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# Losses of Residential Utility from Budget Constraints on Preferences for Homes

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## Abstract

Budget-constrained residential preferences differ from unconstrained residential preferences if residents mentally devalue unaffordable attributes' levels of available homes in comparison with affordable ones. Budget-constrained and unconstrained utilities of 70 recent-mover respondents in Saskatoon SK in 1987 and 74 inner-city respondents in Windsor ON in 2020 are quantified for 12 generic attributes of homes in conjoint choice experiments. Budget constraints on their utilities for homes' attributes' levels are operationalized by superimposing marginal implicit prices from a hedonic housing price model in each city. Residential utilities are then statistically compared both through time and for subsamples within full samples, and losses of utility are predicted. Respondents will experience an approximate one-quarter and one-tenth loss of possible utility for a home in Saskatoon and Windsor, respectively, if they cannot afford their unconstrained most preferred attributes' levels. Losses of utility are predicted even though budget-constrained utilities of subsamples of respondents are higher as hypothesized for affordable levels of four attributes, and lower for unaffordable levels of those attributes. In conclusion, theoretical and practical implications of these predictions of losses of residential utility are discussed for residents, housing providers and policy-makers.

## Keywords

Residential Mobility, Preference, Utility, Loss, Budget Constraint, House Price

## 1. Introduction

Recent studies reiterate how a resident's financial constraints may impede them from exercising their preferences when choosing a type of new home (Anders-

son, Abramsson, & Malmberg, 2019; De Vos, Van Acker, & Witlox, 2016; Howley, Scott, & Redmond, 2009; Hrast et al., 2019; Li et al., 2020). For example, "lower education degree and income imply they may be less able to act on their preferences and think differently about residential mobility (Jiang, Feng, & Timmermans, 2020: p. 5)." Or, "[residential] preferences are inherently connected to assumptions about what is realistic (in terms of price for instance) (Booi & Boterman, 2020: p. 96)." In other words, when a resident behaves as if they assimilate what they can or cannot afford in their residential preferences, this may justify a choice of a less preferred new home (Sirgy, Grzeskowiak, & Su, 2005). They then may have a measurable loss of utility from an inability to afford their unconstrained socially most preferred home (Kahneman & Thaler, 2006; Niedomysl, 2008). This is the first study to quantify theoretical losses of utility for residents, and to compare them through time, specifically in 1987 and 2020.

This theoretical loss of utility from one home versus another is a quantification of a resident's "residential neighbourhood type dissonance"; this is estimated in another study from commuters' stated preferences for four physical neighbourhood attributes contrasted with their actual location in an urban or suburban community (Schwanen & Mokhtarian, 2004). Residents as well as housing providers and policymakers may benefit from exactly knowing how much this superimposition of budget constraints on residential utilities will constrain most preferred affordable levels below unconstrained most preferred ones. Changes in utility may then be simulated for personal, business, or policymaking purposes: Such as by manipulating local prices of these attributes' levels or amounts of housing wealth necessary for residents' affording more preferred homes (Case, Quigley, & Shiller, 2012; Quigley & Raphael, 2004).

Budget-constrained utilities for attributes' levels may supersede unconstrained utilities as articulations of preferences if a resident habitually inserts the budget constraint into evaluations of those attributes' levels (Verhetsel et al., 2017). This hypothesis supplements the general one of resident having quantifiable preferences for homes' attributes in the form of unconstrained residential utilities (Ben-Akiva, McFadden, & Train, 2019; Karsten, 2007). Budget-constrained utilities differ in theory because they filter out unaffordable preferred homes from the unconstrained utility function. A resident can enact these by superimposing omnipresent personal finances onto utility functions for ordering (im-)practical choices of new homes. They can do this while remaining independent from joint influences of local market conditions and homes' availability (Booi & Boterman, 2020; Desbarats, 1983; Maclennan & Williams, 1979; Timmermans, Molin, & van Noortwijk, 1994).

The research question is therefore about empirical differences between a resident's unconstrained and budget-constrained preferences for attributes of homes if these differences produce losses of utility. It is answered with calculated examples of unconstrained and budget-constrained social utilities for 12 generic attri-

butes of homes in two mid-sized Canadian cities of Saskatoon SK in 1987 and Windsor ON in 2020. Observed impacts of budget constraints on utility functions are compared between 1987 and 2020 for similar types of homes of similar residents in two similar cities (Figure 1 and Figure 2).

A further contribution of calculating budget-constrained utilities at different times is the reassessment of whether residential preferences have changed for some attributes of homes and not others during the past more than 30 years. For example, Canadian residents have changed their preferences between 1987 and 2020 by calculating or interpolating utilities for two of 12 generic attributes of new types of single-detached(-like) homes in their utility functions (Phipps, 2021). Their preferences for four generic attributes also changed when they evinced indifference between these attributes' levels in 2020, after discriminating between them with high and low social utilities in 1987. The newly tested hypothesis is that subsamples of residents have different unconstrained or budget-constrained utilities for the same attributes' levels, but these are compensatory in aggregate and thus have an appearance of indifference.

**Figure 1.** Snowy two-storey single-detached houses in a core neighbourhood in Saskatoon SK in 1987.

**Figure 2.** Camouflaged one-and-a-half storey single-detached house in an inner-city neighbourhood in Windsor ON in 2020.

Differences between budget-constrained and unconstrained utilities for subsamples of residents are theorized in the next section for testing with three interrelated datasets for up to 74 respondents and 3000 single-detached(-like) houses in each of Saskatoon SK in 1987 and Windsor ON in 2020. Note that different aspects of the theoretical foundations in the next section and the analyzed datasets in the following section are explained in three published studies (Phipps, 2020, 2021, 2022).

## 2. Residential Utility and Price Theory

A resident will retrieve or activate their residential preferences from cognitive values for anticipated attainment of comfort, freedom, family, health, money, happiness, and pleasure in one home or another (Jansen, 2012; Lawton, Murphy, & Redmond, 2013; Lindberg, Gärling, & Montgomery, 1989; Zinas & Mahmud, 2012). These cognitive values for Canadian single-detached(-like) homes are assumed to translate into evaluations of 12 generic attributes. These attributes include three each of the dwelling unit, represented by its type and size ($x_1$), house age and exterior finish ($x_2$), and basement condition and home renovations ($x_3$); the neighbourhood environment, represented by its lot size and garage ($x_4$), neighbourhood's landscaping ($x_5$), and neighbouring homes' types and repair ($x_6$); the neighbours, represented by their ages, ethnic group and education, and mobility ($x_7$, $x_8$ and $x_9$); and a home's accessibilities to work and retail stores, schools, and parks or waterfront ($x_{10}$, $x_{11}$ and $x_{12}$) (**Table 1**) (Phipps, 1987, 1989, 2021; Phipps & Clark, 1988).

These attributes of houses and neighbourhoods, and their appropriate levels are (re-)confirmed for a study area. First, Multiple Listing Service (MLS) real estate catalogues of single-family homes for sale are examined to determine the attributes perceived by the local realtors to be important in discriminating between houses in the market. Second, these attributes are supplemented with neighbourhood-oriented ones derived from small-area data in the most recent national censuses. And finally, personal knowledge of the researcher and other housing professionals about local housing environments refine the selected sets of attributes. Selected attributes omit irresistibly preferred ones such as a crime-free or tidy neighbourhood, and rare ones such as an isolated or exotic location. They also do not portray the details of a home for which preferences may fluctuate even more than generic attributes in response to faddish marketing. Undescribed details include the dwelling unit's room layout and finishing except where implied in the condition of home; and marginal value-adding attributes such as presence of a fireplace, or more than one bathroom.

