Title: The incongruence between objective and subjective rental affordability: Does residential satisfaction matter?

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Abstract

A variety of objective and subjective indicators have been suggested to measure rental affordability in light of deteriorating housing affordability recently. However, several studies demonstrated that objective and subjective measures of rental affordability are not well-aligned with each other, while the underlying cause of this mismatch is unknown. Drawing on Noll's (2013) objective and subjective social indicator framework, this paper examines the extent to which the subjectively and objectively measured levels of rental affordability are incongruent and the driver of the disparity. Using the longitudinal data of the Labor and Income Panel Study in Korea (2015-2020), we conducted a series of panel multinominal logistic regressions with fixed effects. The results show that the mismatch between objectively and subjectively measured affordability is consistent across income groups, and residential satisfaction, i.e., subjective housing assessment against the 'reference' housing conditions given the household circumstances, affects the discrepancy. The paper calls for more in-depth exploration of residential satisfaction to benefit refined and nuanced policies to address rental affordability problems.

Keywords: housing affordability, objective indicators, subjective indicators, residential satisfaction

Introduction

Rental affordability has received increasing policy attention in recent decades amidst the rapid increase in market housing prices and stagnant income growth (Haffner and Hulse,

2021; Wetzstein, 2017). To effectively address the rental affordability problem, it is vital to define and measure 'affordability' accurately. A variety of approaches to measure rental affordability and their relative (dis)advantages are well-documented in the literature (e.g., Baker et al., 2015; Bramley, 2012; Heylen, 2021; Kutty, 2005; Lerman and Reeder, 1987; Lux, 2007; Stone, 2006; Thalmann, 1999, 2003; Yip, 1995). Among them, the rent-to-income ratio and the residual income measurement—one measuring the share of rent in household income and the other assessing after-housing income against the standard for non-housing basic needs—have been the most widely used as 'a simple rule of thumb' (Kutty, 2005; Stone, 2006; Yip, 1995). The normative ratio standards, however, alone may not be able to fully and accurately depict the rental affordability problem given a different perception of reality each household may have (Noll, 2013). Even when two households' levels of objectively measured affordability are comparable, each household's perception of its rent burden may vary significantly depending on its needs and structure of expenditures.

The potential misalignment between the two affordability measures raises concern in housing policymaking because it implies that the current policy intervention based on objective measures may be ineffectively addressing the issue by either developing interventions that help improve affordability in objective terms but do not sufficiently enhance subjective affordability or by omitting households who are shown to be affordable in objectively measured data despite a clearly perceived affordability problem (Lerman and Reeder, 1987; Noll, 2013). Several studies have demonstrated that objective measures and subjective measures of rental affordability are not well-aligned (see Bramley, 2012; Heylen, 2021; Kearns et al., 1993; Özdemir Sarı and Aksoy Khurami,

2018). Yet the underlying cause of the mismatch between objective and subjective affordability is still unknown.

To fill this knowledge gap, this paper examines two research questions. First, how much does the subjectively and objectively measured level of rental affordability differ from one another? To answer the question, we compare the share of households experiencing objective rental affordability issues to those experiencing subjective affordability issues. Drawing on prior research, we anticipate that objective rental affordability has a weak correlation with subjective rental affordability.

Second, if a significant mismatch between objective and subjective rental affordability is found, what is the driver of the disparity? Noll's (2013) social indicator framework suggests that the differences between objective and subjective assessments are subject to whether one's expectation is met or not. Drawing on this conceptual foundation, we posit that the mismatch between the two affordability measures is influenced by a process of a household's valuation of residential environments as reflected in the expected rent. In other words, the process through which the mismatch occurs is assumed as follows: When assessing the affordability of the unit, households formulate 'expected rent' (expectation for the reasonable rental price) based on their internal valuation of the overall residential environments. They then make a comparison between the actual rent being paid and the expected rent to determine the subjective affordability level. This study presumes that it is through this assessment process involving a series of valuations and comparisons that households develop their perception of affordability. We consider the assessment process of a rental unit to be adequately captured by the notion of residential satisfaction (Riazi and Emami, 2018); a household assessing their residential environment more favorably is likely to show a higher level of

residential satisfaction. We address and attempt to answer these questions by using the example of the Republic of Korea (Korea hereafter).

Assessing rental affordability and housing quality: Objective versus subjective measurements

Use of objective and subjective affordability measurements

Extensive research has adopted a normative ratio measurement to define rental affordability that concerns whether rent exceeds a certain threshold in household income, typically 25-40% (i.e., rent-to-income ratio method) (Hulchanski, 1995; McConnell, 2013); or whether after-housing income suffices to cover basic non-housing needs (i.e., residual income method) (Stone, 2006; Thalmann, 2003). While the former allows for ready comparison of affordability situations across different regions, groups, and years, the latter helps identify households faced with housing-induced poverty, giving useful references for designing housing subsidy programs (Baker et al., 2015; Kutty, 2005; Lau and Li, 2006; Stone, 2006; Yip, 1995).

These objective indicators, which have been widely utilized in prior studies, have evolved over time (e.g., Lux, 2007; Yates, 2007). One of the most significant improvements is the distinction between 'apparent' and 'actual' affordability (Thalmann, 1999). For example, adopting the 'quality-based' measure of rental affordability, Lerman and Reeder (1987) and Thalmann (1999) demonstrated that not all households with high rent-to-income ratio should be considered a policy target since it can also occur due to household's preference for large or luxurious housing. Put differently, these scholars enabled the distinction between households with insufficient income to pay for adequate housing from those who deliberately choose housing cost burden on account of their

strong taste for high standard housing, referred to as 'under-consumption' and 'over-consumption', respectively (Lerman and Reeder, 1987; Thalmann, 2003).

In contrast, subjective rental affordability measured by perceived housing cost burden has received little attention in the field of housing research (Bramley, 2012). The unpopularity of subjective affordability measures stems primarily from the inherent nature of subjective social indicators being unstable due to one's constantly changing aspirations (so-called 'hedonic treadmill effect') (Brickman and Campbell, 1971), resulting in low reliability and comparability (OECD, 2013). Despite the limitations and instability of subjective measures, subjective information on social indicators, such as perceptions and assessments, still bears its own value. As Campbell and Convers (1972) note, people's well-being must be understood through the eye of the beholder. In this regard, subjective measures have a strong advantage over objective measures in that they can capture an individual's experience and preferences directly (Veehnhoven, 2002), whereas objective measures can only provide indirect reflections of how people feel about their situations (Heylen, 2021).

