Stated Preference Investigation of Influences on Attractiveness of Residential Locations

J. D. HUNT, J. D. P. MCMILLAN, AND J. E. ABRAHAM

A stated preference experiment concerning residential location choice was conducted in Calgary, Alberta, Canada. Each respondent was asked to indicate an order of preference for a set of hypothetical residential location alternatives. Each alternative was described by specifying a monthly charge, number of bedrooms, travel time to work, travel time to a shopping center, and proximity to light rail transit (LRT). This placed the respondent in a situation in which it was necessary to trade off between better or worse conditions regarding these attributes. Information was also collected on actual home location, actual workplace location (if the respondent was employed), family size, and total household income. The set of observations thus obtained was used to estimate the coefficients for various alternate utility functions in logit models of this choice behavior. All of the attributes were found to have statistically significant effects on the attractiveness of residential locations. Specific findings were that travel time to work is worth approximately 25 Canadian dollars (C$25) per hour, travel time to work is about two times as important as travel time to shop, an additional bedroom is equivalent to approximately C$155 per month, and being within walking distance of an LRT station is worth about C$217 per month. Both household income and family size were found to have significant influences. These results provide empirical evidence that the transport system influences the attractiveness of residential locations. They also contribute to further understanding of this aspect of urban system behavior in Calgary and demonstrate the potential for this process to be used elsewhere. Also included is a table providing an extensive summary of the factors considered in the literature on residential location choice.

It has long been argued that the transportation system, through its effects on accessibilities, has various impacts on the attractiveness of locations as sites for activities. More specifically, it has been asserted that the relative travel times and ease of access provided by the roadway and public transport systems serving an area influence the relative degrees of attractiveness individuals associate with different residential locations in the area.

This paper describes an investigation of the influence of various factors, some of which are transportation related, on housing preferences in Calgary, Alberta, Canada.

REVIEW OF LITERATURE

There is an extensive literature on the study of residential location choice behavior in urban areas. The content of this literature is considered in terms of (*a*) the factors found to have an influence, (*b*) the nature of the observations of preference (revealed versus stated), and (*c*) the analysis procedure used.

Department of Civil Engineering, University of Calgary, 2500 University Drive NW, Calgary, Alberta, Canada T2N 1N4.

Factors

A wide variety of dwelling unit attributes, location attributes, and household characteristics have been shown to influence housing choice behavior. A list of some of these attributes and characteristics is included as Table 1, together with the relevant source references.

Most studies have found that money cost, dwelling unit size, and proximity to activities have major influences. Similarly, household size, life cycle, and income have often been identified as important characteristics.

Various attributes and characteristics have been found to have significant influences in some studies and insignificant influences in others. For example, Butler et al. (*1*) and Weisbrod et al. (*2*) found that the form of tenure (rent versus own) influences housing location selection, whereas McDonald (*3*) found that form of tenure does not improve the explanatory power of models of residential location choice behavior. These differences in findings appear to arise because studies vary in terms of both context and approach.

Revealed Preference and Stated Preference Data

Indications of the actual choices made by households are called revealed preference observations. These data can be used to estimate the parameters of models of residential preferences, and they have a high degree of validity in that they represent actual behavior. However, they suffer from a variety of shortcomings.

Revealed preference data describe the compromises households make, not their true preferences. The disequilibrium and habit that affect real-world residential location behavior cause households to not necessarily realize their preferences, but rather stay put or accept what the market has to offer (*2,4–7*).

A related problem is the existence of correlations among the attributes in real-world data. For example, a positive correlation is to be expected between house size and travel time to work in many cities because larger houses tend to be located toward the edges of built-up areas. Such correlations make it difficult to separate the influences of different factors using statistical analyses of revealed preference data. In addition, collecting real-world data is usually very expensive and time-consuming (*8,9*).

