FACTORS AFFECTING RESIDENTIAL LOCATION CHOICE

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ABSTRACT: *The demand for residential space is influenced by numerous attributes many of which come under the influence of transport planners. Until recently, models of the relationships between this demand and the relevant attributes have relied on empirical comparisons, few have contained a solid behavioural base. The Elimination-by-Aspects model presented in this paper has its origin in the behavioural sciences. Its basic assumption is that an individual searches through the attributes influencing the choice, in order of decreasing importance, and eliminates a location as soon as one of the attributes present in the location is found to be unacceptable. This paper briefly outlines the theory underlying the model and presents its mathematical expression. The procedure for estimating both the importance ratings and the level of acceptance of attribute satisfaction levels is also outlined. The model is then applied to the choice of residence of a group of people in Melbourne. The sensitivity of these people's choices to variations in the attributes influencing residential location choice is investigated.*

INTRODUCTION

Transport is a derived demand, its value is that it provides the link between the activities that people wish to be involved with. Transport decisions do however influence the ease with which people can partake in activities and in turn peoples' desire to partake in certain activities influences transport decisions. This interaction is commonly referred to as the land use/transport interaction.

The considerable importance placed on understanding the land use/ transport interaction can be illustrated by reference to the considerable literature relating to this topic. Ricardo's (1817) treatment of agricultural rent laid the foundation for many economic studies of land use (Alonzo, 1964). Clark (1951) and others developed relationships for predicting population density while Ball (1973) and others studied the determinants of house price to investigate the interaction between individual preference and the availability of housing. The output of many of these models served as input into the traditional 4 step transport planning process used in the numerous transport studies carried out in the 1960's and 70's. More recently (McFadden, 1979) transport planners have moved towards modelling individuals' decisions of how, when and where to travel. An obvious extension of this research is the study of where to live. Hence a growing number of studies are concentrating on this aspect of the land use/transport interaction. This paper presents one approach to studying the location decision of residents and determining the factors influencing this decision.

The approach outlined in this paper recognises that an individual does not have unlimited mental capabilities and therefore cannot include in his/her choice all the attributes describing each possible residential location. Rather the model states that individuals search through the attributes describing each location, proceeding from those attributes which are considered most important through to those that are considered least important. If at any stage in this process an attribute describing a location is found to be unsatisfactory that location is eliminated from the choice process, hence reducing the number of locations considered when looking at the next attribute. This model therefore requires a measure of the resident's attitudes (importances) as well as their minimum level of acceptance for an attribute. Previous studies (Recker and Golob, 1979; Foerster, 1979 and Young, 1982) that have used this Elimination-by-Aspects (EBA) approach have determined only the acceptance levels and have used interviewee estimates of the importance heirarchy. Often, however, these estimates are not available. This paper therefore presents an EBA model where the importances are also estimated by statistical methods.

The paper can be divided into a number of parts. Firstly, there is a discussion of the deficiencies of some existing models of residential location choice. Secondly, the ability of the EBA model to overcome these deficiencies is discussed along with a brief outline of the model theory. Thirdly the data used to illustrate the model's application is introduced before presenting the results of the model calibration. The sensitivity of the model to changes in attribute level is illustrated next prior to some concluding remarks.

REVIEW OF EXISTING RESIDENTIAL CHOICE MODELS

To determine the factors affecting residential location choice, it is first necessary to determine an appropriate model of this decision. Two distinctly different choice structures can be identified in the literature on choice models. These are compensatory and non-compensatory models. Compensatory models assume that an individual can trade-off high levels of satisfaction in some attributes with low levels in others. Non-compensatory models do not allow this trade-off between attribute levels.

Most choice models which have been applied to land use studies (Quigley, 1973; Lerman, 1975) can be classed as compensatory since they use a linear additive procedure for combining the attribute satisfaction levels into an overall measure of satisfaction with each alternative. In the case of Lerman's (1975) model this results in an individual combining a large number of attributes (16) into a composite evaluation for a large number of alternatives (145). This seems beyond the mental capabilities of any individual. A more acceptable behavioural mechanism would be for the individual to rank the attributes in order of importance and then consider each attribute in order of importance. Locations are then eliminated each time an attribute describing that location is found to be unsatisfactory. This non-compensatory approach forms the basis for the EBA model discussed in this paper.