Recognizing the merits of subjective indicators, the European Union, Belgium, and England have recently begun to incorporate subjective measures of affordability in their national housing or social surveys. Further, a number of studies utilizing the collected data have examined whether objective and subjective affordability indicators paint the same or different pictures, as well as which objective measures are more closely aligned with subjective measures (Acolin and Reina, 2022; Bramley, 2012; Brandolini et al., 2013; Heylen, 2021; Sunega and Lux, 2016). One notable finding of these studies is that a considerable portion of households paying less (more) than the normative thresholds in the ratio or residual income approaches actually do (not) feel rental cost

120 burden. For instance, in a study based on the EU-2016 survey, the correlation between
121 objective and subjective measures was found to be rather weak, with only about 30% of
122 all households having the two affordability measures matched (Heylen, 2021). However,
123 very little is known about the reasons why subjective and objective rental affordability
124 are misaligned in the non-negligible population segments.
125
126 *Misalignment between objective and subjective affordability measurements*
127 Against this backdrop, the primary goal of this study is to identify the potential drivers of
128 this misalignment. We attempt to do so by employing a theoretical framework from the
129 literature on quality of life, which contends that internal, subjective indicators should be
130 taken into account in addition to the predominant external, objective indicators for a more
131 comprehensive explanation (Angner, 2010; Christoph and Noll, 2003; Diener and Suh,
132 1997).
133 In particular, Noll's (2013) framework of objective and subjective well-being
134 throws valuable insight into our understanding of the relationship between objective and
135 subjective social indicators (Berhe et al., 2014). It suggests four types of welfare positions
136 based on a combination of objective and subjective dimensions. The first category, 'well-
137 being', denotes households in which favorable objective living conditions go together
138 with positive subjective well-being. On the other hand, the combination of inadequate
139 objective living conditions and poor subjective well-being is classified as the 'deprivation'
140 category. These two types demonstrating consistency between subjective and objective
141 measures present an easily anticipated outcome. More attention must be paid to the
142 categories that show a conflicting assessment between objective and subjective measures:
143 'Dissonance' category (also known as 'satisfaction dilemma') reflects a low level of

144 subjective well-being despite the good conditions, and 'adaptation' represents a high level
145 of subjective well-being despite poor living conditions ('satisfaction paradox').
146 According to Noll (2013), 'dissonance' results from one's unsatisfied or heightened
147 expectations, and 'adaptation' occurs due to one's tendency to adapt to unfavorable
148 objective conditions based on low expectations.

149 Applying this constellation, we identify the 'dissonance' and 'adaptation' groups
150 in the context of rental affordability (Table 1). The 'dissonance' group can be understood
151 as households whose rent is less than the normative thresholds but still perceive the
152 burden of housing costs. In contrast, the 'adaptation' group can be described as
153 households who pay more than the thresholds yet perceive no housing cost burden,
154 adapting to the high housing costs. From Noll's (2013) point of view, the key factor
155 distinguishing these two groups is a household's *expectation*[1] of the appropriate rent.
156 Although a household pays less than a threshold set by the normative approach, it is likely
157 to feel burdened if they are paying more than they expect to pay for the dwelling. In
158 contrast, even if a sizable portion of income is spent on housing, a household is less likely
159 to perceive housing cost burden if it anticipates paying that much for the dwelling. It is
160 with this understanding that we contend that an individual's rental expectations are
161 intrinsically grounded in their internal assessment of the housing conditions in relation to
162 their household circumstances.

163 [Table 1 here]

164

[1] Conceptually, the *expectation* of the appropriate rent is different from the *aspiration* for the appropriate rent in that the former refers to how much people *think they will* pay for the house, and the latter pertains to how much they *want to pay* for the house (Boxer et al., 2011).

As for the determinants of the rental affordability problem, however, the existing research focuses on the objective measures of housing conditions (e.g., housing size, location, amenities), household factors (e.g., having children, family size, education, income), and the regional and local externalities (e.g., supply and demand, rental vacancy rate, demographic structure, economic recession) (Babalola, 2013; Dong, 2018; Egner and Grabietz, 2018; Kutty, 2005; Samarin and Sharma, 2021; Seymour et al., 2020; Su et al., 2021). While these studies still provide valuable insights into our research questions, they apparently lack consideration of renters' internal assessment of their housing given their household circumstances.

In this paper, we presume that the subjective assessment of housing is encapsulated in the notion of 'residential satisfaction' (Bao, 2020; Galster, 1985; Riazi and Emami, 2018). According to Galster (1987), the measure of satisfaction determined by a household's subjective housing assessment process. An individual first evaluates housing based not only on the physical environmental features but also on residents' personal or household characteristics associated with the housing (Amerigo and Aragones, 1997; Balestra and Sultan, 2013). One's evaluation of the current residential situation is then compared to cognitively constructed standards of comparison, also referred to as *"reference"* conditions. If the current housing conditions correspond to the reference point, they feel satisfied. Conversely, if the housing conditions are not considered to be congruent with the reference point, residential dissatisfaction appears salient.

We can anticipate three possible scenarios for those who are dissatisfied with their current housing situation as a result of the incongruence. First, one may alter one's present housing situation by, for instance, moving to a new home or renovating the current one. Alternatively, one may put up with the current housing situation and feel dissatisfied and

189 housing cost burden. This will often be the case for low-income people with limited
190 resources available to enhance their housing. Lastly, it is also possible that low-income
191 households adapt by reconciling their reference condition and lowering their housing
192 expectations. If so, they will show residential satisfaction despite the current unfavorable
193 housing situation and perceive less housing cost burden. Hui et al. (2014) found that low-
194 income older adults have relatively lower housing expectations and hence tend to show a
195 high level of residential satisfaction—less subject to the housing conditions—and
196 perceive less housing cost burden. In this sense, we anticipate that residential satisfaction
197 will influence affordability assessments and the gap between objective and subjective
198 indicators, such that the more satisfied households are with their housing, the less likely
199 they are to feel the housing cost burden.
200
201 **Rental affordability in South Korea**
202 Since the early 1990s, Korea has achieved significant qualitative and quantitative
203 improvements in housing outcomes. However, as rising housing prices have outpaced
204 wage growth in the recent decades, Korea's housing prices have increasingly become
205 unaffordable; While the median equivalized household income grew by 29.7% between
206 2011 and 2020 (Statistics Korea, 2021), the prices of high-rise apartments, the most
207 common type of housing in Korea, increased by 82% in the capital region during the same
208 period (KOSIS, 2022). The recent spike in *Jeonse* rental prices, Korea's unique tenure
209 model utilizing a lump-sum deposit rental system, has exacerbated the housing
210 affordability problem for private renters. Particularly, the limited share of public housing
211 (7.8%) in the national housing stock (MoLIT, 2020) has channeled low-income renters
212 into great housing difficulties. The bottom 10% of households in income distribution

spend 47% of their income on housing, and over 370,000 households live in non-residential structures susceptible to severe weather (Kang et al., 2019).

