasrodashti, Majedi & Paydar, 2017),

housing satisfaction was found the most influential for moving intention. Compared with the residents in class 2 who tend to consider most residential gaps important, the housing satisfaction of residents in class 1 is only influenced significantly by gap index of house size, technical quality and walkability (influence of governmental repair support and non-shared kitchen and bathroom are insignificant). The gap ratio regarding house size is the most important indicator for residents in both classes. Even though house size is also found significant in studies for other urban areas (Huang et al., 2014; Huang & Du, 2015), it is regarded as the most significant in historical blocks as the small house size in these blocks is a large constraint for residents. Moreover, the residential gaps show different effects on living environmental satisfaction between the two classes. Compared with residents in class 1 whose living environmental satisfaction is only significantly influenced by walkability and distance to shopping mall, respondents in class 2 also consider good road conditions, gas pipe and small community park important.

Results of the membership estimation show that on average people who own or rent a house and need to support elderly are more likely to belong to class 2, while people who have shared property rights and are not bounded to support elderly are more likely to belong to class 1.

The model proposed in this chapter combines a latent class analysis and a path model to estimate the intention to move and the direct and indirect dependencies with the levels of satisfaction and residential gaps. The heterogeneity among different groups of residents are captured. Future studies may consider incorporating additional dimensions of influential indicators in the integrated model besides the physical ones, e.g. social network characteristics. Moreover, the model may be re-estimated with the difference and ratio gap indices from chapter 8.

10

Conclusions and Discussion

Although gap theory has been introduced in housing studies for a long time, it still leaves room for improvement. Residential gap and several similar concepts have been operationalised in different ways. The literature lacks intense methodological discussion. Integrated studies linking residential gap to satisfaction and intention to move are scarce.

This PhD study therefore has developed a systematic framework between intention to move, various levels and dimensions of residential satisfaction, the gap between aspiration and reality and individual/ household characteristics. Using empirical data from renovated historical blocks in selected Chinese cities, the framework was investigated. Following the trend in residential studies, first the single relationships between the key concepts in the theoretical framework are examined. Next, the multiple relationships between all the concepts were analysed simultaneously.

Overall, the empirical findings support the potential value of the concept of gap. Evidence not only shows that gap is systematically related to residential satisfaction and further moderated the intention to move house, but also indicates that gap-based models outperform classic models in which residential satisfaction is directly explained in terms of a set of physical attributes, controlling for socio-demographics.

These results have important ramifications for urban planning and renovation of historical blocks. First, urban planners should realise that aspirations of people matter. Commonly adopted views that more is better are not necessarily true. Better understanding local needs and aspirations would give planners information about the differences in gaps between residents' aspirations and current or planned reality. It helps planners to understand the real and urgent needs of residents rather than simply put efforts on the "insufficient elements". Second, the results of our analyses have provided empirical evidence about the relative importance of the various attributes. In

case of limited budgets in renovation, results indicate that urban planners can enhance satisfaction most by investing in housing attributes, infrastructure and walkability due to the particularity of these renovated historical blocks. Other attributes seem less contributing to residential satisfaction. This may in fact save a lot of money in renovation. Third, more governmental repair support should be provided to reduce the deterioration of those historical buildings and better the living environment as having rental property rights restricts residents' action of upgrading their houses. From the results of the survey and the interviews, residents mentioned that governmental repair support is always helpful despite low influence on residential satisfaction due to the insufficiency. Especially for families having elderly to support or residents without jobs, if aspiration remains, more governmental repair support is important due to their financial loads. Besides improving the housing and environment, local authorities can invite more residents participate in the renovation process, which could enhance the communication and cooperation between government and residents for future renovations.

In addition to estimate the various relationships between the key concepts of the conceptual framework using classic methods, this thesis explored two methodological issues. First, several non-linear models expressing the relationship between residential gap and satisfaction were explored. The estimation results indicate that overall the nonlinear asymmetric gap models outperform the linear gap models. The model fit for housing and living environmental attributes are very good. Satisfaction for housing attributes is predicted best with nonlinear asymmetric gap ratio models, while the environmental attributes are best represented by nonlinear asymmetric difference models. In case of the neighbourhood dimension, nonlinear asymmetric gap ratio models show the best performance, while these gap ratio models yield a good fit only for two attributes. Second, unobserved heterogeneity was assessed by estimating a latent class path model. To the best of our knowledge, this is the first time such a model was estimated in the residential mobility literature. Results added to the interpretability of the basic findings.