Another characteristic of many existing location choice model results from the historical development of choice models in transport planning. Most applications of choice models to transport problems have used the logit model. It was therefore not unreasonable to expect that this model would be applied to studying location choice. This was in fact the case (see Mayo, 1973; Quigley, 1973; Lerman, 1975).

There is however, one major problem in applying the logit model to residential location choice and this results from the fact that the basic premise on which the model relies is violated in the case of residential location choice. This assumption is the Independence from Irrelevant Alternatives (IIA) axiom. It states that the odds of choosing an alternative over another are constant irrespective of the other alternatives in the choice set.

To illustrate the problems associated with the IIA assumption, take two suburbs, one near the centre of the city (x) and one in the outer suburbs (y). The probability of choosing x is 0.60 and the probability of choosing y is 0.40. Suburb y is now subdivided into two smaller suburbs. The second suburb becomes known as location z. If the supply of housing has no influence on choice and the new residents are indifferent to the two outer suburbs the probability of choosing y from a choice between y and z is 0.50. However the probabiliy of choosing y from locations x, y, z given the IIA axiom holds is now 0.29. Hence the probability of choosing y or z is 0.58. Thus the subdivision of a suburban area means a developer can capture 58% of the market compared with his previous share of 40%. In fact, if a third outer suburban area was introduced, by further subdivision, the model would predict that the developer's share of the market would rise to 67% and so on. The full derivation of these percentages can be found in Young (1982).

The paradox outlined above is commonly referred to as the "red bus/ blue bus" problem in the mode choice literature. It highlights a serious deficiency in applying the logit model to residential location choice. This defficiency is not present in the EBA model since it incorporates similarities between alternatives into the model structure.

An attempt to overcome the IIA problem, in the logit model, could be made by grouping the alternatives with similarities and forming a heirarchy of choices. This model is called a nested logit and was first discussed by Daly and Zachary (1978). There are however two problems with this approach.

The first problem is that there is no clear distinction between one residential area and another. Rather every residential area within an urban area is related to the others due to spatial proximity. It is therefore necessary to adopt a trial and error procedure for determining the most appropriate groupings of areas and then determine the hierarchical order of these groupings. This is a complicated, time consuming and expensive task.

The second problem with the nested logit would result when the model is applied. Application of the nested logit would use the same hierarchy as that developed at the calibration stage. However there can be no certainty that if a change in the urban system is made that this change does not result in new groupings and a new hierarchy of choice, hence making the old hierarchy of choice inappropriate. The building of a road bridge would for instance make two areas which were distinctly different before its construction much more similar in their spatial proximity to activities after its construction.

Both these problems cast doubt on the usefulness of the nested logit model for modelling residential location choice. A model framework that overcomes these problems is needed. The EBA model provides such a framework.

THEORETICAL FOUNDATIONS OF THE EBA MODEL

Two features of the EBA model are fundamental. The first is that it is assumed that, rather than consider all attributes describing a location simultaneously in order to generate an overall composite evaluation of the alternative, the individual conducts a mental search of the attributes in a sequential fashion proceeding from that attribute which is considered most important through to that attribute which is considered least important. It may well occur, however, that this search is not completed and that the individual will make a choice before all attributes have been considered. The method by which this attribute-search is terminated is the second feature of such a model. It is assumed that at each stage of the search (ie. when each attribute is considered), the level of the attribute for each location is compared to a minimally acceptable level of that attribute. If a location fails this test, (i.e. the attribute level is less than the minimally acceptable level) then that location is eliminated from further consideration. If it passes the test, it continues in the attribute-search to be compared with other remaining locations with respect to the next most important attribute. The search continues until all bar one of the locations have been eliminated. The remaining location is then considered to be the chosen alternative. Both the importance and acceptance level associated with each attribute need to be determined prior to application of the EBA model.