To alleviate the housing challenges faced by the vulnerable population, the national and local governments have been expanding public housing programs and various housing benefits. However, Korea's housing policies for renters have not been driven by systematic assessments of housing affordability. Despite regular data collection on rent-to-income ratio and perceived burden of housing costs by the Ministry of Land, Infrastructure, and Transports, there has been insufficient effort to translate these indicators into policymaking (Bae and Kim, 2014; Kang et al., 2019). Given the growing severity of housing unaffordability issues and the Korean government's plans to significantly increase housing assistance under the 2017 Housing Welfare Roadmap, it is essential to work toward a more thorough and refined understanding of rental affordability that would lead to the development and implementation of effective housing policies.

Data

This study uses the Korean Labor and Income Panel Study (KLIPS) data set, a nationally representative longitudinal annual survey. Since 1998, The Korea Labor Institute, a government-funded research organization, has been compiling a wealth of information on income, education, employment, and demographic characteristics of urban Korean households and their members.

According to a recent Korean housing market study (Chun, 2019), housing prices, including rental prices, started to increase significantly in 2014, and the rising trend stayed constant until 2019. Therefore, to control for the housing market cycle and its influence,

237 especially on the subjective affordability measure[2], we choose the study period from 2015
238 to 2020.[3] Our sample includes private renters. In longitudinal surveys, the difficulty in
239 following up with respondents over time poses a potential for attrition bias if participants
240 who drop out of the study systematically differ from those who remain. Thus, to prevent
241 possible bias, we opt to use the balanced sample in the main analysis.[4] Given that rental
242 unaffordability is more challenging to low-income households, the main policy target
243 groups, (Bentley et al., 2011; Baker et al., 2015; Park and Seo, 2020), we also create a
244 subgroup that is in the bottom 40% of the household income distribution (3,462
245 observations) and compare the results to the full sample (5,814 observations).

246 Using the KLIPS data has a couple of key advantages for this study. Because it is
247 longitudinal, it enables us to mitigate the influence of different attitudes towards
248 perception and assessment of affordability by using the within-household variations. Also,
249 the data set contains both a subjective affordability indicator and information that allows
250 for the construction of two objective affordability indicators (i.e., rent-to-income ratio and
251 residual income). Yet, it is a limitation of using the KLIPS that measuring perceived
252 housing cost burden should only be based on a single-item measure (i.e., whether or not
253 the respondent feels housing cost burden).

254

255 **Variables**

256 *Dependent variable*

[2] As Sunega and Lux (2016) mention, for example, a larger share of households may report that they feel housing cost burden when the housing expenses increase nationally over time regardless of their actual housing cost ratio.

[3] The KLIPS contains the information compiled a year before it is released (e.g., 2015 KLIPS data set shows 2014 information).

[4] The results with unbalanced panel are also tested and included in the supplemental file.

Our outcome of interest measures whether the objective and subjective rental affordability indicators match. We formulated two alternative dependent variables using the rent-to-income ratio and residual income approach, each of which consists of three categories. For the first dependent variable, we use the *ratio* of the monthly rent to reported monthly household income. Following the previous housing affordability studies (Baker et al., 2020; McConnell, 2013), if the ratio is equal to or higher than 30%, it is coded as 1 (unaffordable), and 0 otherwise. Next, the objective indicator is compared with the subjective indicator to see if the two indicators are aligned. For the subjective indicator, we use a self-reported assessment on the housing cost burden. As a result, a three-category dependent variable is created: households that are cost-burdened when measured using the objective indicator yet are not subjectively cost-burdened (coded as 2); households that are not cost-burdened based on the objective indicator but subjectively cost-burdened (coded as 1); households that show matching indicators, serving a reference group in our multinomial logistic regressions (coded as 0).

The formulation of the second dependent variable follows the same logic but uses the *residual income* approach. Households whose residual income after paying monthly rent is below the minimum income level necessary to afford other non-housing expenses[5] are considered cost burdened and coded as 1 and 0 otherwise. Then the objective indicator is compared with the subjective measure. Again, as a result, three categories are created.

Independent variables

[5] In accordance with the previous studies (Oh and Oh, 2018), the minimum levels of income for non-housing expenses by household size are calculated using the following formula: Median Income $\times 0.6 \times 0.833$. One-sixth of the median income level is the minimum cost of living set by guidelines on personal financial workout cases article and the share of non-housing needs (i.e., 83.3%) is based on Ministry of Health and Welfare (2017).

A central independent variable for the analysis is residential satisfaction. The residential satisfaction question in the KLIPS offers a series of statements that respondents may choose from on a 5-point Likert scale (from very satisfied (1) to very dissatisfied (5)). For the sake of a more intuitive interpretation, we reverse the scale so that a higher value corresponds to a higher level of residential satisfaction.

We also include several household and housing attributes, and the geography variable in the analyses, following the lead of the previous studies on rent burden (Colburn and Allen, 2018; Samarin and Sharma, 2021; Seo et al., 2022). As for the household attributes, age, education, annual income, number of children, and number of household members are included. The age and education information is obtained from the head of household as in the literature (Moore and Skaburskis, 2004; Meltzer and Schwartz, 2016). When the head of the household possesses a diploma that is higher than high school, the education variable is equal to 1 and 0 otherwise. The reported annual income is log-transformed to address the skewness of income.

