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Environment and Planning A, 1992, volume 24, pages 517-533

Residential choice behaviour of dual earner households: a decompositional joint choice model†

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Received 10 October 1990; in revised form 19 July 1991

Abstract. The residential location decision process has been studied for several decades with use of different approaches. One such approach that has received considerable attention in urban planning is the decompositional approach. This approach involves measuring *individual* preferences. Residential choice behaviour is, however, often the result of a joint decisionmaking process, especially in the case of dual earner households. In the present paper, the original modelling approach is therefore extended to a model of joint decisionmaking. The results of an empirical application in the context of residential choice behaviour in the Netherlands are described.

1 Introduction

The study of residential preferences and choice behaviour has received considerable attention for many years now in a variety of disciplines such as environmental psychology, geography, urban planning, urban sociology, and regional economics. Different approaches have been applied over the years (for example, see Clark and van Lierop, 1986). An approach that has received major attention in geography and urban planning is the decompositional or stated-preference modelling approach (for reviews, see Louviere, 1988a; Timmermans, 1984). It has been developed in reaction to traditional modelling approaches within these disciplines that derived statements about residential preferences from observations of actual behaviour.

In contrast, decompositional models are based on the view that residential preferences cannot be uncovered by examining people's actual residential choices, because actual real-world choices do not necessarily reflect individual preferences. Actual choices may be influenced also by the demand-supply disequilibrium in the housing market. Preferences are therefore difficult to infer from overt choice behaviour, and this difficulty has led researchers to study preferences directly. The decompositional approach is based on the assumption underlying information integration theory that individuals arrive at preferences by combining their part-worth utilities according to some combination rule. Their utility function may be derived by asking them to express some degree of preference for a set of attribute profiles that are constructed according to the principles of the design of statistical experiments. This gives the researcher control over the correlation structure among the attributes. Such designs are usually full factorial, fractional factorial, or trade-off experimental designs which produce sets of descriptions of hypothetical residential environments. Thus, rather than examining actual choices in real-world settings, one analyzes preferences or choices for hypothetical attribute profiles under (quasi)-laboratory conditions. Respondents are requested to evaluate these descriptions by rating or ranking them in terms of overall preference. A variety of estimation

† An earlier version of this paper was presented at the 22nd International Congress of Applied Psychology, Symposium on Environmental Choice Processes, Kyoto, Japan, 22-27 July 1990.
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techniques such as nonmetric multidimensional scaling, linear programming, or multiple regression analysis can be used to decompose this overall preference measure into the part-worth contributions of the various attribute levels used to define the profiles.

One of the first applications of residential decompositional preference modelling was reported by Knight and Menchik (1976). They used a trade-off design to vary the levels of pairs of attributes in a study of residential policy evaluations. Veldhuisen and Timmermans (1984) used a similar approach in a study which compared different specifications and measurement procedures of residential preferences. In contrast, Louviere and Meyer (1976) and Louviere and Henley (1977) studied residential preferences by requesting individuals to evaluate descriptions of all attributes rather than pairs of attributes. These first studies involved only a few attributes. Louviere (1979) later described the results of two more studies which involved fractional factorial designs that allowed one to describe residential environments in terms of 11 and 13 attributes. More recently, Phipps and Carter (1984; 1985; see also Phipps, 1989; Phipps and Clark, 1988) adopted a similar approach, using descriptions based on 12 attributes. Their study differed from previous ones in that the individual-differences scaling methodology (the WADDALS algorithm) was used. Timmermans (1989) used a hierarchical information integration task involving 22 attributes to examine residential preferences.

A disadvantage of these preference models is that the researcher has to assume some ad hoc decision rule if the preference functions are used to predict actual residential choice behaviour. The stated-preference approach does not allow any rigorous testing of the rules individuals apply when making choices. To avoid this shortcoming, Louviere and Woodworth (1983) developed decompositional *choice* models. This approach is similar to preference modelling in that descriptions of hypothetical residential environments are constructed according to statistical design principles. The approach differs, however, in that these profiles are placed into choice sets in a second step of the model-building process. In this case, respondents are not asked to express overall preferences, but rather they are requested to choose the alternative from each choice set they like most, or, alternatively, allocate some fixed amount of resources among the choice alternatives. Because one now has frequency data, different techniques are required to examine the implied choice process. Usually, a multinomial choice process is assumed. The parameters of this model can be estimated, for example, by using logit regression analysis or a reweighted iterative, least-squares analysis (Jenrich and Moore, 1975).

Applications of such choice models in studies of residential choice behaviour are rare. Louviere and Timmermans (1990b) extended the hierarchical information integration approach to problems of choice behaviour and applied it to residential choice behaviour.

Although much progress has thus been made over the years, all these modelling approaches require *individuals* to respond to the experimental task. It should be noted that the same assumption underlies compositional approaches such as multi-attribute utility models and attitudinal models (for example, see Lindberg et al, 1988; 1989a; Rohrman and Borcherding, 1988) for which some application has been found in the context of residential preference analysis as well. A notable exception in this respect is a study conducted by Krishnamurthi (1988), although he was not concerned with choices. Hence, in these models it is implicitly assumed that residential choice is an *individual* choice process. This assumption may, however, be questioned, especially if both partners have a job. The decisionmaking process is much more complicated under such circumstances because both partners have to decide jointly about their choice of residence and their choice of jobs.