The basic difference between the EBA model and most existing models of residential location choice lies in the discontinuous or non-compensatory nature of the attribute-search model. Thus, whereas in a typical residential location choice model (Quigley, 1973; Lerman, 1975) an attribute which is unsatisfactory may be balanced or compensated for by another attribute which is more satisfactory, such a compensation is not possible in the EBA model. This is because at each stage on the search process, all locations with an unsatisfactory attribute are immediately eliminated from further consideration.

The concept of sequential consideration of attributes has been used in many theories of information processing (Luce, 1959; Tversky, 1972) whilst that of minimally acceptable levels of attributes is most notably postulated in the work of Simon (1957) in his expositions on the concept of satisficing. The application of EBA models to residential location modelling is not common. There are, however, a few examples present in the transportation modelling literature (Foerster, 1979; Recker and Golob, 1979)

The model developed in this study is based primarily on the Elimination-by-Aspects model described by Tversky (1972). Thus the EBA model described in this paper assumes that more important attributes have a greater probability of being considered earlier in the attribute-search process. By allowing for individual differences, the probability of selection of each attribute for examination is in proportion to a function of the importance of each attribute. Thus, the most important attributes are likely to be examined first, but not necessarily so for any one individual. Because of the probabilistic nature of the attribute ordering procedure, repeated applications of the model for each individual will not result in the same choice every time but rather will result in a set of probabilities of selection of each location.

To avoid the necessity of actually simulating this decision process on repeated occasions to obtain choice probabilities, it is possible to express this model structure in the form of a general mathematical equation (as first shown by Tversky (1972)). The derivation starts with the representation of a three-alternative choice problem in the form of a Venn diagram, as shown in Figure 1. In residential location choice each location is represented by a circle encompassing those attributes for which the location provides a minimally acceptable level of satisfaction. The area which each attribute contributes to the circle is given by a function of the importance of that attribute. Thus the total area of each circle is given by the sum of the importance of those attributes for which the location provides a minimally acceptable satisfaction level.