In contrast stated preference observations can be obtained by running relatively inexpensive stated preference experiments in which the respondents are presented with hypothetical alternatives and asked to indicate which alternative is preferred. The structure of the data can be controlled to avoid correlations, and the individuals taking part in the experiments are not hindered by real-world supply

TABLE 1 Factors Found To Influence Residential Location Choice and Sources

Factor	Source (ref. no.)
Attributes of Dwelling Unit	
Cost—price, rent, taxes	1, 5, 7, 12, 13, 14, 18, 19, 25, 29, 30, 44, 45, 46, 47, 52, 54, 56, 59, 62, 68, 70, 71, 72, 75, 77, 78, 81, 82, 83, 84
Building size—number of rooms or bedrooms	1, 7, 12, 14, 17, 29, 30, 44, 56, 62, 71, 72, 73, 77, 83
Building size—floor area	19, 46
Lot size	3, 13, 17, 19, 44, 46, 64, 65, 67, 71, 77, 78, 83
Building type—bungalow, multifamily	1, 7, 14, 19, 29, 31, 44, 52, 59, 65, 72, 77, 83
Number of floors	13
Building design and layout of rooms	17
Quality of construction	1, 17, 29, 46, 60, 63, 65, 71, 72
Age	7, 14, 19, 29, 30, 44, 46, 47, 52, 56, 62, 65, 71, 78
State of repair	19
Form of tenure—rent or own	1, 2, 58, 59, 71, 77, 80
Lot layout	17, 52
Availability of enclosed parking	13, 29
Proximity to traffic	17, 52
Attributes of Location	
Accessibility to workplace	1, 3, 5, 7, 14, 17, 18, 28, 29, 30, 31, 41, 44, 46, 48, 49, 52, 54, 59, 62, 71, 72, 73, 75, 77, 78, 80
Accessibility to shopping and other nonwork activities	1, 5, 14, 17, 19, 28, 29, 30, 44, 46, 48, 52, 80, 83, 86
Accessibility to other activity locations	19, 46, 54, 61, 70
Accessibility to schools	19, 29, 46, 52
Accessibility to CBD	47, 51, 63
Public transport quality	2, 7, 12, 17, 28, 29, 46, 52, 54, 59, 85
Availability and quality of public services—water, power, fire, police, etc.	1, 12, 30, 52, 56, 61, 71, 75
Relationship to previous home location	1, 3, 4, 7, 66, 69, 83
Availability of parking	5, 29, 65
Attributes of Neighborhood	
Prestige or quality	1, 14, 30, 45, 46, 55, 56
Average income for households in area	28, 44, 45, 59, 65, 71, 72
Crime rate	3, 44, 46, 54, 71, 72, 75, 79
Demographic mix—race and age	3, 17, 19, 25, 28, 29, 59, 65, 72, 80, 85
Proportion rental properties	25, 84
Housing turnover rate	19
Proportion of single-family dwellings	56
Density and openness of built form	12, 13, 17, 19, 47, 52, 61, 62, 65, 71
Traffic, noise, and air pollution	3, 5, 44, 46, 54, 65, 68, 50
Presence of "antiresidential" land uses	17, 52
Topography	14, 17, 54, 71
Character and maturity of landscaping	17, 19, 52, 71
Pleasantness and degree of interest	65
Quality of view from dwelling unit	13, 52
Pedestrian safety	5
Quality of schools in neighborhood	28
Good area for children	52
Characteristics of Household	
Income	1, 3, 7, 14, 17, 27, 28, 29, 30, 44, 51, 53, 56, 62, 63, 71, 73, 80, 83
Occupation	51, 59, 61, 72
Level of education	27, 29, 44, 71, 72, 75
Number of people in household	1, 7, 14, 28, 29, 30, 31, 55, 56, 57, 59, 63, 71, 74, 77
Number of employed people in household	7, 29
Number of children in household	7, 18, 27, 28, 63, 74, 83
Lifecycle status and related indicators	1, 7, 14, 27, 30, 31, 55, 56, 71, 72, 77, 80, 83
Race	1, 17, 27, 28, 29, 60, 76
Car ownership	29, 57, 59
Mode use	29, 59
Work schedule and its flexibility	7
Familiarity with neighborhood	17

limitations. Attention can be focused on the attributes of interest—with the influences of other attributes held constant. Of course, the question remains: do those playing a hypothetical choice game behave in the same way that they would in reality? There is also the possibility that respondents playing games can be led in their responses and the possibility that the choice behavior exhibited is unrealistic if the respondents find the hypothetical situations too unbelievable. Nevertheless various researchers claim that accurate and realistic results are obtained when the experiments are properly designed to account for these problems (*9–11*).