Selected remaining attributes describe levels of lot size and garage, landscaping, and neighbouring home types and repair for the visible 20-or-so properties down a street. The neighbouring home types portray not only their types of owner or renter occupants but also the structural types of single-detached houses or apartment or condominium buildings. The generalized compositions of

**Table 1.** Correlations of unconstrained (UC) and budget-constrained (BC) utilities, and losses of utility for BC most preferred attributes' levels of displayed homes.

| | | | | Saskatoon 1987 Budget-Constrained Utility | | | | Windsor 2020 Budget-Constrained Utility | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Respondents | | | | Respondents | | | |
| Attributes† | Mean UC and BC Utility Correlation 1987 | Mean UC and BC Utility Correlation 2020 | Attributes' Levels† | Who can Afford a Level (Number) | Who BC Most Prefer a Level (Number) | Who BC Most Prefer a Level (%) | Loss of Utility down from UC Most Preferred if BC Most Preferred (%) | Who can Afford a Level (Number) | Who BC Most Prefer a Level (Number) | Who BC Most Prefer a Level (%) | Loss of Utility down from UC Most Preferred if BC Most Preferred (%) |
| House Type and Size | 0.96 | 0.78 | Bungalow or one-and-a-half storey house. [With less than 950 sq·ft floor space.] Two bedrooms. | 64 | 9 | 14% | 37% | 48 | 9 | 19% | 0% |
| | | | Bungalow. [With 1050 sq·ft. floor space.] Three bedrooms. | 57 | 18 | 32% | 7% | 48 | 11 | 23% | 7% |
| | | | Two-storey house. [With 1250 sq·ft. floor space.] Three-and-a-half bedrooms. | 40 | 9 | 23% | 4% | 48 | 15 | 31% | 1% |
| | | | Two-storey house. [Split- or bi-level with 1400 sq·ft. floor space.] Four bedrooms. | 40 | 16 | 40% | 4% | 29 | 10 | 34% | 0% |
| | | | Two-and-a-half storey house. [With 1700 sq·ft. floor space.] Four-and-a-half bedrooms. | 17 | 12 | 71% | 0% | 29 | 3 | 10% | 0% |
| House Age (and Exterior Finish) | 0.98 | 0.89 | Less than 5 years old. (Brick or stucco exterior finish.) | 40 | 29 | 73% | 0% | 29 | 16 | 55% | 0% |
| | | | Between 5 and 30 years old. (Vinyl or wooden siding exterior finish.) | 51 | 17 | 33% | 4% | 29 | 5 | 17% | 0% |

**Continued**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | More than 30 years old. (Brick or stucco exterior finish.) | 64 | 18 | 28% | 7% | 48 | 27 | 56% | 7% |
| Basement Condition and Home Renovations | 1.00 | 0.99 | No basement or a partial one. No [some] central air conditioning and outstanding features if it is newer; or no [some] central air conditioning and major renovations if it is older. | 59 | 10 | 17% | 20% | 48 | 1 | 2% | 0% |
| | | | An unfinished or partly finished full basement. No central air conditioning and outstanding features if it is newer; or no central air conditioning and major renovations if it is older. | 51 | 4 | 8% | 0% | 48 | 12 | 25% | 7% |
| | | | An unfinished or partly finished full basement. Some modern features including central air conditioning if it is newer; or some renovations, such as central air conditioning, new wiring, plumbing, windows and roof if it is older. | 51 | 5 | 10% | 4% | 48 | 18 | 38% | 4% |
| | | | An insulated, completely finished full basement. Some modern features including central air conditioning if it is newer; or some renovations, such as central air conditioning, new wiring, plumbing, windows and roof if it is older. | 46 | 6 | 13% | 1% | 29 | 10 | 34% | 0% |

**Continued**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | An insulated, completely finished full basement. All modern features including central air conditioning if it is newer; or central air conditioning and extensive interior/exterior renovations if it is older. | 44 | 34 | 77% | 0% | 29 | 7 | 24% | 0% |
| Lot size (and Garage) | 1.00 | 1.00 | Small, about 400 sq·m. or 30 ft by 120 ft., and so the house is close to neighbouring houses. (No front driveway or garage.) | 57 | 9 | 16% | 24% | 40 | 4 | 10% | 9% |
| | | | Medium, about 500 sq·m. or 55 ft. by 110 ft., and so the house (is separated from neighbouring houses) [has space for a driveway at its side]. (Single attached or detached front garage.) | 49 | 10 | 20% | 1% | 40 | 21 | 53% | 3% |
| | | | Large, about 700 sq. m. or 60 ft. by 125 ft., and so the house is separated from neighbouring houses. (Double attached or detached front garage.) | 46 | 38 | 83% | 0% | 25 | 15 | 60% | 0% |
| Landscaping | 1.00 | 0.95 | Newly planted, with sparse shrubs and thin trees. | 51 | 1 | 2% | 0% | 40 | 1 | 3% | 0% |
| | | | Maturing, with lawns and some trees and shrubs. | 51 | 18 | 35% | 2% | 40 | 12 | 30% | 0% |
| | | | Mature but overgrown and in need of replanting or pruning. | 49 | 5 | 10% | 0% | 40 | 7 | 18% | 0% |

**Continued**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Very mature, with lawns, large trees and dense shrubs. | 46 | 27 | 59% | 0% | 40 | 20 | 50% | 0% |
| Neighbouring Home Types (and Repair) | 1.00 | 0.99 | Almost all single-detached houses with owner-occupiers. (No houses in need of major repair.) | 57 | 56 | 98% | 0% | 40 | 21 | 53% | 0% |
| | | | Single- and semi-detached houses with mostly owners and some renters. (Some houses in need of major repair.) | 51 | 0 | 0% | 0% | 40 | 6 | 15% | 0% |
| | | | Includes some nearby modern walk-up rented-apartment or owned-condominium buildings. (Quite a few houses in need of major repair.) | 46 | 0 | 0% | 0% | 40 | 7 | 18% | 0% |
| | | | Includes some nearby high-rise rented-apartment or owned-condominium buildings. (No houses in need of major repair.) | 46 | 1 | 2% | 0% | 40 | 6 | 15% | 0% |
| Ages of neighbours | 1.00 | 0.98 | Youthful single-person households [and mature families]. No children at home. | 49 | 12 | 24% | 0% | 39 | 5 | 13% | 0% |
| | | | Middle-aged residents. Elementary school-aged children at home. | 49 | 29 | 59% | 0% | 39 | 17 | 44% | 0% |
| | | | Middle-aged residents. Teenaged children at home. | 49 | 4 | 8% | 1% | 39 | 15 | 38% | 0% |

**Continued**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Elderly residents [and older families]. With or without children at home. | 46 | 4 | 9% | 0% | 39 | 2 | 5% | 0% |
| Ethnic Group and Education of Neighbours | 0.99 | 0.87 | Working people with high-school education. Most are from same ethnic group as you. | 64 | 13 | 20% | 4% | 39 | 10 | 26% | 0% |
| | | | Working people with high-school education. Most are from different ethnic groups than you. | 64 | 10 | 16% | 2% | 39 | 5 | 13% | 0% |
| | | | Skilled and white-collar workers with high-school or technical-college education. Most from same ethnic group as you. | 51 | 20 | 39% | 0% | 39 | 8 | 21% | 0% |
| | | | Skilled and white-collar workers with high-school or technical-college education. Most are from different ethnic groups than you. | 49 | 3 | 6% | 0% | 39 | 12 | 31% | 0% |
| | | | Professional workers with university or college degree. Most are from same ethnic group as you. | 44 | 18 | 41% | 0% | 39 | 4 | 10% | 0% |
| Mobility of Neighbours | 1.00 | 1.00 | Few neighbours move each year. | 49 | 47 | 96% | 0% | 39 | 19 | 49% | 0% |
| | | | Several neighbours move each year. | 49 | 2 | 4% | 0% | 39 | 15 | 38% | 0% |
| | | | Lots of neighbours move each year. | 46 | 0 | 0% | 0% | 39 | 5 | 13% | 0% |

