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Citation for published version (APA):
Oppewal, H., Timmermans, H. J. P., & Louviere, J. J. (1997). Modelling the effects of shopping centre size and store variety on consumer choice behaviour. *Environment and Planning A*, *29*(6), 1073-1090. https://doi.org/10.1068/a291073

DOI:
10.1068/a291073

Document status and date:
Published: 01/01/1997

Document Version:
Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Environment and Planning A 1997, volume 29, pages 1073 – 1090

Modelling the effects of shopping centre size and store variety on consumer choice behaviour

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Received 30 October 1995; in revised form 6 March 1996

Abstract. In this paper it is argued that models of consumer choice of shopping destination have included few attributes related to the selection of stores available in a shopping centre. The authors seek to develop and illustrate empirically a way to define the selection of stores in shopping centres, such that effects of various modifications to the available selection can be modelled by conjoint analysis (or stated preference of decompositional choice) methods. Profiles of hypothetical shopping centres are developed that describe the total size of centres as well as the marketing mix positionings of the individual stores within these centres. The approach is implemented in choice experiments, one on food shopping and one on shopping for clothing and shoes. Logit models are estimated and compared for these two product categories and for large versus small centres.

1 Introduction

Traditionally, models to predict consumer choice of shopping destination always included some variable representing the selection or choice range available at the destinations, whether these destinations were stores or shopping centres. Clearly, the available selection is, with travel time, the most important determinant of the spatial distribution of consumer expenditure at retail outlets (for example, Fotheringham, 1988). Consumer choice models, however, have typically included only limited operationalizations of the selection variable. Consequently, although the models may predict well, they give retail managers and planners little guidance as to how to improve the selection or range of choice. Models of shopping-centre choice seem particularly limited in this respect. In this paper we therefore seek to develop and illustrate empirically a way to define the selection available at shopping centres, such that the consumer choice effects of various possible changes in the available selection can be modelled and predicted. We focus particularly on finding ways to define attributes that represent the selection available in a shopping centre and that can be independently manipulated in a conjoint task.

We focus on conjoint-based approaches because they allow efficient measurement of consumers' preference structures and because they allow one to predict responses to alternatives that are not (yet) available in the real decision context. Conjoint-based models can be used in a variety of (new) circumstances to model and simulate choice probabilities and market shares. Conjoint analysis (also called stated preference or decompositional choice) methods involve the collection of responses to hypothetical choice alternatives. These alternatives are described as lists of features or attributes. Efficient subsets of all possible alternatives are selected by using the theory of statistical experimental design. Respondents rate or rank alternatives, or they choose from designed sets of alternatives. Depending on the type of response

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Table 1. Selective review of attributes and levels in conjoint studies of choice of retail destination.

Source	Type of destination	Convenience	Selection or choice range	Prices or value for	Quality of products	Store service
[1]	Supermarket	Distance: 1, 3, 5, or 7 miles Parking: 100 200, or 300 ft from shop		10%, 5% below average, average, 5%, 10% above average	30%, 15% below average, average, 15%, 30% above average	Wait at till 5, 10, or 15 min
[2]	Store	Drive and park time: 10, 20, or 30 min	Above average, ...average,............. below average			
[3]	Food store	Distance: 5, 15, or 25min away	Food; + household goods; +cosmetics, and periodicals	Weekly purchases of 100, 110, or 120 guilder	One spoiled product a week, a month, or every 6 months	
[4]	Shopping centre (clothes)	Distance: 15, 30, or 45 min away Parking: 3, 6, or 9 min search time	Number of stores: 10, 40, or 70			
[5]	Shopping centre (clothes)	Distance: 15, 30, or 45 min away Parking: 4, 12, or 20 min search time	Number of shops: small, medium, or large			
[6]	Supermarket	.........Given positions 2, 5, or 8 on a subdesign scale........				
[7]	Shopping centre or anchor store (clothes)	Distance: 15 or 30 min away	50 or 100 stores; ....Anchor stores are given ratings.................. 1 or 2 anchor stores;			
[8]	Grocery store	Distance: 3 levels Parking: 3 levels	3 levels	3 levels	Above average, average	
[9]	Supermarket	....Names of 5 competitors....................................				
[10]	Department store (apparel)	....Names of 5 competitors....................................				Return policy: names of 5 competitors

Sources: [1] Schuler, 1979; [2] Louviere and Meyer, 1981; [3] Verhallen and De Nooi, 1982; [4] Timmermans, 1982; [5] Timmermans et al, 1984; [6] Louviere and Gaeth, 1987; [7] Ahn and Gosh, 1989; [8] Moore, 1990; [9] Louviere and Johnson, 1991; [10] Louviere and Johnson, 1990.

measure, one can use ordinary least squares or logit analysis to decompose the responses into the contributions of the attributes to the utility that is assumed to underlie the response-generating process (for example, Batsell and Louviere, 1991; Carson et al 1994; Green and Srinivasan, 1978; 1990; Louviere, 1988; Louviere and Timmermans, 1990a; Timmermans, 1984).

A typical limitation of conjoint studies in retailing is that they include only limited sets of attributes. This is illustrated in table 1, in which we present a review of academic conjoint studies in retailing. It can be seen that consumer destination choice studies, in particular those focused on choice of shopping centre, typically included between only three and six attributes. Particularly important in the present context is that they included few attributes related to the selection available in shopping centres. Two studies included only the attribute number of stores (Timmermans, 1982; Timmermans et al, 1984); another, a hybrid type of conjoint study, included names and numbers (and image ratings) of anchor stores in addition to a 'size of centre' attribute (Ahn and Ghosh, 1989). However, there are many variables of interest to centre managers and planners that relate to the selection dimension, which has been shown to be the most important dimension in consumer cognition of shopping centres (for example, see Timmermans et al, 1982).