Although this thesis has examined all the relationships between the key concepts, there is still some room for extensions and to address challenges in further studies. It would be possible to analyse the formation of aspirations. Even though aspiration is included in this thesis as the component of residential gap, the difference between the ways that individuals perceive their aspirations is still unclear. People with certain background may tend to express a higher aspiration. Exploring the determinants

of aspiration can help understand the residential gap. Thus, the determinants of aspiration are worthy to investigate.

Several chapters of the current thesis have used intention to move house as the final dependent variable. As discussed, intentions do not always materialise into real moves. Hence, future research may wish to add the direct and indirect relationships of the selected variables to the question whether the intention to move was followed by a real move or not. It takes longitudinal data to achieve this extension.

As for the challenges, the newly introduced models are based on a priori definition of the reference point of the model. That is, we assumed that satisfaction is highest when aspiration equals perceived reality. This assumption would only be correct if aspirations and perceived reality can be measured with error, and the relationship between gap and satisfaction is deterministic. None of these conditions is likely true. Hence, the challenge would be to estimate the measurement of aspiration and gap and the functional relationship between residential gap and satisfaction simultaneously, which may indicate that the maximum satisfaction is located elsewhere. Even if we would measure aspiration as an ideal point, it may be that respondents are more satisfied if their perceived reality exceeds this ideal.

Then, one more challenge could be incorporating the nonlinear asymmetric gap model into a complex model to examine the heterogeneity issue. In chapter 9, we proposed the latent class path model using the asymmetric and truncated gap index. As we already indicated in chapter 8 that the gap index could be either difference or ratio formulation without truncation and the relationship between residential gap and satisfaction should be nonlinear and asymmetric, so proposing a new structure equation model that can incorporate this new raised gap model could be worth working on in future.

Finally, another challenge for future research is to better model how residential gap finally leads to the actual move. According to the theory, dissatisfaction stemming from the discrepancy between aspiration and perceived reality should reach some accumulated threshold before people start considering moving house. However, residents may also reduce their aspiration and accept reality or make adjustment to their living situation. Unfortunately, we could not study this decision-making process because our sample is selective in the sense that we could not observe any people who moved. The challenge is how to design and administer a longitudinal study that would follow people over a long period of time and regularly measure their aspirations,

satisfaction, intention to move and actual move. Challenging is also how to analyse such data. We hope that future studies will embark on this challenge.

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Author index

Subject index

Curriculum Vitae

Wen Jiang was born on 13th September, 1985 in Chengdu, China. She obtained her Bachelor degree in Urban Planning and City Design in Chongqing University in 2009. Ranked 5th in the whole department, she was recommended to continue the Master study in Urban Planning with a three-year scholarship. During her master study, she successfully applied for innovative research funding from Chongqing University. Besides conducting research on urban regeneration, she was also involved in many applied planning projects, which helped her to better understand the planning circumstances in China. In 2012, she graduated with honours at the Chongqing University.

The next year, funded by the Chinese Scholarship Council, she moved to the Netherlands and joined the Eindhoven University of Technology for PhD study. During the PhD study, she focused on the analyses of residential satisfaction and intention to move. Part of that project has appeared in Cities, other parts are currently under review. Her research interests range from urban regeneration and urban planning to residential behaviour.

Publication list

Jiang, W., Feng, T., Timmermans, H., & Li, H. (2017). A gap-theoretical path model of residential satisfaction and intention to move house applied to renovated historical blocks in two Chinese cities. *Cities*, *71*(11), 19–29.