Various forms of ranking exercise and stated preference technique have been used in a number of studies of housing preferences, and these have successfully provided insight into the influences of different attributes and aspects of the choice processes involved (*5,7,12–24*). However, in most cases respondents were asked to give direct indications of the importance of different attributes rather than make choices that involved trade-offs among attributes—thereby limiting the analysis of choice behavior that was possible.

Analysis Procedure

A number of statistical analysis procedures have been used with observations of choice behavior to investigate how preferences are influenced by various factors. One technique that has been used extensively with success in residential location choice analysis is the estimate of logit models, in which the resulting coefficient estimates and associated statistics are used to make inferences about the strength and statistical significance of the influences of specific factors (*25–31*).

METHOD

The logit model estimation process was employed in this research: disaggregate stated preference observations of housing choice behavior were collected and used to estimate coefficients for various housing attributes in logit models of location choice behavior. The details of this procedure are described in the following paragraphs.

Modeling Framework and Statistics

The logit model is a mathematical model that represents the behaviors of individuals trading off among the attributes of alternatives when selecting one alternative out of a set of available alternatives (*32*). It has the following simple and convenient form for the choice situation considered in this research:

$$P_i^* = \frac{\exp(U_i^*)}{\Sigma_i \exp(U_i)} \qquad (1)$$

where

i = index representing housing alternatives,
i^* = a particular housing alternative,
P_i^* = probability that housing alternative i^* is selected, and
U_i = utility value associated with alternative i.

The utility function that ascribes utility values to the housing alternatives has the following general, linear form:

$$U_i = \phi_1 \cdot X_{1i} + \phi_2 \cdot X_{2i} + \ldots + \phi_n \cdot X_{ni} + \ldots \qquad (2)$$

where

n = index representing attributes,
X_{ni} = value of attribute n for alternative i, and
ϕ_n = utility function coefficient associated with attribute n.

The statistical properties of the linear utility function coefficient estimates are well behaved (*32*). Consequently, this formulation is a very attractive one for modeling choice behavior, and it enjoys widespread use (*33*).

When the values for the utility function coefficients have been estimated, the relative influences of factors can be determined by taking ratios among the resulting coefficient values. The significance of differences among the estimates can be considered using standard t-statistics and t-ratios, with the t-ratio for a given parameter estimate being the t-statistic for the estimate's difference from 0. A t-statistic or t-ratio is significant when it has an absolute value greater than 1.96, indicating that there is a less than 5 percent chance that the associated difference is due to random effects only (*34*). The overall model goodness-of-fit can be considered by using a goodness-of-fit index as follows (*35*):

$$\rho^2(0) = 1 - \frac{L(*) - N}{L(0)} \qquad (3)$$

where

N = number of coefficients in estimated model,
$L(0)$ = log-likelihood for model with zeros for all coefficients, and
$L(*)$ = log-likelihood for model with estimated coefficients.

This $\rho^2(0)$ index is analogous to the R^2 statistic for linear regression in that it ranges from 0 to 1, with larger values indicating a better fit. It also takes into account the number of parameters used in the model, favoring more parsimonious model specifications (*35*).

Housing Attributes Considered

It has been found that only a relatively small number of attributes should be presented in stated preference experiments (*10*). The influences of the transportation system on housing preferences were of primary interest in this research. Accordingly consideration was limited to a subset of what appeared from the literature review to be some of the most important attributes influencing housing preferences, including some related to transportation. These are as follows:

- Money cost per month, representing a rent or a mortgage payment, with three values considered: 500, 800, and 1,000 Canadian dollars (C$);
- Number of bedrooms, representing the size of a dwelling unit, with two values considered: two and four;
- Minutes of in-vehicle travel time to work, with two values considered: 15 and 30 min;
- Minutes of in-vehicle travel time to a shopping center, with two values considered: 5 and 15 min; and
- Proximity to a light rail transit (LRT) station, with two values considered: within walking distance and not within walking distance.