The above limitation is not unique to conjoint applications. Models based on choice behaviour observed in real markets also typically include few attributes related to the selection available in a shopping centre. For example, Koppelman and Hauser (1978) included only the attribute 'variety', which was a factor derived in a principal components analysis of ratings of a larger set of shopping-centre attributes; Verster et al (1979) included retail floor space by category; and Gautschi's (1981) model included a factor dimension 'assortment' as an independent variable. In a similar vein, among five dimensions obtained from a principal components analysis, McCarthy (1980) included one dimension in his model that related to the selection available in shopping areas. The 'generalized shopping area attraction' dimension in his model was defined by five items, one of which concerned 'variety of merchandise at shopping area'. The other dimensions that were obtained in the five-dimension-solution principal components analysis of nineteen items concerned characteristics of the trip or mobility aspects of the shopping area.

Last, Weisbrod et al (1984) went as far as including four objectively defined selection variables in their logit model of the combined choice of mode and trip destination (regional centres only): the total number of stores, the proportion of stores devoted to clothing and general merchandise, the proportion of stores devoted to other shopping goods, and the percentage of general merchandise stores that were variety stores. These variables were supposed not only to represent the selection but also to represent the price level of the shopping centres. Weisbrod et al found positive and significant parameter estimates for each of these variables, but they added a cautionary note about the potential instability of these estimates arising from high intercorrelations.

Thus, for a variety of reasons, it remains unclear from previous studies how the importance or impacts of more detailed marketing mix instruments or planning measures concerning selection should be determined. Data requirements prohibit the development of relevant models based on choice behaviour in real markets; conjoint models have a limited number of attributes and leave the question unanswered as to how marketing mix instruments or planning measures should be translated into the metric in which the attributes were defined in the experiment.

Our purpose here is to propose and illustrate a definition of the selection available in shopping centres, such that (1) the quality of the selection is functionally dependent on the positionings of individual stores, (2) the attributes are measurable and applicable to policy problems, and (3) the dependent variable in the conjoint task concerns choice of shopping centre.

The paper is organized as follows. In section 2 we present our method, including the line of reasoning underlying our operational definition of the selection available in shopping centres and details about our procedure and experimental design. In section 3, the data are analyzed in order to answer the three research questions in our application: what are the effects of our attributes on the choice probabilities (that is, what are the attribute importances)? Are attribute effects for large centres different from attribute effects for small centres? Do attribute effects differ between the two product categories in our study (food products compared with clothing and shoes)? We conclude the paper in section 4 with a discussion of results and with suggestions for further research.

2 Method: a conjoint choice experiment

2.1 Definition of selection attributes

There are two interpretations of the concept of selection available in a store or shopping centre. First, with respect to stores, selection may denote the total number of product groups in a store; the larger the number of product groups the larger the selection. This has also been described as the variety, or breadth of the available merchandise (for example, Arnold et al, 1983). With respect to shopping centres, the equivalent interpretation of selection involves the total number of store types available in the centre.

The second interpretation concerns the choice range that is available *within* each product group; this is typically called the depth of the assortment of merchandise (for example, Arnold et al, 1983). For shopping centres, depth can be defined as the available number of stores of each type. Store types, however, can be defined in various ways. One way to describe differences between store types or store formats is to classify stores according to retail mix variables such as price image, product quality range, store assortment or range of choice, service level, and design of the store interior.

We include and independently manipulate these two aspects of selection in a conjoint study. We define attributes to describe the size of centres as well as the distribution of store positionings in those centres in terms of the above retail mix variables. The following line of reasoning underlies our experimental procedure. Assume that the position of each store in terms of the marketing mix variables can be identified, either from consumer perception measurements, deductive reasoning, checklist store judgments, or retail questionnaires. In particular, we dichotomized all retail mix variables (except location) to obtain a set of store features, such that for each store it could be decided whether or not a feature applied to that store. For example, for a particular store the variable 'prices' could take the values 'has competitive prices' or 'does not have competitive prices'. This allows us to measure the position of a shopping centre on some feature, for example, price, simply by counting the number of stores in the centre that qualify for this particular feature. In order to obtain attributes that are independent of the size of shopping centre, attributes were defined as the percentage of stores in the centre that qualify for the particular feature. For example, the price level of a shopping centre was defined as 'the percentage of stores in this centre that have competitive prices'. As is demonstrated below, this allowed us to vary the size of a hypothetical centre independent of its other attributes.

Pilot tests were performed to find the best way to present the attributes to respondents. Subjects had no problem in considering and imaging shopping centres in terms of the attributes when the attributes were presented one at a time. However, profiles of attributes appeared to be difficult to appraise when levels were presented in numerical and/or verbal formats: arrays of percentages or verbal descriptions tended to confuse subjects. We therefore displayed the percentage levels in graphical format. For each retail mix variable, individual stores in the hypothetical shopping centre were represented by a box. Stores for which the corresponding feature did not apply were presented as open boxes, and stores for which the feature did apply were presented as solid boxes, as shown in figure 1. This allowed subjects to see at a glance both the number and the percentage of stores that qualified for the feature, and the size or total number of stores in the centre. Further pilot tests confirmed