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Generic Representations
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Johann Santini Aichel: Architectuur en Ambiguiteit
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Concrete Behaviour in Multiaxial Compression
Erik van Geel

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Modelling Site Selection
Frank Witlox

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Ecolemma Model
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Conjoint Approaches to Developing Activity-Based Models
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Eric Molin

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Modelling Architectural Design Information by Features
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A Spatial Decision Support System for the Planning of Retail and Service Facilities
Theo Arentze

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Integrated Lighting System Assistant
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Temporal Aspects of Theme Park Choice Behavior
Astrid Kemperman

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Manon van Middelkoop

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Urban Form and Activity-Travel Patterns
Daniëlle Snellen

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Design Research in the Netherlands 2000
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Computer Aided Dimensional Control in Building Construction
Rui Wu

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A Bamboo Building Design Decision Support Tool
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Heating Monumental Churches
Henk Schellen

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Van Woningverhuurder naar Aanbieder van Woongenot
Patrick Dogge

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Moisture Transfer Properties of Coated Gypsum
Emile Goossens

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Plybamboo Wall-Panels for Housing
Guillermo E. González-Beltrán

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The Future Site-Proceedings
Ger Maas
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Radon transport in Autoclaved Aerated Concrete
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Well Being in Hospitals
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Solares Bauen: Implementierungs- und Umsetzungs-Aspekte in der Hochschulausbildung in Österreich
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Shauna Mallory-Hill

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Chengyu Sun

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Uncertainty and Sensitivity Analysis in Building Performance Simulation for Decision Support and Design Optimization
Christina Hopfe

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Influence of Temperature on Concrete Beams Strengthened in Flexure with CFRP
Ernst-Lucas Klamer

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Sturen op Klantwaarde
Jos Smeets

nr 139
Lateral Behavior of Steel Frames with Discretely Connected Precast Concrete Infill Panels
Paul Teewen

nr 140
Integral Design Method in the Context of Sustainable Building Design
Perica Savanović

nr 141
Household Activity-Travel Behavior: Implementation of Within-Household Interactions
Renni Anggraini

nr 142
Design Research in the Netherlands 2010
Henri Achten

nr 143
Modelling Life Trajectories and Transport Mode Choice Using Bayesian Belief Networks
Marloes Verhoeven

nr 144
Assessing Construction Project Performance in Ghana
William Gyadu-Asiedu

nr 145
Empowering Seniors through Domotic Homes
Masi Mohammadi

nr 146
An Integral Design Concept for Ecological Self-Compacting Concrete
Martin Hunger

nr 147
Governing Multi-Actor Decision Processes in Dutch Industrial Area Redevelopment
Erik Blokhuis

nr 148
A Multifunctional Design Approach for Sustainable Concrete
Götz Hüsken

nr 149
Quality Monitoring in Infrastructural Design-Build Projects
Ruben Favié

nr 150
Assessment Matrix for Conservation of Valuable Timber Structures
Michael Abels

nr 151
Co-simulation of Building Energy Simulation and Computational Fluid Dynamics for Whole-Building Heat, Air and Moisture Engineering
Mohammad Mirsadeghi

nr 152
External Coupling of Building Energy Simulation and Building Element Heat, Air and Moisture Simulation
Daniel Cóstola

nr 153
Adaptive Decision Making In Multi-Stakeholder Retail Planning
Ingrid Janssen

nr 154
Landscape Generator
Kymo Slager

nr 155
Constraint Specification in Architecture
Remco Niemeijer

nr 156
A Need-Based Approach to Dynamic Activity Generation
Linda Nijland

nr 157
Modeling Office Firm Dynamics in an Agent-Based Micro Simulation Framework
Gustavo Garcia Manzato

nr 158
Lightweight Floor System for Vibration Comfort
Sander Zegers

nr 159
Aanpasbaarheid van de Draagstructuur
Roel Gijsbers

nr 160
'Village in the City' in Guangzhou, China
Yanliu Lin

nr 161
Climate Risk Assessment in Museums
Marco Martens

nr 162
Social Activity-Travel Patterns
Pauline van den Berg

nr 163
Sound Concentration Caused by Curved Surfaces
Martijn Vercammen

nr 164
Design of Environmentally Friendly Calcium Sulfate-Based Building Materials: Towards an Improved Indoor Air Quality
Qingliang Yu

nr 165
Beyond Uniform Thermal Comfort on the Effects of Non-Uniformity and Individual Physiology
Lisje Schellen

nr 166
Sustainable Residential Districts
Gaby Abdalla

nr 167
Towards a Performance Assessment Methodology using Computational Simulation for Air Distribution System Designs in Operating Rooms
Mônica do Amaral Melhado

nr 168
Strategic Decision Modeling in Brownfield Redevelopment
Brano Glumac

nr 169
Pamela: A Parking Analysis Model for Predicting Effects in Local Areas
Peter van der Waerden

nr 170
A Vision Driven Wayfinding Simulation-System Based on the Architectural Features Perceived in the Office Environment
Qunli Chen

nr 171
Measuring Mental Representations Underlying Activity-Travel Choices
Oliver Horeni

nr 172
Modelling the Effects of Social Networks on Activity and Travel Behaviour
Nicole Ronald

nr 173
Uncertainty Propagation and Sensitivity Analysis Techniques in Building Performance Simulation to Support Conceptual Building and System Design
Christian Struck

nr 174
Numerical Modeling of Micro-Scale Wind-Induced Pollutant Dispersion in the Built Environment
Pierre Gousseau

nr 175
Modeling Recreation Choices over the Family Lifecycle
Anna Beatriz Grigolon

nr 176
Experimental and Numerical Analysis of Mixing Ventilation at Laminar, Transitional and Turbulent Slot Reynolds Numbers
Twan van Hooff

nr 177
Collaborative Design Support: Workshops to Stimulate Interaction and Knowledge Exchange Between Practitioners
Emile M.C.J. Quanjel

nr 178
Future-Proof Platforms for Aging-in-Place
Michiel Brink

nr 179
Motivate: A Context-Aware Mobile Application for Physical Activity Promotion
Yuzhong Lin

nr 180
Experience the City: Analysis of Space-Time Behaviour and Spatial Learning
Anastasia Moiseeva

nr 181
Unbonded Post-Tensioned Shear Walls of Calcium Silicate Element Masonry
Lex van der Meer

nr 182
Construction and Demolition Waste Recycling into Innovative Building Materials for Sustainable Construction in Tanzania
Mwita M. Sabai

nr 183
Durability of Concrete with Emphasis on Chloride Migration
Przemysław Spiesz

nr 184
Computational Modeling of Urban Wind Flow and Natural Ventilation Potential of Buildings
Rubina Ramponi

nr 185
A Distributed Dynamic Simulation Mechanism for Buildings Automation and Control Systems
Azzedine Yahiaoui

nr 186
Modeling Cognitive Learning of Urban Networks in Daily Activity-Travel Behavior
Şehnaz Cenani Durmazoğlu

nr 187
Functionality and Adaptability of Design Solutions for Public Apartment Buildings in Ghana
Stephen Agyefi-Mensah

nr 188
A Construction Waste Generation Model for Developing Countries
Lilliana Abarca-Guerrero

nr 189
Synchronizing Networks: The Modeling of Supernetworks for Activity-Travel Behavior
Feixiong Liao

nr 190
Time and Money Allocation Decisions in Out-of-Home Leisure Activity Choices
Gamze Zeynep Dane

nr 191
How to Measure Added Value of CRE and Building Design
Rianne Appel-Meulenbroek

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Secondary Materials in Cement-Based Products: Treatment, Modeling and Environmental Interaction
Miruna Florea

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Concepts for the Robustness Improvement of Self-Compacting Concrete: Effects of Admixtures and Mixture Components on the Rheology and Early Hydration at Varying Temperatures
Wolfram Schmidt

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Modelling and Simulation of Virtual Natural Lighting Solutions in Buildings
Rizki A. Mangkuto

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Nano-Silica Production at Low Temperatures from the Dissolution of Olivine - Synthesis, Tailoring and Modelling
Alberto Lazaro Garcia

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Building Energy Simulation Based Assessment of Industrial Halls for Design Support
Bruno Lee

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Computational Performance Prediction of the Potential of Hybrid Adaptable Thermal Storage Concepts for Lightweight Low-Energy Houses
Pieter-Jan Hoes

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Application of Nano-Silica in Concrete
George Quercia Bianchi

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Dynamics of Social Networks and Activity Travel Behaviour
Fariya Sharmeen

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Building Structural Design Generation and Optimisation including Spatial Modification
Juan Manuel Davila Delgado

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Ariën de Korte

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De Politieke Werkingen van het Ontwerp in Regionale Planvorming
Bart de Zwart

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Effects of Energy Price Increases on Individual Activity-Travel Repertoires and Energy Consumption
Dujuan Yang

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Geometry and Ventilation:
Evaluation of the Leeward Sawtooth Roof Potential in the Natural Ventilation of Buildings
Jorge Isaac Perén Montero

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Hamid Montazeri

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Ronald van der Meulen

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Framing the Integration of Urban and Heritage Planning in Multilevel Governance
Loes Veldpaus

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Urban Design Pragmatics to Achieve a Sustainable City
Ernesto Antonio Zumelzu Scheel

nr 209
Development of Sustainable Protective Ultra-High Performance Fibre Reinforced Concrete (UHPFRC):
Design, Assessment and Modeling
Rui Yu

nr 210
Uncertainty in Modeling Activity-Travel Demand in Complex Uban Systems
Soora Rasouli

nr 211
Simulation-based Performance Assessment of Climate Adaptive Greenhouse Shells
Chul-sung Lee

nr 212
Green Cities:
Modelling the Spatial Transformation of the Urban Environment using Renewable Energy Technologies
Saleh Mohammadi

nr 213
A Bounded Rationality Model of Short and Long-Term Dynamics of Activity-Travel Behavior
Ifigeneia Psarra

nr 214
Effects of Pricing Strategies on Dynamic Repertoires of Activity-Travel Behaviour
Elaheh Khademi

nr 215
Handstorm Principles for Creative and Collaborative Working
Frans van Gassel

nr 216
Light Conditions in Nursing Homes: Visual Comfort and Visual Functioning of Residents
Marianne M. Sinoo

nr 217
Woonsporen: De Sociale en Ruimtelijke Biografie van een Stedelijk Bouwblok in de Amsterdamse Transvaalbuurt
Hüseyin Hüsnü Yegenoglu

nr 218
Studies on User Control in Ambient Intelligent Systems
Berent Willem Meerbeek

nr 219
Daily Livings in a Smart Home: Users' Living Preference Modeling of Smart Homes
Erfaneh Allameh

nr 220
Smart Home Design: Spatial Preference Modeling of Smart Homes
Mohammadali Heidari Jozam

nr 221
Wonen: Discoursen, Praktijken, Perspectieven
Jos Smeets

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Personal Control over Indoor Climate in Offices: Impact on Comfort, Health and Productivity
Atze Christiaan Boerstra

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Personalized Route Finding in Multimodal Transportation Networks
Jianwe Zhang

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Elke Daemen

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Experimental and Numerical Analysis of Climate Change Induced Risks to Historic Buildings and Collections
Zara Huijbregts

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Wind Flow Modeling in Urban Areas Through Experimental and Numerical Techniques
Alessio Ricci

nr 227
Clever Climate Control for Culture: Energy Efficient Indoor Climate Control Strategies for Museums Respecting Collection Preservation and Thermal Comfort of Visitors
Rick Kramer

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Arno Keulen

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Remy Wenmaekers

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Municipal Solid Waste Incineration (MSWI) Bottom Ash: From Waste to Value Characterization, Treatments and Application
Pei Tang

nr 235
Large Eddy Simulations Applied to Wind Loading and Pollutant Dispersion
Mattia Ricci

nr 236
Alkali Activated Slag-Fly Ash Binders: Design, Modeling and Application
Xu Gao

nr 237
Sodium Carbonate Activated Slag: Reaction Analysis, Microstructural Modification & Engineering Application
Bo Yuan

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Shopping Behavior in Malls
Widiyani

nr 239
Smart Grid-Building Energy Interactions; Demand Side Power Flexibility in Office Buildings
Kennedy Otieno Aduda

nr 240
Modeling Taxis Dynamic Behavior in Uncertain Urban Environments
Zheng Zhong