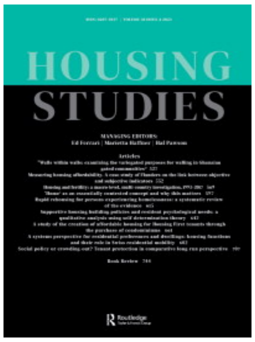

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Reference-dependent housing choice behaviour: why are older people reluctant to move?

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ABSTRACT

Loss aversion has been identified as an inhibiting factor in residential mobility and may contribute to a well-documented reluctance to move of older people. This paper provides insights on whether loss aversion, in relation to the locational attributes of housing alternatives, affects the preference for alternative housing choices of older people. We propose an extended framework to measure symmetric as well as asymmetric valuation of losses and gains by an individual. The framework is applied in a discrete choice model based on a stated choice experiment with 440 Dutch home owners in the age group of 65 - 75 years. We find clearly that the current living situation (reference) affects the housing choice behaviour. Among other things, we find a general aversion to changing the type of location for almost all possible moves between city, suburban and town. The results have clear implications for ageing-in-place policies which are currently being developed in many countries.

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Older people housing; housing preferences; reference-based choice; discrete choice modelling; stated choice experiment

Introduction

Older citizens are often reluctant to move to another dwelling, even when their own home becomes less suitable for their changing needs (e.g. Angelini & Laferrère, 2012; de Jong *et al.*, 2018; Lowies *et al.*, 2019). This may reduce the effectiveness of ageing-in-place policies that aim at stimulating older people to live independently as long as possible. With ageing several changes in housing needs can occur that could be reasons to move. These are extensively discussed in the literature.

First, at older age the maintenance of the dwelling and garden may be felt increasingly as a burden (Banks *et al.*, 2012; Ewen & Chahal, 2013), no longer offer the same benefits once children have moved out (Abramsson & Andersson, 2012), or be less suitable to altered health and functional capabilities (Ewen & Chahal, 2013). Second, decline in mobility at older age causes an increasing dependence on

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the availability of amenities for basic needs (shopping, health care) at short distance to the home (Abramsson & Andersson, 2012; Burgess & Quinio, 2021; Robison & Moen, 2000). The functional characteristics of both dwelling and location may be important in enabling older people to live independently for longer, explaining motivations to live more centrally in older age (Andersson *et al.*, 2018). Third, relocation may be driven by financial reasons. Moving to a more affordable smaller housing, or renting a dwelling, is a way to release housing equity that can complement household income after retirement (Clark & Deurloo, 2006). However, life-course events such as disability, retirement or loss of a partner (widowhood or divorce) also increase the probability of moving (Herbers *et al.*, 2014; Painter & Lee, 2009), sometimes more than wealth expectations (Painter & Lee, 2009).

Despite numerous reasons why older people might move, evidence shows that the propensity to move is rather low among older people (Abramsson & Andersson, 2012; Lowies *et al.*, 2019). Several studies point to place attachment as an inhibiting factor (Evans *et al.*, 2002; Buffel *et al.*, 2014). Older people in many cases have built up an emotional bond with their dwelling. Furthermore, they generally do not want to lose social relationships in the neighbourhood where they live. Ewen & Chahal (2013) identified that the grief associated with losing a home and ties with a local community is a major stressor of relocation among the women who had moved to congregate senior housing. Lowies *et al.* (2019) found that within the older age group the intention to age in place even becomes stronger with increase in age which may be related to this bonding with place.

Apart from place, a reluctance to move may also be caused by psychological barriers related to down-sizing (moving to a smaller or more affordable house). Clark & Deurloo (2006) explain this as a reluctance to give up the extra space. They argue that older people will only make the step when the extra space is no longer tenable, for example, due to physical health or financial reasons. Robison & Moen (2000) referring to well-known prospect theory of Kahneman & Tversky (1979) similarly point to loss aversion and risk aversion, as a possible barrier to explain the reluctance to move by older people. They distinguish gain and loss considerations as possible ways of framing the option of moving. When there is no urgent need for moving but only potential gains (e.g. moving closer to facilities, reducing the burden of maintenance, releasing capital), a moving decision may be perceived as a risk and trigger risk avoidance behaviour. When on the other hand reasons become more urgent, staying will be viewed as a potential loss which, according to prospect theory, will trigger risk seeking behaviour which increases the probability of moving. This reasoning shows that framing (viewing a change as a loss or a gain) and risk avoidance versus risk seeking tendencies offer an additional explanation.

Although literature indicates that loss aversion may play a role, this psychological factor has received only limited attention in studies on older people's housing decisions and preferences. Loss aversion is a general tendency of individuals to display a strong aversion for a choice alternative that would cause a loss in outcomes compared to a reference point. The concept of reference-dependent choice behaviour is central in the prospect theory by Kahneman & Tversky (1979) and Tversky & Kahneman (1991). The theory predicts that people evaluate outcomes of their choices relative to a specific reference point (often the status quo), classify these outcomes as gains and losses, and prefer avoiding losses to acquiring equivalent gains. In cases of risky choice, individuals tend to take or avoid risks depending on whether outcomes are framed as a loss (risk taking) or as a gain (risk aversive).

More generally, the theory gives an explanation for what is known as the status-quo bias in decision making, that is, a tendency of people to prefer maintaining the current state (Kahneman *et al.*, 1991). Since individuals weigh losses of switching to a new alternative as larger than the gains, keeping the status quo is often considered more attractive than the new alternative (Samuelson & Zeckhauser, 1988). Accordingly, experimental studies have consistently found a gap between the willingness-to-pay (gain ownership) and willingness-to-accept (loose ownership) values of a same amenity, where the latter is consistently larger (Masiero & Rose, 2013). The gap is also known as the endowment effect.