Another disadvantage of existing models is that they are based on the assumption of invariant preference functions. In these models it is typically assumed that residential preferences and choices are independent of context which might be a too rigorous assumption in many empirical situations. Hence, in theory at least, it would be fruitful if existing decompositional preference and choice models could be extended to include the effect of contextual variables on preferences and choices.

This paper reflects an attempt to fill these two gaps in the decompositional modelling approach. That is, the aim of our study is twofold. First, a decompositional model of joint choice behaviour is developed and tested in the context of residential choice behaviour. Second, this model is extended to a context-dependent model of joint choice behaviour, and the significance of contextual variables on residential preferences and choice behaviour is empirically tested.

In general, at least two different approaches could be followed to derive models of joint decisionmaking within the decompositional modelling approach. First, one could still use conventional methods and design strategies, but ask couples rather than individuals to express their joint preference for residential profiles. The disadvantage of this approach would be that the individual preferences of the two people would not be analyzed explicitly, implying that the model would be more difficult to use for prediction in the case where the job of only one partner changes. Moreover, the reliability of the responses might be in doubt. Last, this approach would not allow one to identify the influence of the partners on preference or choice. In the present paper, therefore, an alternative approach is followed. It involves measuring and analyzing each person's preferences separately by using conventional methods, and then developing a model of joint choice behaviour given each person's preference ratings. The approach followed in this paper is based on recent developments in hierarchical information integration (Louviere, 1984; Louviere and Timmermans, 1990a; 1990b) and follows some general ideas mentioned by Louviere (1988b).

The paper is organized as follows. First, the basic assumptions of the model are discussed. This is followed by a description of the experiment and the study area. Next, the model of joint decisionmaking is applied to the problem of residential choice behaviour of dual earner households. Then, the significance of a set of contextual variables on residential preferences and joint choice behaviour is empirically tested. Finally, the limitations of the method and the implications of the results of this study for future research in spatial choice analysis are discussed.

2 The model

The model of joint decisionmaking applied in this paper is based on developments in information integration theory (Anderson, 1974; 1981; 1982) and thus shares some underlying assumptions. It is assumed that individuals arrive at some overall utility for choice alternatives (for instance, residential environments) by cognitively integrating their part-worth utilities associated with the various attribute levels (the utility they derive from each attribute level) into some overall measure of utility or preference. This integration process can be approximated or represented by simple algebraic rules. For example, it could be hypothesized that an individual's overall preference for a house can be represented by a linear function of his or her utility for rent, number of bedrooms, tenure, and location vis-à-vis work. The problem, then, is how one can measure an individual's utility for these attribute levels. It is assumed that an individual's response to an attribute profile as observed on some numerical psychological scale is linearly related to the individual's underlying, but unknown and unobservable, overall utility for that choice alternative. Thus, one creates a set of attribute profiles, consisting of different combinations of rent, number

of bedrooms, tenure, and location and then one asks a respondent to express his or her degree of overall preference for each attribute profile. These profiles are typically constructed according to the principles of the design of statistical experiments. In addition, it is assumed that the response observed on the psychological scale used in the experiment approximates an equal interval measurement scale. This assumption allows one to use regression analysis or analysis of variance to decompose overall preferences for attribute profiles into the separate contributions of the attribute levels, if the hypothesized preference-utility function (for example, a linear one) is valid. An operational problem of this approach is that the experimental task for the respondent becomes too demanding if the number of attributes and/or the number of attribute levels becomes too large. For example, if rent, number of bedrooms, and location have three levels each and tenure has two levels, a full factorial design (a design with all possible combinations of attribute levels) involves $3^3 \times 2$ ($= 54$) profiles. Obviously, the number of profiles is much larger if residential environments are described in terms of say 10 or more attributes. Even fractional factorial designs (typically an orthogonal fraction of the full factorial design) would involve too many profiles.

One way of avoiding this problem is to use a hierarchical information integration task (Louviere, 1984; Louviere and Timmermans, 1990a; 1990b). This approach is based on the assumption that an individual's preference formation or choice process for complex problems (problems involving many attributes) can be represented by a hierarchical process. Individuals are assumed to form preferences first for higher-order constructs (for example, housing characteristics, characteristics of the residential environment, relative location) and then trade-off their preferences for such higher-order constructs to arrive at some overall preference or choice. In terms of research design, the approach thus involves (a) constructing separate experimental tasks for each higher-order construct separately as one would typically do for simple preference tasks and then (b) developing a separate overall task in which respondents are requested to express their overall preference or arrive at some choice given their subjective preference ratings of the higher-order constructs used in step (a).