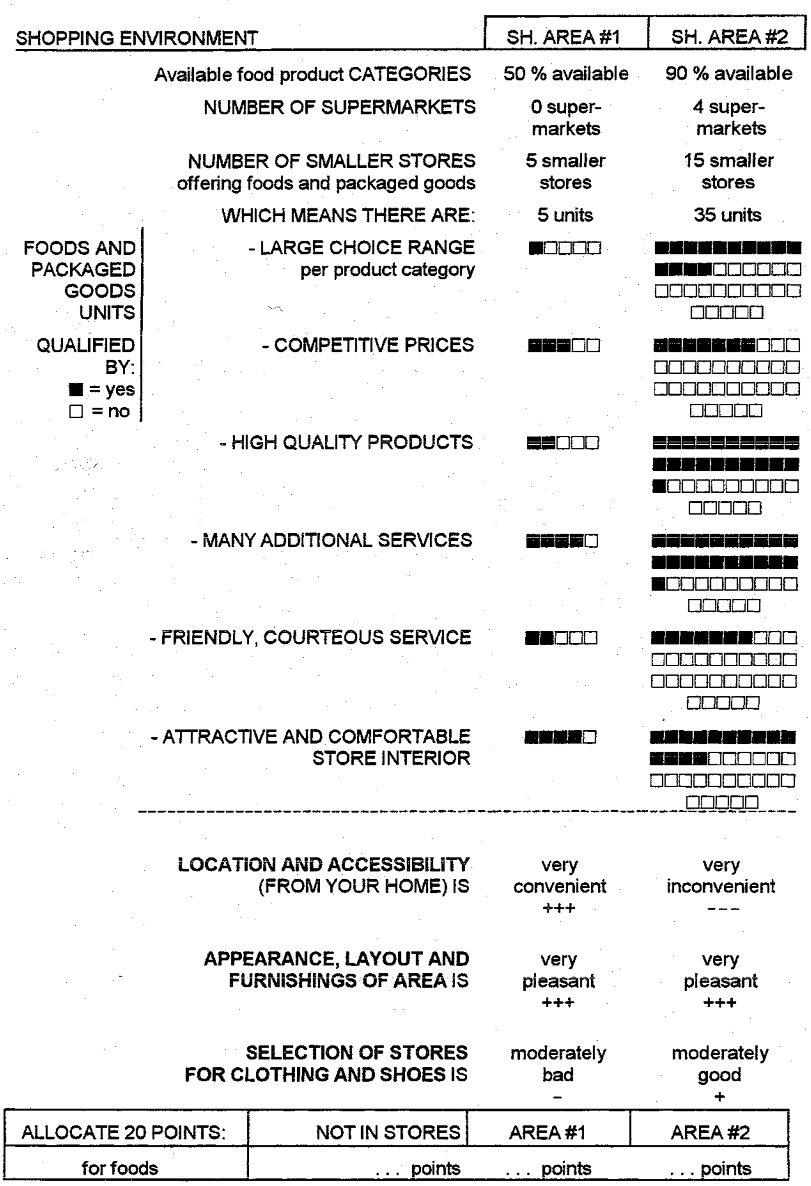

Figure 1. Example choice set for the food-store-selection application. Each solid box represents a store unit which qualified as having the specified characteristic.

that our conjoint task with graphically displayed distributions of store features was comprehensible and had face validity.

The advantages of our procedure are that the shopping centre attributes have quantitatively defined values and that these values may be derived directly from (assumed available) information on individual stores. Also, attributes can be independently manipulated. Moreover, one can choose experimental designs that allow the independent estimation of interaction effects of marketing mix variables with the total number of stores. In our application, this meant that we could estimate the effects of marketing mix variables separately for large and small centres.

2.2 Experimental design

The procedure to define attributes that describe the selection available in a shopping centre was applied in two independent but parallel studies. One study was focused on the allocation of consumers' budgets to food purchases among available shopping centres, the other on the allocation of budgets for clothing and shoes. Figure 1 and table 2 show how we described the selection of good stores in shopping centres in the food purchases application. Nine attributes describe this selection. Attributes were defined in terms of store units instead of individual stores to acommodate the differences in store size (small stores compared with large stores). Respondents were told that in this research project smaller stores equal single units and that larger stores, such as supermarkets, equal about five store units.

Table 2. The nine attributes and levels used to describe the food-store selection in shopping centres.

Number of food-store units (or departments)[a]			
level 1: 5 units	level 2: 15 units	level 3: 25 units	level 4: 35 units
Proportion of all food and packaged-good product categories that are available with at least some basic level of supply			
level 1: very small	level 2: small	level 3: large	level 4: very large
Actual definitions, however, depended on size of shopping area			
size = 5 units or 15 units		size = 25 units or 35 units	
level 1 = 40%		level 1 = 70%	
level 2 = 50%		level 2 = 80%	
level 3 = 60%		level 3 = 90%	
level 4 = 70%		level 4 = 100%	
Number of supermarkets compared with the number of smaller food stores			
level 1 = relatively small	level 2 = relatively large		
Actual definitions, however, depended on size of shopping area:			
size = 5 units		size = 15 units	
level 1 = 0 supermarket, 5 small stores		level 1 = 1 supermarket, 10 small stores	
level 2 = 1 supermarket, 0 small stores		level 2 = 2 supermarkets, 5 small stores	
size = 25 units		size = 35 units	
level 1 = 1 supermarket, 20 small stores		level 1 = 2 supermarkets, 25 small stores	
level 2 = 3 supermarkets, 10 small stores		level 2 = 4 supermarkets, 15 small stores	
Percentage of food store units that have:[b] large range of choice within product categories; competitive prices; high-quality products; many additional services; friendly, courteous service; attractive and comfortable store interior			
level 1 = 20%	level 2 = 40%	level 3 = 60%	level 4 = 80%

[a] Size was presented both in arabic numbers and graphically, as a set of boxes (see figure 1).
[b] Each of the proportions was displayed graphically, as a set of boxes (see figure 1). The levels shown apply individually to each of the five attributes described.

Three attributes were added in order to obtain descriptions that completely define alternatives of the most important perceptual dimensions of shopping destinations. These three so-called higher order constructs were summary measures of larger sets of more detailed attributes (see Louviere and Gaeth, 1987; Louviere and Timmermans, 1990b). Relations between these detailed attributes (for example, travel time, parking fees, or the physical appearance of a centre), the higher order constructs, and consumer choice behaviour were studied in other parallel but independent experiments that have been reported elsewhere (Oppewal et al, 1994). The three construct attributes are displayed in table 3 and involve 'selection of stores offering clothing and shoes', 'appearance, layout, and furnishings of shopping area', and 'location and accessibility of shopping area'. These attributes were defined as hypothetical consumer evaluations of the shopping centre. This means that, depending on the experimental conditions, subjects were assumed to have rated the shopping centres as 'very good', 'moderately good', 'moderately bad', or 'very bad' on the respective attributes.

Table 3. Higher-order decision constructs that were added to the food-store selection profiles, and their levels. Note that the relations of the appearance and convenience decision constructs with attributes that define these constructs were empirically estimated in a separate study (see Oppewal et al, 1994).

