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Measuring the part worth of the mode of transport in a trip package: An extended Bradley–Terry model for paired-comparison conjoint data

Reinhold Hatzinger, Josef A. Mazanec *

Vienna University of Economics and Business Administration, Augasse 2-6, A-1090 Vienna, Austria

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Abstract

This study measures the travelers' perceived change in utility by accepting one of the modes of transport air, rail, or bus as one component of a packaged city trip. The part-worth values for the trip product elements are expected to depend on a number of traveler characteristics. The predictors hypothesized are city travel experience, general modal preference, socio-economic status, and car ownership. In the survey, the combinations of trip attributes differed between the two subgroups of leisure and business travelers. The leisure travelers rated three levels of mode, length of stay, and price, but only one level of the hotel category. The business travelers were shown four mode alternatives and only two levels for each of the other trip product elements. The conjoint measurements were elaborated by fitting an Extended Bradley–Terry Model. Demonstrating the application of the EBTM is the main purpose of the paper. The EBTM offers several advantages over the more popular versions of conjoint analysis. It correctly treats ties and allows for simultaneous estimation of the trip package (‘object’) parameters, object covariates (trip attributes), subject covariates (traveler characteristics) and their interactions. For both the business and the leisure travelers, the mode of transport dominated the assessment of a city trip package. For leisure tourists, e.g., switching from train 2nd class to an economy flight boosted the trip package more than twice as much as replacing train for bus. A variation of the package price was much more important for the leisure than for the business travelers. The socio-economic status proved to be an important factor and was particularly influential among the business travelers. In the leisure tourists' sub-sample age was not only important for valuing the mode of transport, but had a preferential impact for all trip components. Finally, the limitations of this demonstration study that discourage extrapolation to city travelers in general are emphasized.

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1. Introduction

This research uses data from a project aimed at assessing the ‘importance of air transport’ for the Greater Vienna area. While many different ways may be conceived of how to tackle this issue, the authors decided to focus on the travelers’ point of view. If a raison d’être exists for air transport then — in the simple mind of a marketing scientist — the reason likely relates to the airlines’ customers. The problem was downsized to a workable version involving travelers ex Vienna on leisure or business trips to another European city. From the consumer behavior point of view the ‘importance’ of air transport may be interpreted in terms of preference or utility. Its value becomes apparent as a variation in the height of preference or the amount of perceived utility — the ‘part worth’ in the terminology of classical conjoint analysis — the airplane seat contributes to the overall benefit attributed to a city trip package.

Measuring the travelers perceived utility of a means of transport is nothing new. In transport studies, of course, the choice of a mode of transport represents one of the most popular problems. It may be analyzed on aggregate level by means of cross elasticities (Wardman, 1997) or by discrete choice micro-models (such as the multinomial logit). During the 1970s, MNL models were introduced by 2000 Nobel Laureate Daniel McFadden for investigating modal choice. Today, they are standard tools in transportation research and consulting practice (Wardman et al., 1992; Cambridge Systematics, Inc., 2002). Later, choice models were embraced by marketing scientists and have become one of the major threads in advanced consumer behavior research. A comprehensive review of choice models in tourism is provided by Crouch and Louviere (2001); among the

* Corresponding author.
E-mail address: mazanec@wu-wien.ac.at (J.A. Mazanec).
38 pieces of research itemized, however, there is none dealing with alternative modes of transport in a trip package.

Sheldon and Mak (1987) applied logistic regression to analyze various attributes of package tours and traveler covariates. The mode of transport, however, was not included. In this study the mode of transport will be a prominent part of a trip package. Its utility as perceived by the travelers then may be compared to those of the other trip components simultaneously present in the package. A conjoint analysis approach is usually preferred for exploring the portions of utility contributed by individual product features. Again, this is not new methodology in tourism and hospitality research. Renaghan and Kay (1987) analyzed the part-worth utilities aroused by the services tied together in a convention product. One of the most popular sample applications of conjoint analysis for very complex mixtures of services also originates from hospitality research; it is the “Courtyard by Marriott” case outlined by Wind et al. (1989). Carmichael (1992) applied a standard version of conjoint analysis to analyze artificial attribute bundles representing ski resorts. Mazanec (2002) analyzed the effects of Euro versus old currency pricing of tour packages; he used a conjoint model with random coefficients to allow for traveler heterogeneity in the part-worth estimates.