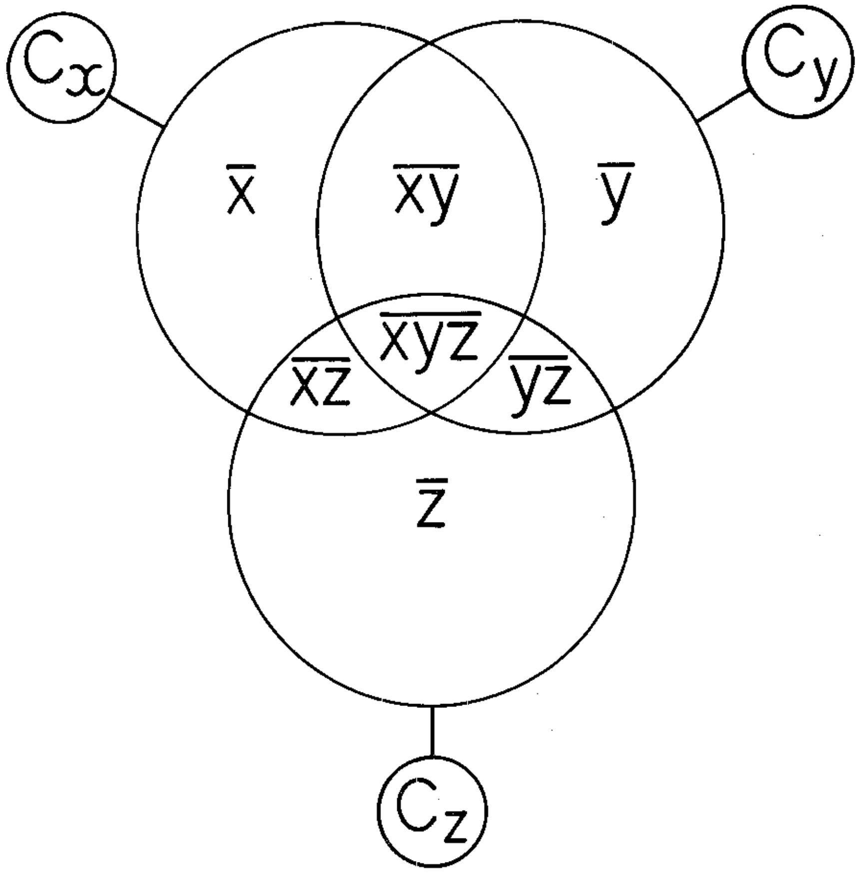

Figure 1. Venn diagram for EBA model

Areas of overlap between the circles represent attributes which are satisfactory for two or more locations, while areas occupied by only one circle represent attributes which are satisfactory for only that location. The sets of satisfactory attributes may be represented by set notation, such that $\bar{x}$ represents the set of attributes which are satisfactory for location x alone, $\overline{xy}$ represents the set of attributes which are satisfactory for location x and y (but not others) while $\overline{xyz}$ represents the set of attributes which are satisfactory for all three locations. The area of each part of the circles is given by the sum of the importances over the relevant attributes and may be denoted by (eg. $I(\bar{x})$, $I(\overline{xy})$ etc.). In addition to those satisfactory attributes actually specified for each of the locations, it is assumed that there also exists one set of unspecified satisfactory attributes for each of the locations. These location-specific attributes are mutually exclusive and non-zero. The size of these sets may be obtained through the calibration process in the form of location specific constants. These constants (or attribute sets) are represented by C_x, C_y and C_z.

The probability of selection of x is given by

$$p(x|xyz) = \frac{Cx + I(\bar{x}) + I(\overline{xy})\ .\ P(x|xy) + I(\overline{xz})\ .\ P(x|xz)}{K} \qquad (1)$$

where $p(x|xyz)$ = probability of choosing x from a choice between x y and z.

$$K = Cx + Cy + Cz + I(\bar{x}) + I(\bar{y}) + I(\bar{z}) + I(\overline{xy}) + I(\overline{xz}) + I(\overline{yz}).$$

A more complete derivation of the mathematical expression can be found in Young (1982).

Another problem to be addressed is the method by which minimally acceptable satisfaction levels are to be set. The present study uses a "minimum regret" criterion whereby attribute satisfaction levels are considered to be acceptable if they lie within a specific fractional tolerance of the maximum satisfaction level for that attribute over all locations for that individual. Thus,

$$\text{Acceptable } S_{kjq} \geq (1 - T_k) \max_j \{S_{kjq}\} \qquad (2)$$

where S_{kjq} = satisfaction with the k^{th} attribute of the j^{th} location for the q^{th} individual

T_k = tolerance for the k^{th} attribute

$\max_j \{S_{kjq}\}$ = the maximum satisfaction with the k^{th} attribute for the q^{th} individual over all j alternatives.

Thus if satisfactions are measured on a 1-100 psychometric scale and the maximum satisfaction for an attribute over all alternatives is 80 then, assuming a tolerance of (say) 0.20, the remaining alternatives would be satisfactory if their satisfaction scores were greater than or equal to 64 (i.e. 80 - .20 x 80).

Hence the determination of the most appropriate set of critical tolerances and importance ratings is the task of the calibration process, wherein the importances and tolerances are selected such that a specified objective function is maximised. Input into the model is the subject level of satisfaction associated with each of the attributes describing each location. Because the output of the EBA model described above is a probability of selection (Eqn. 1), maximum likelihood is used to estimate these parameters.

Before leaving this discussion of the EBA model, it is necessary to discuss the EBA model in the context of the three criticisms leveled at existing location choice models in the previous section. The first criticism relates to the complexity of the choice process. The EBA model allows the individual the opportunity of reducing the complexity of the choice by eliminating many locations early in the choice process. The few locations left can be compared using a more comprehensive set of attributes.

The second criticism related to the IIA axiom and was illustrated by reference to a developer subdiving land and increasing his market share. The EBA model overcomes this problem since it allows for similarities between locations (see Figure 1), any location which is the same as any other will be considered as such. Hence the probability of being attracted to an outer suburban location will not be increased by subdividing that suburb.

The final criticism relates to the application of the choice model and the need for the model to be sensitive to changes in the similarities between locations. Unlike the nested logit model the EBA model discussed in this paper allows the degree of interdependence between locations to vary with variations in the satisfaction levels associated with the attribute describing each location.

The EBA model therefore appears to be an appropriate model for studying the factors affecting residential location choice.

DATA SET

To estimate the model parameters, data collected in a survey of residential location choice in Melbourne (Young, Morris and Ogden, 1978) was used. The survey was conducted in 1977-78 and provided measures of the attitudes and behaviour of a sample of new male residents in Burwood, Wantirna and Belgrave, three outer suburban areas of Melbourne. These three areas were not vastly different in social and physical characteristics and were located along the same transport corridor. It was therefore expected that the residents in the study would have reasonable knowledge of the character of each area.

Residents in the three areas were interviewed as soon as possible after moving into their new home. Measures of their perception of the satisfaction they would obtain from each of the attributes shown in Table I for each of the three areas were obtained. One hundred point semantic scales were used to obtain the satisfaction ratings. In total 716 households were interviewed. Interviews were also conducted with female members of the household but these data were not used in the present study.

The data used in this paper was similar in concept to the subjective ratings used by Foerster (1979) and Recker and Golob (1979). The use of this psychometric data has one major advantage in that it allows the isolation of the task of choosing a location from the attribute perception and evaluation phase of the choice process (Young, 1982). For the application of the model developed in this paper it would, however, be necessary to develop separate models to take account of the relationship between the physical levels of attributes and psychometric measures of those attribute levels. Data on the physical measures of the attribute levels were also collected in the survey to investigate these relationships. Young and Richardson (1978) and Young and Morris (1980) present studies of these relationships.

TABLE 1 ATTRIBUTE CONSIDERED IN STUDY

ATTRIBUTE	ABBREVIATION
Closeness to present workplace	Work
Closeness to open country	Country
Closeness to parks	Parks
Closeness to entertainment	Entertain
Closeness to friends	Friends
Closeness to relatives	Relatives
Closeness to people of same age	Age
Closeness to people of same social level	Social
Availability of suitable shops	Shops
Availability of suitable schools	Schools
Public transport	Transport
Pedestrian safety	Safety
Traffic congestion	Congestion
Tidiness of area	Tidiness
How well buildings are maintained	Maintain
How clean the air is	Air
Presence of trees, shrubs, grass	Trees
Dwelling type in the area	Dwelling
Type of dwelling you can afford	Afford
Expected financial gain from reselling dwelling	Gain

EBA MODEL CALIBRATION

Initial Model Calibration

As a starting point, an EBA model was constructed for the sample of 716 new residents using all twenty attributes shown in Table I. The results of this model calibration, together with the associated statistics describing the significance of the attribute tolerance and importance and the overall model performance are shown in Table II.

Since maximum likelihood estimation techniques have been used in the calibration procedure, it is possible to use specific values of the likelihood function to test the overall signficance of the model. Specifically the likelihood ratio test (Hensher and Johnson, 1981) shows that the overall fit is significant at the 5% level ($-2\ell n\lambda = 983.4 > 31.41 = \chi^2_{0.05}$ with degrees of freedom 40). Furthermore McFadden's ρ^2 value of 0.61 is satisfactory.

To test the significance of the parameters it is also possible to use the likelihood ratio test. The test was discussed by Westin (1974) who states that if two models, of the same form, are built from the same data set and the first model has M parameters and the second M' parameters, then the significance of the second model with respect to the first can be tested using the likelihood-ratio test where:

$$-2\ell n\lambda = -2(L^*(\hat{T},\hat{I})_{M'} - L^*(\hat{T},\hat{I})_M) \qquad (3)$$

where $L^*(\hat{T},\hat{I})_{M'}$ = the log-likelihood of the second model with M' parameters

$L^*(\hat{T},\hat{I})_M$ = the log-likelihood of the first model with M parameters.