The present model of joint decisionmaking follows a similar reasoning. As in hierarchical information integration, it is assumed that the residential choice process of dual earner households is complex; that is, it involves many attributes. In addition, it is assumed that preference formation of the two people should be analyzed separately. Thus, an experimental task should be constructed for each partner and each individual's preference rating should be analysed separately. In addition, it is assumed that the partners arrive at a joint choice by trading off their individual preferences for the higher-order constructs or attributes involved. This joint process can thus be analyzed by creating an experimental task in which the partners are requested to choose jointly among attribute profiles that differ in terms of each person's preference ratings of the higher-order constructs used in the experiment. In the present study, two such higher constructs were used: the residential environment and the job situation.

3 Methodology

The conceptual considerations discussed above require an experimental task which structures the overall evaluation process of each partner into separate tasks for the job and the residential environment, and an overall integration task of joint decision-making. The model of joint decisionmaking thus involves the following steps.

(1) Attributes that are assumed to influence the choice process are identified.

(2) These causal variables are clustered into 2 sets: one set describing attributes of the job, the other set describing attributes of the residential environment.

(3) An experimental design is constructed to produce multiattribute descriptions of jobs and residential environments respectively.
(4) Each partner is requested to evaluate each combination of attribute levels for the job situation and residential environment separately and individually. In addition, he or she is requested to evaluate the combined job-residential environment profiles.
(5) The response data for each set and each partner are analyzed separately to develop statistical models that describe how the part-worth utilities associated with the job and the residential environment are integrated to arrive at the overall preference for these two higher-order constructs.
(6) Statistical models are developed to describe the contribution of the selected job and residential environment attributes to the evaluation of the overall profile.
(7) The overall preference scores of the two partners for job profiles and residential environment profiles are treated as factors in a subsequent choice design. In the present study, we thus have 2×2 ($=4$) (2 partners; 2 higher-order constructs) factors. The levels of these factors are numerical scores from the rating scales that the partners used to evaluate the two higher-order constructs. If, for example, a 10-point rating scale has been used in step 4, appropriate levels could be 2-5-8 or 3-5-7. The alternatives in this choice design thus consist of different combinations of preference ratings for the higher-order constructs.
(8) Choice sets are created; the partners are asked to imagine that they have given the ratings for job and residential environment, respectively, and choose jointly the combination of preference ratings in each choice set they like best.
(9) These choice data are statistically analyzed by using an assumed choice model.

4 An application to residential choice behaviour

4.1 *Sample*

Unfortunately, there exist no official statistics about dual earner households in the Netherlands. This lack of sampling frame implies that it is difficult to know how the results of this study generalize to the populations. The sample is necessarily a convenience sample. The data for the present study were collected in the spring of 1990 by using mailed questionnaires. A list of addresses of recent graduates was obtained from the School of Transportation (HTV) in Tilburg, the Netherlands. It was assumed that many of these graduates would be potential candidates to complete the questionnaires because the school represents a form of higher education, and because of the age of the graduates. Respondents were asked if both partners had a job. If they had, they were requested to participate in the present study. Those who qualified were told that the researchers wished to gain more understanding of the residential choice process of dual earner households: how different places of work were compared and how the interactions between the partners affected their residential choice behaviour. They were requested first to complete individually an experimental design, describing potential jobs and residential situations separately and in combination. Next, they were asked to complete jointly a second, overall, design that described each partner's overall evaluation of job profiles and residential situations. In addition, a series of questions were asked which allowed us to relate the responses to socioeconomic background variables. Survey questionnaires were mailed to the respondents through their former school. To ensure accurate responses, respondents were promised complete confidentiality. They were instructed to return the questionnaires directly to the university. A self-addressed return envelope was provided. Usable responses were obtained from 187 couples.

4.2 *Measurement procedures*

The first step of the model-building process involved determining the attributes that influence residential choice behaviour. Because we assumed that job attributes influence residential choices, two sets of attributes (2 higher-order constructs) were identified: one describing the residential environment and one representing the job situation. A total of 5 attributes described job situations, and 8 attributes described residential environments. In table 1 we provide a list of these attributes and their associated levels. Note that, as is common in the residential choice literature, characteristics of the house, the environment, and relative location were used to describe the residential situation. Job situations were described in terms of travel time from the residence to the job location, the number of working hours per week, the income per month, the length of contract, and the flexibility of the work schedule.

Table 1. The attributes selected.

Description	Description
Job situation	*Residential situation* (continued)
1 Distance to work location	8 Tenure:
5 km	rent
10 km	own
25 km	9 Building period:
50 km	before 1975
2 Income (after tax) per month:	after 1975
Fl 1400	10 Number of bedrooms:
Fl 2200	2
Fl 3000	4
Fl 3800	11 Size of municipality and location of dwelling:
3 Number of working days per week:	5 000 or less inhabitants
2 days (16 hours)	20 000 inhabitants, located in city centre or located in midtown older residential area
3 days (24 hours)	20 000 inhabitants, located in new uptown residential area
4 days (32 hours)	75 000 inhabitants, located in city centre or located in midtown older residential area
5 days (40 hours)	250 000 inhabitants, located in city centre
4 Length of contract:	250 000 inhabitants, located in midtown older residential area
less than 1 year	250 000 inhabitants, located in new uptown residential area
longer than 1 year	12 Distance to public transport:
5 Flexibility of work schedule:	less than 300 metres
no flexibility (fixed work schedule)	more than 300 metres
overtime is compensated by free hours	13 Frequency of public transport:
overtime is compensated by free hours and part of the job can be done at home	once per hour in each direction
maximum flexibility (freedom to work at home, no fixed work schedule)	four times per hour in each direction
Residential situation	
6 Type of dwelling:	
detached	
semidetached	
row house	
apartment	
7 Cost per month:	
Fl 600	
Fl 900	
Fl 1200	
Fl 1500	