**Continued**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Stores and Work Access | 1.00 | 0.99 | Within easy driving- or walking-access, up to 10 [15] minutes to major stores and/or work. | 49 | 46 | 94% | 0% | 41 | 29 | 71% | 0% |
| | | | Not too far from major stores and/or work, up to 20 [30] minutes by car or bus. | 49 | 3 | 6% | 0% | 41 | 8 | 20% | 0% |
| | | | Far from major stores and/or work, at least 30 [up to 60] minutes by car or bus. | 51 | 2 | 4% | 37% | 41 | 4 | 10% | 0% |
| Schools Access | 1.00 | 1.00 | Within 10 minutes walking to a school. | 49 | 45 | 92% | 0% | 41 | 27 | 66% | 0% |
| | | | About 20 minutes walking or 10 minutes driving to a school. | 49 | 2 | 4% | 0% | 41 | 11 | 27% | 0% |
| | | | Up to 25 to 30 minutes drive or bus ride to a school. | 49 | 2 | 4% | 0% | 41 | 3 | 7% | 0% |
| (Riverbank) [or Park] Access | 1.00 | 1.00 | (On the Detroit riverbank.) [Down the street to a neighbourhood park.] | 49 | 41 | 84% | 0% | 41 | 32 | 78% | 0% |
| | | | (About 10 minutes walking of a few blocks to the Detroit riverbank.) [Within 15 minutes walking or 5 minutes driving to a neighbourhood park.] | 49 | 4 | 8% | 0% | 41 | 6 | 15% | 0% |
| | | | Not conveniently close to (the Detroit riverbank) [a park.] | 51 | 6 | 12% | 12% | 41 | 3 | 7% | 0% |

[†]Windsor's possible new name or description of an attribute is in parentheses, and Saskatoon's possible alternate name or description is in square brackets.

familiar neighbours are represented by their household members' ages, ethnic group and education, and mobility. Three accessibility attributes locate homes with respect to work and stores, schools, and the waterfront or parks. Distances and travel times are those in relatively compact urban areas, within which most intra-city travel by private or public vehicle requires one half-hour or less.

One operational cognitive scale in the literature for evaluating these attributes is in terms of a home's usefulness or social utility; a second is its asset-accumulation potential realized in a price (Phipps, 1987; Weinberg, Friedman, & Mayo, 1981). These two scales in principle measure a home's commensurate value with different metrics, but a resident may emphasize one or the other when evaluating the same home for a different purpose. Altogether, residents may have different scales of value for a home's social utility and its affordability depending on their gender (Darab, Hartman, & Holdsworth, 2018), income, occupation and race/ethnicity (Boschman, 2018; Clark, 2009; Li et al., 2020), age and family composition (Booi & Boterman, 2020; Jiang, Feng, & Timmermans, 2020), and length of residence and knowledge of the housing market (De Vos, Van Acker, & Witlox, 2016). In other words, unconstrained and budget-constrained utilities, and consequent utility losses may be (dis-)similar for residents who have (in-)comparable ways of evaluating attributes' levels, even while they are not necessarily higher (or lower) income residents with higher (or lower) search prices.

Budget-constrained utilities synthesize two cognitive scales of a home's social utility and price by filtering unaffordable attributes' levels out of a resident's unconstrained utility function. Unaffordable attributes' levels are filtered if their prices are above the resident's indicated search price for affordable homes in the local market. Following Phipps (2022), the $n^{\text{th}}$ resident has a budget-constrained utility for a $j^{\text{th}}$ level of an $i^{\text{th}}$ attribute of a home, $u_n^t\left(x_{ij^*}\right)$, if the price of this attribute's level, $p_n^t\left(x_{ij}\right)$, is less than or equal to their search price for alternative homes at time $t$, $p_n^t\left(x_{ij^*}\right)$. A resident who is knowledgeable of prices will assign no utility to unaffordable attributes' levels, or at least lower utility than somebody who can afford them,

$$\forall i \text{ if } p_n^t\left(x_{ij}\right) \le p_n^t\left(x_{ij^*}\right), u_n^t\left(x_{ij^*}\right) = u_n^t\left(x_{ij}\right) \tag{1}$$

Otherwise,

$$\text{if } p_n^t\left(x_{ij}\right) > p_n^t\left(x_{ij^*}\right), \lim_{j^* \to 0}\left(u_n^t\left(x_{ij^*}\right)\right) = 0 \tag{2}$$

An observed difference between a resident's unconstrained and budget-constrained utilities for an attribute's levels, $u_n^t\left(x_{ij}\right) - u_n^t\left(x_{ij^*}\right)$, will translate into a theoretical loss of utility, $\Delta u_n^t\left(x_{ij^1}\right)$, especially between their unconstrained and budget-constrained socially most preferred $j^1$ attributes' levels. If unable to trade off these positive-valued attributes' levels' losses of utility, a resident is assumed to cumulate them for an overall loss, $\sum_{i=1}^{12} \Delta u_n^t\left(x_{ij^1}\right)$, rather than averaging them or emphasizing the maximum of them. Attributes' assumed equal weighting in

an overall cumulative loss of utility is less consequential for results, as interpretation focuses on losses of utility for individual attributes.

Magnitudes of differences between a resident's unconstrained and budget-constrained utilities depend upon not only their social utilities but also the position of their affordable price for homes within the range of prices for an attribute's levels in the market. Following Phipps (2022), each price in theory is their willingness to pay for the $j^{\text{th}}$ level of the $i^{\text{th}}$ attribute of the home, $p_n^t\left(x_{ij}\right)$. In reality, they will revise these to conform with prices in the local real estate market after interacting with that market. Prices of attributes' levels of the $J^{\text{th}}$ home at time $t$ are marginal implicit prices comprising its overall sale price in the local market,

$$P^t\left(X_J\right)=\sum_i w_i \times p^t\left(x_{ij}\right) \tag{3}$$

where $w_i$ is the contribution of each $i^{\text{th}}$ attribute's price to overall price in that market.

In sum, a resident's budget-constrained utilities for an attribute will diverge more from their unconstrained utilities if they can afford some but not all the attribute's levels. Larger losses of utility are therefore predicted for attributes with wide-ranging affordable and unaffordable marginal prices such as those of the house type and size, house age and exterior finish, basement condition and home renovation, and lot size and garage (Malpezzi, 2002). In comparison, attributes of the neighbourhood such as the neighbours' ethnic group and education, ages, and mobility tend not only to be weaker predictors of overall prices but also to have less variability as independent variables in hedonic housing price models (Sirmans, Macpherson, & Zietz, 2005). Similarly, accessibilities to workplaces and stores, schools, and parks or riverbank may have relatively unvarying marginal prices for uniformly short distances in two mid-sized Canadian cities, regardless of their statistical correlation with overall prices (Des Rosiers, Dubé, & Thériault, 2011).

Tested hypotheses in this study are about marginal utilities and prices of attributes' levels rather than overall valuations and prices of homes. This is just in case a resident is not utilizing a linear compensatory form of utility and price functions. That is, they are not behaving as if summing each attribute's social utility for an overall valuation of a $J^{\text{th}}$ home at time $t$,

$$U_n^t\left(X_J\right)=\sum_i w_{n,i} \times u_n^t\left(x_{ij}\right) \tag{4}$$

This is after possibly weighting each $i^{\text{th}}$ attribute by its $w_{n,i}$ importance for them. Nonlinear noncompensatory functional forms may preclude tradeoffs in an overall evaluation or price of a home between not only more and less preferred attributes' levels, but also affordable and unaffordable ones, respectively. A wise resident will ultimately utilize the linear compensatory form of utility function for evaluating all attributes of a home. They should revert to it after using a nonlinear noncompensatory form for screening a home's attributes such as during an intensive or unfamiliar search process (Phipps, 2018).

## 3. Utility, Price and Respondents' Data

As already mentioned, hypothesized differences between budget-constrained and unconstrained utilities for subsamples of residents are tested with three interrelated datasets for Saskatoon SK in 1987 and Windsor ON in 2020. The first dataset includes respondents' utilities for homes' attributes' levels, and the measurement of these is described in the next subsection. The second dataset, described in the subsection following that, has additional data about personal characteristics of respondents and their search prices for a home if they looked for one tomorrow. The third dataset has marginal sale prices of attributes' levels in the local real estate market, and their calculations are described in a subsection preceding the results of hypothesis tests.