Selection of stores offering clothing and shoes
level 1 = very bad (− − −)
level 2 = moderately bad (−)
level 3 = moderately good (+)
level 4 = very good (+ + +)
Appearance, layout, and furnishings of shopping area
level 1 = very unpleasant (− − −)
level 2 = moderately unpleasant (−)
level 3 = moderately pleasant (+)
level 4 = very pleasant (+ + +)
Location and accessibility of shopping area
level 1 = very inconvenient (− − −)
level 2 = moderately inconvenient (−)
level 3 = moderately convenient (+)
level 4 = very convenient (+ + +)

In the parallel clothing-and-shoes application, the same procedure was used to define the available selection of stores offering clothing and shoes in terms of a larger and more applicable set of attributes. The only differences between this and the food application were that: the size (number of store units) varied between 5 − 50 units instead of between 5 − 35 units to cover the larger diversity of shopping centres offering clothing and shoe shopping; the store units were presented as outlets carrying clothing and shoe stores instead of food and packaged goods; and the third added attribute was called 'selection of stores offering food' instead of 'selection of stores offering clothing and shoe stores'.

In sum, in both applications, twelve attributes were used to describe hypothetical shopping centres. Eleven of these attributes had four levels, and one attribute had only two levels. A plan to consider only the main effects and selected interactions was used to select a convenient fraction from the $4^{11} \times 2$ full factorial design. This fraction involved 256 different profiles. Among the estimable interactions are the interactions of the 'number of store units' factor with all other factors; we therefore can estimate models for small and large centres separately.

For each application, these 256 profiles were combined into sets of either two or three shopping centre profiles, which resulted in 96 different choice sets of varying size and composition. To each set a 'not in stores' base alternative was added in order to make the task more realistic and to be able to assess how the available set of shopping alternatives affects the probability of buying at nonstore retailers (this line of investigation is not further pursued in this paper). In figure 1 we showed an example choice set from the food stores application. Respondents were allocated randomly to one of both applications and received blocks of six choice sets. A consequence of this design strategy was that for each application sixteen respondents were required to produce one complete design. For each choice set respondents were asked to allocate 20 points among the shopping alternatives, representing the monthly household budget spent on food products, or on clothing and shoes.

2.3 Sample

Data were collected in Maastricht, the Netherlands, a city with approximately 117 000 inhabitants. Streets were selected randomly in each of eighteen residential zones in that city. Locally hired and trained interviewers were instructed to select random households residing on these streets and to ask the person in the household who did most of the shopping to participate in the study. A total of 405 persons successfully completed the experiment: 198 persons participated in the food-stores application and 206 participated in the clothing-and-shoe-stores application. Though in this paper we focus only on the presently described experiments, it should be noted that respondents were asked many additional questions, including the question to rate each patronized shopping centre on each of the selection attributes. In addition, respondents rated shopping centres on each of five location convenience and accessibility attributes, and on ten appearance, layout, and furnishings attributes. The relation of these attributes to the corresponding, subjectively defined, construct attributes that were used in the present experiments and to consumer choice behaviour were the focus of experiments that have been reported elsewhere (Oppewal et al, 1994).

3 Analysis and results

3.1 Data preparation and model structure

For each of the two applications, budget allocations were aggregated across respondents to obtain allocation totals for the 256 different profiles and the 96 base alternatives. For estimation purposes, a 352-record (one for each profile or base alternative) data matrix was constructed which included these totals and in addition contained the attribute values of these alternatives. Orthogonal coding was used to represent attributes in this design matrix. This means that the levels of four-level attributes were recoded into independent linear (codes −3, −1, 1, 3), quadratic (codes 1, −1, −1, 1), and cubic (codes −1, 3, −3, 1) components. Levels of the two-level attributes were coded as −1 and 1, respectively (see Louviere, 1988).

A multinomial logit (MNL) choice model and an additive utility function were assumed to underlie the experimental choice data. Recall that the MNL model is defined as follows (for example, see Ben-Akiva and Lerman, 1985):

$$p(r|A) = \exp(V_r) \bigg/ \sum_{r'} \exp(V_{r'}), \quad \forall r,\ r' \in A, \qquad \text{and} \qquad V_r = \boldsymbol{\beta} \boldsymbol{X}_r ,$$

where $p(r|A)$ is the probability that alternative r is chosen from choice set A; V_r is the systematic utility of alternative r; $\boldsymbol{X}_r$ is a vector that describes the (recoded) values of attributes of r; $\boldsymbol{\beta}$ is the vector of parameters to be estimated.

3.2 Attribute importances

The first research question in this application was whether attributes had any effect at all on budget allocations, and, if so, what was the relative importance of the utility contributions of the attributes. To answer this question, two logit models were estimated for each application: the first model included only the constant for shopping in stores compared with shopping not undertaken in stores whereas the second model includes all attribute main effects. Estimation results are displayed in table 4 (see over). In the food-purchases application, the model with the constant only had a log-likelihood (LL) value of -4285.98 ($\rho^2 = 0.40$), whereas the model with all attribute main effects had an LL value of -1299.93 ($\rho^2 = 0.82$). Hence, the attributes contributed significantly to the model fit. For the clothing-and-shoes application a similar result was obtained, with the LL value being -1392.19 ($\rho^2 = 0.82$).

Orthogonal coding allowed us to conclude separately for each linear and quadratic component whether it had a statistically significant effect on the choice probabilities. A disadvantage of orthogonal coding, however, is that parameters are not always easy to interpret. Therefore, we calculated the utility that attribute levels contributed to the average, or constant, utility of alternatives. These utility contributions are shown in figure 2. The attribute importances are derived as the maximum difference in part-worth utility between any two levels of the attribute.