Residential situations were represented by type of dwelling, monthly costs, tenure, building period, number of bedrooms, size of the municipality and the location of the dwelling, distance to bus stop, and frequency of public transport. The selection of attributes was based on a literature search and previous findings of the authors in analyses of residential preferences and choice behaviour.

An experimental design was constructed to vary job profiles and residential situations simultaneously. This design consisted of 32 treatments and constitutes an orthogonal fraction of the full $8 \times 2^6 \times 4^6$ factorial design. Partners were asked to evaluate individually (1) the job profiles, (2) the residential environment profiles, and (3) the combined job-residential environment profiles on a 1-10 evaluation scale, ranging from extremely bad to extremely good. They were asked first to study carefully the attribute levels used in the tasks to familiarize themselves with the range of possibilities. They were also asked to provide preference ratings for a number of trial profiles which were not used in the analysis. Job and residential environment profiles were printed on the same page to save costs. This might, however, increase halo effects. To test for the significance of such effects, the evaluation of job profiles was regressed against attributes of residential environments, and the evaluation of profiles of residential environments was regressed against job attributes. The results of both analyses indicated that none of the regression coefficients were statistically significant. This supports the validity of the measurements.

In addition to the preference-evaluation tasks, the present approach necessitates an overall integrative task which links the individual evaluations of partners to their subsequent joint choice behaviour. This design was constructed as follows: in the previous experimental task, partners were requested to provide individual preference ratings for job profiles and residential situations on a 1-10 rating scale. We thus have scores on 2×2 ($=4$) ratings scales (preference ratings of partner 1 for job profiles and residential situations, and preference ratings of partner 2 for job profiles and residential situations). Each of these 4 preference scales was used as a factor in the overall joint choice design. Each factor was assigned 4 rating levels (2, 4, 6, and 8) from the 1-10 category rating scale used in the preference designs. These ratings were used as the levels in the overall (integrative) joint choice design to create job-residential environment combinations described in terms of the partners' preference ratings of job profiles and residential situations. Thus, each treatment represents different combinations of the partners' preference ratings of job profiles and residential environments. Because we are interested in joint choice behaviour, these profiles were placed into choice sets. More specifically, a paired comparison design, consisting of two alternatives (combinations of different preference ratings), was constructed by using an orthogonal fraction consisting of 32 different pairs of alternatives from the 4^8 full factorial design. Thus, we used 2×4 ($= 8$) preference ratings. This ensured that orthogonality was preserved both within and between the choice alternatives. Partners were asked to choose jointly one alternative from each pair that would reflect their choice process in the real world.

The use of (fractional) factorial designs in studies of residential preference and choice behaviour typically leads to some potential problems that should be avoided if possible. First, the combination of attribute levels, implied by this type of design, may lead to profiles that are unrealistic. For example, in the Dutch case, it is virtually impossible to find apartment buildings in small villages. Second, in the case of choice tasks, one alternative may dominate another alternative. To avoid this problem, the attribute levels were recoded to minimize the occurrence of dominating choice alternatives.

A relatively novel aspect of the present application of decompositional preference and choice models in housing research concerns the use of contextual variables.

It is assumed that preferences and joint decisions are influenced by some general variables such as working experience, available transportation modes, plans to change jobs, and number of hours work at home. Evidently, it is impossible to estimate all such effects simultaneously if one wishes to keep the number of treatments or choice sets small. However, the effects of a limited number of contextual variables, defined in terms of two levels, can be estimated simultaneously. This was accomplished by nesting the attribute design under the 2^n context design, resulting in $2^n \times 32$ treatments or choice sets in total, where n is the number of 2-level contextual variables. Each respondent is presented with only 16 randomly selected treatments in the preference task and 16 choice sets in the choice task. Respondents' preference scores and choice frequencies may however be aggregated across the treatments and choice sets, allowing the estimation of the main and interaction effects of selected contextual variables.

5 Analysis and results

The following research questions guided the analyses.
(a) What is the goodness of fit of a main-effects-only model of preference formation and a multinomial logit model of joint choice behaviour?
(b) What is the relative contribution of the selected attributes to respondents' preferences and choice behaviour?
(c) To what degree are selected contextual variables significantly influencing preferences for and joint choice of job location and residential environment?
(d) Are preferences and choice behaviour systematically related to socioeconomic characteristics of the respondents?