The link between tourism and transport is ambiguous. The literature offers two interpretations of the transport-tourism interface: the transport “for” tourism or the transport “as” tourism philosophy. The former acknowledges only the utilitarian character of transport services while the latter admits “intrinsic value as tourism experience” (Lumsdon and Page, 2004). Regardless of which interpretation one chooses to follow, the role of the mode of transport in the travelers’ evaluation of a trip package seems largely unexplored. There are, of course, innumerable travel and guest surveys from commercial sources including the mode of transport among their repertoire of trip attributes. However, these studies present their results in a usually narrative manner reporting about the frequencies of modes preferred without exploring the modes’ contribution to the overall utility of the trip. One of the rare exceptions employing an up-to-date model of mode choice in a tourism setting is Nerhagen (2003)’s recent analysis of the influence of previous experience on choice behavior. This author proposes a binomial probit model with train and car as the alternatives and a linear utility function combining mode and traveler attributes. She also estimates the willingness-to-pay for a fictitious return trip dependent on former car or train usage.

This study demonstrates a new method for analyzing conjoint data. The extended Bradley–Terry Model (EBTM) has not yet been applied in tourism research. This study employs it for measuring the travelers’ perceived change in utility by adopting one of the modes air, train, or bus as part of a packaged city trip. The respondents assess a set of fictitious city trips on a ten-point rating scale. They indicate the likelihood of booking such a trip package. Given the questionable metric properties of the rating data only the preferential relationships among pairs of trip alternatives (preferred, not preferred, no preference) will be exploited. The trip packages consist of the key product elements destination, mode of transport, type of accommodation, length of stay, and price. Realistic combinations were formed after examining the catalogues of 17 tour operators offering city trips to European destinations.

2. Method

2.1. Underlying hypotheses and data availability

The part-worth values for the trip product elements are expected to depend on a number of traveler characteristics. The
The respondents assessed each package on a ten-point rating scale expressing their degree of preference. Further processing was restricted to those respondents with a complete set of covariate values and who differentiated at least five packages. This leaves 499 (536) cases from a N = 600 sample for leisure (business).

### 2.2. An extended Bradley–Terry Model

The conjoint exercise will be elaborated by fitting an Extended Bradley–Terry Model (EBTM). The EBTM offers several advantages over more popular versions of conjoint analysis (Dittrich et al., 1998). In particular, it allows for simultaneous estimation of the trip package (‘object’) parameters, object covariates (trip attributes), subject covariates (traveler characteristics) and their interactions. In fact, the EBTM is a model for paired comparison data, i.e., the aim is to obtain estimated overall rankings of objects (with locations on an interval scale), where each subject (or judge) makes one or more comparisons between pairs of objects. This type of model can be applied to rating data as recorded in the current study by simply transforming the ratings of two trip packages, $A$ and $B$, into a paired comparison response which can be either $A$ preferred, ‘$B$ preferred’ or ‘equal preference’ depending on the rating value for the two packages. Using such models may prove useful in overcoming problems arising from questionable metric properties of rating scale responses.

This section provides a short presentation of the Bradley Terry (BT) Model (Bradley and Terry, 1952) and an extended version (EBTM) as introduced by Dittrich et al. (1998).

### Table 1
Elements of the fictitious trip packages

| Trip package element | Levels of the elements |
|----------------------|------------------------|
| Destination          | Prague, Budapest or Munich, Amsterdam, Brussels or Rome |
| Mode                 | Air-economy class*, Air-Economy Class ** |
|                      | Air-Business Class**, Train-2nd class* |
| Length of stay       | –, 2 days* |
| Hotel category       | Four stars*, Five stars** |
| Price                | €258*, €372*, €424*, €482*, €642* |

* = leisure trips ** = business trips.