Descriptions of the hypothetical alternatives considered in the stated preference experiments performed for this research were developed by selecting one out of a set of possible values for each of these attributes and combining these selected values into a bundle representing a complete alternative. To keep the total number of possible alternatives at a manageable level, only a few realistic values were specified for each attribute. The money values were staggered to allow for a wider range of trade-off rates (*36*). The result was a set of 48 separate hypothetical alternatives. A separate 7.5- × 12.5-cm card was prepared showing the bundle of values for the attributes for each of these alternatives.

Clearly many important attributes were left out. In the interviews the respondents were told that all other attributes were constant among the hypothetical alternatives, with the intention that these attributes should not influence the relative attractiveness of the alternatives. This made it possible to focus in on what was of interest in this case.

Data Collection

Calgary is the principal metropolitan center in southern Alberta, with a 1991 population of 710,000. It has an extensive public transport system, including 85 LRT vehicles running on 29.3 km of track radiating from the central business district (CBD).

In November 1992 more than 390 choice experiments were conducted with individuals selected randomly at various shopping areas in Calgary. Each experiment was a voluntary interview in which the respondent was approached and asked to rank four hypothetical housing alternatives in order of preference from best to worst, taking into account the needs and wants of the respondent's present household. In each case these four alternatives were selected randomly from the full set of 48 alternatives in the "deck" of cards to maintain the orthogonality of the variables (*9*). Each respondent was also asked a variety of questions regarding socioeconomic status and household characteristics, including

- home location,
- workplace location, if the respondent was working,
- number of people in household,
- combined annual before-tax income of household,
- number of licensed drivers in household, and
- number of cars available for use by people in household.

After removing incomplete interviews, the result was a data set with 377 disaggregate stated preference observations. This data set was used to estimate the coefficients in a variety of logit models with different utility functions as described in the results section.

The logit model estimations were performed by using the exploded logit technique (*37*). This technique attempts to predict the full ranking of the alternatives in an observation—in contrast to the more limited prediction of the single, most-preferred alternative in standard logit analysis.

RESULTS

Various alternate utility functions were considered by using different combinations of variables. The estimation results for a selection of some of these utility functions are discussed below.

Function 1

The estimation results for the initial utility function considered are (the numbers in parentheses below each parameter estimate are *t*-ratios for the estimates)

$$U_i = \underset{(13.9)}{-0.003163} \cdot COST_i + \underset{(10.8)}{0.4905} \cdot BEDS_i + \underset{(9.5)}{-0.05384} \cdot WORK_i + \underset{(3.0)}{-0.02474} \cdot SHOP_i + \underset{(8.3)}{0.6866} \cdot LRTP_i \quad (4)$$

where

$L(0) = -1198.13$; $L(*) = -967.56$; and $\rho^2(0) = 0.188$,
$COST_i$ = money cost per month for alternative *i* (C$),
$BEDS_i$ = number of bedrooms for alternative *i*,
$WORK_i$ = in-vehicle travel time for trip from alternative *i* to workplace (min),
$SHOP_i$ = in-vehicle travel time for trip from alternative *i* to shopping center (min), and
$LRTP_i$ = 1 when an LRT station is within walking distance of alternative *i* and 0 otherwise.

All of the coefficient estimates are statistically significant and have signs (positive or negative) consistent with what would be expected. For example, the coefficient for $COST_i$ is negative, consistent with the expectation that an increase in price would make an alternative less attractive. The value for $\rho^2(0)$ is reasonable, indicating a reasonable model fit.

The *t*-statistic for the difference between the coefficient estimates for $WORK_i$ and $SHOP_i$ is 2.83, making these two estimates significantly different. This indicates that these two types of in-vehicle times have significantly different impacts and should be considered separately. The ratio between these two estimates is 2.18, indicating that in-vehicle travel time for home-based work trips is 2.18 times as important as the equivalent time for home-based shopping trips when selecting housing locations.

The coefficient estimates for $COST_i$ and $BEDS_i$ together imply a trade-off money value for a bedroom of C$155.07 per month, which seems reasonable. That is, it seems reasonable to expect a household to be willing to pay an additional C$155.07 per month in rent for an additional bedroom.