Apartment, housing size, and *Jeonse* variables are included to measure the effects of housing attributes. Apartments are coded as 1 and other types are coded as 0. Housing size is a continuous variable, and when households use *Jeonse*[6] it is equal to 1 and 0 otherwise. Lastly, we dummy-code the Seoul metropolitan area (i.e., Seoul, Incheon, and Gyeonggi province) as 1 and 0 otherwise to reflect the regional heterogeneity and different level of market activity.

Table 2 presents summary statistics of the variables. The dependent variables show similarities in mean levels and standard deviations. Looking at some key features

[6] '*Jeonse'* is generally regarded as a more affordable tenure choice than monthly rentals in Korea because tenants pay no monthly rent during the tenancy and can have the lump sum deposit back upon the contract termination.

of the explanatory variables, on average, approximately 42% hold higher than a high school diploma and the average age is about 53. Only 6% of the respondents live in Seoul metropolitan region while about half of the households live in *Jeonse*. The average residential satisfaction score is moderate, 3.2 on a scale of 5.

[Table 2 here]

Empirical Analysis and Results

The first primary goal of the analysis is to explore whether and to what extent the objective and subjective rental affordability indicators match. Figure 1 shows the relationships between the measures, in which the X-axis represents the rent-to-income ratio and the Y-axis shows residual income. Households that perceive cost burden are represented by cross-shaped marks. The plot (Panel a) for the entire household presents a much longer tail than for the bottom 40% income group (Panel b), apparently due to the income gaps between the two groups.

The data highlights that both objective indicators do not appear to be well aligned with perceived cost burden: 40.2% (50.8%) of the entire (bottom 40% income group) households do not have matching indicators when measured with rent-to-income and the subjective indicator, whereas 41.3% (49.8%) of the households (bottom 40% income group) are not aligned when measured with residual income and the subjective indicator. Both groups with and without 'perceived rental burden' are almost evenly distributed along the X- and Y-axis in the full sample and subsample (bottom 40%). It means that a considerable number of households feel rental cost burden although they pay below the normative thresholds of affordability, or perceive no burden although they pay more than the thresholds.

[Figure 1 here]

What factors, then, contribute to the discrepancy between objective and subjective rental affordability? We use panel multinomial logistic regressions with fixed effects to study the question. The specification adopted is following:

$$Discrepancy\ between\ the\ objective\ and\ subjective\ measures_{it} = \beta_0 + \beta_1(Household\ attributes_{it}) + \beta_2(Housing\ attributes_{it}) + \beta_3(Geography_{it}) + v_i + v_t + \mu_{it}$$

where i denotes a household, and t is a year. The dependent variable is one of the above-explained three categories for household i in year t and the base category is *both objective and subjective indicators are either 0 or 1*. $Household\ attributes_{it}$ is a matrix of age, education, log-transformed annual income, number of children and household members, and residential satisfaction. $Housing\ attributes_{it}$ is a matrix of residential type, tenure, and housing size. $Geography_{it}$ indicates whether a household lives within the Seoul metropolitan area. The model also includes households (v_i) and time-fixed effects (v_t). The household fixed-effects allow us to control for the inherent and unobserved fixed attitudes towards perception and assessment of affordability. Not accounting for such an arguably time-invariant factor may be subject to the omission of a critical component and estimation bias. The year fixed effects control for shocks in the housing market that occurred in that specific year. Lastly, μ_{it} denotes the idiosyncratic error.

347 Regression results are presented in Table 3 in which we include odds ratios
348 obtained by regressing the first dependent variable on the explanatory variables. The
349 results reveal that when *residential satisfaction* increases by 1 unit, households are 0.748
350 times less likely to be in an *objectively affordable but subjectively unaffordable* state
351 (hereafter dissonance), compared to the basic state of having two matching affordability
352 indicators.[7] On the flip side, households with higher residential satisfaction are more
353 likely to feel that they are not cost-burdened (or less likely to feel cost-burdened) even
354 when their rent-to-income ratio is above 30% as seen in column 3. Although *residential*
355 *satisfaction* coefficient in column 3 is not statistically significant, when the coefficients
356 are taken together, it implies that even if rent-to-income ratio exceeds the widely accepted
357 threshold of the housing cost burden, the households do not necessarily perceive that they
358 are paying more than they should. Households may regard the seemingly high rent level
359 as appropriate for their house and residential environments.
360 [Table 3 here]
361
362 The income variable shows positive effects on the probability of being in the
363 dissonance group. It may be due to dissonance between what they expect and the quality
364 of the houses: The current residential environments may not measure up to their
365 expectations which are heightened as income rises. Households in *Jeonse* and those with
366 larger household sizes are less likely to fall into a state of dissonance. Also, having a
367 higher number of children tends to put more pressure on the cost burden.

[7] One might be concerned about a possibility of reverse causality since, for instance, low perceived rent burden could lead to higher residential satisfaction (Balestra and Sultan, 2013). However, the results from our analysis (Figure 1) show that even if the perceived cost burden is low, the alignment with the objective measure seems to be random, which makes it hard to find a systematic correlation between our dependent variables and the satisfaction variable.

As expected, the explanatory variables in column 3 in Table 3 that compare *objectively unaffordable but subjectively affordable* (hereafter adaptation) to the base category of matching two affordability indicators show opposite effects. *Apartment* and *Jeonse* variables increase the probability of being in the adaptation group while *income* decreases the probability.

Next, columns 4 and 5 in Table 3 present the results with an alternative dependent variable based on the residual income approach. For a few variables, the magnitudes and significance of the coefficients show a slight change; however, key findings and signs of the coefficients are not reversed. For instance, *residential satisfaction*, again, decreases the odds of being in a state of dissonance. In contrast, the more satisfied households are with their residential environments, the more likely they are to be in the adaptation group, though the effect does not achieve significance.

Then, we run the same multinomial logistic regressions for the bottom 40% income group to see if possible varying effects emerge. The conclusions are largely unaffected for both dependent variables. In column 2 of Table 4 which uses the rent-to-income ratio for the objective indicator, *residential satisfaction*, once again, has mitigating effects on being in the dissonance group whereas the variable has a positive but insignificant effect on the probability of being in the adaptation group. Again, *income* and *Jeonse* variables significantly contribute to the model along with *age*. But the magnitudes of the coefficients are more modest relative to the model for the entire model in Table 3. The effect of income, in particular, is now much weaker, as the income level is constrained to the bottom 40%.