### 3.1. Experimental Measurement of Utilities for Homes' Attributes

Social utilities for homes were measured in two similar conjoint choice experiments in Saskatoon SK in late-1986 and early-1987, and Windsor ON in late-2019 and early-2020. The first experiment is part of a human-computer simulation game "played" on a portable personal computer; the second experiment is part of an online surveying project on webpages. Additional images of screen input for the human-computer simulation game and the subsequent online housing survey project are in another study (Phipps, 2021). A respondent in the simulation game or online surveying project rated their desirability or like/dislike for up to 18 hypothetical homes composed of combinations of 12 generic attributes of homes. Each home is represented in a first screen or tabbed display by levels of three attributes of the dwelling unit; in a second screen or tabbed display by three attributes' levels of the neighbourhood environment; and so on for three attributes' levels of the neighbours and three of the home's accessibilities.

Displayed attributes' levels differ slightly between the 1987 and 2020 experiments (**Table 1**). Also, a Saskatoon home's desirability is rated on a zero-to-100-line scale, whereas a Windsor home's like or dislike is rated with between zero and five stars. Also calculated from these overall ratings during each experiment are a respondent's utilities for attributes' levels of homes. These were calculated by means of the non-metric WADDALS conjoint scaling program in the standalone personal computer experiment in 1987 (Takane, Young, & de Leeuw, 1980), and multiple linear regression functions in the online webpage experiment in 2020 (Rosetta Code, 2020). While using dummy independent variables for attributes' displayed levels, utilities were calculated for predicting the desirability or like/dislike of each displayed home; and the prediction was instantaneously displayed next to the observed desirability or like/dislike of it.

### 3.2. Subsamples of Residents

Subsamples of residents are formed from among 70 and 74 respondents who participated in each conjoint choice experiment in Saskatoon and Windsor, re-

spectively. The former number is approximately one-quarter of identified recent movers in the annual city directory who agreed to play the simulation game in their home; the latter number includes residents of four inner-city neighbourhoods who participated in the online surveying project after three-times receiving a hand-delivered recruitment flyer. Windsor respondents and their households have statistically representative personal characteristics of all residents of dissemination areas encompassing four inner-city neighbourhoods in the most recent national census of 2016, as explained in another study (Phipps, 2021). Saskatoon respondents' representativeness of movers or other households was not statistically established at the time of their participation. Respondents' characteristics are fully tabled in another study (**Table 2** in Phipps (2022)).

Subsamples of respondents in two cities have similar combinations of personal characteristics that are possibly related to housing budgets. For example, most respondents' search prices for a new home "if looking tomorrow", measured in dollars in 1987 and in classified dollar ranges in 2020, are within the ranges of their respective for-sale or sold houses' predicted prices: 47 of 70 Saskatonians indicate a search price between the minimum and maximum predicted house prices; and 34 of 60 Windsorites have one in the corresponding range of their predicted house prices. Then, approximately one-half of respondents' search prices are up to $90,000 in 1987 or $200,000 in 2020. Coincidentally, approximately one-half or more of each city's respondents are 36 or 40 years old and

**Table 2.** Statistics for clustered intercorrelations of respondents' attributes' levels' utilities.

| | Agglomeration Coefficients | | | |
|---|---|---|---|---|
| | Saskatoon 1987 Utilities | | Windsor 2020 Utilities | |
| Number of Clusters | Unconstrained | Budget-constrained | Unconstrained | Budget-constrained |
| Maximum Number (69, 63, 70, 49) | 0.50 | 0.66 | 0.98 | 1.04 |
| ... | | | | |
| 5 | 2.13 | 3.88 | 4.83 | 4.05 |
| 4 | 2.17 | 4.09 | 5.05 | 4.61 |
| 3 | 2.57 | 4.41 | 5.44 | 4.68 |
| 2 | 3.87 | 5.61 | 6.24 | 5.26 |
| 1 | 6.35 | 10.30 | 8.79 | 6.71 |
| Average Difference | 0.09 | 0.16 | 0.11 | 0.12 |
| Standard deviation of Differences | 0.34 | 0.60 | 0.32 | 0.23 |
| Maximum Difference | 2.48 | 4.68 | 2.55 | 1.45 |
| Second-Maximum Difference | 1.31 | 1.20 | 0.79 | 0.57 |
| Third-Maximum Difference | 0.39 | 0.44 | 0.40 | 0.55 |
| Selected Number of Clusters | 2 | 2 | 3 | 2 |

older; are owner-occupiers, especially in Saskatoon; and have lived in the current home for five years or less. More than one-half of Saskatoon respondents have children at home, and managerial or professional occupations; approximately one-third of Windsor respondents have each of these. And, almost equal numbers of respondents in Windsor are self-identified male or female, whereas almost two-thirds of them are women in Saskatoon.

Potentially interpretable subsamples of respondents are inferred from hierarchical cluster analyses of intercorrelations between individual respondents' unconstrained and budget-constrained utilities for all 12 attributes in each study year (Deurloo, Dieleman, & Clark, 1988; Hrast et al., 2019). Two clusters summarize intercorrelations between unconstrained utilities of Saskatoon respondents, their budget-constrained utilities, and the budget-constrained utilities of Windsor respondents; whereas the latter's unconstrained utilities have three clusters (**Table 2**). Final clusters are inferred from not only the maximum or second-maximum increments in agglomeration statistics but also numbers of included respondents. Note that agglomeration coefficients, derived from mean distances within clusters, are indices of similarity between clusters formed at each stage. Larger coefficients indicate relatively more heterogeneous clusters with more dissimilar members.

Clusters of Windsorites are more interpretable than Saskatonians' skewed ones. The latter's clustered unconstrained utilities from one stage to the next have one respondent in a single cluster and up to eight of 70 respondents in another regardless of the agglomeration coefficients; and their clustered budget-constrained utilities have similar combinations of three and 10 of 64 respondents. Already mentioned has been the relative homogeneity of Saskatoon respondents who were recruited as recent owner-occupant movers in the city. In comparison, two of three clusters of Windsorites' unconstrained utilities have 42 and 26 of 71 respondents, whereas the third has three respondents who are excluded from the subsequent loglinear analysis. Their more balanced two clusters of budget-constrained utilities have 24 and 26 respondents, of whom approximately three-quarters are members of the same unconstrained cluster.

These two clusters of intercorrelated budget-constrained utilities of 50 Windsorites (minus one with a missing classified occupation) are more interpretable from statistically-significant parameter estimates of hierarchical loglinear models at 5% significance level or less (Agresti, 1990; Alba, 1987; Timmermans, Van Der Heyden, & Westerveld, 1984). Budget-constrained respondents in the first cluster are probably wealthier. They are two-and-a-half times more likely to have a managerial or professional occupation, a search price above $200,000 and to be in that cluster than they are in the second cluster with the same base combination (**Table 3**). Correspondingly more likely in the second cluster than this base combination are budget-constrained respondents who do not have a managerial or professional occupation while having a search price up to $200,000. Note that these odds of a cluster's members being respondents with a particular combination

Table 3. Loglinear model with clusters of budget-constrained utilities of Windsor respondents.

| Data Information | | | | | |
|---|---|---|---|---|---|
| Cases | Number of cases | | 49 | | |
| Cells | Number of cells | | 8 | | |
| Categories | Managerial or professional occupation | | 2 | | |
| | Search price | | 2 | | |
| | Budget-constrained utility cluster | | 2 | | |
| **Goodness of Fit Test** | | **Value** | **DF** | **Significance** | |
| Likelihood Ratio | | 0.0 | 0.0 | | |
| Pearson Chi-Square | | 0.0 | 0.0 | | |
| **Combination of categorical variables** | | **Parameter Estimate** | **Std. Error** | **Z** | **Significance** | **Odds Ratio: Exp(Estimate)-1** |
| Constant | | 1.25 | 0.54 | 2.34 | 0.02 | 2.5 |
| Not Managerial or professional occupation * Search price up to $200,000 * Unconstrained first cluster | | 0.45 | 0.68 | 0.66 | 0.51 | 0.57 |
| Not Managerial or professional occupation * Search price above $200,000 * Unconstrained first cluster | | 0.76 | 0.65 | 1.18 | 0.24 | 1.14 |
| Managerial or professional occupation * Search price up to $200,000 * Unconstrained first cluster | | -1.95 | 1.51 | -1.29 | 0.20 | -0.9 |
| Managerial or professional occupation * Search price above $200,000 * Unconstrained first cluster | | 1.27 | 0.61 | 2.11 | 0.04 | 2.6 |
| Not Managerial or professional occupation * Search price up to $200,000 * Unconstrained second cluster | | 1.19 | 0.61 | 1.95 | 0.05 | 2.29 |
| Not Managerial or professional occupation * Search price above $200,000 * Unconstrained second cluster | | 0.89 | 0.64 | 1.40 | 0.16 | 1.4 |
| Managerial or professional occupation * Search price up to $200,000 * Unconstrained second cluster | | 0.00 | 0.76 | 0.00 | 1.00 | 0.0 |
| Managerial or professional occupation * Search price above $200,000 * Unconstrained second cluster | | 0 | | | | |

of categorical variables are especially derived from statistically significant parameter estimates in a loglinear model at 5% significance level or less. These odds are ratios as they are relative to a cluster membership of respondents with a specified base combination of categorical variables.