### Table 2
Object parameter estimates for 8 trip packages (business)

| Package | Estimate | Std. error | Destination | Mode   | Length | Hotel categ. | Price in € |
|---------|----------|------------|-------------|--------|--------|--------------|-----------|
| 1       | .1910    | .0120      | Prague      | Economy| 2      | 5*           | 424       |
| 2       | .1541    | .0119      | Prague      | Business| 1     | 4*           | 424       |
| 3       | -.1306   | .0121      | Prague      | Train/ 1st cl./Sl.| 1     | 5*           | 642       |
| 4       | -.0864   | .0119      | Prague      | Train/ 1st cl.    | 2     | 4*           | 642       |
| 5       | .1177    | .0118      | Amsterdam   | Economy| 1      | 4*           | 642       |
| 6       | .2630    | .0123      | Amsterdam   | Business| 2     | 5*           | 642       |
| 7       | -.0528   | .0118      | Amsterdam   | Train/ 1st cl./Sl.| 1     | 5*           | 424       |
| 8       | .0000    |            | Aliased     | Train/ 1st cl.    | 2     | 5*           | 424       |
The basic Bradley–Terry (BT) Model is defined by

\[ P_{jk} = \frac{\pi_j}{\pi_j + \pi_k}, \]

where in a given comparison of object \( j \) to object \( k \) denoted by \((jk)\), \( \pi_{(jk)} \) is the probability that object \( j \) \((O_j)\) is preferred to object \( k \) \((O_k)\) and \( \pi_j \) and \( \pi_k \) are non-negative parameters describing the location of the objects on the preference scale. The Bradley–Terry Model may be fitted using ordinary methods for binomial logistic regression models.

Alternatively, the BT model can be fitted as a log-linear model. Given \( J \) objects, \( \binom{J}{2} \) distinct pairwise comparisons between objects are possible. Let \( n_{(jk)} \) be the number of comparisons between object \( j \) and object \( k \) and let \( Y_{(jk)} \) be the number of preferences for object \( j \) and \( \pi_{(jk)} \) the number of preferences for object \( k \). The outcome of a paired comparison experiment can be regarded as a \( \binom{J}{2} \times J \) incomplete two-dimensional \textit{object pair} \( \times \text{decision for object } j \) contingency table. E.g., given three objects the appropriate contingency table is given as follows:

| Comparison | Decision | Total number |
|------------|----------|--------------|
| (12)       | \( y_{(12)1} \) | \( n_{(12)} = y_{(12)1} + y_{(12)2} \) |
| (13)       | \( y_{(13)1} \) | \( n_{(13)} = y_{(13)1} + y_{(13)2} \) |
| (23)       | \( y_{(23)2} \) | \( n_{(23)} = y_{(23)2} + y_{(23)3} \) |

The random variables \( Y_{(jk)} \) and \( \pi_{(jk)} \) are assumed to follow a Poisson distribution. Conditional on fixed \( n_{(jk)} \), the \((Y_{(jk)}; \pi_{(jk)})\) are multinomially (here binomially) distributed.

The expected number of preferences of object \( j \) to object \( k \) is denoted by \( m_{(jk)} \) and given by \( n_{(jk)} \pi_{(jk)} \). Using a respecification for the \( \pi_{(jk)} \)'s and standard notation for log-linear models for contingency tables the log-linear formulation of the basic BT model is given by the following two equations:

\[ \ln n_{(jk)} = \mu_{(jk)} + \pi_0 j + \pi_0 k \]

\[ \ln m_{(jk)} = \mu_{(jk)} - \pi_0 j + \pi_0 k \]

where \( \mu_{(jk)} \) are nuisance parameters and may be interpreted as interaction parameters representing the objects involved in the respective comparisons, fixing therefore the corresponding marginal distribution, i.e., the \( n_{(jk)} \)'s. The \( \pi_0 j \)'s represent object parameters \((O) \) is used for objects) and are related to the \( \pi_j \)'s by

\[ \ln \pi_j = 2\pi_0 j, \quad j = 1, \ldots, J. \]