[Table 4 here]

The models estimated based on the residual income approach show similar results. In columns 4 and 5 of Table 4, *residential satisfaction, log annual income,* and *Jeonse* continue to have significant effects on both dependent variable categories and *number of household members* becomes a significant effect as well.

Robustness check

To ensure that the main results are robust, we carry out additional analyses. First, we estimate the regressions without removing observations that have missing data over time to show that our results are robust to an unbalanced panel of households. Table A.1 and A.2 in the supplemental file confirm the findings. The variables with significant effects in the main models remain unchanged. Also, the *Seoul metro area* and *housing size* now indicate significant effects, especially for the entire income group model. That is, living in Seoul metropolitan area raises the likelihood of being in the state of adaptation while *housing size* shows significant effects on both categories. The results for the bottom 40% income group are also likewise comparable, with slightly less significant *Seoul metro area* and *housing size.* Other variables including *residential satisfaction, Jeonse,* and *log annual income* show the same significant effects identified in the main results.

For sensitivity checks, we also assess whether the findings are robust to other rent-to-income ratio thresholds. The results are consistent when using 25% and 35%, instead of 30%, as a threshold (see Tables B.1 and B.2 in the supplemental file). Finally, we demonstrate that our results are robust to excluding observations with the extreme values of the dependent variables as shown in Figure 1, with a meagre change in significance and the magnitudes of the coefficients in Table C in the supplemental file.

Discussion

The majority of current policies addressing rental affordability concentrate on identifying households that pay more than the normative thresholds for housing. However, we found the segments of households whose perceived housing payment burden is not in accordance with the thresholds of the normative assessments, as identified in the previous studies (Heylen, 2021; Sunega and Lux, 2016). The evident difference between objective and subjective rental affordability in fact represents the gap between policymakers' and tenants' perspectives in interpreting housing affordability. Subjective rental affordability and its use yield insightful data on people's sentiments towards the housing market and their likely future housing decisions (Sunega and Lux, 2016), which can be used to allocate public resources more effectively. Additionally, the revelation of a sizable proportion of 'dissonance' and 'adaptation' groups suggests that the existing housing policies may have not been optimally effective and should be adjusted to better address the affordability situation.

Furthermore, the use of subjective indicators has the potential to benefit health research particularly examining the health impact of housing unaffordability. Prior research has up until now relied heavily on the use of objective indicators, primarily the 30% rent-to-income threshold, to show the adverse effects of housing cost burden on health outcomes, both physical and mental well-being (for example, Acolin and Reina, 2022; Baker et al., 2020; Bentley et al., 2016; Meltzer and Schwartz, 2016). However, subjective measures of affordability (i.e., how they feel) may hold greater significance and better capture the psychosocial impact of the housing cost burden than objective measures (i.e., how much they pay). Therefore, we may conclude that combining subjective affordability indicators with objective ones would help fully capture the

multifaceted housing affordability problem rather than relying solely on objective indicators, preventing misleading policy interventions; and it contributes to advancing the theoretical understanding of the linkage between multifaceted housing affordability and its impact.

Nevertheless, it seems challenging to put forward the ways to effectively integrate the two sets of indicators in policies and surveys. Also, perceived affordability is influenced by the interaction of an individual with the society, and hence, the outcome of subjectively measured affordability can only be properly interpreted and used when detailed contextual information is provided alongside, such as information on the housing market and housing systems. Furthermore, setting out universal standards for perceived housing cost burden for international comparison seems difficult, compared to objective affordability indicators. Yet, subjective affordability still has a significant advantage in understanding what the current housing cost means to various types of households, which could produce a wealth of nuanced information about housing affordability.

As a second primary question, we explore which factors affect the discrepancy between objective and subjective rental affordability. Arguably, the study's most intriguing finding may be that some of the discrepancies can be attributed to residential satisfaction. Our analysis finds that people dissatisfied with their current housing are more likely to feel their housing is unaffordable, even if their rent is lower than the normative thresholds. Conversely, people satisfied with their housing are less likely to feel cost-burdened, even if their rent is above the normative thresholds. The level of residential satisfaction is affected by what people expect from their residential environments and the results of comparison between what they ‘expect to pay’ and what they ‘actually pay’. If the actual paying rent exceeds what they expect to pay for the house, the level of

residential satisfaction decreases, leading them to feel their home is unaffordable. This pattern is found to be consistent across different income groups; both the models for the bottom 40% of income earners and the entire income group show the same effects on residential satisfaction.

The 'dissonance' group has not been the major concern in housing policies, and little is known about how and why the dissonance emerges. Our research suggests that residential satisfaction may be a critical element in resolving this query. It is inherently difficult to formulate simple strategies to enhance residential satisfaction due to its subjective nature (Galster and Hesser, 1981). We could, however, benefit from the accumulated knowledge of the determinants of residential satisfaction (Balestra and Sultan, 2013; Boschman, 2018; Riazi and Emami, 2018). Residential satisfaction is known to be heterogeneous across different households even in the same housing estate or neighborhood. Therefore, a more comprehensive understanding of the local housing context and housing preferences of different population groups would benefit housing policy design to improve residential satisfaction and, by extension, relieve subjective affordability problems. In the Korean context, for example, our finding implies that upper-income renters prefer to live in *Jeonse* rental housing that requires a large lump sum deposit compared to monthly rentals, and hence, the recent shortage of *Jeonse* rentals might have had adverse effects on subjective affordability.

Conclusions

This paper adds to the existing 'quality-based' affordability approach (Lerman and Reeder, 1987; Thalmann, 1999, 2003) in the housing affordability scholarship by engaging with residential satisfaction by which the 'quality' of housing is defined by

488 residents, not by policymakers or researchers. It would also inform the formulation of
489 more refined policies to address rental affordability problems. This study focuses on
490 private renters only, but it is possible that the relationship between objective and
491 subjective housing affordability and the role of residential satisfaction would be different
492 when homeowners and public renters are concerned. If the data allows, matching the unit
493 of analysis for objective affordability (usually measured on a household basis) and
494 subjective affordability (usually measured on an individual basis) would also provide new
495 insights into the interpretation of the linkage between objective and subjective
496 affordability measurements.
497
498
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Table 1. Relationship between objective and subjective rental affordability

Objective rental affordability	**Subjective rental affordability**	
	Affordable	*Unaffordable*
Affordable	Less policy concern	Dissonance ('Satisfaction dilemma')
Unaffordable	Adaptation ('Satisfaction paradox')	Major policy target

Source: Authors, adjusted from Noll (2013).