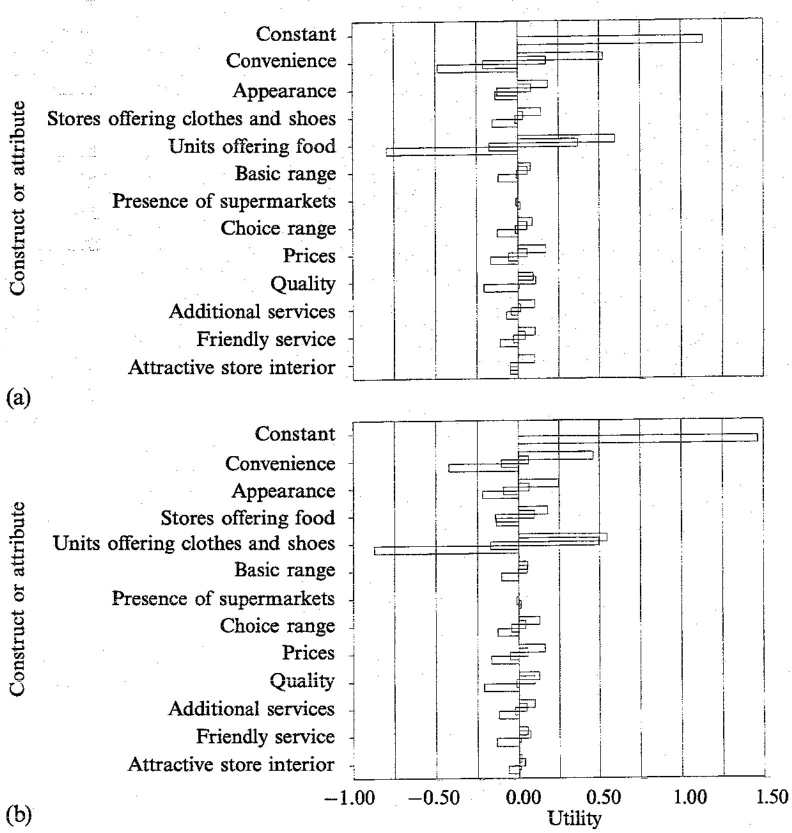

Figure 2. Part-worth utilities for (a) food-stores selection and (b) clothing-and-shoe-stores selection applications. Note: each box corresponds to one attribute level; within attributes the level numbers are ordered from bottom to top; see tables 2 and 3 for definition of attribute levels; full descriptions of each construct and attribute effect are given, in the same order as here, in tables 4 and 5.

Table 4. Logit estimation results for the choice experiment: dependent variables are allocations of 20 points that represent monthly budgets for food or for clothing and shoes.

	Food stores		Clothing and shoes stores	
	parameter estimate	asymptotic t-statistic	parameter estimate	asymptotic t-statistic
Constant	1.1350	50.54	1.4662	55.57
Construct[a]				
location and accessibility of shopping area				
linear	0.1709	42.53	0.1406	34.91
quadratic	0.0190	2.16	0.0207	2.19
cubic	−0.0072	−1.77	0.0196	4.42
appearance, layout, and furnishings of shopping area				
linear	0.0585	14.76	0.0773	18.33
quadratic	0.0232	2.53	0.0139	1.54
cubic	−0.0149	−3.51	0.0009	0.02
selection of stores offering food and packaged goods				
linear	na	na	0.0587	13.43
quadratic	na	na	0.0219	2.36
cubic	na	na	−0.0196	−4.92
selection of stores offering clothing and shoes				
linear	0.0466	11.16	na	na
quadratic	−0.0065	−0.73	na	na
cubic	0.0079	2.05	na	na
Attribute[a]				
number of units offering specified goods				
linear	0.2357	48.45	0.2457	49.84
quadratic	−0.0985	−9.27	−0.1618	−14.70
cubic	−0.0118	−2.12	−0.0290	−5.11
percentage of all product categories that are available with at least some basic level of supply				
linear	0.0326	8.32	0.0267	7.05
quadratic	−0.225	−2.41	−0.0246	−2.58
number of supermarkets compared with the number of small stores				
linear	−0.0122	−1.40	−0.0134	−1.45
percentage of units that have large choice ranges within the product categories				
linear	0.0354	8.27	0.0423	10.19
quadratic	−0.0192	−2.11	0.0000	−0.01
percentage of units that have competitive prices				
linear	0.0553	13.47	0.0544	11.70
quadratic	0.0016	0.19	−0.0015	−0.18
percentage of units that have high-quality products				
linear	0.0496	12.12	0.0556	13.03
quadratic	−0.0575	−6.24	−0.0415	−4.16
percentage of units that supply many additional services				
linear	0.0287	7.14	0.0363	8.76
quadratic	0.0142	1.60	−0.0119	−1.30
percentage of units that provide a friendly, courteous service				
linear	0.0355	8.21	0.0308	7.32
quadratic	−0.0049	−0.54	−0.0403	−4.01
percentage of units that have an attractive and comfortable store interior				
linear	0.0246	6.20	0.0128	3.11
quadratic	0.0244	2.78	−0.0224	−2.43
Number of choice sets		96		96
Number of cases		352		352
LL(0)		−7128.71		−7821.98
LL(B)		−1299.93		−1392.19
ρ^2		0.82		0.82
−2[LL(0)−LL(B)]		11657.54		12859.59
χ^2 degrees of freedom		28		28

Note: LL(0), LL(B), log-likelihood values of the models with zero parameters and the models at convergence, respectively. na Not applicable.

[a]The components of the constructs and attributes are coded as linear, quadratic, or cubic (see text, section 3.1).

The part-worth utilities indicate that the construct relating to the number of store units (stores or store departments) that carry foods and packaged goods had the largest influence on budget allocations among shopping areas for these kinds of products. Next most important was the construct relating to location convenience and accessibility, which was a summary measure of the effects of travel time, parking costs, ease of parking, additional services available in the centre, and accessibility to or by public transport. The other two decision constructs were also significant. The effect of the construct relating to the selection of stores offering clothing and shoes could indicate a general preference to combine trip purposes; for example, buying food and (window)shopping for clothing and shoes. Other significant selection attribute effects include the percentage of store units that have competitive prices and the percentage of store units that have high-quality products. Other attributes had less dramatic, but still significant, effects: large choice ranges within product categories (80% compared with 20% of the store units have large choice ranges), friendly and courteous service in the stores (80% compared with 20% of the store units offer friendly and courteous service), the percentage of all possible food product categories that is available in the area (70% compared with 40% for small centres; 100% compared with 70% for large centres), additional services offered in the stores (80% compared with 20% of the store units offer many additional services). Almost equally important are whether stores have attractive and comfortable store interiors (80% compared with 20% of the store units). The only attribute that is not statistically significant is the proportion of retail space that is occupied by supermarkets. With respect to this attribute, it may be that all features that characterized differences between supermarkets and small (specialty) stores were captured effectively by the other attributes.