5.1 *Goodness-of-fit measures*

Respondents individually rated a set of job profiles and profiles of residential environments. These overall preferences can be decomposed into the contributions of the attribute levels, given some combination rule which represents the way respondents combine their attribute evaluations in a preference rating. In the present study, a simple main-effects-only model was assumed. In this model it is assumed that respondents apply a compensatory decision strategy in the sense that low evaluations of some attributes may, at least partially, be compensated by high evaluations of one or more of the remaining attributes. Multiple regression analysis was used to estimate the parameters of this model. The estimated coefficients will be discussed in the next section. Here we will concentrate on the goodness of fit of the model. The Pearson product moment correlation coefficient between predicted and observed average preferences for the job profiles is 0.98, and is 0.95 for the residential environment. This excellent fit indicates that the simple main-effects-only models represent the preference ratings of the respondents quite well.

This goodness of fit is considerably higher than that typically obtained for so-called compositional models (expected utility; Fishbein–Azjen models, etc); that is, models which are not based on experimental design data but on data on how consumers evaluate and weigh housing attributes. Evaluations and importance weights are explicitly and separately measured. Part of the difference might be explained by the fact that decompositional models generally have considerably less degrees of freedom. Hence, it seems better to use adjusted R^2-values as an indication of goodness of fit. The adjusted R^2-value for the job profiles in the present study is 0.86, and for the residential environment it is 0.77. Although these outcomes represent a slight drop in goodness of fit, the results are still much higher than those typically obtained for compositional models. This supports previous research findings which suggest that decompositional models outperform compositional models

in terms of validity and reliability (for instance, see Akaah and Korgaonkar, 1983; Timmermans, 1987).

The contribution of job profile and residential environment to overall evaluation was estimated by using multiple regression analysis. Respondents' preference ratings were averaged. The average evaluation scores for the 32 profiles were used in the analysis. The results are presented in table 2, in which it is demonstrated that respondents' overall evaluations are more influenced by their evaluation of the housing attributes than by their evaluation of the job attributes. The goodness of fit of the overall preference model is good, as indicated by an explained variance of 0.99; the adjusted R^2-value is also 0.99.

The integrative design involves a joint choice task. Hence, the analysis of this design requires a choice model to link preference ratings to subsequent joint choice behaviour. In general, the properties of the choice design dictate the kind of choice models that are estimable. In the present study, a simple multinomial logit model was assumed to represent the joint choice process. The orthogonality of the constructed choice design represents a sufficient condition to estimate the multinomial logit model. The model performed quite well: the correlation between observed and predicted choice probabilities is 0.984. The improvement over the null model in log-likelihood is 94.4%. The parameter estimates of the choice model are presented in table 3. This table shows that all parameters, except the parameter related to the quadratic effect of the evaluation of the residential environment by the former HTV student and that related to the quadratic effect of the evaluation of the job by the partner, are statistically significant beyond the 5% probability level. The size of the parameters suggests that in the overall joint choice task the job attributes are more important than the residential environment attributes.

Table 2. Contribution of evaluation of job and residential environment to overall evaluation.

Variable	Coefficient	Standard error	*t*-value
Constant	−0.771	0.104	−7.446
Evaluation of job	0.505	0.013	37.826
Evaluation of residential environment	0.584	0.018	33.062
Number of observations	32		

Table 3. Parameter estimates of the multinomial choice model.

Attribute	Coefficient	Standard error	*t*-value
Evaluation of residential environment:			
linear	0.402	0.028	14.367
quadratic	−0.030	0.041	−0.746
Evaluation of job:			
linear	0.643	0.033	19.619
quadratic	−0.137	0.035	−3.902
Evaluation of residential environment by partner:			
linear	0.367	0.025	14.627
quadratic	−0.164	0.049	−3.367
Evaluation of job by partner:			
linear	0.500	0.033	15.086
quadratic	−0.076	0.044	−1.715
Number of observations	32		

This is an interesting result because it suggests that although each individual attaches more importance to the residential environment attributes in forming overall preferences, the joint decisionmaking and choice process is more heavily influenced by job considerations. Apparently, preference formation is psychologically quite different from choice processes (compare Billings and Sherer, 1988; Lindberg et al, 1989b; Tversky et al, 1988).

5.2 *Attribute contributions*

The relative contribution of each attribute level to the respondents' preference ratings can be determined by applying a multiple regression analysis to respondents' preference data. The dependent variable of the regression equation is formed by respondents' average preference ratings for the 32 attribute profiles; the independent variables consist of a series of indicator variables used to represent the levels of the selected attributes. Each attribute k with n_k levels is coded by $n_k - 1$ indicator variables. In the present study, effect coding was used to represent the attribute levels. This implies that the regression coefficients may be interpreted as the differential contribution of attribute levels to overall preference compared with the mean. This analysis was performed for the job profiles and for the residential environment profiles separately. The results are presented in tables 4 and 5, respectively.

Table 4 demonstrates that the evaluation of job profiles decreases monotonically with increasing distance to work. This is consistent with our a priori theoretical expectations. The same result is obtained for the income attribute: evaluation increases

Table 4. Contributions of attributes to evaluation of job profiles.

Attribute	Coefficient[a]	Standard error	t-value
Distance to work:			
5 km	0.44437	0.10733	4.140
10 km	0.23000	0.10733	2.143
25 km	−0.05438	0.10733	−0.507
50 km	(−0.61999)		
Net income per month:			
Fl 1400	−1.45125	0.10733	−13.521
Fl 2200	−0.50250	0.10733	−4.682
Fl 3000	0.65437	0.10733	6.097
Fl 3800	(1.29938)		
Number of working days per week:			
2 days	−0.62938	0.10733	−5.864
3 days	0.08187	0.10733	0.763
4 days	0.30438	0.10733	2.836
5 days	(0.24313)		
Length of contract:			
less than 1 year	−0.37437	0.06197	−6.042
longer than 1 year	(0.37437)		
Flexibility of work schedule:			
none	−0.27625	0.10733	−2.574
hours compensation	0.01563	0.10733	0.146
partly at home	−0.05437	0.10733	−0.507
full flexibility	(0.31499)		
Constant	5.24188	0.06197	84.591

[a] The coefficients sum to 1; hence one of the coefficients is redundant and this coefficient is put in parentheses.

with increasing income levels. Table 4 also shows that overall evaluation increases as the number of working days increases, although there appears to be a saturation after the fourth day. As far as length of contract is concerned, the results of the analysis indicate that respondents prefer on average a long-term contract. Again, this finding is consistent with our expectations. Table 4 also demonstrates that preference is highest for jobs with full flexibility in working hours and less for jobs with no flexibility at all. The evaluation of the other possibilities is somewhere in between these two extremes, with a slightly higher preference for a job which compensates overtime by extra days off only. Thus, the additional possibility of being allowed to work partly at home as well does not significantly increase respondents' evaluations.

The importance of the attributes can be examined by calculating the range in parameter estimates (at least for attributes with the same number of attribute levels).

Table 5. Contributions of attributes to evaluation of residential environments.

Attribute	Coefficient	Standard error	*t*-value
Type of dwelling:			
detached	0.85156	0.11864	7.178
semi-detached	0.61281	0.11864	5.165
row house	−0.28281	0.11864	−2.384
apartment	(−1.18156)		
Costs per month:			
Fl 600	0.43281	0.11864	3.648
Fl 900	0.28594	0.11864	2.420
Fl 1200	−0.15219	0.11864	−1.283
Fl 1500	(−0.56656)		
Tenure:			
rent	−0.22813	0.06850	−3.330
own	(0.22813)		
Building period:			
before 1975	−0.09031	0.06850	−1.318
after 1975	(0.09031)		
Number of bedrooms:			
2	−0.39750	0.06850	−5.803
4	(0.39750)		
Size of municipality and location of dwelling:			
5000	−0.16469	0.18123	−0.909
20000 centre	−0.15094	0.18123	−0.833
20000 uptown	−0.07594	0.18123	−0.419
75000 centre	−0.10344	0.18123	−0.571
75000 uptown	0.27156	0.18123	1.498
250000 centre	0.19531	0.18123	1.078
250000 midtown	0.00091	0.18123	0.050
250000 uptown	(0.02723)		
Distance to public transport:			
less than 300 metres	0.03219	0.06850	0.470
more than 300 metres	(−0.03219)		
Frequency of public transport:			
once per hour	−0.12000	0.06850	−1.752
four times per hour	(0.12000)		
Constant	5.30594	0.06850	77.460

Table 4, then, illustrates that respondents consider income, distance to work, and number of working days to be the most important attributes influencing their evaluation of job profiles.

In table 5 the parameter estimates of the attributes influencing the evaluation of residential environments is presented. As expected, respondents prefer detached and semi-detached dwellings to row houses and apartments. Also, their evaluation decreases as the costs of living increase. Respondents appear to prefer new dwellings with 4 bedrooms that they can own. Table 5 demonstrates that none of municipality-size attribute parameters are significant, suggesting either that this attribute is unimportant, that there is a considerable degree of heterogeneity with respect to this attribute, or both. The parameters are highest for the larger municipalities; a finding consistent with the literature on gentrification, which suggests that younger people prefer living in larger cities. Last, table 5 shows that the parameters associated with the public transport attributes, although consistent in terms of sign, are not statistically significant.

5.3 *Contextual effects*

Contextual effects can be studied in relation to preference tasks by including an additional variable in the regression analysis which represents the variable of interest. That is, the design consisting of 32 treatments is nested under all combinations of levels of context variables, and a single model is estimated for the enlarged design matrix. The results of the analysis, then, indicate whether significant differences between the categories of the context variables exist. In addition, it is possible to test whether differences in part-worth utilities are present between the context variables. This can be done by creating additional indicator variables which represent departures from mean part-worth utilities by context. In case of choice tasks, contextual variables can be included in the utility function by specifying interactions between such contextual variables and the attributes of the choice alternatives (see also Oppewal and Timmermans, 1991).