So far, there is no advantage in using the log-linear over the logit model. However, there are often situations where no decision can be made. This indeterminate state of preference for a pair of alternatives \((\text{ties})\) is easily incorporated into the log-linear form of the basic BT model when using another respecification for the \( \pi_{(jk)} \)'s, i.e., by adding a third equation to the above,

\[ \ln m_{(jk)} = \mu_{(jk)} + \delta, \]

where \( \ln m_{(jk)} \) is the expected number of ‘no decision’ in the comparison \((jk)\) and the parameter \( \delta \) represents a general tendency to indecisiveness.

A major advantage of the log-linear formulation is the possibility to extend the basic BT model by incorporating parameters for subject (rater) and object characteristics. Considering subject covariates allows for moving away from the assumption of equal preference orderings for all subjects and object covariates allow for investigating certain characteristics of objects that make up the degree of preference for a certain object. Moreover, possible interaction effects might reflect

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**Table 3**

| Object covariate # | Estimate | Std. error | Object covariate (acronym in Fig. 2) |
|--------------------|----------|------------|-------------------------------------|
| 1                  | .0478    | .0074      | Amsterdam (AMS)                     |
| 2                  | .0298    | .0279      | Train/1st cl./Sl. (T1S)             |
| 3                  | .2930    | .0130      | Business Cl. (BC)                   |
| 4                  | .2389    | .0128      | Economy Cl. (EC)                    |
| 5                  | .0826    | .0190      | 2 days (2D)                         |
| 6                  | .0086    | .0170      | 5*-Hotel (5*)                       |
| 7                  | -.0300   | .0074      | 642 Euro (P6)                       |

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**Table 4**

| Package | Estimate | Std. error | Destination | Mode | Length | Hotel cat. | Price in € |
|---------|----------|------------|-------------|------|--------|------------|------------|
| 1       | -.2659   | .0121      | Prague      | Bus  | 4      | 4*         | 372        |
| 2       | -.3842   | .0126      | Amsterdam   | Bus  | 3      | 4*         | 482        |
| 3       | .0536    | .0121      | Amsterdam   | Economy | 2   | 4*         | 372        |
| 4       | -.2857   | .0121      | Prague      | Bus  | 2      | 4*         | 258        |
| 5       | -.3434   | .0124      | Prague      | Train/2nd | 2 | 4*         | 482        |
| 6       | -.0924   | .0118      | Prague      | Economy | 4    | 4*         | 482        |
| 7       | -.1382   | .0118      | Prague      | Train/2nd | 3 | 4*         | 372        |
| 8       | .1162    | .0124      | Prague      | Economy | 3    | 4*         | 258        |
| 9       | .0000    |            | aliased     | Amsterdam | 2nd | 4*         | 258        |
different importance of object characteristics according to subject variables.

To initially illustrate the approach for incorporating subject specific covariates, such as gender, assume that the judges are classified according to one categorical covariate $S$ ($S$ is for subjects as opposed to the $O$ above). Let $m_{l,jk}$ be the expected number of preferences for object $j$ (when compared to object $k$) where the judges are classified in covariate class $l$, $l = 1, \ldots, L$. The log–linear representation of this extended Bradley–Terry Model is given by the following equations:

$$\ln m_{l,jk} = \mu_{l,jk} + \lambda_j^S + \lambda_k^S + \lambda_{jk}^{OS} - \lambda_{kl}^{OS}$$