Some of the other trade-off money values implied by the coefficient estimates are

- A value of in-vehicle time for home-based work trips of C$17.02/min/month (which converts to a value of C$25.53/hr, assuming 20 round-trips to work per month) and
- A value of C$217.07/month for being within walking distance of the LRT.

The value for in-vehicle time is within the range for such values and appears reasonable (*38*). The value for being within walking distance of the LRT may be slightly high, but it may be picking up some respondents' anticipation of the potential money savings associated with reduced dependency on an automobile.

Function 2

The total household income can be expected to influence the perception of money costs. An attempt was made to include representation of this influence within the model by dividing the money cost for each alternative by the income for the household. The results for a utility function that includes this indication are as follows:

$$U_i = \underset{(12.5)}{-118.8} \cdot COST_i/INC + \underset{(10.4)}{0.4761} \cdot BEDS_i + \underset{(9.2)}{-0.05185} \cdot WORK_i + \underset{(3.2)}{-0.02649} \cdot SHOP_i + \underset{(8.0)}{0.6697} \cdot LRTP_i \quad (5)$$

with $L(0)$ equal to $-1,198.13$, $L(*)$ equal to -944.38, and $\rho^2(0)$ equal to 0.208 and where INC is the total annual income for the respondent's household (C$/year).

All of the coefficient estimates are again statistically significant and have signs consistent with what would be expected. The value for $\rho^2(0)$ is higher than that for $\rho^2(0)$ in Function 1, indicating a better model fit. It is therefore appropriate to represent the effect of income in the utility function in this way.

The units of the implied trade-off values with this utility function change from what they were in Function 1: with this function an additional bedroom is worth 4.8 percent of the respondent's income; being within walking distance of LRT is worth 6.8 percent of the respondent's income; and in-vehicle time for home-based work trips has a value of 0.0004364 of the respondent's annual income per minute per month, which converts to a value of 126 percent of the respondent's wage rate. The calculation of this conversion is as follows: With 20 round-trips per month, a 1-min trip duration adds up to 40 min over a month. The implied value of a minute of travel time is therefore $0.0004364/40 = 0.00001091$ of annual income. With 240 working days of 8 hr each, the wage rate per minute is $1/(240 \cdot 8 \cdot 60) = 0.000008681$ of annual income. Thus, a minute of travel time is worth $0.00001091/0.000008681 = 1.257$ of a minute of wage.

Function 3

The number of people in a household can be expected to influence the perception of the number of bedrooms. To investigate this the variable for the number of bedrooms was split into a series of separate variables according to the number of people in the household. Initially, this series included a separate variable for one, two, three, four and five or more people. The results indicated that it was most appropriate to use two separate variables, one for two or less and the other for three or more people. The results for this utility function are as follows:

$$\begin{aligned} U_i = & -124.8 \cdot \mathrm{COST}_i/\mathrm{INC} + 0.1230 \cdot \mathrm{BEDS}_i^{2-} + 0.8703 \cdot \mathrm{BEDS}_i^{3+} \\ & \quad (12.6) \qquad\qquad (2.0) \qquad\qquad (12.1) \\ & + -0.05575 \cdot \mathrm{WORK}_i + -0.03013 \cdot \mathrm{SHOP}_i + 0.6421 \cdot \mathrm{LRTP}_i \\ & \quad (9.6) \qquad\qquad (3.5) \qquad\qquad (7.6) \end{aligned} \tag{6}$$

where

$L(0) = -1{,}198.13$, $L(*) = -911.28$, and $\rho^2(0) = 0.234$;

BEDS_i^{2-} = number of bedrooms for alternative i when number of persons in household is 2 or less and 0 when number of persons in household is more than 2; and

BEDS_i^{3+} = number of bedrooms for alternative i when number of persons in household is 3 or more and 0 when number of persons in household is less than 3.

All of the coefficient estimates are still statistically significant and have retained signs consistent with what would be expected. The value for $\rho^2(0)$ is higher than that for $\rho^2(0)$ in Function 2, indicating that it is appropriate to use this representation of the effect of household size.