$\hat{T}$ = parameter estimate for tolerance

$\hat{I}$ = parameter estimate for importance

$-2\ell n\lambda$ is distributed like χ^2 but with (M-M') degrees of freedom. If $-2\ell n\lambda$ is less than the critical value of χ^2 then it may be assumed that the two models are not significantly different from each other.

To use this test to determine the significance of removing individual attributes from the model, it is necessary to first construct the model with M parameters and calculate $L^*(\hat{T},\hat{I})_M$. The attribute in question is then omitted from the model, hence removing an importance and tolerance parameter, and the value of $L^*(\hat{T},\hat{I})_{M-2}$ calculated. The value of $-2\ell n\lambda_k$ (the measure of significance of the parameters associated with attribute k) is then calculated and compared with the critical value of χ^2 with 2 degrees of freedom. Using a 5% level of significance the critical value of χ^2 is 5.99. Hence if the value of $-2\ell n\lambda_k$ is less than 5.99 then the tolerance and importance associated with the attribute in question can be assumed to have no significant influence on the model and can be removed from the model's attribute set.

Table II shows the $-2\ell n\lambda_k$ values for each of the twenty attributes. It can be seen that ten of the twenty attributes appear to have non-significant parameters.

Table II PARAMETER ESTIMATES FOR INITIAL EBA MODEL

Attribute	Importance Parameter	Tolerance Parameter	$-2 \ln \lambda_k$
Trees	100	0.20	44.92
Friends	80	0.20	42.28
Schools	70	0.10	39.60
Afford	100	0.15	31.98
Air	100	0.35	27.44
Dwelling	100	0.25	18.94
Tidiness	75	0.20	18.04
Relatives	100	0.60	17.66
Shops	95	0.20	14.64
Country	55	0.45	9.34
Congestion	25*	0.50*	4.18
Maintain	45*	0.35*	4.10
Work	15*	0.60*	4.00
Parks	45*	0.90*	2.08
Age	5*	0.10*	1.20
Social	100*	0.95*	0.04
Entertain	5*	0.90*	0.02
Transport	100*	1.00*	0.00
Safety	100*	1.00*	0.00
Gain	100*	1.00*	0.00
<u>Constants</u>			
Burwood	5		
Wantirna	5		
Belgrave	5		
$L^*(0,\infty)$	-783.6		
$L^*(\hat{I},\hat{T})$	-301.9		
$-2 \ln \lambda_T$	983.4		
ρ^2	0.61		

* not significant at the 5% level.

Refined Model Calibration

To provide a more accurate picture of the choice process, the attributes associated with non-significant parameters should be omitted from the total attribute set. This was carried out by removing the attribute with the lowest $-2\ln\lambda_k$ value and recalibrating the model, until all the attributes had significant parameter estimates. This procedure allowed for the effects of omitting attributes which are correlated with the attributes left in the model. Table III presents the refined model.

Table III PARAMETER ESTIMATES FOR REFINED EBA MODEL

Attribute	Parameter		$-2\ln\lambda_k$
	Importance	Tolerance	
Schools	65	0.10	40.88
Friends	70	0.20	40.76
Trees	80	0.20	38.74
Afford	100	0.15	36.25
Tidiness	55	0.05	25.73
Air	100	0.35	24.11
Shops	90	0.20	22.53
Dwelling	100	0.25	21.81
Relatives	100	0.60	16.27
Country	50	0.45	9.16
Constants			
Burwood	5		
Wantirna	5		
Belgrave	5		
$L^*(0,\infty)$	-783.6		
$L^*(\hat{I},\hat{T})$	-310.1		
$-2\ln\lambda_T$	947.0		
ρ^2	0.60		

It can be seen (Table III) that ten attributes were removed from the model specification. However the model is still found to be highly significant as shown by the values of $-2\ell n\lambda$ and ρ^2. Of the ten attributes that were removed, closeness to present workplace is the most noticeable. This attribute is a commonly used attribute in most land use models. In the context of the EBA model, however, all that is being said is, given the spatial relationship between each of the three areas and the respondent's workplaces, most respondents are insensitive to or satisfied with this separation. Put another way, the proximity to workplace provides an outer limit to where people will locate, and within this limit the cost and standard of housing, provision of schools and shops, and the quality of the physical environment have a large role in determining the actual location.