The following contextual variables were identified: present dwelling type, present tenure, present costs for dwelling per month, building period, moved within the past two years, plans to move, number of years of job experience, number of working hours, travel time to job location, transportation mode used to go to work, change of jobs within the past two years, and plans to seek another job. The analyses were performed for the evaluation of the job, the evaluation of the residential environment, the evaluation of the combined job-environment profiles, and the joint choice task. The results of the analyses indicated that most of these contextual variables were not statistically significant beyond the 5% significance level. In fact, only a few parameters were significant, but none of these related to the same contextual variables across all 4 tasks, nor to different attributes for the same contextual variable. Therefore, we will not discuss these parameters in any detail. In this study, difference in preferences and choice behaviour are not systematically related to context variables, but seem to reflect respondents' idiosyncrasies or personal characteristics.

5.4 *Socioeconomic characteristics*

To test the effect of individuals' idiosyncrasies, analyses similar to those described for context effects were conducted. The following socioeconomic correlates were used: gender, difference in education, presence of children, mean age of partner, family income, household type, and difference in income between partners. With the exception of household type and difference in income between partners, most of these covariates were statistically significant beyond the 5% alpha level. To illustrate this type of analysis, we will use 'presence of children' as an example.

More specifically, we will discuss how the presence or absence of children will affect respondents' part-worth utilities of jobs and residential environments.

The results pertaining to job evaluation are presented in table 6. Parameter estimates reflect differences in evaluation for that particular attribute level between respondents with children and respondents without any children. Table 6 demonstrates that some of the effects are significant. More specifically, the signs of the regression coefficients indicate that respondents with children on average have a significantly lower preference for a 4-day or 5-day working week and a relatively higher evaluation of a lower net income level (Fl 1400 per month). This suggests that they wish to be at home for their children some days of the week and that they are less concerned about the lower income. More detailed analysis showed that especially women with children favour fewer working days. They also have higher evaluation scores for jobs with full flexibility, although the associated parameters are not statistically significant at conventional levels. The other coefficients, although not significant, may seem counterintuitive. For example, one might expect people with children to value security and hence evaluate higher those jobs with a longer contract. On the other hand, the variables really of interest here, but unmeasured in the present study, are people's attitudes towards risk, their career plans, etc, and the distribution of such variables across the samples is not necessarily strongly correlated

Table 6. Contributions of attributes to evaluation of job profiles given presence or absence of children.

Attribute	Average effect			Differential effect for households with children[a]		
	coefficient	standard error	*t*-value	coefficient	standard error	*t*-value
Distance to work:						
5 km	0.44437	0.07877	5.642	−0.02969	0.07877	−0.377
10 km	0.23000	0.07877	2.920	0.09719	0.07877	1.234
25 km	0.05438	0.07877	−0.690	−0.03594	0.07877	−0.456
50 km	(−0.61999)			(−0.03156		
Net income per month:						
Fl 1400	−1.45125	0.07877	−18.425	0.19719	0.07877	2.503
Fl 2200	−0.50250	0.07877	−6.380	−0.16031	0.07877	−2.035
Fl 3000	0.65437	0.07877	8.308	0.01281	0.07877	0.163
Fl 3800	(1.29938)			(−0.0497)		
Number of working days per week:						
2 days	−0.62938	0.07877	−7.990	0.31906	0.07877	4.051
3 days	0.08187	0.07877	1.039	0.15281	0.07877	1.940
4 days	0.30438	0.07877	3.864	−0.16219	0.07877	−2.059
5 days	(0.24313)			(−0.30968)		
Length of contract:						
less than 1 year	−0.37437	0.04548	−8.232	0.03281	0.04548	0.722
more than 1 year	(0.37437)			(−0.03281)		
Flexibility of work schedule:						
none	−0.27625	0.07877	−3.507	−0.07781	0.07877	−0.988
hours compensation	0.01563	0.07877	0.198	0.01031	0.07877	0.131
partly at home	−0.05437	0.07877	−0.690	−0.00097	0.07877	−0.123
full flexibility	(0.31499)			(0.06847)		
Constant	5.24188	0.04548	115.267	−0.17781	0.04548	−3.910

[a] The effect for households without children can be calculated by subtracting these coefficients from the coefficients for the average effects.

with the presence or absence of children. Especially women with children may not mind a shorter contract. Maybe they are pleased to find a job in the first place.

The results pertaining to the evaluation of residential environments are presented in table 7. Table 7 shows that only one of the effects is significant: respondents with children demonstrate significantly lower evaluations of two-bedroomed dwellings. Although not statistically significant, most of the other parameters are consistent with our theoretical expectations. Respondents with children evaluated detached and semidetached dwellings higher; they also value owned housing more. In contrast, the parameters for costs of living and type of municipality may be counterintuitive

Table 7. Contributions of attributes to evaluation of residential environments given presence or absence of children.