In the clothing-and-shoes application the total number of store units (stores or store departments) that carry clothing and shoes appears to be the most important determinant in the decision of where to buy clothing and shoes. The next, also very large, effect is from the construct (or cognitive dimension) relating to location convenience and accessibility. The construct relating to appearance, layout, and furnishings and that relating to the selection of stores offering foods and packaged goods are the next most important determinants of expenditure on clothing and shoes at shopping centres. Also important, in order, are the proportion of store units that have high-quality products, the proportion that have competitive prices, and the proportion that have a wide choice change. Other aggregate store positioning attributes had significant effects, except for whether most of the store units were in large (for example, department) stores or were separate small stores. With respect to this last attribute, it may be that all features that characterized differences between large stores and small (specialty) stores were captured effectively by the other attributes.

3.3 Size-of-centre interactions

We also wanted to know whether the attribute effects are specific to the size of the centre. Therefore, for both applications, we estimated additional models which include the interactions of the size-of-centre attribute with other attributes, as shown in table 5. Recall that our design allows the independent estimation of these effects.

For the food-purchases application, this extended model had an LL value of -1245.47. Twice the difference of this LL value and the LL value of the main-effects-only model is χ^2-distributed with degrees of freedom equal to the difference in numbers of parameters. This test statistic has a value of 108.92, with 18 degrees of freedom. Hence, the size-specific attributes significantly improve the fit of the model.

Table 5. Models with specific attribute parameters for small and large shopping centres.

	Food stores		Clothing and shoe stores	
	parameter estimates	asymptotic *t*-statistic	parameter estimates	asymptotic *t*-statistic
Constant	1.1365	50.26	1.4614	55.11
Construct[a]				
location and accessibility of shopping area				
linear				
small centre	0.16563	25.47	0.11711	17.97
large centre	0.17564	31.73	0.15541	27.32
quadratic				
small centre	0.03037	2.10	0.05277	3.54
large centre	0.01427	1.13	0.00530	0.42
appearance, layout, and furnishings of shopping area				
linear				
small centre	0.05154	8.30	0.06699	10.22
large centre	0.05552	9.99	0.08685	14.92
quadratic				
small centre	0.03649	2.54	0.04497	3.07
large centre	0.01058	0.85	0.00769	0.60
selection of stores offering food and packaged goods				
linear				
small centre	na	na	0.07504	11.37
large centre	na	na	0.03847	6.49
quadratic				
small centre	na	na	0.04571	3.21
large centre	na	na	−0.00772	−0.60
selection of stores offering clothing and shoes				
linear				
small centre	0.04349	6.81	na	na
large centre	0.04248	7.41	na	na
quadratic				
small centre	−0.00502	−0.37	na	na
large centre	−0.00361	−0.31	na	na
Attribute[a]				
number of units offering specific goods				
linear	0.23495	47.44	0.24961	49.19
quadratic	−0.09748	−8.95	−0.16334	−14.60
cubic	−0.00951	−1.63	−0.02287	−3.82
percentage of all product categories that are available with at least some basic level of supply				
linear				
small centre	0.01288	2.08	0.03535	5.57
large centre	0.05195	9.87	0.01805	3.46
quadratic				
small centre	−0.08368	−5.88	−0.04844	−3.36
large centre	0.03268	2.64	−0.00112	−0.07
number of supermarkets compared with the number of small stores				
linear				
small centre	−0.00400	−0.28	0.00183	0.13
large centre	−0.01581	−1.31	−0.02330	−1.86
percentage of units that have large choice ranges within the product categories				
linear				
small centre	0.03695	5.82	0.04964	7.55
large centre	0.03518	6.14	0.03504	6.31
quadratic				
small centre	−0.02523	−1.82	−0.01465	−1.03
large centre	−0.01536	−1.27	0.00980	0.81

Table 5 cont'd.

	Food stores		Clothing and shoe stores	
	parameter estimate	asymptotic t-statistic	parameter estimate	asymptotic t-statistic
percentage of units that have competitive prices				
linear				
small centre	0.08103	12.78	0.06502	9.84
large centre	0.03844	7.08	0.04319	6.76
quadratic				
small centre	0.03455	2.40	−0.01605	−1.08
large centre	−0.02837	−2.43	0.00143	0.11
percentage of units that have high-quality products				
linear				
small centre	0.05057	8.00	0.04620	7.31
large centre	0.04974	8.77	0.07420	12.41
quadratic				
small centre	−0.05215	−3.84	−0.03501	−2.51
large centre	−0.06271	−5.35	−0.03885	−2.99
percentage of units that supply many additional services				
linear				
small centre	0.03144	5.20	0.04559	7.21
large centre	0.02033	3.55	0.03117	5.37
quadratic				
small centre	0.00477	0.35	0.02353	1.63
large centre	0.02834	2.16	−0.02852	−2.31
percentage of units that provide a friendly, courteous service				
linear				
small centre	0.03327	5.02	0.02957	4.35
large centre	0.03804	6.95	0.04001	7.17
quadratic				
small centre	−0.00020	−0.02	−0.01188	−0.84
large centre	−0.00048	−0.04	−0.06088	−4.80
percentage of units that have an attractive and comfortable store interior				
linear				
small centre	0.00688	1.10	0.00779	1.20
large centre	0.03460	6.08	0.01696	2.87
quadratic				
small centre	0.01977	1.47	0.02372	1.70
large centre	0.02224	1.73	−0.05027	−4.13
Number of choice sets		96		96
Number of cases		352		352
LL(0)		−7 128.7069		−7 821.9832
LL(B)		−1 245.4671		−1 350.7931
ρ^2		0.83		0.83
−2[LL(0)−LL(B)]		11 766.480		12 942.380
χ^2 degrees of freedom		46		46

Note: LL(0), LL(B), log-likelihood values of the models with zero parameters and the models at convergence, respectively. na not applicable.
[a]The components of the constructs and attributes are coded as linear, quadratic, or cubic (see text, section 3.1).