Table 2. Summary statistics

Variable	**Obs**	**Mean**	**Std. dev.**	**Min**	**Max**
Dependent variable 1 (based on rent-to-income ratio)	5,814	0.52	0.69	0.00	2.00
Dependent variable 2 (based on residual income)	5,814	0.59	0.78	0.00	2.00
Age	5,814	53.02	14.67	20.00	96.00
Education	5,814	0.42	0.49	0.00	1.00
Marriage	5,814	0.21	0.41	0.00	1.00
Log annual income	5,814	7.91	0.85	1.61	11.14
Seoul metro area	5,814	0.62	0.48	0.00	1.00
Number of children	5,814	0.36	0.71	0.00	4.00
Number of household members	5,814	2.36	1.28	1.00	7.00
Apartment	5,814	0.42	0.49	0.00	1.00
Housing size	5,814	19.16	9.28	1.00	300.00
Jeonse	5,814	0.48	0.50	0.00	1.00
Residential satisfaction	5,814	3.23	0.63	1.00	5.00

Notes: Data come from Korean Labor and Income Panel Study and covers the years 2015 to 2020; Housing size is measured with Pyeong which is equivalent to 3.3 square meter; Survey weights are applied

Table 3. Regression results for the entire observations with balanced panel data, 2015-2020

	Dependent variable is calculated using rent-to-income ratio		Dependent variable is calculated using residual income	
	Obj. affordable & sub. unaffordable	*Obj. unaffordable & sub. affordable*	*Obj. affordable & sub. unaffordable*	*Obj. unaffordable & sub. affordable*
	Odds ratio	Odds ratio	Odds ratio	Odds ratio
Residential satisfaction	0.748***	1.168	0.793***	1.051
	(0.055)	(0.144)	(0.068)	(0.101)
Age	0.956	0.995	1.001	1.042
	(0.030)	(0.029)	(0.035)	(0.029)
Education	0.682	0.836	0.672	2.988
	(0.532)	(0.784)	(0.537)	(3.021)
Log annual income	2.349***	0.106***	5.521***	0.123***
	(0.258)	(0.020)	(0.810)	(0.018)
Seoul Metro Area	0.969	3.207	0.787	1.169
	(0.506)	(2.389)	(0.469)	(0.869)
Number of children	1.373**	0.828	1.178	0.971
	(0.221)	(0.212)	(0.215)	(0.190)
Number of household members	0.691***	1.465	0.512***	1.832***
	(0.091)	(0.380)	(0.078)	(0.343)
Apartment	0.76	2.967***	0.661*	1.217
	(0.154)	(1.011)	(0.156)	(0.318)
Housing size	0.996	1.036	1.000	1.001
	(0.006)	(0.023)	(0.006)	(0.017)
Jeonse	0.162***	3.274***	0.114***	2.844***
	(0.027)	(0.901)	(0.022)	(0.631)
Household fixed effects		Yes		
Year fixed effects		Yes		
Observations	5,245		5,411	
Likelihood Ratio Chi^2	626.995***		847.893***	

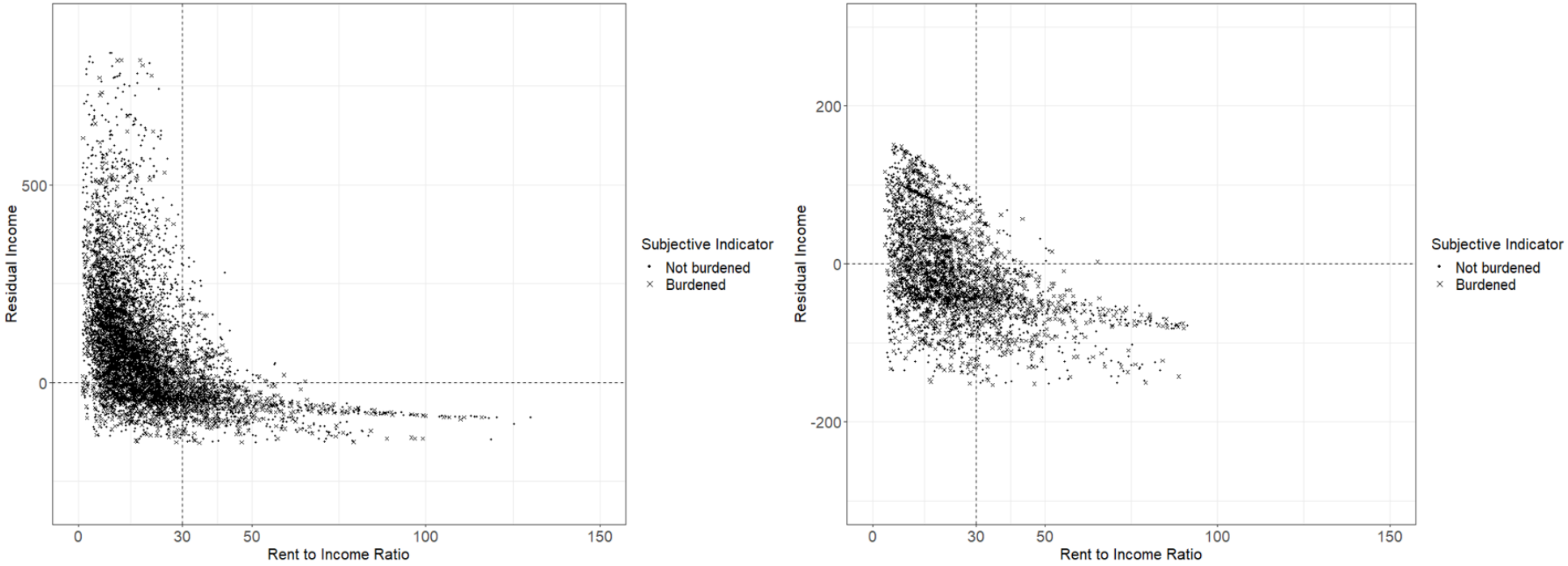
Notes: Numbers in parentheses show standard errors; ***p<0.01, **p<0.05, *<0.1; The reference category is both objective and subjective indicators are either 0 or 1.

Table 4. Regression results for the bottom 40% income group with balanced panel data, 2015-2020

	Dependent variable is calculated using rent-to-income ratio		Dependent variable is calculated using residual income	
	Obj. affordable & sub. unaffordable	*Obj. unaffordable & sub. affordable*	*Obj. affordable & sub. unaffordable*	*Obj. unaffordable & sub. affordable*
	Odds ratio	Odds ratio	Odds ratio	Odds ratio
Residential satisfaction	0.752***	1.006	0.655**	1.063
	(0.080)	(0.147)	(0.114)	(0.117)
Age	0.934*	1.009	1.061	1.032
	(0.038)	(0.035)	(0.061)	(0.031)
Education	0.742	0.513	0.257	2.542
	(0.795)	(0.550)	(0.395)	(3.021)
Log annual income	1.001***	0.998***	1.002***	0.999***
	(0.000)	(0.000)	(0.000)	(0.000)
Seoul Metro Area	1.751	2.022	3.026	0.836
	(1.502)	(2.137)	(4.112)	(0.862)
Number of children	1.415	1.169	2.336	0.809
	(0.454)	(0.506)	(2.276)	(0.254)
Number of household members	0.774	1.811	0.173***	2.743***
	(0.183)	(0.679)	(0.085)	(0.682)
Apartment	1.157	1.546	1.128	0.891
	(0.354)	(0.695)	(0.544)	(0.290)
Housing size	0.971	1.020	0.976	1.011
	(0.022)	(0.038)	(0.033)	(0.024)
Jeonse	0.32***	2.274**	0.190***	3.853***
	(0.079)	(0.791)	(0.071)	(1.063)
Household fixed effects		Yes		
Year fixed effects		Yes		
Observations	2,530		2,581	
Likelihood Ratio Chi^2	268.815***		453.287***	

Notes: Numbers in parentheses show standard errors; ***p<0.01, **p<0.05, *<0.1; The reference category is both objective and subjective indicators are either 0 or 1.

Figure 1. Panel (a) Relationships among affordability indicators for the entire observations (left); Panel (b) Relationships among affordability indicators for the bottom 40% income group



Notes: Data come from Korean Labor and Income Panel Study and covers the years 2015 to 2020; Top and bottom 1% of each objective indicator are trimmed.

Supplemental Material

A. Regression results with unbalanced data

Table A.1 Regression results for the entire observations with unbalanced panel data, 2015-2020

	Dependent variable is calculated using rent-to-income ratio		Dependent variable is calculated using residual income	
	Obj. affordable & sub. unaffordable	*Obj. unaffordable & sub. affordable*	*Obj. affordable & sub. unaffordable*	*Obj. unaffordable & sub. affordable*
	Odds ratio	Odds ratio	Odds ratio	Odds ratio
Residential satisfaction	0.817***	1.011	0.878**	1.053
	(0.043)	(0.084)	(0.053)	(0.071)
Age	0.998	1.03	1.864	1.064**
	(0.023)	(0.026)	(1.237)	(0.027)
Education	1.178	0.927	4.954***	2.371
	(0.699)	(0.628)	(0.512)	(1.850)
Log annual income	2.259***	0.100***	0.796	0.105***
	(0.179)	(0.013)	(0.264)	(0.011)
Seoul Metro Area	0.865	2.452*	1.252	0.898
	(0.279)	(1.275)	(0.178)	(0.438)
Number of children	1.308**	0.967	0.544***	1.085
	(0.166)	(0.189)	(0.063)	(0.165)
Number of household members	0.704***	1.167	0.841	1.839***
	(0.072)	(0.212)	(0.131)	(0.262)
Apartment	1.012	2.129***	0.992	1.086
	(0.144)	(0.452)	(0.006)	(0.212)
Housing size	0.984**	1.058***	0.135***	1.009
	(0.007)	(0.014)	(0.018)	(0.012)
Jeonse	0.191***	2.408***	0.191***	1.768***
	(0.023)	(0.446)	(0.023)	(0.289)
Household fixed effects	Yes			
Year fixed effects	Yes			
Observations	10,319		10,580	
Likelihood Ratio Chi^2	1245.398***		1655.194***	

Notes: Numbers in parentheses show standard errors; ***p<0.01, **p<0.05, *<0.1; The reference category is both objective and subjective indicators are either 0 or 1.

Table A.2 Regression results for the bottom 40% income group with unbalanced panel data, 2015-2020

	Dependent variable is calculated using rent-to-income ratio		Dependent variable is calculated using residual income	
	Obj. affordable & sub. unaffordable	*Obj. unaffordable & sub. affordable*	*Obj. affordable & sub. unaffordable*	*Obj. unaffordable & sub. affordable*
	Odds ratio	Odds ratio	Odds ratio	Odds ratio
Residential satisfaction	0.945	0.953	0.757**	1.079
	(0.035)	(0.097)	(0.094)	(0.086)
Age	0.906	1.045	1.051	1.061**
	(0.859)	(0.030)	(0.059)	(0.029)
Education	1.001***	0.815	0.261	2.099
	(0.000)	(0.646)	(0.388)	(1.820)
Log annual income	1.545	0.998***	1.002***	0.998***
	(0.897)	(0.000)	(0.000)	(0.000)
Seoul Metro Area	1.202	3.721*	1.127	0.689
	(0.315)	(2.852)	(0.818)	(0.464)
Number of children	0.771	0.910	1.266	0.813
	(0.155)	(0.308)	(0.910)	(0.206)
Number of household members	1.254	1.512	0.208***	2.476***
	(0.282)	(0.432)	(0.083)	(0.500)
Apartment	0.975	1.303	1.000	0.824
	(0.016)	(0.396)	(0.339)	(0.204)
Housing size	0.386***	1.038*	0.966	1.004
	(0.075)	(0.023)	(0.024)	(0.017)
Jeonse	0.191***	2.201***	0.170***	2.654***
	(0.023)	(0.545)	(0.051)	(0.554)
Household fixed effects	Yes			
Year fixed effects	Yes			
Observations	4,725		4,762	
Likelihood Ratio Chi^2	542.58***		835.585***	

Notes: Numbers in parentheses show standard errors; ***p<0.01, **p<0.05, *<0.1; The reference category is both objective and subjective indicators are either 0 or 1.