In comparison, memberships of clusters of unconstrained utilities of 68 Windsorites (minus 14 with missing values for classified occupations or search prices) are less definitive about wealthier respondents with managerial and professional occupations in the first cluster, and poorer ones with other occupations in the second cluster (Table 4). This is because unconstrained respondents who have a managerial or professional occupation and a search price above $200,000,

Table 4. Loglinear model with clusters of unconstrained utilities of Windsor respondents.

| Data Information | | | | | |
|---|---|---|---|---|---|
| Cases | Number of cases | | 54 | | |
| Cells | Number of cells | | 8 | | |
| Categories | Managerial or professional occupation | | 2 | | |
| | Search price | | 2 | | |
| | Budget-constrained utility cluster | | 2 | | |
| **Goodness of Fit Test** | **Value** | **DF** | **Significance** | | |
| Likelihood Ratio | 0.0 | 0.0 | | | |
| Pearson Chi-Square | 0.0 | 0.0 | | | |
| **Combination of categorical variables** | **Parameter Estimate** | **Std. Error** | **Z** | **Significance** | **Odds Ratio: Exp(Estimate)-1** |
| Constant | 0.92 | 0.63 | 1.45 | 0.15 | 2 |
| Not Managerial or professional occupation * Search price up to $200,000 * Unconstrained first cluster | 1.61 | 0.69 | 2.32 | 0.02 | 4 |
| Not Managerial or professional occupation * Search price above $200,000 * Unconstrained first cluster | 1.34 | 0.71 | 1.88 | 0.06 | 3 |
| Managerial or professional occupation * Search price up to $200,000 * Unconstrained first cluster | -1.61 | 1.55 | -1.04 | 0.3 | -0.8 |
| Managerial or professional occupation * Search price above $200,000 * Unconstrained first cluster | 1.61 | 0.69 | 2.32 | 0.02 | 4 |
| Not Managerial or professional occupation * Search price up to $200,000 * Unconstrained second cluster | 1.44 | 0.70 | 2.04 | 0.04 | 3 |
| Not Managerial or professional occupation * Search price above $200,000 * Unconstrained second cluster | 0.96 | 0.74 | 1.28 | 0.2 | 2 |
| Managerial or professional occupation * Search price up to $200,000 * Unconstrained second cluster | 0.34 | 0.83 | 0.41 | 0.69 | 0.4 |
| Managerial or professional occupation * Search price above $200,000 * Unconstrained second cluster | 0 | | | | |

are the same four-times more likely in the first cluster as those who do not have a managerial or professional occupation and have a search price up to $200,000, while the latter combination is also three times more likely in the second cluster.

Despite this, the combination of cluster membership and two variables of managerial or professional occupation and search price is the sole saturated log-linear model with perfect, zero, goodness of fit statistics (Table 3 and Table 4). In other words, this loglinear model with 1987 or 2020 data performed better than those with alternative characteristics of respondents such as gender, age, tenure class and length of residence.

### 3.3. House Prices

Different subsamples of respondents defined by their classified occupations and search prices are hypothesized to have different budget-constrained utilities for attributes' levels. They may have these differences if they have either different unconstrained utility for attributes' levels or different willingness and ability to pay the prices of them. Hence after measuring utilities for attributes' levels, their marginal implicit prices are calculated with regression coefficients of a hedonic housing price model for each city (Phipps, 1987, 2020). Each regression model includes independent variables representing the 12 generic attributes' levels of displayed homes in each city's conjoint choice experiment.

Saskatoon's hedonic housing price model has data for 2702 single-family homes listed in MLS catalogues as for sale in sample weeks in each spring and fall from fall of 1980 to spring of 1986. Neighbourhood data from the city's 1981 census tract (CT) data for each sampled home's location are merged with its MLS data. Windsor's hedonic housing price model has data for all 2920 inhabitable single-detached, duplex and row houses sold through the MLS in two inner-city neighbourhoods from early- or mid-1980s to end of December 2018. Merged neighbourhood data are from the 2001, 2006, 2011 or 2016 national census closest to a home's time of sale or resale (Statistics Canada, 2016).

Six attributes' levels constructed from MLS and census data in the city of Saskatoon and inner-city Windsor almost exactly correspond with descriptions in the conjoint choice experiments. These are displayed attributes' levels of house type and size, age of construction (and exterior finish), basement condition and renovations, lot size (and garage), landscaping, and neighbours' mobility. (Windsor's possible new name of an attribute is in parentheses.) Correspondences are more approximate in a second group of five attributes of neighbouring home types (and repair), neighbours' ages, ethnic group and education, and accessibilities to schools and parks in Saskatoon or riverbank in Windsor. The least corresponding attribute of work and stores accessibility is represented by inverse distance to downtown Windsor in kilometres for homes in two relatively compact inner-city neighbourhoods; and by a similar coding to schools' access for near to and far from major workplaces and stores in Saskatoon. Neither multiple regression is the most parsimonious model, owing to entry of independent variables for calculating marginal prices of attributes' levels (cf., Phipps (2020)).

## 4. Budget-Constrained versus Unconstrained Residential Preferences

Mean unconstrained social utilities are calculated for full samples of up to 70 respondents in Saskatoon in 1987 who have no missing values; and up to 71 in Windsor in 2020 who have no missing values for attributes of at least one of the dwelling unit, neighbourhood, neighbours, or accessibilities. Corresponding mean budget-constrained utilities are calculated for up to 64 Saskatonians and up to 50 Windsorites who indicate a search price for a new home and have a budget-

constrained utility for at least one attribute's level.

Comparisons of attributes are helped by graphing subsamples' mean unconstrained and budget-constrained utilities for four attributes' levels, with their 95% confidence intervals. A graph's single horizontal X-axis has descriptions of an attribute's levels. Its primary vertical Y-axis has mean unconstrained and budget-constrained utilities and 95% confidence intervals of the "wealthier" first cluster of Windsorites in 2020 for an attribute's levels (as blue or purple solid lines, respectively, and same-coloured above and below dashes), as well as those of the "poorer" second cluster (as red or orange solid lines and dashes). The secondary Y-axis has predicted marginal prices of sold homes' attribute's levels in Windsor in 2020 (as a green dashed line).

Mean utilities are also statistically correlated for affirming visual differences between unconstrained and budget-constrained preferences for attributes' levels through time. Three attributes have exceptions to the full samples' almost perfect correlations between their mean budget-constrained and unconstrained utilities. Exceptions in 2020 are the strong but imperfect correlations from 0.78 to 0.89 for attributes' levels of house type and size, house age and exterior finish, and neighbours' ethnic group and education (Table 1). In addition, respondents' subsamples have interpretable higher or lower budget-constrained utilities than unconstrained utilities for the first two of these attributes' levels as well as two additional attributes' levels of basement condition and home renovations, and lot size and garage. Respondents' losses of utility are consequently calculated with their unconstrained and budget-constrained utilities especially for five attributes' levels.

Losses of utility are percentage differences between utilities for unconstrained most preferred attributes' levels and budget-constrained most preferred levels along the full 0/"totally disliked" to 5/"totally liked" utility scale in 2020, or derived −2/"very undesirable" to 2/"very desirable" scale in 1987. They are not calculated with the ranges between a respondent's minimum and maximum utilities for attributes' levels. This is because their minimum or maximum may not equate with an attribute's truly totally disliked or totally liked level, respectively.

### 4.1. Two Attributes' Unaffordable Levels for Some Respondents

Beginning with the full Saskatoon sample, a three-bedroom bungalow with 93 sq·m. or 1050 sq·ft. floor space is the budget-constrained most frequently most preferred attribute's level of house type and size in 1987. This attribute's level is Saskatonians' most frequently most preferred one, that is, by 18 respondents or one-third of those who can afford it (Table 1). They however will experience an average 7% loss of utility if choosing this budget-constrained most preferred house type and size as opposed to their unconstrained most preferred one. A two-and-a-half storey four-and-a-half-bedroom home with 158 sq·m. or 1700 sq·ft. floor space is the unconstrained most frequently most preferred attribute's level by over two-thirds of the full sample. Only 17 respondents however can af-

ford this attribute's highest priced largest-home level. They have as hypothesized a statistically significantly higher mean budget-constrained utility than all 70 respondents' mean unconstrained utility for it, based on non-overlapping 95% confidence intervals (**Figure 3** in Phipps (2022)).

Relatively higher budget-constrained utilities for more preferred attribute's levels, but losses of utility if unable to afford most preferred attribute's levels, are therefore two observed relationships for attribute's levels of house type and size. These are also relationships in statistically significant differences between two subsamples' mean budget-constrained and unconstrained utilities for this attribute's levels in Windsor in 2020.

Clustered respondents have higher budget-constrained utilities for affordable attribute's levels of house type and size if a wealthier subsample is in the first cluster and a poorer one is in the second cluster. Twelve respondents in the first cluster, or one-half of them, are respondents who most frequently most preferred a two-storey house with three-and-a-half bedrooms (**Figure 3**). (Similar tabulated results for clustered Windsor respondents as those in **Table 1** for budget-constrained respondents are available from the author.) Wealthier first-cluster respondents then have lower mean budget-constrained utilities for the most frequently most preferred bungalow or one-and-a-half storey house with two bedrooms by nine respondents in the poorer second cluster, or one-third of them.

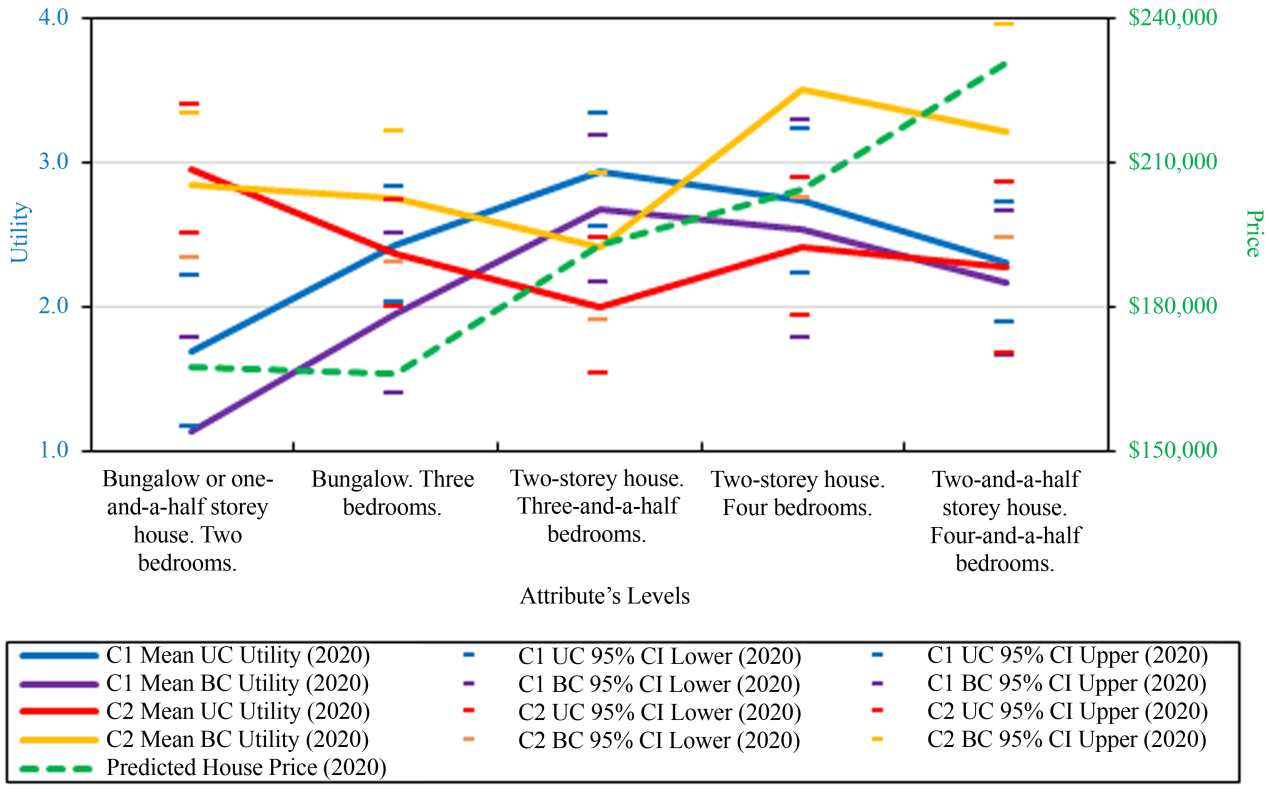


**Figure 3.** Clustered (C1 and C2) house type and size unconstrained (UC) and budget-constrained (BC) mean utility and predicted house price functions, and 95% confidence intervals (CI) lower and upper bounds in 2020.

Thus, the first cluster will experience an average 2% loss of utility if choosing their budget-constrained most preferred one and not their unconstrained most preferred one; the second cluster will have no loss of utility if making the same choice.

In comparison, Windsorites will lose an average 5% in utility if they cannot afford a house such as the most frequently most preferred one less than 5 years old with brick or stucco exterior finish by nine respondents in the first budget-constrained cluster, or more than one-third of them (Figure 4). This is their average lost utility if they instead choose one such as the most frequently most preferred house more than 30 years old with the same exterior finish by 18 second budget-constrained cluster's respondents, or three-quarters of them. Correspondingly, Saskatonians will lose up to an average 7% in utility if unable to afford a house with unconstrained most preferred young age.

### 4.2. Two Attributes' Differences in Utility between Respondents

Discrepancies between budget-constrained and unconstrained utilities for two attributes' levels of house type and size, and house age and exterior finish, prove the unaffordability of the preferred highest priced attributes' levels for many respondents, and thus predict theoretical losses of utility for them. Moreover, their more discriminating budget-constrained preferences for these two attributes' levels, as well as those of basement condition and home renovations and lot size and garage, contradict the inferred evolution in unconstrained preferences towards indifference for these attributes from 1987 to 2020.

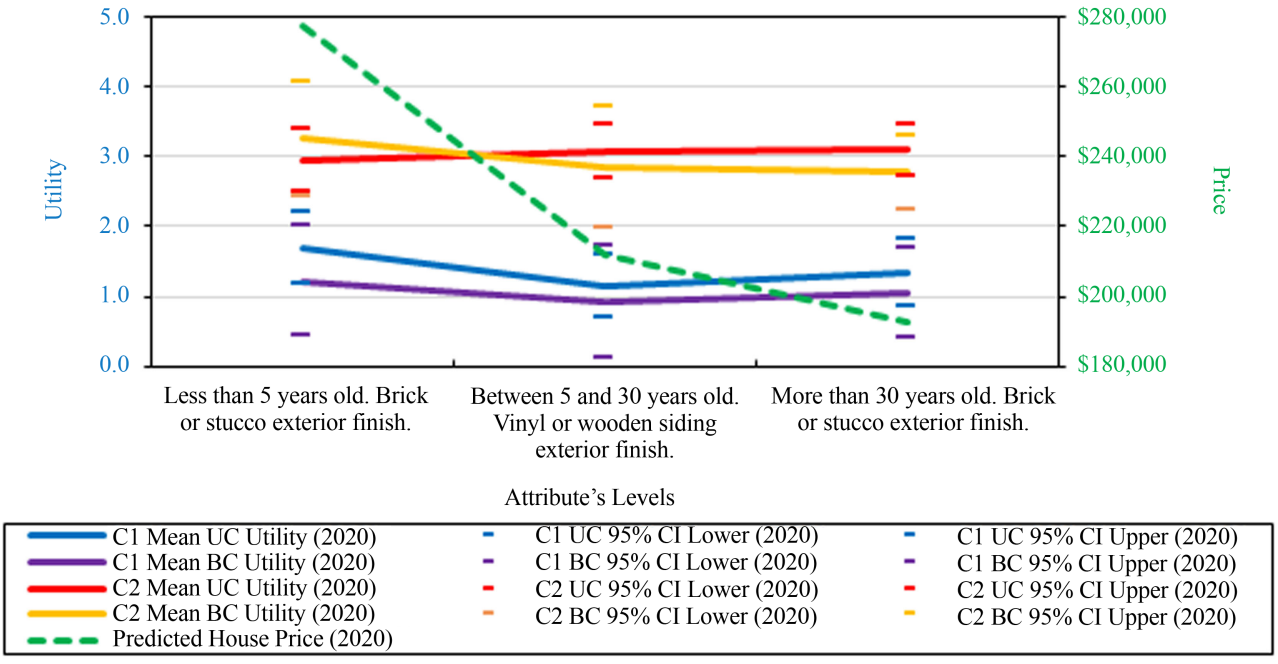


**Figure 4.** Clustered house age and exterior finish UC and BC mean utility functions and 95% CIs, and predicted house price functions in 2020.

For example, Windsorites in the second unconstrained or budget-constrained cluster have statistically significantly higher mean utilities for two lowest-priced attribute's levels of no basement or a partial one, or an unfinished or partly finished full basement with no central air conditioning and outstanding features if it is newer, etc. (Figure 5). The first cluster's mean utilities for this attribute's two lower-priced levels are not only statistically significantly lower than those of respondents in the second cluster. They are also statistically significantly lower than their own mean utilities for three higher-priced levels.

Altogether, 18 budget-constrained respondents in Windsor, or more than one-third of those who can afford it, most preferred a less expensive unfinished or partly finished full basement with some modern features, etc. if it is newer or some renovations, etc. if it is older (Table 1). In comparison, 21 unconstrained respondents in Windsor, or one-third of the full sample, most preferred a more expensive insulated completely-finished full basement with some modern features, etc. if it is newer or some renovations, etc. if it is older. Windsorites who cannot achieve their unconstrained highest preference will consequently lose up to an average 7% utility, for example, if only able to afford either no basement, a partial one or an unfinished or partly finished full basement; Saskatonians will have up to a larger average 20% loss in the same circumstances.

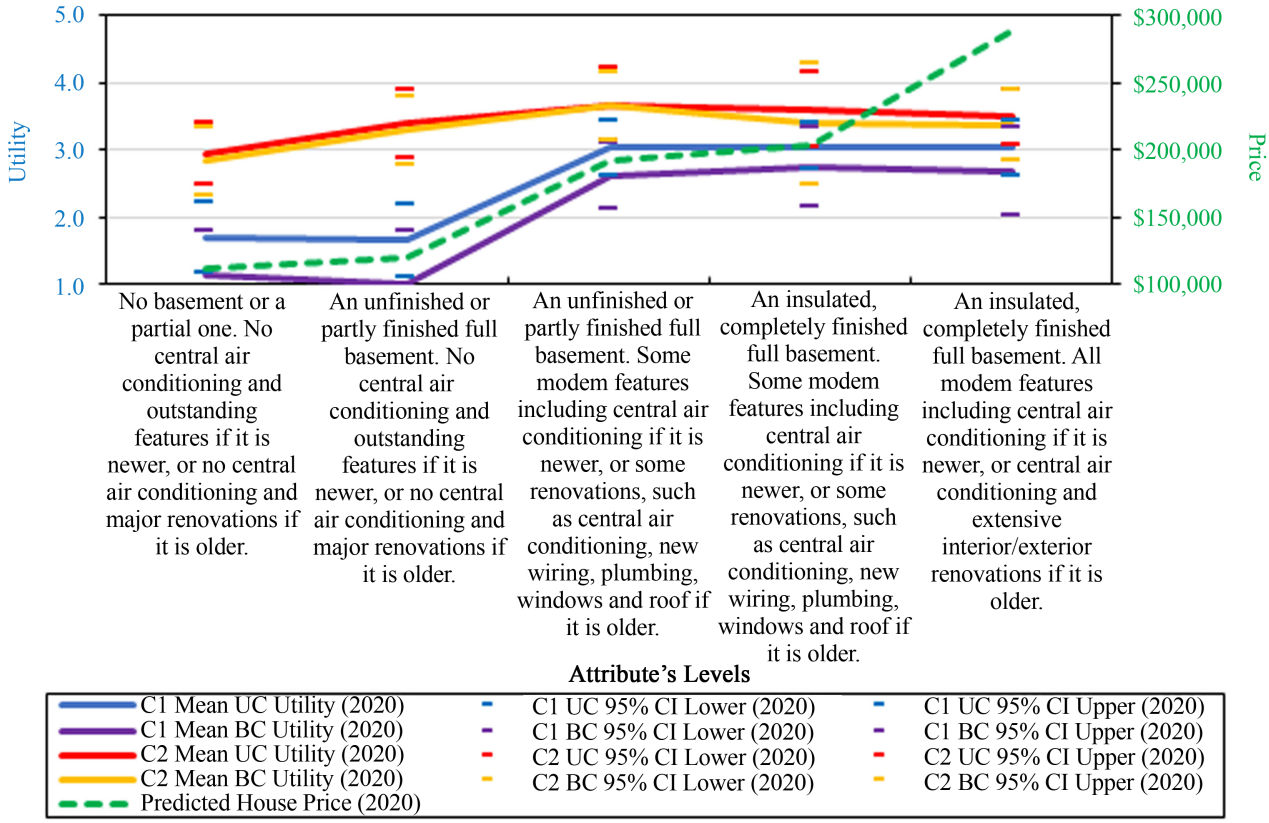


**Figure 5.** Clustered basement condition and home renovations UC and BC mean utility functions and 95% CIs, and predicted house price functions in 2020.

Respondents also have budget constraints on their preferences for attribute's levels of lot size and garage: 21 budget-constrained Windsorites, or one-half of those who can afford it, most preferred a medium-sized lot, about 500 sq·m. or 55 ft. by 110 ft., etc. with a single attached or detached front garage. This compares with an unconstrained preference for a large lot, about 700 sq·m. or 60 ft. by 125 ft., etc. with double attached or detached front garage that was most preferred by 27 respondents, or one-half of the full sample. Up to an average 9% in utility in Windsor and 24% in Saskatoon will be lost if an unconstrained most preferred lot such as the large one is unaffordable.

### 4.3. Four Attributes' Differences in Utility Unrelated to Affordability

Predicted losses of utility for four attributes of the dwelling unit and its lot therefore cumulate to an average 11% loss for a respondent in Windsor, and 19% in Saskatoon. These are their average losses of utility if they are unable to afford four attributes' unconstrained most preferred levels, even if they have relatively high values for more preferred attributes' levels. Meanwhile, differences between either Windsor or Saskatoon respondents' budget-constrained and unconstrained utilities for eight remaining attributes produce lower or no average losses of utility for them.

An already-mentioned attribute with a strong but imperfect correlation between a full sample's mean budget-constrained and unconstrained utilities is the neighbours' ethnic group and education. Mean utilities however are not statistically significant different between this attribute's levels, just like those of three attributes' levels of landscaping, and neighbours' ages and mobility, based on overlapping 95% confidence intervals. Instead, clusters of respondents have unhypothesized statistically significant differences between their average utilities for these attributes, even while having different most frequently most preferred levels of two attributes.

Utilities for four attributes' levels, such as those of neighbours' ages (**Figure 6**), are different because respondents' average unconstrained or budget-constrained utilities in one cluster are uniformly higher than those of respondents in the other cluster, regardless of prices of attributes' levels. Parallel utility functions are indicative of respondents' different utilities for attributes' levels unrelated to affordability.

Nevertheless, an environmental limitation might not apply elsewhere in calculating budget-constrained utilities for attribute's levels of neighbours' ages, and four more attributes of neighbouring home types and repair, neighbours' ethnic group and education and mobility, and home's accessibility to schools in Windsor. This limitation is the exclusion of the same respondents from budget-constrained calculations by narrow less-than-$14,000 ranges of predicted marginal prices for each attribute's levels in 2020. A corresponding narrow range of approximately $3500 for predicted marginal house prices in 1987 excludes the

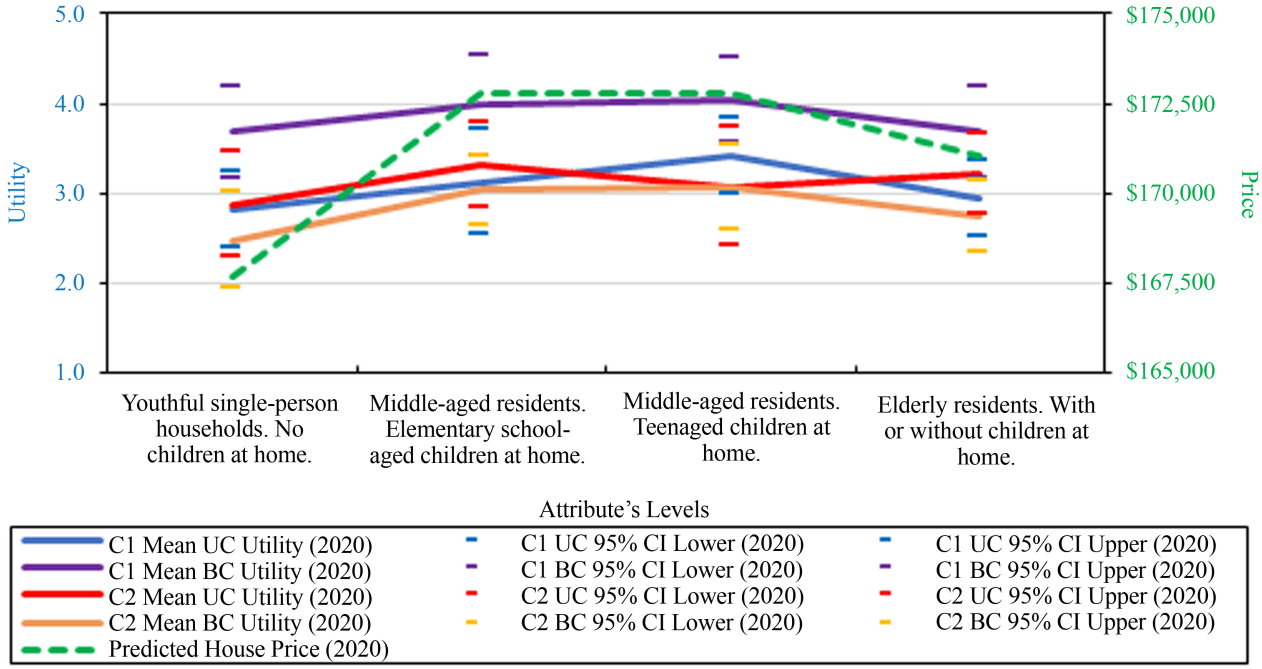


**Figure 6.** Clustered neighbours' ages UC and BC mean utility functions and 95% CIs, and predicted house price functions in 2020.

same respondents for six attributes' levels of landscaping, neighbours' ages and mobility, and accessibilities to work and stores, schools, and parks in Saskatoon. In short, differences between budget-constrained and unconstrained utilities in both 1987 and 2020 may be nullified by narrow price ranges' exclusions of the same respondents who cannot afford any type of neighbours, neighbourhood, or accessibility.

## 5. Discussion

Relatively narrow ranges of predicted marginal prices for six attributes' levels in Saskatoon SK in 1987 and five in Windsor ON in 2020 lead to a violation of one of two conditions under which residents can evaluate homes with budget-constrained utilities. This first condition is that they can afford some but not all attributes' levels' marginal prices. Some respondents however will have incalculable budget-constrained utilities for all unaffordable attributes' levels, though they may afford them by trading off higher-priced attributes for lower-priced ones of a displayed home. Still, most respondents fulfill the second condition of familiarity with attributes' prices in the local real estate market. For example, majorities of respondents in Saskatoon had recently moved into a new home, and in Windsor knew a neighbour who had recently listed a home or property for sale, or did this themselves.

If excluding attributes with narrow ranges of predicted marginal prices, respondents have potentially different budget-constrained utilities than unconstrained utilities for six or seven attributes in 1987 or 2020, respectively. Budget-constrained utilities are particularly consistent with hypotheses for evaluations

of three attributes' levels of the dwelling unit of single-detached (-like) homes, plus its lot size, by up to 70 respondents in each of two mid-sized Canadian cities.

Respondents on average have higher utilities for affordable attributes' levels, such as those in wealthier households preferring a more expensive larger house type and size that is a newer home possibly with a brick or stucco finish; with a finished full basement and extensive home renovations; and a large lot possibly with space for double attached or detached front garage. In comparison, respondents who cannot afford those attributes' levels have relatively higher utilities for less expensive attributes' levels: such as a three-bedroom bungalow that is more than 30 years old and has a brick or stucco finish; and has an unfinished or partly finished full basement with some modern features or renovations; and a medium lot with space for a single attached or detached front garage.

Subsamples of respondents who have different affordabilities therefore have compensatory differences between their unconstrained and budget-constrained utilities for four attributes' levels. They are more discriminating between these attributes' levels' utilities than unconstrained respondents in the full sample appeared to be in another study (Phipps, 2021). Consequently, residents have not necessarily become more indifferent about these attributes' levels in 2020 than 1987. Notwithstanding, currently-defined subsamples of respondents are as indifferent or discriminating about remaining attributes' levels as the full samples were. Mean budget-constrained preferences are not statistically significantly different from mean unconstrained preferences for attributes' levels of the neighbouring home types and repair, and the three accessibilities of single-detached(-like) homes in 1987 and 2020. Also, four attributes of the dwelling unit and neighbours have uninterpretable statistically-significant differences in relation to hypotheses.

Hence, residents at least in inner-city Windsor ON can have the same most frequently most preferred levels of eight remaining attributes regardless of whether they are budget-constrained or unconstrained: A single-detached(-like) home in a neighbourhood with very mature landscaping, with lawns, large trees and dense shrubs; and almost all single-detached houses with owner-occupiers and no houses in need of major repair. With neighbours who are middle-aged residents with elementary school-aged children at home; who are skilled and white-collar workers with high-school or technical-college education, most of whom are from different ethnic groups than them; and few of whom move each year. With a location within easy driving- or walking-access, up to 10 minutes to major stores and/or work; within 10 minutes walking to a school; and on the Detroit riverbank.

## 6. Conclusion

In conclusion, respondents will have a home in Saskatoon in 1987 with an approximate average one-quarter loss of utility, or a one-tenth loss in Windsor

in 2020 if they cannot afford their unconstrained most preferred levels of 12 attributes of a single-detached(-like) home. A typical resident with a moderate loss of utility will be living in a home with a satisfactory but imperfect combination of attributes' levels. Loss of utility from living in a budget-constrained preferred home, as opposed to the unconstrained most preferred one, may be an "alternative explanation for the low residential satisfaction of rural residents… that these people might have been forced to live in these neighbourhoods due to budget restraints" (De Vos, Van Acker, & Witlox, 2016: p. 855). It also may substantiate whether "this group of families with older children is increasingly made up of households that want to stay in the city, instead of households that had to stay because of limited options on the housing market" (Booi & Boterman, 2020: p. 111). Under these circumstances, a resident's and policymaker's probable question is about the required compensation for affording unconstrained most preferred attributes' levels. Preliminary analyses predict average decreases in attributes' levels' prices or increases in household wealth of $21,000 for Saskatonians and $47,000 for Windsorites as compensating for their loss of utility in 1987 and 2020, respectively. The assessment of these compensatory expenditures is a focus of future research.

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## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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