In Figure 3 we display the part-worth utilities for both shopping-centre sizes side by side for each attribute.

The following effects appear to be particularly different for large compared with small centres in the food-purchases application.

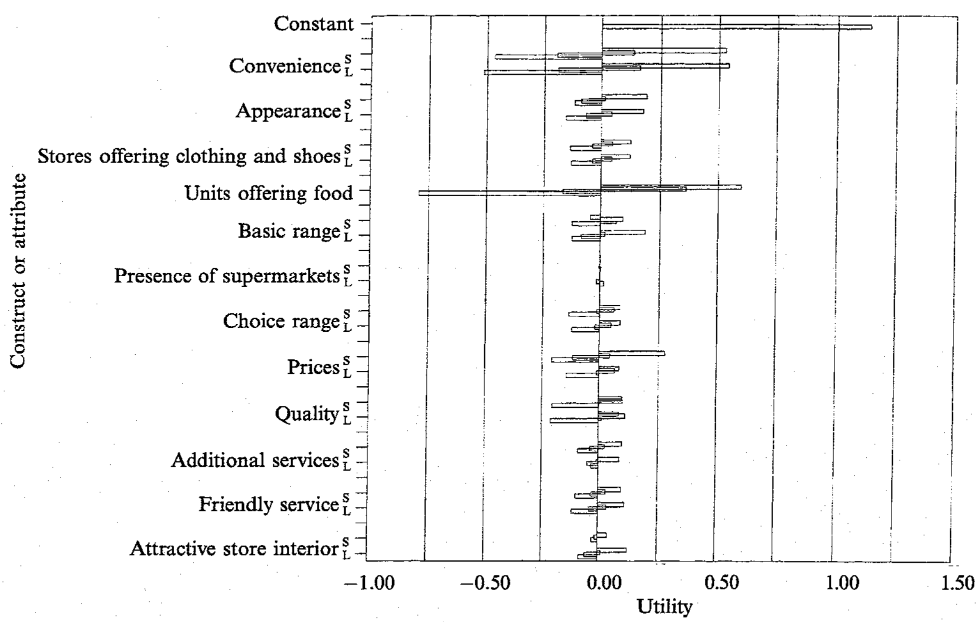

Figure 3. Part-worth utilities for three decision constructs and nine food-stores selection attributes, specified separation for small (S) and large (L) shopping centres. Note: each box corresponds to one attribute level; within attributes the level numbers are ordered from bottom to top; see tables 2 and 3 for definition of attribute levels; full descriptions of each construct and attribute effect are given, in the same order as here, in tables 4 and 5.

(a) The percentage of all food product categories that are available in the centre has a smaller effect for small centres than for large centres. It should be noted, however, that the levels of this attribute were different for the different centre sizes. The proportion varied between 40%–70% for small centres and between 70%–100% for large centres. Hence the utility difference can also be interpreted as an effect of this difference in attribute-level definition.
(b) The percentage of food-store units that have competitive prices has particularly large effects on small centres if the proportion is 20% or 80%.
(c) In large centres, the percentage of food-store units that have attractive and comfortable store interiors has a larger effect than it does in small centres.

For the clothing-and-shoes-purchases application the LL value at convergence was −1350.80, hence the statistic that tests this model against the main-effects-only model has a value of 82.78, which is significant. In figure 4 we show that the differences between large and small centres were as follows.
(1) Convenience and appearance evaluations are more important for large centres than they are for small centres.
(2) The quality of the food stores selection is more important for small centres than it is for large centres.
(3) In contrast to the food-purchases application, for clothing and shoes the percentage of all clothing and shoes product categories that are available in the centre has a larger effect for small centres than it does for large centres. Again, however, it should be noted that the levels of this attribute were different for the different centre sizes, similar to the food-stores application.
(4) The percentages of store units that have large choice ranges, competitive prices, and many additional services are more important for small centres than they are for large centres.

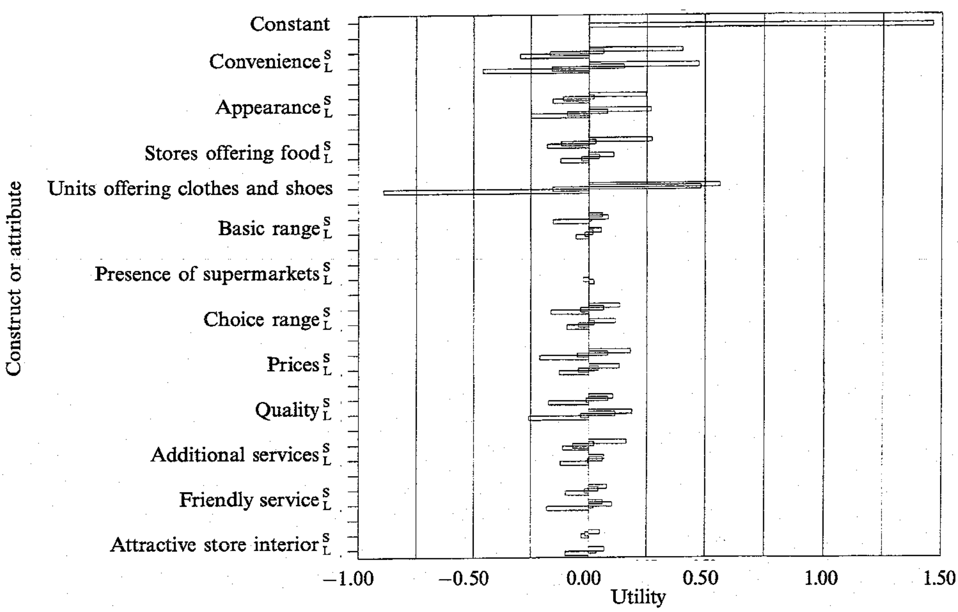

Figure 4. Part-worth utilities for three decision constructs and nine clothing-and-shoe-stores attributes, specified separately for small (S) and large (L) shopping centres.

(5) In contrast, the percentage of store units with high-quality products and attractive and comfortable store interiors are more important for large centres than they are for small centres.