B. Regression results with alternative rent-to-income thresholds

Table B.1 Regression results for the entire observations with balanced panel data, 2015-2020

	Dependent variable is calculated using rent-to-income ratio **(25% threshold)**		Dependent variable is calculated using rent-to-income ratio **(35% threshold)**	
	Obj. affordable & sub. unaffordable	*Obj. unaffordable & sub. affordable*	*Obj. affordable & sub. unaffordable*	*Obj. unaffordable & sub. affordable*
	Odds ratio	Odds ratio	Odds ratio	Odds ratio
Residential satisfaction	0.758***	1.214*	0.787***	0.980
	(0.058)	(0.129)	(0.057)	(0.139)
Age	1.005	1.001	0.972	1.025
	(0.031)	(0.029)	(0.026)	(0.036)
Education	0.937	0.877	0.539	0.535
	(0.683)	(0.779)	(0.399)	(0.538)
Log annual income	2.702***	0.091***	2.021***	0.137***
	(0.323)	(0.016)	(0.211)	(0.027)
Seoul Metro Area	0.779	1.945	0.914	3.367
	(0.411)	(1.165)	(0.470)	(2.688)
Number of children	1.449**	1.032	1.456**	0.793
	(0.239)	(0.219)	(0.236)	(0.233)
Number of household members	0.648***	1.332	0.722**	1.379
	(0.089)	(0.286)	(0.093)	(0.423)
Apartment	0.749	1.537	0.824	3.271***
	(0.154)	(0.440)	(0.165)	(1.332)
Housing size	0.992	1.052***	0.998	1.050*
	(0.007)	(0.019)	(0.006)	(0.028)
Jeonse	0.188***	4.329***	0.140***	2.579***
	(0.031)	(1.081)	(0.023)	(0.787)
Household fixed effects	Yes			
Year fixed effects	Yes			
Observations	5,401		5,034	
Likelihood Ratio Chi^2	690.510***		537.603***	

Notes: Numbers in parentheses show standard errors; ***p<0.01, **p<0.05, *<0.1; The reference category is both objective and subjective indicators are either 0 or 1.

Table B.2 Regression results for the bottom 40% income group with balanced panel data, 2015-2020

	Dependent variable is calculated using rent-to-income ratio **(25% threshold)**		Dependent variable is calculated using rent-to-income ratio **(35% threshold)**	
	Obj. affordable & sub. unaffordable	*Obj. unaffordable & sub. affordable*	*Obj. affordable & sub. unaffordable*	*Obj. unaffordable & sub. affordable*
	Odds ratio	Odds ratio	Odds ratio	Odds ratio
Residential satisfaction	0.799*	1.121	0.839*	0.961
	(0.093)	(0.146)	(0.088)	(0.157)
Age	0.998	1.012	0.954	1.011
	(0.040)	(0.032)	(0.031)	(0.037)
Education	0.572	0.766	0.634	0.505
	(0.631)	(0.772)	(0.626)	(0.544)
Log annual income	6.967***	0.289***	3.957***	0.280***
	(1.560)	(0.048)	(0.712)	(0.053)
Seoul Metro Area	0.843	1.896	1.759	3.161
	(0.699)	(1.852)	(1.458)	(3.673)
Number of children	1.272	1.206	1.659	0.949
	(0.422)	(0.423)	(0.592)	(0.460)
Number of household members	0.657*	1.299	0.830	1.539
	(0.163)	(0.403)	(0.192)	(0.677)
Apartment	1.201	1.046	1.425	2.192
	(0.397)	(0.412)	(0.448)	(1.114)
Housing size	0.939***	1.014	0.983***	1.005
	(0.022)	(0.031)	(0.022)	(0.043)
Jeonse	0.393***	3.732***	0.204	1.534
	(0.101)	(1.205)	(0.052)	(0.543)
Household fixed effects	Yes			
Year fixed effects	Yes			
Observations	2,522		2,487	
Likelihood Ratio Chi^2	286.995***		271.428***	

Notes: Numbers in parentheses show standard errors; ***p<0.01, **p<0.05, *<0.1; The reference category is both objective and subjective indicators are either 0 or 1.

C. Results after excluding top and bottom 1% of observations

Table C. Regression results for the bottom 40% income group with balanced panel data, 2015-2020

	Dependent variable is calculated using rent-to-income ratio after excluding top and bottom 1%		Dependent variable is calculated using rent-to-income ratio after excluding top and bottom 1%	
	Obj. affordable & sub. unaffordable	*Obj. unaffordable & sub. affordable*	*Obj. affordable & sub. unaffordable*	*Obj. unaffordable & sub. affordable*
	Odds ratio	Odds ratio	Odds ratio	Odds ratio
Residential satisfaction	0.742***	1.205	0.787***	1.076
	(0.055)	(0.161)	(0.068)	(0.107)
Age	0.957	1.000	0.997	1.044
	(0.030)	(0.031)	(0.034)	(0.029)
Education	0.701	0.703	0.669	2.943
	(0.568)	(0.723)	(0.534)	(3.141)
Log annual income	2.047***	0.026***	6.200***	0.068***
	(0.243)	(0.007)	(0.977)	(0.012)
Seoul Metro Area	0.935	4.422*	0.791	1.728
	(0.498)	(3.691)	(0.472)	(1.363)
Number of children	1.403**	0.861	1.219	0.955
	(0.230)	(0.239)	(0.224)	(0.199)
Number of household members	0.697***	1.898**	0.485***	2.08***
	(0.092)	(0.538)	(0.076)	(0.413)
Apartment	0.719	2.983***	0.653*	1.327
	(0.147)	(1.054)	(0.156)	(0.360)
Housing size	0.996	1.047*	1.000	1.002
	(0.006)	(0.025)	(0.006)	(0.018)
Jeonse	0.16***	3.151***	0.118***	2.939***
	(0.026)	(0.926)	(0.022)	(0.687)
Household fixed effects		Yes		
Year fixed effects		Yes		
Observations	5,129		5,272	
Likelihood Ratio Chi^2	677.047***		879.016***	

Notes: Numbers in parentheses show standard errors; ***p<0.01, **p<0.05, *<0.1; The reference category is both objective and subjective indicators are either 0 or 1.