This finding has general support from a number of studies (Highway Research Board, 1969; Catanese, 1971; Richardson, 1971; O'Farrell and Markham, 1975; Guest and Cluett, 1976).

The Highway Research Board's report on moving behaviour and residential choice concludes that the "accessibility to a number of regular, out-of-home activities, including workplace was found to be a relatively unimportant factor in household residential mobility and in a household's choice of new residence". The report does however, state that households living at more than 40 minutes distance from work have a greater tendency to move than households that lived nearer to work.

Catanese (1971) observed that, rather than home to work place distances being minimised, such distances increase with income. O'Farrell and Markham (1975) came to a similar finding but went further and stated that the majority of car owners did not even know their running cost, let alone their total travel cost.

Richardson (1971), using a similar logic to that described in the previous paragraph, contends that home to work expenses are considered only in determining an outer constraint to location choice. Within this constraint the residential environment, household quality and cost as well as the accessibility to other facilities plays a major part in influencing location choice. Guest and Cluett (1976) confirm this finding in their study of the interrelationship between home and workplace location decisions.

If closeness to workplace does provide this outer constraint then improvements to the traffic system, such as freeways and area traffic control, may influence where people live. These improvements will allow people to travel more quickly between their home and workplace. In turn, this decreased travel time to work increases the area suitable for locating and may result in people living a greater spatial distance from their work than people do at present. The energy consumption received from these road improvements may therefore be reduced by the tendency of people to travel further to work.

Many of the attributes that remained in the model related primarily to aspects of the local area. Accessibility to schools and shops were found to have significant parameter estimates. The quality of the local environment was measured by the presence of trees and shrubs, the tidiness of the area, closeness to open country, the cleanliness of the air and the dwelling type in the area. The social environment was influential through access to friends and relatives. Finally, the cost dimension was introduced through the type of dwelling the respondent could afford.

It is interesting to note that with these attributes in the model the values of the constants are very low. This indicates that the model is well specified and that most of the attributes influencing the choice are included in the model.

ELASTICITIES

Introduction

The significance of the overall model and the parameter estimates are a necessary prerequisite for model prediction. However, to test the effect of policy initiatives it is necessary to test the response of the model to changes in attribute satisfaction. Elasticity is often defined as the percentage change in model prediction consequent on a one percent change in satisfaction. For the EBA model it is, however, unlikely that a one percent change in satisfaction will illustrate the influence of the tolerances. Hence larger changes in satisfaction ratings are required. Specifically, changes in satisfaction with Burwood between -100% and 100%, using 5% increments were input into the model and the percentage change in model prediction consequent upon these changes calculated. The ratio between the percentage change in model prediction and the change in satisfaction is referred to as the arc-elasticity.

The results of the elasticity calculations for five attributes are shown in Figure 2. It is obvious from Figure 2 that the elasticity is not a smooth function of the change in attribute satisfaction. This is mainly because the EBA model is inherently discontinuous in nature. Changes in prediction can only occur when the satisfaction level for that attribute crosses the minimally acceptable satisfaction level for that attribute. In such a situation, a location changes from unsatisfactory to satisfactory with respect to that attribute when satisfaction is rising and hence the probability of selection of that location increases in a discontinuous way.

This tolerance effect can be seen by comparing the rate of change of the model prediction with the value of the tolerance. For instance, tidiness of the area has a sharp change in model prediction between +5 and 10%, and -0 and -5% change in satisfaction. Its tolerance is 0.05. The threshold effects illustrated in Figure 2 would provide quite a different model prediction from those obtained from the more conventional compensatory logit or regression models.