The t-statistic for the difference between the coefficient estimates for BEDS_i^{2-} and BEDS_i^{3+} is 7.92, which means that these two variables should be kept separate. The ratio between these two estimates indicates that the number of bedrooms is 7.08 times as important to households with more than two people when selecting housing locations. This ratio may be somewhat exaggerated in this instance: the hypothetical alternatives had either two or four bedrooms only, which meant that this research did not obtain any indications of preferences for two bedrooms rather than one bedroom. Such preferences would likely be most prevalent in households with two people, and missing indications of them in particular likely reduced the apparent importance of bedrooms for these households more than for other households.

In fact it is rather encouraging that smaller households tended not to place as high a value on larger dwellings. This tendency suggests that respondents were making choices on the basis of their actual situations rather than merely reacting to what was presented to them out of context, which lends validity to the indications of behavior provided by the results.

A wider range of numbers of bedrooms in the hypothetical alternatives and a more complete description of the life-cycle status of households would have allowed a more complete analysis of preferences regarding numbers of rooms. However, wide ranges of attribute levels lead to sets of alternatives that are so large that the use of a deck of cards becomes infeasible.

Function 4

The total household income can be expected to influence the perception of travel times as well as money costs. An attempt was made to indicate this by multiplying the travel times by the logarithm of the income for the household. The results for a utility function that includes this indication are as follows:

$$\begin{aligned} U_i = & -124.3 \cdot \mathrm{COST}_i/\mathrm{INC} + 0.1239 \cdot \mathrm{BEDS}_i^{2-} + 0.8725 \cdot \mathrm{BEDS}_i^{3+} \\ & \quad (12.6) \qquad\qquad (2.0) \qquad\qquad (12.1) \\ & + -0.05134 \cdot \mathrm{WORK}_i \cdot \mathrm{LN(INC)} \\ & \quad (9.7) \\ & + -0.002719 \cdot \mathrm{SHOP}_i \cdot \mathrm{LN(INC)} + 0.6409 \cdot \mathrm{LRTP}_i \\ & \quad (3.5) \qquad\qquad (7.6) \end{aligned} \tag{7}$$

with $L(0)$ equal to $-1{,}198.13$, $L(*)$ equal to -911.57, and $\rho^2(0)$ equal to 0.234.

All of the coefficient estimates continue to be significantly different from 0 and have signs consistent with expectations. The value for $\rho^2(0)$ is the same as that for $\rho^2(0)$ in Function 3, indicating that the two utility functions have the same goodness of fit. This means that combining INC with WORK and with SHOP does not improve the fit of the model, even though it adds further complexity. On this basis it is judged appropriate to not include INC in this way.

Function 5

It is not unreasonable to expect that those people living within walking distance of LRT and those people not living within walking distance of LRT differ in terms of their perceptions of the benefits of proximity to LRT. This is because there will be some self-selection in that households most concerned about being close to LRT will be more inclined to move to locations close to LRT. As time progresses this will lead to a relatively larger proportion of LRT-proximity-sensitive households in areas close to the LRT. There may also be some ex post rationalization in which respondents who live within walking distance of LRT add support to their home location selection by exaggerating (either consciously or subconsciously) the importance of proximity to LRT—which is a form of what has been called *postpurchase* or *reporting bias* (*39,40*). In addition members of those households who actually live close to

LRT will have had relatively more opportunity to use LRT to its full advantage and may thereby develop a more accurate appreciation of the actual value of being within walking distance of the service.

The evidence of such a difference was investigated with the data obtained in this research. The results for a utility function that distinguishes between the perceptions of those who do and those who do not live within walking distance of LRT are as follows:

$$\begin{aligned} U_i = {} & -125.2 \cdot \underset{(12.7)}{\mathrm{COST}_i/\mathrm{INC}} + \underset{(2.1)}{0.1279 \cdot \mathrm{BEDS}_i^{2-}} + \underset{(12.0)}{0.8658 \cdot \mathrm{BEDS}_i^{3+}} \\ & + \underset{(9.6)}{0.05571 \cdot \mathrm{WORK}_i} + \underset{(3.5)}{-0.02981 \cdot \mathrm{SHOP}_i} + \underset{(3.9)}{1.369 \cdot \mathrm{LRTP}_i^C} \\ & + \underset{(6.8)}{0.5952 \cdot \mathrm{LRTP}_i^F} \end{aligned} \quad (8)$$

where

$L(0) = -1{,}198.13$, $L(*) = -908.86$, and $\rho^2(0) = 0.236$;

LRTP_i^C = 1 when an LRT station is within walking distance of alternative i and the respondent's actual home location is within 400 m walking distance of an LRT station (designated C for close) and 0 otherwise; and

LRTP_i^F = 1 when an LRT station is within walking distance of alternative i and the respondent's actual home location is not within 400 m walking distance of an LRT station (designated F for far) and 0 otherwise.