The set of (nuisance) parameters $\lambda_j^S$ represent the main effects of the subject covariate measured on the $l$-th level; $\lambda_{jk}^{OS}$ and $\lambda_{kl}^{OS}$ are the (useful) subject-object interaction parameters describing the effect of the subject covariate observed on category $l$ on the preference for objects $j$ and $k$, respectively, and $\delta$ is again the ‘no preference’ parameter. Effectively, a separate contingency table is constructed for each level of the categorical covariate, giving the dimension of the complete separate contingency table is constructed for each level of the category describing the effect of the subject covariate observed on subjects as opposed to the

$$\lambda_j^O = \sum_{p=1}^{P} x_{jp} \beta_p^X,$$

where the $x_{jp}$’s denote the covariates describing the $p$-th property of the object $j$ and the $\beta_p^X$’s are unknown regression parameters.

The log–linear representation of the Extended Bradley–Terry Model including the effects of one categorical subject covariate and one object covariate is:

$$\ln m_{l,jk} = \mu_{l,jk} + \lambda_j^S + \beta_1^X (x_{j1} - x_{k1}) + \beta_1^YS (x_{j1} - x_{k1}),$$

the other equations are defined analogously.

The EBTM is a multinomial log–linear model and thus a Generalized Linear Model (see, e.g., McCullagh and Nelder, 1999) and can be fitted using standard ML techniques with any software capable of computing log–linear models for contingency tables.

3. Results

The ‘overall utility’ values correspond to the object parameters estimated for the two series of artificial trip packages,
one for leisure and one for business. The part-worth utilities in conjoint terminology are related to the parameters of the object covariates (trip attributes) in the EBTM. The parameters for the subject covariates show the influence of the traveler characteristics hypothesized in Fig. 1. The model selection process commences with the object parameters for the packages.
rated in the survey. Then it adds the object covariates to evaluate the individual trip attributes combined in the packages. Finally, it examines the traveler covariates according to the set of hypotheses outlined in Fig. 1.

3.1. Object parameters and object covariates for business and leisure

Separate parameter estimates were obtained for the two samples of leisure and business travelers. Consider the results for business first (Table 2).

The object parameters describing the overall utility of the pre-designed packages range between .263 (for the 2 days’ trip to Amsterdam/Brussels/Rome, business class, a five-star hotel, priced 642 Euro) and −.131 (for a 1 day trip to Prague/Budapest/Munich, train first-class with sleeping compartment, five-star hotel, also priced 642 Euro). Note that the scaling is arbitrary and was determined by setting one object parameter to zero (viz. for the 2 days’ trip to Amsterdam/Brussels/Rome by train 1st class, 5-star hotel, at 424 Euro). To disentangle the intricate pattern of part-worth utilities contributed by each trip attribute, the parameter estimates for the object covariates are needed. Table 3 and Fig. 2 show these values.

For each object covariate the value shows the difference to be gained by switching from the reference level to one of the other categories of a trip attribute. The attribute level not shown always represents a value of zero (i.e., mode: train/1st class; price: 424 €; destination: Prague, Budapest or Munich; length of stay: 1 day; hotel: 4*). For example, changing the mode of transport from train/1st class (which is the zero base) to train/1st class with sleeping compartment (T1S) produces an insignificant value of .0298. An economy class flight (EC) entails a preference effect of .239 and a business class seat (BC) generates .293, both of which are significant. Recall that the values are in log scale. Thus, a meaningful comparison involves the odds ratios. For example, the estimated odds of preferring EC vs. not preferring EC are exp(0.239) = 1.27 times higher than the estimated odds of preferring T1S (reference category) vs. not preferring T1S.

The practical importance of these changes may be assessed by comparing them with the consequence of a price increase (P6) from 424 to 642 Euro. Such a rise in price exerts a negative effect of .030; so the impact on the overall attractiveness of the trip owing to a change from economy to business is roughly equivalent to a positive change for a price cut of 130 Euro. In the business travelers’ mind sets the mode of transport clearly dominates the formation of preferences for a trip.

![Fig. 5. