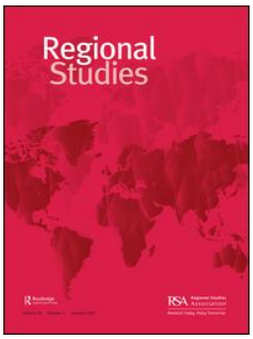

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Housing wealth distribution, inequality and residential satisfaction

Helen X. H. Bao[a] and Charlotte Chunming Meng[b]

ABSTRACT

This research investigates the relationship between housing wealth and residential satisfaction. Using household panel survey data from the UK, we find that individuals' asymmetric responses to changes in housing wealth distribution, that is, loss aversion experienced by the worse-off group, could offset the gain from an increase in housing wealth at the aggregate level. Consequently, housing wealth growth does not necessarily improve residential satisfaction for society as a whole if it leads to housing wealth inequality. Given the significant impact of housing wealth distribution on residential satisfaction, it is important to consider housing wealth inequality in making public policy decisions.

KEYWORDS

housing policy; panel data analysis; fixed effects; social preference; behavioural economics

JEL D31, I31, R11, R21, R28

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1. INTRODUCTION

Residential properties are not only consumption and positional goods but also investment goods to store and accumulate wealth (Hillig, 2019; Smith, 2008). Since the beginning of the financial market deregulation in the UK in the 1980s, the liberalization of the banking sector, and particularly the mortgage lending industry, has helped many households to get on the property ladder. This process has profoundly changed the nature of housing assets. According to the latest statistics from the Office of National Statistics (ONS), the homeownership rate in the UK increased significantly from around 50% in the 1970s to over 70% in the 2000s, and it stabilized at around 65% in the last decade. Meanwhile, housing wealth as a percentage of household annual gross disposable income more than doubled during the same period. Nowadays the role of residential properties as investment goods is much more important than before. Many households are using their homes to finance retirement (French et al., 2018) and to pass on wealth to next generations (Doling & Ronald, 2010). As a result, housing wealth plays an increasingly important role in many aspects of our lives, such as health and care (Jou et al., 2021; Wood et al., 2021), consumption (Aladangady, 2017; HE et al., 2020; Zhu et al., 2019), energy conservation (Bao & Li, 2020) and education (Li & Xiao, 2020; Lovenheim, 2011).

Residential satisfaction is an assessment of a resident's overall experience with the consumption of housing. It is an important determinant of subjective well-being, that is, life satisfaction or happiness (Clark & Díaz Serrano, 2020; Gur et al., 2020; Mouratidis, 2020) and labour mobility (Van Assche et al., 2019). An effort has been made to understand the factors that can influence residential satisfaction, such as the physical characteristics of the dwellings (Foye, 2017; Kabisch et al., 2021), social environment and neighbourhood facilities (Mohit et al., 2010; Teck-Hong, 2012), and the demographic and socio-economic traits of residents (Nowok et al., 2018; Wolbring, 2017). However, a link between residential satisfaction and housing wealth has not been formally established.

This research sets out to increase our knowledge in this area. A preliminary examination of the relationship between the two factors reveals the challenge of the undertaking. First, reliable and compatible data are not readily available. Figure 1 illustrates the development of house prices and residential satisfaction in both the UK and the US between 1970 and 2019. For the UK residential satisfaction indicator, we piece together time-series data from the British Household Panel Survey (BHPS) (1997–2008) and the English Housing Survey (2009–19).

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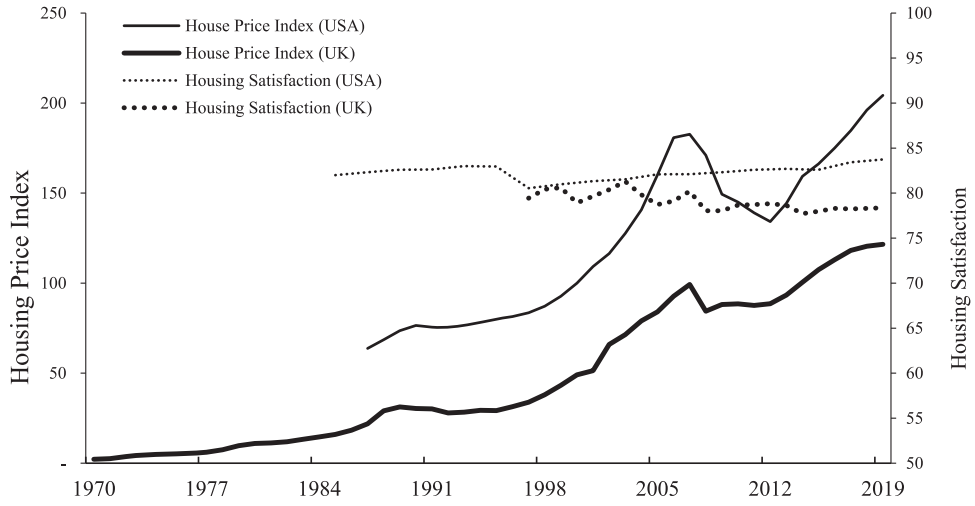

Figure 1. The Easterlin Paradox in housing markets in the US and UK.
Notes and sources: The US housing satisfaction index is calculated based on the question 'Overall opinion of present home/structure' from the American Housing Survey; index numbers are the weighted average of responds between 1 (worst) and 10 (best), divided by 10. The US house price index is the S&P/Case–Shiller US National Home Price Index, January 2000 = 10.
The UK housing satisfaction index is calculated based on the question 'How dissatisfied or satisfied you are with your house/flat?' from the British Household Panel Survey (BHPS) between 1997 and 2008, and the question 'How satisfied are you with this accommodation?' from the English Housing Survey between 2009 and 2019. Index numbers are the average responds ranging from 1 = not satisfied at all to 7 = completely satisfied, divided by 7 for the 1997–2008 period, and the average responds ranging from 1 = very dissatisfied to 5 = very satisfied, divided by 5 for the period between 2009 and 2019. The UK house price index is from the Office of National Statistics (ONS), January 2015 = 100.

For US residential satisfaction, although the series is from the same source, that is, the American Housing Survey, the question we used was changed from 'the overall opinion about current structure' to 'the overall opinion about current home' after the 2011 wave. Furthermore, the question does not ask about residential satisfaction directly, and the statistics were calculated by using answers from both renters and homeowners. Therefore, there is also a possibility of measurement errors. Second, no consistent housing wealth measurements are available during this period. House price indices are used as a proxy for housing wealth in Figure 1. Finally, and most importantly, Figure 1 shows that although house prices more than doubled during the sampling period, residential satisfaction hardly changed over the same time period. This is true for both countries.

The pattern shown in Figure 1 is a close resemblance of the Easterlin Paradox in the happiness literature. Easterlin sets out the paradox that despite the significant increase in real income in Western countries over decades, reported happiness levels have not risen correspondingly (Easterlin, 1974). Figure 1 suggests the presence of the Easterlin Paradox in housing markets as well. Although satisfaction may rise with housing wealth in the cross-section, there is no apparent relationship between the two variables over time. Two explanations have been found for the Easterlin Paradox: comparison and adaptation (Clark et al., 2008). Comparison matters because human beings are social animals by construction. Subjective well-being is determined by relative income position in comparison with reference groups. In a closed system, one person's gain is another individual's loss. The worse-off individuals' loss offsets the gain of a better-off counterpart, and the overall satisfaction level can remain the same. Adaptation can be seen as the outcome of evolution. To survive is to adapt. We make mental adjustments to changes in physical and social environment. An increase in income will make us happy. However, over a certain period of time the excitement eases off. Consequently, in the long run, happiness level remains stable.

Given rising income inequality and residential segregation (Kane & Hipp, 2019; Tammaru et al., 2020), the study of the comparison and adaptation effects in the housing market is important. If it is adaptation at work, everyone could work hard to improve over their past, and the world will move forward progressively, for good. It is a win–win for everyone. When it comes to the effect of comparison, however, the story is different. It is not necessarily a zero-sum game when the benchmark of comparison is not objectively set. As the share of wealth by the top decile increases, and the middle-income group shrinks, it is likely that the size of the worse-off group grows faster than the better-off group. Consequently, the aggregate residential satisfaction level could drop when overall housing wealth increases.

Leveraging tested models from the happiness and the behavioural economics literature, we develop an analytical framework to investigate the relationship between housing wealth and residential satisfaction. Two hypotheses, that is, social comparison and adaptation, are tested by using household panel survey data from the UK. We find support for the social comparison hypothesis. Individuals' asymmetric responses to changes in housing wealth distribution, for example, loss aversion experienced by the worse-off group, could offset the gain from an increase in housing

wealth at the aggregate level. As a result, housing wealth growth does not necessarily improve residential satisfaction for society as a whole if it leads to housing wealth inequality. Although our empirical evidence is from the UK, regional disparity of housing prices is commonplace in many parts of the world. Our findings are particularly relevant to developing countries, where economic growth is often accompanied by widening income gap and rising wealth inequality. Policymakers should be mindful about the far-reaching effect of housing wealth inequality.

2. ANALYTICAL FRAMEWORK AND TESTABLE HYPOTHESES

Economists have been fascinated by the Easterlin Paradox. This line of research is summarized in Clark et al. (2008), where a theoretical framework is developed to incorporate the two factors that keep satisfaction levels stable over time: comparison and adaptation. Specifically, happiness is determined based on relative changes against certain reference levels (i.e., comparison), and individuals become accustomed to changes in their life over time (i.e., adaptation). This framework can be summarized by equation (1):

$$Sat_{life}i,t = f\left(C_{i,t},\ \frac{C_{i,t}}{\sum_{j\in R_i} a_{ij}C_{j,t}},\ \sum_{p=1}^{P} C_{i,t-p}\right), \quad (1)$$

where $Sat_{life}i,t$ is individual i's life satisfaction level at time t; $C_{i,t}$ is individual i's consumption of a good/service at time t; R_i is a group of comparable individuals; a_{ij} is the weight, which is given by individual i to the consumption of individual j; and $\sum_{p=1}^{P} C_{i,t-p}$ is individual i's consumption in the past. The three terms within $f(.)$ capture the relationship between life satisfaction and the absolute and relative consumption in the current period, and the consumption level in the past. In the happiness literature, $C_{i,t}$ is routinely measured by income.

Although the framework has been well tested in the happiness literature, it is not well-suited to investigate residential satisfaction. Houses are complex goods. We used to treat houses mainly as consumption goods. However, financial deregulation and the subsequent expansion of both the residential mortgage markets and homeownership across the world has made the other two roles of houses more important, that is, as an investment good (French et al., 2018; Goodman & Mayer, 2018) and a positional good (Charles, 2019; Foye et al., 2018). Therefore, the determination of the second term in equation (1), or the comparable group R_i, is as difficult as determining it for consumption, income or individual behaviours.

We use prospect theory (Kahneman & Tversky, 1979) to develop a theoretical framework to model the relationship between housing wealth and housing satisfaction. Prospect theory is one of the most tractable theories in behavioural economics. It has also seen applications in urban and housing studies (e.g., Bao & Gong, 2016; Feng et al., 2014; Yan & Bao, 2018). According to prospect theory, the value function of the consumption of housing can be defined as.

$$V_k(C_{i,t}) = \begin{cases} (C_{i,t} - R_{i,k,t}) & if\ C_{i,t} > R_{i,k,t} \\ -\lambda_k(R_{i,k,t} - C_{i,t}) & if\ C_{i,t} < R_{i,k,t} \end{cases}, \quad (2)$$

where $V_k(C_{i,t})$ is the value an individual i can derive from housing consumption, $C_{i,t}$, at time t, evaluated at a reference point $R_{i,k,t}$. This is analogue to the ratio form of

$$\frac{C_{i,t}}{\sum_{j\in R_i} a_{ij}C_{j,t}}$$

used in equation (1), where income is measured relative to other comparable individuals' consumption. Equation (2) classifies housing consumption into either a gain domain (i.e., when $C_{i,t} > R_{i,k,t}$) or a loss domain (e.g., when $C_{i,t} < R_{i,k,t}$). $\lambda_k > 1$ is the loss aversion parameter, indicating that losses loom larger than gains.

As housing is a positional good (Bellet, 2019; Foye, 2021; Marsh & Gibb, 2011), individuals make comparisons with relevant social groups in order to determine their relative position in society. For example, research has shown that subjective well-being is significantly affected by comparisons with people living in the same neighbourhood (Luttmer, 2005; Noy & Sin, 2021) or region (Lenzi & Perucca, 2021), or working in similar jobs (Noy & Sin, 2021). We assume that there are k domains in this complex social comparison endeavour, such as people living in the same geographical location or within the same age range. Housing consumption $C_{i,t}$ will be assessed with each of the k reference groups to obtain $V_k(C_{i,t})$, and the overall relative value of the housing consumption is a weighted average of $V_k(C_{i,t})$ across the k domains, as defined in equation (3):

$$SC_{i,t} = \sum_{j=1}^{k} w_k V_k(C_{i,t}) \quad (3)$$

where $SC_{i,t}$ can be seen as a social comparison index that capture the relative value of the housing consumption $C_{i,t}$ based on the comparisons within k social groups.

We then develop the model for residential satisfaction based on equations (1) and (3). Equation (4) is derived by extending equation (1) to include lagged terms of social comparisons, by using equation (3) to measure social comparison, and by using the level of housing wealth as an overall measurement of housing consumption:

$$Sat_{housing}i,t = f\left(HW_{i,t},\ SC_{i,t},\ \sum_{p=1}^{P} HW_{i,t-p},\ \sum_{p=1}^{P} SC_{i,t-q},\ \sum_{k=1}^{K} X_k\right), \quad (4)$$

where $HW_{i,t}$ is the level of housing wealth of individual i in period t. $\sum_{p=1}^{P} HW_{i,t-p}$ and $\sum_{p=1}^{P} SC_{i,t-p}$ are lagged terms of

absolute and relative housing wealth, respectively. They are used to capture adaptation effects (Kaiser, 2020). $\sum_{k=1}^{K} X_k$ controls for the effect from other satisfaction determinants such as demographic characteristics and housing attributes. Homeowners' housing preference may not remain constant across markets and different stages of their life cycle. Therefore, house value appreciation does not necessary lead to increases in housing satisfaction if specific housing needs are not met (e.g., a shortage of space while household size is expanding). The inclusion of house characteristics (ideally being measured relative to one's expectation/aspiration) should be included in the equation to separate the net effect of housing wealth. This unique aspect of housing satisfaction study will be further explored in the empirical investigation part.

Our prospect-theory-based framework offers three advantages. First, it recognizes that multiple social domains are involved in the determination of residential satisfaction. This is a necessary revision to equation (1), where the relative consumption is based on one measurement. Second, equation (2) allows asymmetric responses to the gains and losses in housing wealth, which means individuals with their house values below/above the reference level response differently to the same change in housing consumption. This effect is captured by the loss aversion parameter, λ_k. Finally, equation (4) considers the effect of social comparison and adaptation to be identified in a unified framework, which could reduce the estimation biases in previous studies where the two dimensions of satisfaction are considered in isolation.

Based on equation (4), we derive hypotheses to verify the two aspects of the relationship between housing wealth and housing satisfaction, as outlined below.

Hypothesis 1: Social comparison affects residential satisfaction asymmetrically in loss and gain domains.

To test this hypothesis, we expect that the loss aversion parameter $\lambda > 1$ for $SC_{i,t}$. Specifically, the drop of residential satisfaction among worse-off individuals is larger than the increase of residential satisfaction among better-off individuals, given the same changes in housing wealth. Subsequently, the aggregated residential satisfaction level does not necessarily catch up with the improvement in housing wealth if there is also an increase in housing wealth inequality.

Hypothesis 2: Adaptation stabilizes residential satisfaction in the long run.

To test this hypothesis, we expect the coefficient estimates of $HW_{i,t-p}$ and $SC_{i,t-q}$ to be able to offset the coefficient estimates of their contemporary counterparts. If individuals fully adapt to their housing wealth level within p periods (Kaiser, 2020):

$$\sum_{p=1}^{P} \frac{\partial Sat_{housing} i,t}{\partial HW_{i,t-p-1}} = 0$$

$$\sum_{p=1}^{P} \frac{\partial Sat_{housing} i,t}{\partial SC_{i,t-p-1}} = 0$$

For example, although a positive shock to housing wealth can increase residential satisfaction temporarily, that is:

$$\frac{\partial Sat_{housing} i,t}{\partial HW_{i,t}} > 0$$

$$\frac{\partial Sat_{housing} i,t}{\partial SC_{i,t}} > 0)$$

in the long run this positive effect will be cancelled out by negative responses in the future.

3. EMPIRICAL IMPLEMENTATION

We test the hypotheses by using data from the British Household Panel Survey (BHPS) between 1997 and 2008, when both residential satisfaction scores and home valuations are available. The BHPS has been used extensively in environment and urban studies (e.g., Bao & Li, 2020; Corrado et al., 2013; Hand, 2020). In 2009, the BHPS was merged into a larger longitudinal survey project, Understanding Society. We use the data before the transition to ensure its consistency. We include homeowners (about 73% of all respondents during our sampling period) because the home valuation question was only asked to this group of respondents. Our dataset contains 99,701 observations from 18,359 individuals across the UK. For variable definitions and descriptive statistics, see Table 1.

3.1. Dependent variable

We use the answers to the question 'How dissatisfied or satisfied you are with your house/flat?' as the measurement of residential satisfaction. The answers are coded from 1 to 7, with 1 being 'not satisfied at all' and 7 being 'completely satisfied'. Figure 2 illustrates the changes of household income, home value and residential satisfaction scores between 1997 and 2008. The average value of residential satisfaction (*HOUSAT*) is 5.59 during the sampling period. Although both household income and home value increased steadily over the 12-year period, satisfaction scores remained remarkably stable over the time. The Easterlin Paradox works in the housing market.

3.2. Control variables

We include three groups of control variables in order to reliably isolate the net effects of social comparison and adaptation (Table 1). The first group of control variables is demographic and socio-economic indicators such as annual household income (*INCOME*) and household type (e.g., *COUPLE* and *SINGLE*). We also include the total number of children (*NUMKIDS*) and whether the household has a new baby (*NEWBORN*) in the survey year, because the literature suggests that these important

Table 1. Variable definitions and descriptive statistics.

Variable	Definition	Observations	Mean	SD	Minimum	Maximum
Dependent variable						
HOUSAT	Residential satisfaction	102,055	5.59	1.28	1.00	7.00
Housing wealth						
VALUE	Estimated home value in £100,000s	117,142	1.46	1.02	0.05	6.5
$VALUE_{loss}$	= 1 if $VALUE_t < VALUE_{t-1}$, and 0 otherwise	117,142	0.15	–	0.00	1.00
Personal characteristics						
INCOME	Annual household income in £100,000s	117,142	0.15	0.15	0.00	11.91
$INCOME_{loss}$	= 1 if $INCOME_t < INCOME_{t-1}$, and 0 otherwise	117,142	0.27	–	0.00	1.00
AGE1	= 1 if 16–25 years old	117,142	0.12	–	0.00	1.00
AGE2	= 1 if 25–34 years old	117,142	0.16	–	0.00	1.00
AGE3	= 1 if 35–44 years old	117,142	0.21	–	0.00	1.00
AGE4	= 1 if 45–54 years old	117,142	0.18	–	0.00	1.00
AGE5	= 1 if 55–64 years old	117,142	0.15	–	0.00	1.00
AGE6	= 1 if ≥ 65 (omitted as the base category)	117,142	0.19	–	0.00	1.00
HIGHEDU	= 1 if college education or above	117,142	0.23	–	0.00	1.00
MEDEDU	= 1 if secondary school or equivalent	117,142	0.51	–	0.00	1.00
LOWEDU	= 1 if primary school or less (omitted as the base category)	117,142	0.27	–	0.00	1.00
EMPLOYED	= 1 if in employment (omitted as the base category)	114,776	0.62	–	0.00	1.00
RETIRED	= 1 if retired	114,776	0.19	–	0.00	1.00
INACTIVE	= 1 if not active in labour market	114,776	0.14	–	0.00	1.00
UNEMPLOYED	= 1 if unemployment	114,776	0.02	–	0.00	1.00
MANAGER	= 1 if managers	117,142	0.10	–	0.00	1.00
EMPLOYER	= 1 if employers	117,142	0.02	–	0.00	1.00
PROFESSIONAL	= 1 if professional jobs	117,142	0.04	–	0.00	1.00
OTHERJOBS	= 1 if other job types (omitted as the base category)	117,142	0.84	–	0.00	1.00
NUMKIDS	Number of children in the household	117,142	0.58	0.94	0.00	8.00
NEWBORN	= 1 if the family has newborns in the survey year	117,142	0.03	–	0.00	1.00
COUPLE	= 1 if married or civil partnership (omitted as the base category)	117,142	0.80	–	0.00	1.00
LONE PARENT	= 1 if single parent with dependent children	117,142	0.07	–	0.00	1.00
SINGLE	= 1 if single	117,142	0.11	–	0.00	1.00
OTHERHT	= 1 if other household types	117,142	0.02	–	0.00	1.00
REGION	19 regions: Inner London, Outer London, Rest of South East, South West, East Anglia, East Midlands, West Midlands Conurbation, Rest of West Midlands, Greater Manchester, Merseyside, Rest of North West, South Yorkshire, West Yorkshire, Rest of Yorkshire & Humberside, Tyne & Wear, Rest. of North, Wales, Scotland, and Northern Ireland	117,142	–	–	1	19
WAVE	= 1997, 1998, … , 2008 for each corresponding survey year	–	–	–	1997	2008

(*Continued*)

Table 1. Continued.

Variable	Definition	Observations	Mean	SD	Minimum	Maximum
Objective attributes of residential environment						
MORTGAGE	= 1 if have a mortgage	117,142	0.62	–	0.00	1.00
MOVER	= 1 if moved house in the survey year	117,142	0.07	–	0.00	1.00
DETACHED	= 1 if detached house	116,974	0.34	–	0.00	1.00
SEMIDETACHED	= 1 if semidetached house	116,974	0.34	–	0.00	1.00
TERRACED	= 1 if terraced house	116,974	0.24	–	0.00	1.00
FLAT	= 1 if flat	116,974	0.06	–	0.00	1.00
OTHERAT	= 1 if other accommodation types	116,974	0.01	–	0.00	1.00
GARDEN	= 1 if the property has a private garden	117,142	0.97	–	0.00	1.00
CENTRAL	= 1 if the property has central heating	117,142	0.95	–	0.00	1.00
DAMP	= 1 if property has problems with damp walls, floors, foundation	117,142	0.05	–	0.00	1.00
ROT	= 1 if property has rot in windows or floor, 0 otherwise	117,142	0.04	–	0.00	1.00
TALKNEIGH1	= 1 if talk to neighbours on most days, 0 otherwise	117,142	0.36	–	0.00	1.00
TALKNEIGH2	= 1 if talk to neighbours once or twice a week, 0 otherwise	117,142	0.41	–	0.00	1.00
TALKNEIGH3	= 1 if talk to neighbours once or twice a month, 0 otherwise	117,142	0.15	–	0.00	1.00
TALKNEIGH4	= 1 if talk to neighbours less often than once a month, 0 otherwise	117,142	0.06	–	0.00	1.00
TALKNEIGH5	= 1 if never talk to neighbours, 0 otherwise	117,142	0.02	–	0.00	1.00
POLLUTION	= 1 if there is pollution, grime or other environmental problems caused by traffic or industry	117,142	0.06	–	0.00	1.00
CRIME	= 1 if there is vandalism or crime in the area	117,142	0.14	–	0.00	1.00
Subjective attributes of residential environment						
FINNOW	= 1 if managing well financially, 0 otherwise	117,142	0.95	–	0.00	1.00
FINFUTURE	= 1 if believes will be financially better off or about the same a year from now, 0 otherwise	117,142	0.90	–	0.00	1.00
SPACE	= 1 if there is short of space, 0 otherwise	117,142	0.18	–	0.00	1.00
NEIGHNOI	= 1 if there is noise from neighbours, 0 otherwise	117,142	0.08	–	0.00	1.00
STREETNOI	= 1 if there is street noise, 0 otherwise	117,142	0.13	–	0.00	1.00

Note: Only homeowners are included in the sample. Standard deviations (SD) are not reported for dummy variables. Means of dummy variables within each group might not add up to 100% due to missing values.

factors affect residential satisfaction (e.g., NOWOK et al., 2018).

The second group of control variables includes objective measurements of the residential environment. These variables are derived from questions to which the respondents can provide relatively objective answers, such as whether the respondents are still paying a mortgage on their homes (i.e., *MORTGAGE* = 1) and if the accommodation has central heating (*CENTRAL*). We also considered the effect of recent moving on residential satisfaction, as suggested by the literature (Wang & Wang, 2020). Specifically, variable *MOVER* = 1 for individuals who changed home address during the survey year.

The last group of controls consists of subjective measurements of the residential environment. We use *FINNOW* to capture the current financial situation of a household. It is based on the question 'How well would you say you yourself are managing financially these days?'. We also define *FINFUTURE* based on the question 'Looking ahead, how do you think you will be financially a year from now?'. This variable reflects the expectation an individual has about her financial situation in the coming years. Three variables gauge the level of

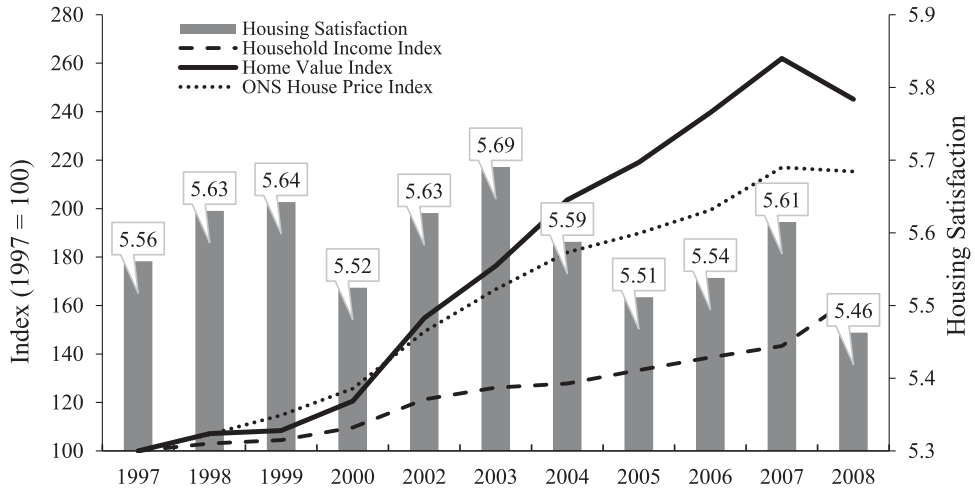

Figure 2. Income, home value, and housing satisfaction in the UK, 1997–2008.
Note and source: Household income index and home value index are calculated based on annual average value of *INCOME* and *VALUE*, with 1997 as the base year. The Office for National Statistics (ONS) house price index is retrieved from https://landregistry.data.gov.uk/app/ukhpi. Year 2001 is not included because housing satisfaction scores were not available in the public release in that year.

noise from neighbours or street and the shortage of space. Note that these variables are constructed based on the respondents' perception instead of objective measurement of noise and space. For example, variable *NEIGHNOI* measures the level of noise from neighbours. It is based on the question 'Does your accommodation have any of the following problems: Noise from neighbours?'; someone who plays rock music occasionally may be classified as a noisy neighbour by a mother of a young baby but not by a college student who parties hard. Hence, the answers to this question are subjective measurements of neighbourhood noise level.

As emphasized in section 2, the inclusion of a comprehensive set of controls over housing characteristics is critical to isolate the net effect of housing wealth on housing satisfaction. During our sampling period, the UK housing market experienced significant growth while the real income level did not. Coupled with the inelastic housing supply, this caused some households to struggle to climb the property ladder. The mismatch between the characteristics of houses available and within reach and the demand from these households may confound the estimation of housing wealth effects. We control for this factor by including the relative measurement of financial situation and housing quality. Although not an exhaustive list of housing attributes, the included variables cover the most important aspects of housing needs. Therefore, the identified relationship between housing wealth and housing attributes is unlikely to be significantly affected by omitted variable bias. This issue is further addressed in the robustness checks section.

3.3. Housing wealth

We use the answers to the question 'About how much would you expect to get for your home if you sold it today?' as the measurement of housing wealth in this study. This subjective assessment of home value has two advantages. First, professional house valuation is not included in the BHPS dataset, and it is challenging to derive from other data sources. Using perceived house values from the same dataset ensures consistency and reliability. Second, most homeowners will not sell their houses; they are not experienced enough to give a fair valuation of their home either. Their perceived value and the market value of their home do not necessarily agree. Residential satisfaction is more responsive to perceived home value than market valuation because the former is more salient and available for homeowners.

The estimated home value (*VALUE*) averages £145,589 between 1997 and 2008. This slightly higher than the national statistics, which is about £128,000 according to the ONS. We compare the trend of average home values from our sample and ONS house price index (Figure 2). The BHPS figures are generally higher than those from the ONS. The discrepancy could come from multiple sources, such as homeowner's tendency to overestimate their home's value, a higher turnover ratio of cheaper (perhaps smaller) houses, and hence an overrepresentation of such properties in the ONS statistics. However, the long-term trend is consistent between the two series. Because we are investigating the long-run relationship between housing wealth and residential satisfaction, this consistent overestimation of home value will not affect our conclusions.

3.4. Self-comparison measurements

Individuals make comparison not only with others but also with their own past or status quo. We introduce two self-comparison measurements based on *INCOME* and *VALUE* in order to understand how much the relative loss aversion effect comes from own income and house value. To separate out individuals whose income or home values fell from one year to the next, we created two self-comparison dummy variables, that is,

$INCOME_{loss} = 1$ if $INCOME_t < INCOME_{t-1}$, and 0 otherwise. $VALUE_{loss} = 1$ if $VALUE_t < VALUE_{t-1}$, and 0 otherwise. According to Table 1, about 27% of the respondents experienced losses of income from the previous survey year, and about 15% of the respondents estimated that their houses depreciated from the previous survey year.

3.5. Social comparison measurements

The current literature does not provide guidelines regarding how social comparison groups are determined. We follow the approach in BAO (2020) and assume that people refer to other individuals within the same age group, with similar education background, living in the same region, or working in the same type of jobs. Housing consumption is measured relative to the average level of consumption in one's reference groups. Those who consume significantly less/more than their peers will be classified as worse-off/better-off group.

Individuals cannot accurately estimate what their reference group believes their houses are worth. They can only estimate what their housing wealth position roughly is within their reference groups. To take into account the ambiguity and uncertainty in the estimation of one's relative social position in a reference group, we assume that the reference point in social comparison should be a value range instead of a specific value. We define the worse-off groups to include those individuals whose housing wealth is below the 25th percentile within their reference groups and better-off groups to include those with housing wealth above the 75th percentile. The reference point in this definition is the 50% of individuals whose housing wealth level is considered to be average or typical.

For age, as an example, we allocate individuals in the six age groups as defined in Table 1. Within each group, if an individual's house value is below the 25th percentile of the house values in her age group (i.e., her house value is lower than 75% of the people in her age group), she will be identified as worse-off, and $LOW_{age} = 1$. If, on the other hand, an individual's house value is above the 75th percentile of the house values in her age group (i.e., her house value is greater than 75% of the people in her age group), she will be identified as better-off, and $HIGH_{age} = 1$.

Using the same method, we define three more sets of social comparison indicators based on education (three groups), socio-economic status (four groups), and region (19 groups), respectively. This gives six more social comparison variables: LOW_{edu}, $HIGH_{edu}$, LOW_{se}, $HIGH_{se}$, LOW_{reg}, and $HIGH_{reg}$. This multidimensional approach of social comparison measurement has two advantages. First, it helps us to identify where and how social comparisons are made. The determination of $SC_{i,t}$ in equation (4) is not a black box. Second, it also helps to establish the robustness of the relative residential satisfaction theory, if we can find that the effect is present in most or even all of the social comparison groups considered.

4. RESULTS AND DISCUSSION

We estimate panel regression models with individual fixed effect and lagged terms of both social comparison indicators and house valuations. Household-clustered standard errors are used to deal with correlations among members within the same household. We normalized the two variables (i.e., transforming the mean to be 0 and the variance to be 1) in all models to facilitate the comparison of their effect size with other dummy variables included in the models. Most of the demographic indicators and all housing attributes have statistically significant coefficient estimates with expected signs. For brevity, we report coefficient estimates of key variables only in Table 2; for the full set of regression outputs, see Table A6 in Appendix A in the supplemental data online.

4.1. Social comparison

We first verify the effect of the four types of social comparison both in isolation and in combination. The results are show in Table 2. In models (1) to (4), we include only one of the four sets of social comparison indicators in each model. The results are consistent among all four models. The coefficient loading on the *LOW* variables is negative and statistically significant, while the coefficient loading on the *HIGH* indicators is positive and statistically significant. The estimated loss aversion parameter (i.e., the ratio between the absolute value of the coefficient estimates for the *LOW* and *HIGH* indicators) is 2.38, 2.01, 2.10 and 1.30 in models 1 to 4, respectively. This supports the first hypothesis that social comparison affects residential satisfaction asymmetrically. Our findings are largely in line with the literature where most of the studies found the value of loss aversion parameter between 1.04 and 3.50 by using experimental data (Bao & Meng, 2017). The findings are also consistent with empirical evidence based on observational data. For example, the income loss aversion parameter is estimated to be about 2 in a life satisfaction study using household survey data from the UK (Boyce et al., 2013), and between 2 and 6 by using aggregated national level data (De Neve et al., 2018).

In model (5) we include all four sets of social comparison indicators. Although the coefficient estimates of the eight variables are different from those in models (1) to (4) due to collinearity, our conclusion still holds: social comparison matters, and worse-off and better-off individuals respond to relative change in their housing wealth differently. We calculate the weights based on the social comparison coefficient estimates from model (5) in Table 2.

$$LOW_{sc} = \begin{cases} 1, & \sum_{i=1}^{4} (LOW_i \times W_{LOW,i}) > 0.5 \\ 0, & otherwise \end{cases},$$

$$HIGH_{sc} = \begin{cases} 1, & if \ \sum_{i=1}^{4} (HIGH_i \times W_{HIGH,i}) > 0.5 \\ 0, & otherwise \end{cases},$$

Table 2. Construction of social comparison index.

	Socio-economic status (1)	Education (2)	Age (3)	Region (4)	All four dimensions (5)	SC index (6)
INCOME	0.0107*	0.0107*	0.0112*	0.0110*	0.0110*	0.0111**
VALUE	0.0656***	0.0636***	0.0632***	0.0564***	0.0384***	0.0583***
$INCOME_{loss}$	−0.0050	−0.0053	−0.0049	−0.0051	−0.0052	−0.0049
$VALUE_{loss}$	−0.0219**	−0.0220**	−0.0213**	−0.0202*	−0.0133	−0.0204*
LOW_{se}	−0.1127***				−0.0364*	
$HIGH_{se}$	0.0473***				0.0013	
LOW_{edu}		−0.1066***			−0.0350*	
$HIGH_{edu}$		0.0531***			0.0253	
LOW_{age}			−0.1169***		−0.0487**	
$HIGH_{age}$			0.0556***		0.0245	
LOW_{reg}				−0.1119***	−0.0690***	
$HIGH_{reg}$				0.0859***	0.0725***	
LOW_{sc}						−0.1126***
$HIGH_{sc}$						0.0831***
Hausman χ^2	1270.57***	1272.55***	1271.7***	1264.21***	1261.64***	1264.47***
R^2 (within)	0.0463	0.0463	0.0464	0.0466	0.0472	0.0466
R^2 (between)	0.0414	0.0423	0.0419	0.0447	0.0470	0.0433
R^2 (overall)	0.0535	0.0543	0.0539	0.0564	0.0582	0.0552
F-statistic	27.35***	27.35***	27.41***	27.52***	25.64***	27.63***
Observations	99,701	99,701	99,701	99,701	99,701	99,701

Note: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. Only reported are the coefficient estimates of *INCOME*, *VALUE*, self- and social-comparison variables. For the full regression outputs of these models, see Table A2 in Appendix A in the supplemental data online.

where $i =$ se, age, edu or reg (i.e., the four dimensions of social comparison).

$$w_{LOW,\,i} = \frac{|LOW_j|}{\sum |LOW_j|}$$

$$w_{HIGH,\,i} = \frac{|HIGH_j|}{\sum |HIGH_j|},$$

where $j = 1, 2, 3$ and 4, representing the socio-economic status, education, age and region social comparison coefficient estimates in model (5) in Table 2. The weights of these four categories are 0.19, 0.18, 0.26 and 0.37 for LOW_i, and 0.01, 0.20, 0.20 and 0.59 for $HIGH_i$. The number (proportion) of sample points that are classified in the LOW_{sc} and $HIGH_{sc}$ group is 29,382 (25.08%) and 31,199 (26.63%), respectively. The 0.5 cut-off point is chosen such there are roughly a quarter of respondents in the better-off and the worse-off group, respectively.

Finally, we re-estimate the panel regression model by using the composite social comparison indicator LOW_{sc} and $HIGH_{sc}$. The result is given in the last column in Table 2. The coefficient estimates of LOW_{sc} and $HIGH_{sc}$ are consistent with the prediction by our theoretical model in section 2; the loss aversion parameter is 1.35, which is within the range reported by Bao and Meng (2017). We find evidence to support the social comparison hypothesis. LOW_{sc} and $HIGH_{sc}$ are used to test the adaptation hypothesis in the next section.

4.2. Adaptation

To test Hypothesis 2, the determination of lag length or the time it takes to adapt is critical. In the literature, lag length of three or four years is the most commonly used in life satisfaction studies (Di Tella et al., 2010; Kaiser, 2020; Vendrik, 2013). Following this practice, we considered lag lengths up to five years. Table 3 reports the *F*-test statistics and their statistical significance for both absolute (i.e., *VALUE*) and relative (i.e., LOW_{sc} and $HIGH_{sc}$) measurement of housing wealth. The null hypothesis is $\sum_{p=0}^{T} \beta_{t-p} = 0, \; T = 1, \; \ldots 5$, or the long-term effect of housing wealth on residential satisfaction is negligible. If the null hypothesis is true for both absolute and relative housing wealth measurements, adaptation is an explanation of the stable residential satisfaction level over time, despite of the steady increase of housing wealth. Table 4 also provides fixed effect panel regression results for a baseline model with neither social comparison indicators nor lagged terms, and a model with social comparison indicators. We also included two models with three and four years lagged terms by following the specifications in Kaiser (2020) and Di Tella et al. (2010), respectively. When social comparison indicators are added to the baseline model, the contemporary effect of house value is reduced from 0.0898 to 0.0583, indicating that about one-third of housing value is positional (see the social comparison model in Table 4).

Table 3. Tests of adaptation.

Lag	House value	LOW_{sc}	$HIGH_{sc}$
1	20.55***	18.87***	23.74***
2	5.75**	7.71***	20.91***
3	7.47***	3.65*	8.37***
4	8.83***	0.55	0.68
5	9.16***	0.11	< 0.01

Note: Reported are the *F*-test statistics and their statistical significance. The null hypothesis of the test is the sum of the coefficients of the contemporary and the lagged terms equals zero (i.e., the long-term effect is zero, or adaptation). *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. For the full regression outputs of these models, see Table A9 in Appendix A in the supplemental data online.

This pattern remains largely unchanged when lagged terms are added.

According to Table 3, there is no evidence of adaption for all lag length considered. The null hypothesis of $\sum_{p=0}^{T} \beta_{t-p}$ is rejected for *VALUE* for all lag lengths. When no lagged terms are considered (i.e., model 4 in Table 4), the marginal effect of house value on housing satisfaction is 0.0583. This effect remains stable when lagged terms of house value are added to the baseline model. Although the coefficient estimates turn negative from year $t-2$, they are not large enough to offset the positive effect in year t. For example, in the three-year lagged model (i.e., model 5 in Table 4) the null hypothesis of $\beta_{VALUE_t} + \beta_{VALUE_{t-1}} + \beta_{VALUE_{t-2}} + \beta_{VALUE_{t-3}} = 0$ has an *F*-test statistic of 7.47, and is significant at the 1% level. Because the coefficient estimates of $VALUE_t$ is positive and much larger than those of the lagged terms, the long-term effect of housing wealth on residential satisfaction is positive and significant. This means individuals derive pleasure from the increases of their housing wealth, and this effect does not wear off over time. This is not adaption to changes in absolute housing wealth.

The null hypothesis of $\sum_{p=0}^{T} \beta_{t-p}$ is not rejected for LOW_{sc} and $HIGH_{sc}$ when lag length is increased to four years. A close examination of the coefficient estimates in Table 4 reveals this is not because the coefficients cancel each other out within those years, but rather because the standard errors of the estimates are large. The former can be interpreted as the evidence of adaptation, whilst the latter is often a consequence of multicollinearity among the lagged terms. One may argue that multicollinearity biases individual coefficient estimates only, and the combined effect of correlated variables can still be reliably obtained. Therefore, it is reasonable to conclude

Table 4. Social comparison and adaptation.

	Baseline model lag = 0 (1)	Baseline model lag = 3 (2)	Baseline model lag = 4 (3)	Social comparison lag = 0 (4)	Social comparison lag = 3 (5)	Social comparison lag = 4 (6)
VALUE (lag = 1)	0.0898***	0.0867***	0.0706***	0.0583***	0.0656***	0.0544***
VALUE (lag = 2)		0.0576***	0.0815***		0.0411**	0.0696***
VALUE (lag = 3)		−0.01	−0.0123		−0.0142	−0.0157
VALUE (lag = 4)		−0.0339**	−0.0114		−0.0281*	0.0036
VALUE (lag = 5)			−0.0184			−0.0185
LOW_{sc} (lag = 1)				−0.1126***	−0.0465*	−0.0311
LOW_{sc} (lag = 2)					−0.0436*	−0.0238
LOW_{sc} (lag = 3)					0.0095	0.0032
LOW_{sc} (lag = 4)					−0.0078	0.0268
LOW_{sc} (lag = 5)						−0.0227
$HIGH_{sc}$ (lag = 1)				0.0831***	0.0562***	0.0433*
$HIGH_{sc}$ (lag = 2)					0.0397*	0.028
$HIGH_{sc}$ (lag = 3)					0.033	0.0158
$HIGH_{sc}$ (lag = 4)					0.0002	−0.0248
$HIGH_{sc}$ (lag = 5)						−0.0154
Hausman χ^2	1284.21***	784.81***	616***	1058.94***	621.34***	571.33***
R^2 (Within)	0.0454	0.0428	0.0417	0.0466	0.0435	0.0421
R^2 (between)	0.0370	0.0283	0.0287	0.0433	0.0321	0.0310
R^2 (overall)	0.0498	0.0341	0.0327	0.0552	0.0374	0.0345
F-statistic	27.88***	14.01***	11.74***	27.63***	12.76***	10.37***
Observation	99,701	38,813	32,934	99,701	38,813	32,934

Note: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. Reported are the *F*-test statistics and their statistical significance. The null hypothesis of the test is the sum of the coefficients of the contemporary and the lagged terms equals zero (i.e., the long-term effect is zero, or adaptation). For the full regression outputs of these models, see Table A9 in Appendix A in the supplemental data online.

Table 5. Effect of housing wealth distribution.

	Housing wealth distribution			Housing satisfaction	
	Low	Medium	High	Average changes	Relative to the effect of a 1 SD shock in housing wealth
Baseline	25%	50%	25%	0	0%
Inequality scenario 1	30%	50%	20%	−0.0098	−17%
Inequality scenario 2	40%	40%	20%	−0.0210	−36%
Inequality scenario 3	50%	40%	10%	−0.0406	−70%
Equality scenario 1	20%	55%	25%	0.0056	10%
Equality scenario 2	15%	60%	25%	0.0113	19%
Equality scenario 3	10%	65%	25%	0.0169	29%

Note: The baseline scenario allocates equal proportions of individuals into the better- and worse-off groups (i.e., 25% each). The three inequality scenarios are created primarily by increasing the proportion of individuals in the worse-off group (i.e., more than one-quarter of people consider themselves to have relatively low housing wealth). The three equality scenarios are created mainly by reducing the proportion of population in the worse-off group.

that there is adaptation to relative measurement of housing wealth (i.e., LOW_{sc} and $HIGH_{sc}$) in four years. However, even if this is true, the long-term effect of absolute housing wealth (i.e., *VALUE*) is still positive and shows no sign of adaptation; residential satisfaction should rise as housing wealth increases over time. In conclusion, the models in Table 4 does not support the adaption hypothesis, while the social comparison hypothesis still holds in most of the models.

4.3. Relationship between housing wealth and residential satisfaction

Because the adaptation hypothesis is rejected, we use the social comparison only model (i.e., model 4 in Table 4) to interpret the relationship between housing wealth and residential satisfaction in the UK housing market.

In model (4), the coefficient estimate of *VALUE* is the changes in residential satisfaction in response to one standard deviation shock in housing wealth. The value is 0.0583 and significant at the 1% level. This indicates that when housing wealth increases, residential satisfaction will improve as well. However, the coefficient estimates for LOW_{sc} and $HIGH_{sc}$ are −0.1126 and 0.0831, respectively. The results are based on the assumption that about 25% of the population perceived them as being worse- or better-off when comparing their housing wealth with others in their reference groups, and about 50% of the population considered themselves as being normal or average in comparison with others. In other words, the distribution of housing wealth is symmetric, and there are equal number of happy and unhappy people in the society. If this assumption holds true while housing wealth increases, although there will be people moving in or out of the better- and worse-off group, the effect will always cancel each other out as the proportion of better- and worse-off individuals remains constant.

However, when the movement is not balanced among the three groups, the overall satisfaction level can be changed, even if the aggregated housing wealth level remains constant. Moreover, if the increase of housing wealth is not equally distributed among all individuals, leaving more people in the LOW_{sc} than in the $HIGH_{sc}$ group, the average residential satisfaction level will drop accordingly.

To understand the relationship between housing wealth distribution, inequality, and housing satisfaction, we run a simulation to demonstrate how housing wealth distribution, and consequently, individuals' relative housing wealth position, affects the overall residential satisfaction level. In Table 5, the baseline case is calculated based on our main results reported in model 4 in Table 4. This is based on the assumption that the proportion of worse-off, average and better-off individuals is 25%, 50% and 25%, respectively (the sensitivity of the results to this assumption is checked in section 5.4). We also assume that housing wealth has been increasing for everyone and hence the effect of housing wealth self-comparison (i.e., $VALUE_{loss}$) can be held constant. We adopt this approach because the focus of our analysis is on social comparison. Releasing this assumption and letting $VALUE_{loss}$ to vary as people moving among the three social comparison groups will generally exaggerate the results as reported in Table 5, because individuals in the worse-off group are more likely to experience losses in housing wealth, and hence the effect of loss aversion (self- and social comparison) combined would be stronger.

We investigate how changes in housing wealth distribution affect housing satisfaction while holding the overall level of housing wealth constant. Hence the value of baseline case is set to zero in Table 5, (i.e., $0.0583 \times 0 + (-0.1126) \times 0\% + 0 \times 0\% + 0.0831 \times 0\% = 0$). In other words, if changes in housing wealth and the proportion of individuals in the three social comparison groups are zero, average housing satisfaction level will remain unchanged. Next, we hold housing wealth level constant, and let housing wealth distribution vary among three unequal and three equal scenarios.

The level of inequality increases from inequality scenarios 1–3 as reflected in the increased proportion of house-poor individuals. When housing wealth is concentrated in a smaller proportion of the population, there will be a larger percentage of individuals feeling worse-off. As a result, average residential satisfaction level drops steadily as the level of inequality increases, while holding the level of average housing wealth constant. For example, in Inequality scenarios 3, the changes of the proportion of worse-off,

average and better-off individuals are 25%, −10% and −15%, respectively. Consequently, the change in housing satisfaction is $(-0.1126) \times (25\%) + 0 \times (-10\%) + 0.0831 \times (-15\%) = -0.0406$. This essentially mitigates about 70% of the increase in housing satisfaction due to one standard deviation increase in housing wealth (i.e., the coefficient estimate of *VALUE*, 0.0583).

Equality scenarios 1–3 are three cases of more equally distributed housing wealth, which is captured by the expansion of the middle group. As housing wealth gets more equally distributed, the baseline residential satisfaction level can be improved by as much as 30% (i.e., in equality scenario 3). This is achieved by not changing the overall level of housing wealth in the society. The distribution of housing wealth matters.

In summary, our analysis shows that although housing wealth and residential satisfaction is positively related, the loss aversion effect among the worse-off individuals could reduce the average level of residential satisfaction if the distribution of housing wealth is unequal. Consequently, residential satisfaction at the aggregate level does not change despite the steady increase of housing wealth over time.

4.4. Robustness checks

As our conclusions depend heavily on the coefficient estimates of social comparison indicators, the robustness of these estimates is critical to ensure the reliability of the findings. We carried out a series of robustness checks to verify whether the estimates are sensitive to alternative social comparison index construction methods, different self-comparison (based on income and house value) measurements, various functional forms of *INCOME* and *VALUE*, alternative social comparison definitions, the inclusion of subjective assessment of financial situations, and potential endogeneity issues. The results are reported in Appendix A in the supplemental data online. Overall, our results are robust to the issues investigated.

5. CONCLUSIONS

Based on prospect theory, we developed an analytical framework to study the relationship between housing wealth and residential satisfaction. Using more than 10 years of household panel survey data from the UK, we did not find evidence to support the adaption to housing wealth hypothesis. On the other hand, individuals' asymmetric responses to changes in housing wealth distribution, that is, loss aversion experienced by the worse-off group, could offset the gain from an increase in housing wealth at the aggregate level. As a result, housing wealth growth does not necessarily improve residential satisfaction for the society as a whole if there is corresponding change in housing wealth inequality.

We find a behavioural explanation for the Easterlin Paradox in the housing market, that is, the effect of social comparison. Although changes in the level of housing wealth are positively related to residential satisfaction, individuals' relative housing wealth position also matters. Because housing is a status good, people make comparison with their reference groups constantly. As we move along these social ladders, residential satisfaction at the individual level could change significantly even if the absolute value of housing wealth remains constant. Our analytical framework effectively incorporates this micro-level dynamic into the estimation of residential satisfaction, which is routinely reported at the aggregate level.

Our findings have significant implications to public policies regarding housing inequality, wealth disparity, and subjective well-being. An increase of housing wealth at the aggregate level does not necessary benefit all members of the society. The distribution of housing wealth determines each individual's relative social position in the society and subsequently affects their residential satisfaction. As demonstrated in our simulations, reducing housing wealth disparity is an effective way to improve the average residential satisfaction level among all individuals. When regional disparity of housing prices is commonplace in many parts of the world, policymakers should be mindful about the far-reaching effect of housing wealth inequality. According to the ONS, the Gini coefficient of housing wealth increased from 62% in 2014 to 66% in 2020, while the Gini coefficient of income stabilized at around 35% in the same period. Therefore, housing wealth inequality is a real concern in the UK. Given the significant impact of housing wealth distribution on residential satisfaction, and ultimately people's subjective well-being, it is important to reduce inequality in housing markets.

While the debates about the relationship between income and life satisfaction has been ongoing for decades, the investigation of the relationship between housing wealth and housing satisfaction has just begun. Our analysis shows that housing wealth has much larger influences on housing satisfaction than income and relative housing wealth position matters. Although the findings are robust across a wide range of alternative measurements and model specifications, there are areas where more empirical evidence are needed. First, our sample is restricted to the 1997–2008 period in the UK only. Although the BHPS is one of the largest household surveys in the world, the 9000 households included in the survey are unlikely to include sufficient respondents from either end of the housing wealth distribution. Consequently, the level of housing wealth inequality could be underestimated.

Moreover, the 1997–2008 period is also a rather turbulent period in the UK housing market, when neither the growth of real income nor the inelastic housing supply responded well to the rapidly increasing house prices. The ability to consume many aspects of housing goods is subject not to absolute income but income relative to those in the market, that is, what a household could afford. Although we included household income and mortgage information as well as subjective measurements of housing quality to remove these confounding effects, it is possible that the omitted variable bias is not fully controlled. Our findings should be interpreted with this caveat in mind, and further analysis with better data, from both the UK and the rest of the world, is needed to verify the external validity of the results in this paper.

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