Again, all of the coefficient estimates are statistically significant and have signs consistent with what would be expected. The value for $\rho^2(0)$ is higher than that for $\rho^2(0)$ in any other function, indicating that this utility function provides the best model fit out of those considered.

The t-statistic for the difference between the coefficient estimates for LRTP_i^C and LRTP_i^F is 2.13, which means that these two variables should be kept separate. The ratio between these two estimates indicates that being within walking distance of LRT is 2.30 times as important to households located within walking distance of LRT in reality.

It should be noted that only 10 percent of those interviewed were from households located within walking distance of LRT. This will have increased the sampling error for the information concerning these households' evaluations of proximity to LRT in particular. The amount of confidence placed in the coefficient estimate for LRTP_i^C must be reduced accordingly. Nevertheless, the results indicate that there is a statistically significant difference in these two groups' perceptions of the importance of being within walking distance of LRT.

Several studies (*7,17*) have found that transit service quality and availability have only marginal effects on housing location preference overall. The findings here suggest a much more dramatic effect, in particular among those living within walking distance of LRT. Others (*41*) have found that those households selecting suburban residential locations with poor or non-existent public transport service did so in part because they tended not to use public transport. These various findings suggest that there tends to be at least two groups of households: one group that tends to use public transport and for whom public transport service is an important factor influencing the quality of residential locations and another group that tends not to use public transport and for whom public transport service is almost irrelevant to the quality of housing locations.

CONCLUSIONS

Various housing attributes and household characteristics have been shown to have a statistically significant influence on housing preferences in Calgary. This includes several transportation-related attributes—thus indicating that the transport system has an effect on the attractiveness and hence on the value of residential locations in Calgary. The LRT in particular has been shown to have an impact on housing values. Various trade-off rates among the housing attributes have been identified, and these seem plausible and consistent with indications from other sources. There is some suspicion that the money values are a bit high, for proximity to LRT in particular. Several factors could have acted to make these values somewhat less than completely reliable. Some respondents may have correlated cost with quality and therefore selected more expensive alternatives more readily—even though respondents were told to assume that all unmentioned attributes were the same across all alternatives. Also people may have some tendency to spend hypothetical money more readily than, for example, forgo hypothetical bedrooms. It would be good if the respondents in a survey could be made to feel the impacts of the money costs more directly. This has been done for some forms of choice experiments related to transportation behavior (*42*), but it may be very difficult to do for housing choice behavior given the large amounts of money involved.

The models of housing choice behavior resulting from this work can be used to assess the impacts of changes to the transportation system in Calgary. Function 1 and its implied trade-off values can be used in cases in which the distribution of household characteristics is not known. Function 5 and its implied trade-off values can be used to achieve a greater accuracy when the required information on household characteristics is available.

The stated preference techniques that were used were found to be very successful in many ways. A useful data set with good statistical properties was obtained easily and quickly with very little cost. There is still some concern that all the attributes presented to the respondents proved to have a significant influence simply because values for these factors were specified and the respondents felt compelled to consider them. It would be an interesting experiment to include a factor thought to have little or no influence, such as style of doorknob, to see if such a factor turns out to have little or no influence in the data.

The work reported here has provided necessary tools for planning analysis and has contributed to the further understanding of the behavior of the urban system in Calgary. Of course it has left many questions unanswered, and further work should be done. The existing data set should be used to investigate the potential impacts of automobile availability and workplace location (including its service by LRT) on housing preferences. The results here could be combined with the results from further hypothetical choice experiments investigating other factors. The reliability of these stated preference results could be investigated further by comparing them with revealed preference data (i.e., a sample of the actual housing selections made in Calgary).

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