It is also of note that depending on the percentage change on satisfaction different attributes will have the greatest influence on choice. A +100% change in the satisfaction with the type of dwelling one could afford will result in a larger charge in people moving to Burwood than will any other attribute. For a +10% change or -100% change in satisfaction with Burwood tidiness of the area and closeness to relatives, respectively, will have the largest impact on choice. It is therefore necessary to determine the level of change that can be made in any satisfaction level before the most efficient strategy for attracting people to any location can be determined.

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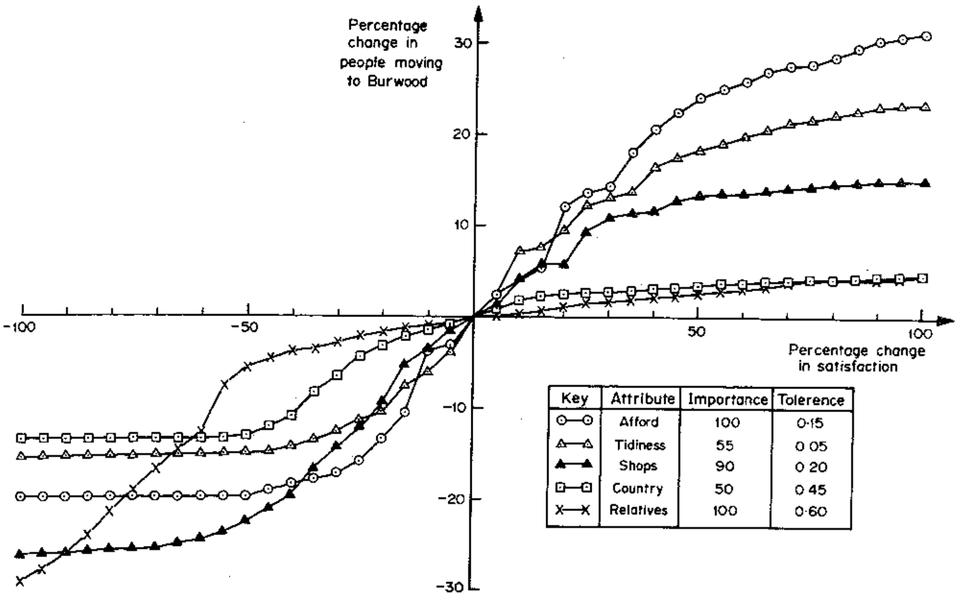

Figure 2 Arc-elasticities for EBA model

CONCLUSION

This paper has outlined the development of a non-compensatory EBA model for which tolerances and importances can be estimated using maximum likelihood procedures. The model has been shown to explain a significant proportion of variance in a data set describing residential location choices in Melbourne. The significant of attribute tolerances has been tested using a likelihood-ratio test. The calculation of arc-elasticities has shown highly non-linear changes in predicted choice with decreases in attribute satisfaction. These non-linearities can however be explained by reference to the basic concepts of the EBA model. It is concluded that the model shows very satisfactory performance with respect to statistical tests of goodness-of-fit and model parameter stability. It is seen however that the use of the model to predict the effect of system changes could result in substantially different policy advice than might be obtained by the use of conventional compensatory models, because of the non-linearities in response to change in some variables.

The model discussed in this paper implied that an individual's proximity to workplace provides an outer constraint on where he will locate. He then chooses a location within this outer constraint that provides him with acceptable levels of house quality, physical and social environment. Major transport investments in freeways, public transport and area traffic control have a large influence on the distribution of land use since they influence how quickly individuals get to and from work and therefore the range of possible locations open to this individual.

ACKNOWLEDGEMENT

The data used in this study were collected as part of a research study funded by the Australian Road Research Board. This support is very gratefully acknowledged. The author would also like to thank Tony Richardson, Peter Gipps and Ken Ogden for their aid in preparing this paper.

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