3.4 Product category differences

The two applications were similar in structure but involved different product categories. To what extent did this difference lead to different attribute effects? For example, we expect that appearance and layout are more important when shopping for clothing and shoes than when shopping for food. Differences are revealed if we compare figures 2(a) and 2(b). The most striking difference is in the constants: the constant is larger in the clothing-and-shoe-stores application than it is in the food-stores application. Hence, clothing and shoes are bought relatively more often in stores than are food products. A possible explanation for the smaller share of in-store purchases for foods is that the study region has a street market for food products that is quite popular.

The differences in attribute effects are much smaller than are the differences between the constants. To test the statistical significance of these differences, we performed a Chow test. To this end, data matrices from both applications were vertically concatenated and rescaled to account for differences in error variance (see Swait and Louviere, 1993). To allow for different market shares of the 'not purchased in stores' alternative, the constants were not restricted to being equal; hence, they appeared as two separate columns in the design matrix. The optimal scale ratio was 0.98, meaning that the scale factor was only slightly smaller in the food-stores application. This implies that, if attribute parameter estimates are constrained to be identical in both applications, the error variance in both applications is similar in size. The estimated model includes all attribute effects and interactions of these attributes with size of centre.

The model estimated from the concatenated data has an LL value of −2693.80. The sum of LL values of the separate food-store model and clothing-and-shoe-stores model was −2573.63. Under the null-hypothesis that the applications do not have different parameters, the χ^2 value that we observed is 240.46, with 49 degrees of freedom, which has a probability of less than 0.000. Hence, we can conclude that the model parameters are different in the two applications. Further inspection of the differences between figures 3 and 4 reveals that the major differences in attribute effects between the two applications are as follows.

1. Location convenience and accessibility is slightly less important as a determinant of clothing and shoes purchases than as a determinant of food purchases. Moreover, for the decision of where to buy clothing and shoes the intermediate levels (moderately convenient, moderately inconvenient) have a relatively small influence.
2. In contrast, and as expected, the attribute relating to appearance, layout, and furnishings has a larger effect on clothing and shoes purchases than it does on food purchases. Again, the differences are most striking for the intermediate levels.
3. The multipurpose effects (that is, the effect of the selection of clothing and shoe stores on food purchases, and the effect of the selection of food stores on clothing and shoes purchases) appear to be similar in size and are both significant.
4. The size-of-centre (number of units) effects are similar in both applications. This is remarkable, as this attribute was defined differently in the two applications. In the food-stores application, the size varied between 5 – 35 units, whereas in the clothing-and-shoe-stores application the size varied between 5 – 50 units.
5. Most store positioning dimension attributes have similar effects in both applications.

4 Conclusions and discussion

In this paper we have proposed and illustrated a new way to define the selection available in a shopping centre. It involves the definition of multiple attributes that are of interest to shopping centre managers, planners, and designers, and that can be manipulated in conjoint tasks that allow the direct study of shopping centre choice (instead of studying store choice).

We described the application of such a conjoint experiment to food purchases and to clothing and shoe purchases. The results that were obtained illustrate that conjoint choice methods can be applied to predict consumers' responses to complex phenomena such as shopping centres. Our results not only confirm that the most important determinants of expenditure on food at retail destinations are size (number of stores or store departments) and location (or convenience) but also show that this expenditure is significantly influenced by the physical appearance and layout of the centre and by remaining selection attributes such as the availability and quality of clothing and shoe stores and the (distribution of) marketing mix positions of individual food retailers. Similar results were obtained for the clothing-and-shoes applications, although the effects of the attributes (and, where relevant, their definitions) differed. Hence, all these features contribute to the appeal that a shopping centre has to consumers and it is not only size and travel time that determine its success. To a certain extent, an attractive mix of merchandise can compensate for larger travel times or smaller centre sizes.

Moreover, the estimated model parameters indicate how retail planners and shopping centre developers in our study area should position or reposition a shopping centre in order to optimize its attractiveness to consumers. With the model, they can trade off the costs of new shopping centre designs against the effects of various shopping centre attribute changes on the attractiveness of the centre as a place to shop for foods and for clothing and shoes. If data are available on how consumers perceive a currently existing shopping centre or a new shopping centre concept in terms of these attributes, one can also use the model to assess on which attributes the shopping centre can be most effectively improved. Last, the model can be used to predict how consumers will allocate their budgets among the available shopping centres; hence it allows planners and developers to assess the impact of changes in one shopping centre on the sales volumes at competing shopping centres.

Because all attributes were defined generically, the model is very versatile and can in principle be applied to any existing or newly designed shopping centre in the study area. In fact, the model can be applied to shopping areas in general because attribute definitions were not restricted to shopping centres only. This also means, however, that the model cannot take into account the special features and peculiarities of particular shopping centres or areas. The models will always only give a 'best guess' based on the general characteristics of a shopping centre or area.

Further research on shopping centre attributes and conjoint tasks should focus on assessing the reliability and validity of the results in the present experiment, in particular with respect to the various ways and formats in which one can describe hypothetical shopping centres in conjoint tasks. If similar results can be obtained in future replications, empirical evidence will accumulate that conjoint choice models are valuable tools to assist shopping centre managers and planners to operationalize the 'selection' dimension and to predict its impact on consumer choice behaviour. Another important topic for further research is the extent to which the model estimated in our study can be generalized to other geographical areas and to what extent recalibrations are required. Also relevant would be the development of a conjoint task that would allow the independent manipulation of the relative location of shopping centres and of the stores within these shopping centres. Note that this is a rather neglected feature in conjoint task as well as in other types of studies of retail destination.

Finally, more sophisticated choice models, such as the mother logit model (for example, Timmermans et al, 1991) could be used to replace the multinomial logit model used in the present study, the design permitting the estimation of much more complex models. It would allow the researcher to rely on less rigorous assumptions of consumer choice behaviour and to test these assumptions. For example, one could test whether the similarity of uniqueness of shopping centres in consumers' choice sets would significantly impact the market shares of these centres. We hope to report on such extensions in future publications.

Acknowledgement. This research was supported by the Social and Environmental Research Foundation, which is part of the Netherlands Organization for Scientific Research (NWO/ESR).

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