Attribute	Average effect			Differential effect for households with children[a]		
	coefficient	standard error	*t*-value	coefficient	standard error	*t*-value
Type of dwelling:						
detached	0.85156	0.11208	7.598	0.08094	0.11208	0.722
semidetached	0.61281	0.11208	5.468	0.06844	0.11208	0.611
row house	−0.28281	0.11208	−2.523	−0.02219	0.11208	−0.198
apartment	(−1.18156)			(−0.12719)		
Costs per month:						
Fl 600	0.43281	0.11208	3.862	−0.11531	0.11208	−1.029
Fl 900	0.28594	0.11208	2.551	−0.08969	0.11208	−0.800
Fl 1200	−0.15219	0.11208	−1.358	0.12219	0.11208	1.090
Fl 1500	(−0.56656)			(0.08281)		
Tenure:						
rent	−0.22813	0.06471	−3.526	−0.02875	0.06471	−0.444
own	(0.22813)			(0.02875)		
Building period:						
before 1975	−0.09031	0.06471	−1.396	−0.01594	0.06471	−0.246
after 1975	(0.09031)			(0.01594)		
Number of bedrooms:						
2	−0.39750	0.06471	−6.143	−0.17062	0.06471	−2.637
4	(0.39750)			(0.17062)		
Size of municipality and location of dwelling						
5000	−0.16469	0.17120	−0.962	−0.09531	0.17120	−0.557
20000 centre	−0.15094	0.17120	−0.882	−0.05906	0.17120	−0.345
20000 uptown	−0.07594	0.17120	−0.444	−0.10906	0.17120	−0.637
75000 centre	−0.10344	0.17120	−0.604	−0.10156	0.17120	−0.593
75000 uptown	0.27156	0.17120	1.586	0.19844	0.17120	1.159
250000 centre	0.19531	0.17120	1.141	0.02469	0.17120	0.144
250000 midtown	0.00091	0.17120	0.053	0.01844	0.17120	0.108
250000 uptown	(0.02723)			(0.12342)		
Distance to public transport:						
less than 300 metres	0.03219	0.06471	0.497	0.03219	0.06471	0.188
more than 300 metres	(−0.03219)			(−0.03219)		
Frequency of public transport:						
once per hour	−0.12000	0.06471	−1.855	0.02187	0.06471	0.338
four times per hour	(0.12000)			(−0.02187)		
Constant	5.30594	0.06471	82.000	−0.20594	0.06471	−3.183

[a] See table 6.

because table 7 suggests that people with children on average have higher evaluation scores for higher costs of living and prefer living in larger municipalities. More detailed analyses showed that this finding arose mainly from men with children.

Last, the results of the joint model are presented in table 8. The results are interesting. The negative signs of the context effects suggest that the choice behaviour of people with children is less influenced by their evaluation of job profiles compared with the joint choice behaviour of people without children. In addition, on average they seem to attach more importance to the evaluation of the residential environment. This is especially true for the partner (usually the wife), although, maybe as a result of the small sample size, these effects are not statistically significant beyond conventional probability levels.

Table 8. Parameter estimates of the multinomial choice model given presence or absence of children.

Attribute	Average effect			Differential effect for households with children[a]		
	coefficient	standard error	*t*-value	coefficient	standard error	*t*-value
Evaluation of residential environment:						
linear	0.410	0.033	12.302	0.010	0.033	0.287
quadratic	−0.061	0.047	−1.313	−0.080	0.047	−1.716
Evaluation of job:						
linear	0.625	0.036	17.318	−0.049	0.036	−1.365
quadratic	−0.162	0.041	−3.934	−0.059	0.041	−1.435
Evaluation of residential environment by partner:						
linear	0.373	0.030	12.569	0.006	0.030	0.205
quadratic	−0.172	0.056	−3.086	0.009	0.056	0.155
Evaluation of job by partner:						
linear	0.457	0.035	13.094	−0.099	0.035	−2.832
quadratic	−0.087	0.052	−1.688	−0.032	0.052	−0.625

[a] See table 6.

6 Conclusion and discussion

The aim in this present paper is to discuss the theoretical underpinnings and results of a decompositional model of joint decisionmaking. The model is derived from the method of hierarchical information integration and was applied to the problem of joint job and residence choice of dual earner households.

The results of this study suggest that the outlined model and measurement procedures may constitute a valuable approach for the analysis of joint decision-making processes. The results seem to have a high validity; the implementation of the measurement task was straightforward and the goodness of fit of the estimated models was satisfactory.

We have also demonstrated how contextual effects might be included in decompositional preference and choice models; a possibility that, to the authors' knowledge, has rarely been pursued in the many studies published in the academic literature. In the present study, however, most of such contextual effects were not significant.

Some of the operational decisions may need additional discussion. As noted in the introduction, it could be argued that joint decisionmaking processes could be studied by using traditional decompositional methods by asking couples to respond jointly to residential profiles. We have argued that it is not readily evident that such a

measurement procedure would be reliable, but valuable insight could be obtained if the present approach were compared with such an approach in terms of reliability.

A crucial step in the present approach is the final integration joint choice design which is based on preference ratings of the partners. It might be that such ratings are too abstract; partners may wish to know more about the particular reasons behind particular preference scores. If this were the case, the reliability of the measurements might be in doubt. An obvious solution would be to have scores on more job and residential attributes, the most extreme case being a duplicate of the original basic design. Unfortunately, the design would become more complex and in some cases might not be feasible at all. It is important, therefore, to examine this methodological issue in future research and to examine how the amount of detail provided in the overall joint choice design would affect the reliability and validity of the results.

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