Applied to housing, Kahneman (2011) argues that the existing location acts as a reference to which choice alternatives are compared. Morrison & Clark (2016) apply prospect theory to housing to identify factors influencing households' decisions to move. They emphasize that migration choices are risky and argue that loss aversion may result in extending the period households stay at their current location. Their hypothesis is tested in later studies of Clark & Lisowski (2017, 2019). Using longitudinal panel data in Australia, a significant effect of a measure of households risk attitude is found in both studies on decisions to move in agreement with loss aversion and the endowment effect.

Given existing evidence of the importance of loss aversion for migration choice, the goal of this study is to examine the role of this factor – and more generally reference-dependence – in housing choice behaviour of older people. Relocating entails costs and possibly stress which at least partly can explain a reluctance to change. In the present study we are interested in the extent to which reference dependent evaluation of housing alternatives in addition plays a role. Because at older age a desire to move often involves down-sizing, the anticipated losses (smaller dwelling, from single-family to multi-family house) may possibly exceed the anticipated gains (of e.g. a supportive amenity-oriented environment). In addition, the change of location often entails simultaneous changes on a multitude of accessibility and neighbourhood attributes that are valued by people. In the present study we will focus on location attributes. Specifically we measure reference dependence with respect to location, green, shops and public transport.

We measure reference-dependence and apply it in a discrete choice model to measure these effects based on a stated choice experiment. The data were collected in 2017 in The Netherlands and involved a sample of 441 homeowners in the age between 65 and 75 years old. The choice experiment asked the participants to choose between the reference status quo and hypothetical housing alternatives that in different sub-experiments were varied in terms of location and dwelling attributes. Using the data of the location sub-experiment our analysis focuses on how location attributes such as proximity to urban amenities are evaluated depending on reference values.

Our paper is connected to a number of literature streams. The first one concerns studies on housing preferences of households. These studies have focused on a range of topics such as tenure choice (Özyıldırım *et al.*, 2005), neighbourhood characteristics (Morrow-Jones *et al.*, 2004), older-people housing (e.g. de Jong *et al.*, 2018;

Ossokina *et al.*, 2020), student housing (Verhetsel *et al.*, 2017), household interaction (Molin *et al.*, 2002), combined transport and housing choice (e.g. Tillema *et al.*, 2010; Teulings *et al.*, 2018), ethnic segregation (Ibraimovic & Hess, 2018) and developing regions (Del Mistro & Hensher, 2009). In studies of migration behaviour, the influence of loss aversion in households' decisions to move has been established (Clark & Lisowski, 2017, 2019). We add to this literature by studying the role of reference dependence and loss aversion in housing choices of older people.

Our study is also connected to the current policy-related debates in different countries. While the proportion of 65+ citizens in the population is increasing sharply,[1] governments make arrangements to stimulate the older people to live independently at home for as long as possible (Mosca *et al.*, 2017). Better insight in living preferences of the older people and in how reference-dependent evaluation of location alternatives impact the willingness-to-move can help policy-makers and housing providers to better adapt the housing supply to the needs of the target group.

The remainder of this paper is structured as follows. Section 2 outlines the proposed conceptual and analysis framework. Section 3 describes the data. Section 4 reports the estimation results and their practical implications. Section 5 concludes by summarizing the major conclusions and discussing avenues for future research.

A framework for analysing reference-dependent choice

Concepts and definitions

Take a household which considers moving to another residence. It evaluates a particular alternative house on offer, based on the attributes of this house – size, type, location, etc. – that affect the utility of the household. The basic discrete choice model assumes that the value households attach to a specific alternative house is based on absolute values of the attributes. There is however convincing evidence that the changes in the performance or quality level of the attributes as compared to the reference (existing situation) also play a role in the evaluation. Morrison & Clark (2016) and Clark & Lisowski (2017) describe the mechanisms posited in prospect theory applied to housing relocation decisions. A decrease of the quality level on a relevant attribute (e.g. a smaller size of the alternative house) is felt as a loss and a positive change as a gain. Losses may have a larger absolute effect on utility, compared with the gains of similar absolute size.

Two possible cases can therefore be distinguished with respect to the subjective weighting of losses and gains: (1) losses and gains have equal weights. In this case, a shift in reference level does not have any effect on the valuation of alternative houses, this valuation is independent of their position relative to the reference; (2) there is asymmetry – losses and gains are not weighted equally, typically, losses have a larger effect on utility (loss aversion). In this latter case, a shift in the reference level changes the valuation of alternatives depending on their position relative to the reference point. In case of attributes such as location type, alternatives cannot be ranked based on a performance or quality level and, hence, a change cannot be framed as loss or gain. For such attributes, a difference in evaluation purely depends on taste, e.g. a certain preference for a location type. Then, reference effects occur if the change is evaluated negatively (a reluctance to change) or positively (novelty seeking). In the modeling framework proposed in the next section below, taste effects can be estimated separately from reference effects whereby all cases mentioned may occur and can be identified.

Reference-dependence choice behaviour has received some attention in discrete choice modelling. In existing approaches, reference-dependence is conceptualized as an asymmetry in evaluation of losses and gains, while zero utility is assumed for reference levels. Masiero & Rose (2013) argue, however, that the idea of asymmetric evaluation does not necessarily imply zero utility for the reference point. They propose a model where the utilities for reference levels (absolute utility values) are estimated in addition to valuations of losses and gains. They argue furthermore that to allow this, choice alternatives in a choice experiment must be presented in terms of absolute attribute values instead of changes relative to reference levels as is done in reference pivoted stated choice experiments (Hess *et al.*, 2008; Rose & Hess, 2009). Reference effects will then emerge in how individuals evaluate choice alternatives depending on the reference levels they use.

Just as in the approach of Masiero and Rose, we estimate utilities for absolute attribute levels as well as influences of reference and use a choice experiment where choice alternatives are presented in terms of absolute values. Compared to Masiero and Rose, however, we consider a wider range of models of reference dependence and aim to identify on a per-attribute basis the best fitting model. We define and test symmetric as well as asymmetric models of evaluation per attribute. The framework we present is generic and can be readily applied in stated choice experiments.

Models

We extend the standard discrete choice model to incorporate reference-dependent evaluation of choice alternatives. In the standard discrete choice model, the utility of an alternative i for an individual n is defined as:

$$U_{in} = V_i + \varepsilon_{in} \tag{1}$$

where V_i is a structural and ε_{in} a random utility component. To incorporate reference-dependence, we redefine the structural utility component which becomes individual-dependent[2], so that the proposed model becomes:

$$U_{in} = V_{in} + \varepsilon_{in} \tag{2}$$

Applied to housing choice, in this equation, V_{in} represents the evaluation of housing choice alternatives, i, by household n. To set a reference value for the utilities, we define:

$$V_{0n} = 0, \forall n \tag{3}$$

where V_{0n} is the utility of the current residential situation. As a consequence of this setting, the (structural) utilities of choice alternatives, V_{in}, are defined relatively to the current utility level, so that these values effectively represent the attractiveness of a housing alternative *for the household*. The reference-dependent utility consists of two parts:

$$V_{in} = D_{in} + V_i \tag{4}$$

where V_i is an absolute utility value based on taste preferences of attributes and D_{in} is an extra attractiveness component (positive or negative) depending on the reference, i.e. the current situation. We expect that $D_{in} > 0$ when the current situation is relatively unattractive so that the alternatives become more attractive and that $D_{in} < 0$ when the household is very satisfied with the current housing with as result that alternatives are less attractive. In sum, D_{in} represents evaluations related to the reference. The standard discrete choice model is the special case where $D_{in} = 0$.

The structural utilities, D and V, are based on the evaluation of attributes of the alternative housing options. Without loss of generality, we will formulate a utility function that assumes discrete attributes. The discrete values of the attributes may refer to values which are purely qualitative (e.g. location type) or that represent certain quantities (e.g. proximity of shops in terms of distance). Irrespective of the nature of the (discrete) attributes, an additive utility function is assumed leading to the following specifications:

$$V_i = \alpha + \sum_{jk} \beta_{jk} \cdot X_{ijk} \tag{5}$$

$$D_{in} = \sum_{jkh} \delta_{jkh} \cdot X_{ijk} \cdot X^0_{njh} \tag{6}$$

where α is a constant utility assigned to choice alternatives other than the reference (e.g. a disutility of moving), $X^0_{njh} = 1$, if individual n currently experiences level h on attribute j and $X^0_{jnh} = 0$, otherwise; $X_{ijk} = 1$, if alternative i has level k on attribute j and $X_{ijk} = 0$, otherwise; β_{jk} is the utility assigned to level k based on taste preference and δ_{jkh} is an evaluation of the change in level from h to k. If evaluation of the reference is not biased compared to new alternatives, we expect that $\delta_{jkh} = -\beta_{jh}$ for each j and each k. Then, the relative attractiveness of any choice alternative decreases with an amount that is equal to the utility currently experienced.

Model (6) allows that the change of an attribute itself can generate a utility effect, so that $\delta_{jkh} \neq -\beta_{jh}$ (for each j and k). Note that a loss occurs if $\beta_{jk} - \beta_{jh} < 0$ and a gain if $\beta_{jk} - \beta_{jh} > 0$. If losses weigh higher than expected based on absolute values then $|\delta_{jkh}| > |\beta_{jh}|$ in case of a loss. Hence, this model is general enough to capture reference effects such as loss aversion and other asymmetric utility evaluations around the reference point. It is also general enough to capture reference effects for attributes that are qualitative. It is furthermore important to note that place attachment, which is known to be an important inhibitor of moving, especially, in the older adults population, is taken into account in the model. The constant utility parameter, α , represents a disutility of moving that captures felt losses that are not related to changes in specific attributes including losses caused by place attachment. Thus, although place attachment is not separately identified by alpha, the parameter can capture the effect.

In addition to model (6), we also consider an alternative model with fewer degrees of freedom for the reference component, *D*. This reduced model is defined as:

$$D_{in} = D_n = \sum_{jh} \delta_{jh} \cdot X^0_{njh} \; \forall i \tag{7}$$

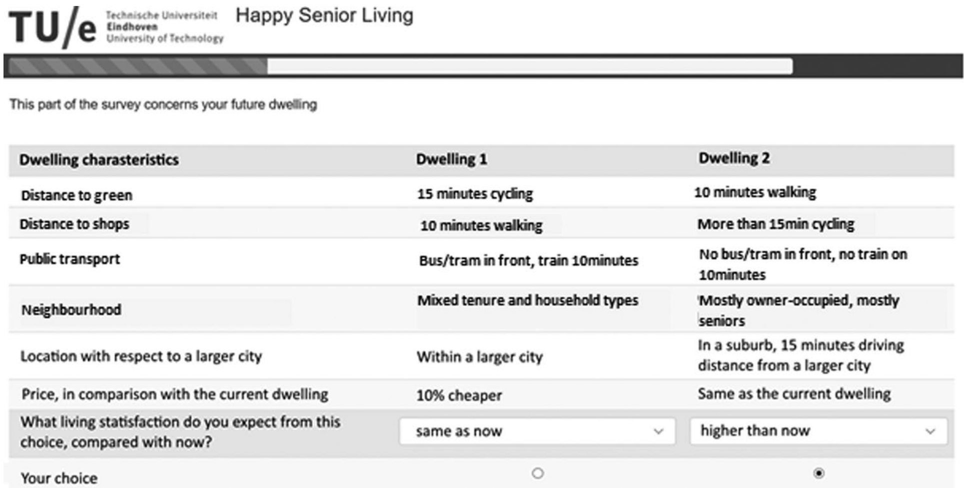
In this model, $\delta_{jh} > 0$ indicates that all alternatives other than reference generally are more attractive for households that currently experience level *h* on attribute *j*, and $\delta_{jh} < 0$ means that alternatives are less attractive. The parameter indicates a constant shift in utilities of attributes dependent on the reference point. The explanation for this is intuitively easy to see: currently experiencing a low (high) level of an attribute means that the utility yield of a move to any other alternative will be higher (lower) with an equal amount. If behaviour is unbiased, we expect $\delta_{jh} = -\beta_{jh}$, that is, the extra attractiveness of an alternative decreases with β_{jh} if *h* is the currently experienced level. Note that this *constant-shift* model has fewer parameters, since δ_{jkh} parameters are replaced by δ_{jh} parameters. A strong assumption of this model, however, is strict symmetric evaluation of utilities around the reference point: the model predicts that with an increase (decrease) of reference point all alternatives become less (more) attractive with an equal amount also when the change in reference would mean that certain levels have changed position relative to the reference point. Clearly, this rules out any loss or gain effects.

The general model (Equation (6)) and the constant-shift model (Equation (7)) offer a framework to analyse reference effects. An increase of fit of the general model compared to the standard model (where $D_{in} = 0$) would be evidence for the presence of such effects. Comparison between the general model and constant-shift model provides information about whether evaluations are symmetric around the reference point. The constant-shift model does not account for asymmetric evaluation. Hence, an increase in fit relative to the constant-shift model in the latter comparison would be evidence for asymmetric evaluation.

Application - analysis of older-people housing preferences

Discrete choice experiment data

The data originate from a stated choice experiment conducted in 2017 on a sample of 441 Dutch home-owners in the age category of 65-75 (see Ossokina *et al.*, 2020). In the choice tasks, respondents were presented choice-sets consisting of two hypothetical housing alternatives. Focusing on a particular housing concept suited for older people, the presented choice alternatives were senior-friendly apartments. For each alternative, the respondents were asked to indicate the expected living satisfaction in comparison with their current housing situation, choosing from five options: much lower than now, lower than now, same as now, higher than now, much higher than now. Figure 1 shows an example of a choice set presented. This


TU/e Technische Universiteit Eindhoven University of Technology Happy Senior Living

This part of the survey concerns your future dwelling

Dwelling charasteristics	Dwelling 1	Dwelling 2
Distance to green	15 minutes cycling	10 minutes walking
Distance to shops	10 minutes walking	More than 15min cycling
Public transport	Bus/tram in front, train 10minutes	No bus/tram in front, no train on 10minutes
Neighbourhood	Mixed tenure and household types	Mostly owner-occupied, mostly seniors
Location with respect to a larger city	Within a larger city	In a suburb, 15 minutes driving distance from a larger city
Price, in comparison with the current dwelling	10% cheaper	Same as the current dwelling
What living statisfaction do you expect from this choice, compared with now?	same as now	higher than now
Your choice	○	◉

Figure 1. Print screen of a choice set.

set up allows us to identify for each choice set the option that is preferred whereby the options include the current housing situation (the current housing situation may be preferred over the presented alternatives). Setting the utility for the current housing situation to zero (Equation (3)), the reference level for presented alternatives are defined.

The survey included three choice experiments that were focused on preferences regarding dwelling, building and location characteristics, respectively. For each experiment, attribute profiles were generated based on an orthogonal experimental design and choice sets were compiled by randomly selecting two profiles from the design. Each respondent received 12 choice tasks divided into 4 choice tasks for each experiment. For the present analysis we use the data related to the location choice experiment. Table 1 shows the attributes of the apartment location alternatives that were varied in the choice task. Each attribute has three levels. The price levels were pivoted around the market value of the current housing of the person to make sure that offered alternatives did not fall outside a price range that is realistic for the respondent. The choice of attributes was based on considerations revealed in preliminary interviews with representatives of this age group. In the Netherlands, proximity to regional level facilities, such as hospitals, is strongly correlated to location type (city versus other) and, hence, is largely captured by this attribute.

An additional part of the questionnaire included questions about the existing residential situation of the respondent that provide information about reference levels. Table 1 also shows the data available from that part. The answer categories of questions about the existing residence do not always correspond exactly to the levels used in the choice experiment. Note, however, that the framework we use does not require such a correspondence either so that this data limitation does not imply a restriction for the analysis.

The choice experiment was administered through an on-line questionnaire. The sample was based on a national panel of the Dutch population. Given the target group of this study, only persons aged between 65 and 75 years and currently living

Table 1. Attributes and attribute levels.

Attribute		Level 1	Level 2	Level 3
Distance to green[a]	DCE	More than 15 minutes cycling	15 minutes cycling	10 minutes walking
	Exist	More than 15 minutes cycling	More than 10 minutes walking, but less than 15 minutes cycling	Less than 10 minutes walking
Shops[b]	DCE	More than 15 minutes cycling	15 minutes cycling	10 minutes walking
	Exist	More than 15 minutes cycling	More than 10 minutes walking, but less than 15 minutes cycling	Less than 10 minutes walking
Public transport	DCE	No Bus/tram in front of the door; No train station on a 10 min car trip	Bus/tram in front of the door; No train station on a 10 min car trip	Bus/tram in front of the door; train station on a 10 min car trip
	Exist	Station in more than 15 minutes cycling	Station in more than 10 minutes walking, but less than 15 minutes cycling	Station in less than 10 minutes walking
Location	DCE	Within a larger city	Smaller city, more than 15 minutes driving from a larger city	Suburbs of a larger city
	Exist	Within a larger city	Smaller city, more than 15 minutes driving from a larger city	Suburbs of a larger city
Price	DCE	10% more expensive	Equal to the current price	10% less expensive
Neighbourhood	DCE	Mixed tenure types, mixed household types	Mostly owner-occupied, mostly seniors	Mostly owner-occupied, mixed household types

(a) Green is defined as the nearest public green space that is suitable for walking and/or cycling (park, forest, nature reserve, etc.).
(b) Shops is defined as the nearest location with more than 20 shops and restaurants.

in a privately owned dwelling could participate. Table 2 describes the composition of the respondents' population. The majority of our respondents are living together with a partner in a single-family dwelling. High educated are somewhat overrepresented, as well as persons with higher than median income. The sample reflects well the different regions and living environments of the Netherlands. Each of the 12 provinces of the country is represented, with at least 15 respondents. Some 50% respondents live in large or middle large cities, around 13% live in rural areas, and the rest lives in small cities.

Set-up of the analysis

The data allow us to study reference effects for the following attributes: Location, Green, Shops and Public transport (see Table 1 for a definition of the attributes). These are all discrete attributes. For discrete attributes, the number of parameters depends on the number of levels of the variables involved. In the general model, the number of delta parameters equals $(H-1)$ x K (H is the number of levels in the existing and K the number of levels in the alternatives for the attribute), as one delta parameter for each level k is set to zero for normalization. Consistently, the delta parameter related to the case where the attribute in the choice alternative has the same level as in the existing situation is set to zero. In this way, the beta parameters represent the evaluations of individuals who currently experience the same level as

Table 2. Description of the respondents.

Socio-economic characteristics of the respondent		Current dwelling and moving preferences	
Aged 65 to 69	63%	Lives in an apartment	15%
Aged 70 to 74	37%	Lives in a one-family dwelling	85%
Couple	86%	Size dwelling, median	120m^2
Alone	14%		
Low educated	22%	Size of garden, for one-family dwellings, median	100m^2
Middle educated	38%		
High educated	40%		
Household yearly gross income less than €30,000	3%	Value of the dwelling, as specified by the fiscal authorities, median	€225,000
Household yearly gross income €30,000 to €50,000	71%		
Household yearly gross income more than €50,000	26%		
Retired	87%		

Source: Ossokina *et al.* (2020).

the presented choice alternative (and therefore should experience no loss or gain in utility). Since each attribute has three levels in the existing situation as well as choice experiment, the number of delta parameters per attribute equals (2×3 =) 6.

The analysis is built up in two steps. The aim of the first step is to identify the best fitting model for each attribute, where the models are (1) no reference dependency (the standard model, D_{in} = 0), (2) asymmetric evaluation around the reference point (the general model, D_{in} defined by Equation 6) and (3) symmetric evaluation around the reference point (the constant-shift model, D_{in} defined by Equation 7). The best fitting model is identified by comparing the model fit of the general model with two reduced models, namely the standard model and the constant shift model. A significant decrease in fit in the first comparison indicates that the reference plays a role and a significant decrease in fit in the second comparison that the influence of the reference cannot be represented as a constant shift. If the decrease in fit in the latter comparison is not statistically significant and the decrease in fit is statistically significant in the comparison between the constant-shift and the standard model then there is evidence for the constant-shift model. Note that when the general model does not outperform the standard model, it is still meaningful to test the performance of the constant-shift model. Since the latter has fewer degrees of freedom, the test may possibly show a positive outcome even when the fit increase of the general model is statistically insignificant.

The results of the first-step analysis are used to specify a final model where the utility function of each attribute is specified according to the best fitting model for that attribute. The estimation of the final model offers insight in the role the current housing situation (the reference) plays in evaluations of housing alternatives. The improvement in fit accomplished by the final model compared to the standard model indicates the overall size of the influence of reference on housing preferences. Given the purpose of the analysis, the basic MNL model is used as framework for the models.

Results of attributes tests

Tables 3 and 4 show the results of the first-step analysis. The analysis is performed for each attribute separately. A model estimation is conducted for the general model and the two reduced models for the attribute considered. The likelihood ratio test is used to test the statistical significance of the decrease in fit taking into account the difference in number of parameters between the models compared. The statistic of this test is defined as $D = 2 \cdot (LL - LL_0)$ which is Chi-square distributed with degrees of freedom $df = K - K_0$ (LL and LL_0 are the loglikelihood values and K and K_0 are the number of parameters of the proposed model and null model).

Table 3 (panel A) shows the analysis results for the comparison between the general and the standard model. To explain the results shown in the table, consider Location as an example. In the standard model, for the location attribute all delta parameters are set to zero (no reference dependency). After re-estimating the model it appears that the loglikelihood drops from −1181.2 to −1202.1. The drop in loglikelihood is highly statistically significant indicating that the fit of the standard model is much poorer. The remaining rows in the table show the results of the same test for the attributes Green, Shops and Public transport, respectively. The results indicate that the decrease in fit is statistically significant for Location and Public transport and not statistically significant for the other attributes (at a 5% significance level). This suggests that the reference plays a role in evaluations for these two attributes only. The drop in fit is particularly large for Location, indicating that the influence of the existing situation is particularly strong for that attribute. Next, Table 3 (panel B) shows the decrease in fit when the general model is reduced to a constant-shift model per attribute. Here the drop in the loglikelihood is statistically significant for Location only. This indicates that for Location the general model cannot be reduced to a constant-shift model without a loss in fit or, in other words, for this attribute reference effects cannot be described in terms of a constant-shift model.

Table 4 shows the results for the comparison between the constant-shift model and the standard model per attribute using the same method as before. Assuming again a significance level of 5%, the tests show that the decrease in fit is statistically significant for Green and Public transport. This indicates that in case of these two attributes reference effects occur in a form that can be described in terms of the constant-shift model.

Combining the results of Tables 3 and 4 allows us to determine the best-fitting model. Location shows statistically significant reference effects that cannot be explained by a constant-shift model. Hence, the general model is the best fitting model for this attribute. On the other hand, Green and Public transport show reference effects that can be described by the constant-shift model as the reduction in fit when the general model is replaced by the constant-shift model is not statistically significant and the decrease in fit when the constant shift model is replaced

Table 3. Decrease in fit of general model when delta parameters are omitted one attribute at a time.

Attribute	LL	Decrease in fit (general vs standard) (A)			Decrease in fit (general vs constant shift) (B)		
		Chisq	df	p-value	Chisq	df	*p*-value
General model (base)	−1181.2						
Location	−1202.1	41.771	6	< 0.0001	39.534	4	< 0.0001
Green	−1185.4	8.260	6	0.220	1.254	4	0.869
Shops	−1187.4	12.265	6	0.056	8.295	4	0.081
Public transport	−1189.6	16.684	6	0.011	7.391	4	0.117

Table 4. Decrease in fit of the constant shift model when delta parameters are omitted one attribute at a time.

Attribute	LL	Decrease in fit		
		Chisq	df	*p*-value
Constant shift model (base)	−1209.6			
Location	−1210.7	2.251	2	0.325
Green	−1213.0	6.971	2	0.031
Shops	−1211.3	3.421	2	0.181
Public transport	−1214.0	8.869	2	0.012

by the standard model *is* statistically significant. For the remaining attribute, Shops, there is no evidence for reference effects.

Results of final model estimation

Table 5 shows the estimation results of the final model and the standard model without reference-based effects for comparison. Recall that the final model is an extension of the standard model that, in addition to the main effects (beta parameters), includes extra terms to take the effects of the reference (the existing housing situation) into account (delta parameters). This involves an extension of the terms for Green and Public transport with constant-shift δ_h -parameters and the extension of the term for Location with more general δ_{kh} -parameters. In total, the final model includes 10 (= 23 − 13) additional parameters as compared to the standard model, and leads to an increase of the adjusted rho-square from $\rho = 0.174$ to $\rho = 0.189$, which is a statistically significant increase in model fit.

Turning to the detailed estimation results: all attributes have statistically significant main effects with the signs as expected. Consistently, the middle level of each attribute was fixed to zero to provide a base level against which the effects of the low and high level were estimated. The estimates indicate that, on average, people of the older age group (65–75 years) when considering an apartment as housing alternative prefer to live in a suburb or town over a city and in a location that is near to green, shops and public transport and has predominantly owner-occupied dwellings. Out of these attributes, proximity to public transport has the highest effect on utility, followed by proximity to shops.

For the present analysis the estimates of the delta parameters (relevant for Public transport, Green and Location) are of particular interest. The results show several effects. First, regarding the distance to green the existing situation has a statistically significant impact on utilities. The estimates indicate that those who currently live far from green (more than 15 min. cycling) assign 1.108 utility units more to housing alternatives offered than those who currently live closer to green. Second, Public transport displays a similar reference effect. People who currently live far from public transport assign 0.287 utility units more and people who currently live close to public transport assign 0.319 utility units less to alternatives for moving compared to the base group, i.e. people who live at medium distance from public transport. Thus, for both Green and Public transport the currently experienced high accessibility level may induce a threshold for moving, while having a poor accessibility to green respectively public transport goes together with a relatively high willingness to relocate to another dwelling.

Location displays more complex reference effects that can only be described by the general model. In the final model, a negative preference for Suburb is the only taste effect. Looking at the reference effects, we see however that a change in location generates a loss in utility for moves from Town or Suburb to City as well as from City to Town. Moves between Suburb and Town and from City to Suburb are evaluated as being neutral. Clearly, location is not a type of attribute where alternatives can be positioned on a scale of increasing or decreasing preference and where the current level determines whether a loss or gain is experienced. Rather, people prefer the location where they currently live when the move involves a change from Town to City or the other way round. Also, when they currently live in a suburb they find a city location less attractive.

Summarizing, the results show that the existing housing situation plays an important role in the evaluation of housing alternatives. However, the effect differs between attributes. Of the attributes tested, proximity to shops does not show a statistically significant influence on the reference level. On this attribute preferences exist but the level currently experienced does not have an influence on how alternatives are evaluated. On the other hand, evaluations of proximity of green, location type and accessibility of public transport *are* affected by the reference levels. In case of green and public transport there is no evidence of asymmetry as positive and negative changes appear to have equal weight. For location type almost every change incurs a (strong) negative effect.

Illustration

The discussed insights into location preferences can be used to improve existing living environments making them more friendly for older people, or to determine a suitable location for homes suitable for older people. Figure 2 gives an example. Here the neighbourhoods of the metropolitan region of the Dutch fifth largest city, Eindhoven, are ordered in terms of their attractivity for people in the older age group. The attractivity has been computed as the predicted utility from Equation (2) using the estimated coefficients from Table 5. Warm colours (brown, red) indicate neighbourhoods that are rich in attractive location features (proximity to public transport, greenery, proximity to shops), and cold colours (blue) for the neighbourhoods that are relatively poor in attractive features. Centrally located neighbourhoods in Eindhoven and a smaller town Helmond to the east of it, for example, score relatively high due to the availability of shops and good public transport. A municipality or developers can use such a map as an analysis tool for various purposes. On the one hand, in this way it becomes clear which locations are particularly suitable for developing dwellings for older people. On the other hand, a lower score for a neighbourhood where many older people live can signal that there is a need for additional facilities there. As our reference-based model suggests, especially improving the availability of public transport and green in locations where these amenities are scarce will lead to a considerable increase in the living comfort for the older people.

Table 5. Estimation results.

Attribute		DCE-level	Current (reference) level	Standard model		Final model	
				Value	t-val.	Value	t-val.
Constant	α			−0.659***	−3.62	−0.364	−1.38
Location	$\beta 1$	City	–	−0.300**	−2.43	−0.165	−0.77
	$\beta 2$	Town (base)	–	0		0	
	$\beta 3$	Suburb	–	0.019	0.16	−0.431**	−2.03
	$\delta 11$	City	City			0	
	$\delta 12$	City	Town			−0.725***	−3.08
	$\delta 13$	City	Suburb			−0.732***	−3.09
	$\delta 21$	Town	City			−1.054***	−4.38
	$\delta 22$	Town	Town			0	
	$\delta 23$	Town	Suburb			−0.235	−1.14
	$\delta 31$	Suburb	City			−0.008	−0.04
	$\delta 32$	Suburb	Town			0.312	1.47
	$\delta 33$	Suburb	Suburb			0	
Green	$\beta 1$	Far	–	−0.285**	−2.31	−0.303**	−2.41
	$\beta 2$	Medium (base)	–	0		0	
	$\beta 3$	Close	–	0.209*	1.79	0.187	1.59
	$\delta 1$	–	Far			1.108**	2.42
	$\delta 2$	–	Medium			0	
	$\delta 3$	–	Close			−0.011	−0.07
Shops	$\beta 1$	Far	–	−0.485***	−3.68	−0.473***	−3.54
	$\beta 2$	Medium (base)	–	0		0	
	$\beta 3$	Close	–	0.431***	3.74	0.443***	3.79
Public transport	$\beta 1$	Far	–	−0.838***	−6.12	−0.897***	−6.45
	$\beta 2$	Medium (base)	–	0		0	
	$\beta 3$	Close	–	0.520***	4.68	0.506***	4.48
	$\delta 1$	–	Far			0.287**	2.17
	$\delta 2$	–	Medium			0	
	$\delta 3$	–	Close			−0.319*	−1.71
Neighbourhood	$\beta 1$	Mixed tenure & household types	–	−0.351***	−2.80	−0.374***	−2.96
	$\beta 2$	Mostly home owners & mostly seniors (base)	–	0		0	
	$\beta 3$	Mostly home owners, mixed household types	–	−0.091	−0.76	−0.143	−1.17
Price	$\beta 1$	+10%	–	−0.241*	−1.93	−0.236*	−1.87
	$\beta 2$	Equal (base)	–	0		0	
	$\beta 3$	−10%	–	0.074	0.62	0.036	0.3
Loglikelihood				−1225.4		−1191.6	
# parameters				13		23	
Rho-squared				0.183		0.205	
Rho-squared adjusted				0.174		0.189	

***significant at 1%, ** significant at 5%, * significant at 10%.

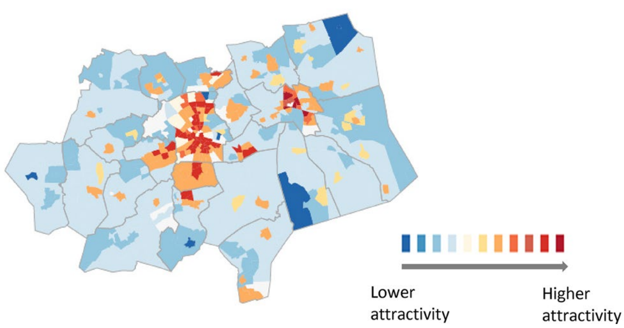


Figure 2. Neighbourhoods of Eindhoven region (Netherlands), predicted attractivity for seniors.

Policy implications

In 2018, the Dutch central government together with various social partners, has set up a policy program Living longer at home (Ministry of Health, 2018). An important focus of the program is on creating more suitable housing for older persons, both by matching the demand and the supply of housing for older people and by investing in age-inclusive neighbourhoods. Related policy discussions on age-inclusive living take place in other developed countries. In different states of the US, 'housing for all ages' makes part of the Master Plans for Aging (National Conference of State Legislators, 2011). In England, various cities are working to achieve the status of 'age-friendly communities', reflecting the priorities of the WHO Age-friendly Communities framework (AgeUK, 2019). In Japan, city planners aim at inducing facilities and dwellings focused on needs of older people around hubs and networks of public transportation, to address the challenges of ageing. Singapore is enhancing parks with older-people-friendly amenities, barrier-free accessibility, more seating and community spaces in housing estates (United Nations, 2018).

What strikes when looking at the policies in various countries and cities is the large diversity of the measures taken. This is not surprising. The WHO Guides to Age-friendly cities (World Health Organization, 2007; World Health Organization, 2017) specify a long list of the attributes that can contribute to age-inclusiveness in housing and neighbourhoods. Unfortunately, in practice available financial funds are often limited, and policy choices need to be made concerning which investments will be given the highest priorities. Different countries make different choices.

Results from our study can support this decision-making by providing insights into the weights that older people attach to different attributes of age-inclusive living and the trade-offs they are willing to make. Our results also provide an understanding of the (reference-dependent) heterogeneity in valuation of amenities between different groups of older people. Based on these insights, policy attention can be directed in the first place to improving those attributes that are most valuable for older persons, and to those groups of older people that are most open for a specific policy.

To illustrate this, let us consider the importance for the older people of good accessibility of public transport. Our experiment suggests that this feature is valued by older persons much higher than, for instance, proximity of green or shops and thus needs attention in the first place when developing new housing or when improving an existing location focused on needs of older people. Good public transport accessibility is thus essential for an age-inclusive neighbourhood. At the same time, we also document that older people who currently face a bad accessibility to public transport, have a (much) higher general propensity to relocate to another dwelling. This suggests that efforts and policy measures supporting older persons in finding suitable alternatives to relocate to, might have more success in locations with relatively poor public transport access. This insight might be used, for instance, in choosing pilot locations for policy measures.

Finally, we note that while our study has focussed on the Dutch older people and the Dutch housing market, the methodology we used can contribute to specifying most cost-efficient investments in age-inclusive living in different countries.

It is readily applicable to identifying the most valuable housing attributes for older people and to studying heterogeneity in this valuation.

Conclusions and discussion

In this study, we considered what the effects are of the existing residential situation on the evaluation of housing alternatives. A loss aversion tendency could increase a resistance to move. We proposed a framework that allows the simultaneous estimation of absolute utilities for particular levels of attributes and the influence of changes on utilities. In this framework, the relative weights assigned to negative and positive changes in attributes can be identified. To account for a range of possible behaviours, we proposed different models to predict how changes are evaluated that allows us to identify the best fitting model on a per-attribute basis. In an application we focused on housing location characteristics. The data used were collected through a stated choice experiment conducted in The Netherlands involving a sample of people in the age between 65 and 75 years old.

The findings indicate that the existing locational attributes of residential context have an important influence on how people evaluate housing location alternatives, and hence, on their willingness to move. Previous studies have shown that place attachment may increase the threshold to move particularly for people in the older age group. The present study has focused on the question how losses or gains related to changes in performance level on relevant attributes influence the valuation of housing alternatives. We find that especially for distance to public transport and distance to green the current levels experienced have an influence. Older people living far from these facilities have a higher willingness to relocate than those living close. For distance to shopping facilities we do not find such reference effects. Regarding location type (large city, town or suburb), however, we conclude that almost any change generates a strong negative effect. This indicates that on top of a possible attachment to the current place, a move when this involves a change in location type will meet strong resistance. This may reflect a status-quo bias (reluctance to change) or a self-sorting effect (people live currently at the place they prefer).

These findings have implications for housing providers and policy makers. Various countries develop policies to provide more suitable housing for older persons, both by matching the demand and the supply of housing for older people and by investing in age-inclusive neighbourhoods. The strong negative preference for a change of location type may generate a threshold for people to move. To stimulate older people to relocate, strong gains on other aspects should compensate for this. These gains could be sought in an increase in accessibility of green, shops and public-transport facilities, especially for those living far from green and public transport.

These implications for policy making demonstrate the practical relevance of taking reference effects into account. The extended modelling framework is able to account for heterogeneity in choice behaviour that relates to households' current housing conditions, which appears to be substantial. It is relatively easy to collect the data on existing levels in the context of stated choice experiments meaning that this extra information can be collected against low costs. Several problems remain for future research. First, the data set used in this study allowed us to analyze reference effects for a limited number of attributes and for a particular user group (older people). As considerations of older people to move are often triggered by a need to down-size (smaller house), the influence of losses and gains related to attributes of the dwelling can differ for the older people. By replicating the study using other datasets and other population groups, general robustness of the findings can be tested. Second, it is useful to extend the analysis and also consider cross-attribute reference effects. In the present paper, we studied the effect of the reference level on the valuation of particular levels of the same attribute. A reference level of one attribute may however also influence valuation related to other attributes. Such an extended analysis may offer a broader view on the transitions that people are willing or reluctant to make in their housing decisions.

Notes

1. In Europe, for instance, one in four people is expected to be older than 65 in 2040 (Eurostat, 2017). In China and in USA, one in four people will be older than 60 in 2030 (United Nations, 2018).
2. In mixed logit formulations the structural utility component V_i may also have an n subscript due to individual-related random components of taste parameters. For ease of presentation and without loss of generality, we will assume non-random taste parameters. Here, the structural component is individual specific due to the influence of the reference point that may vary across individuals.

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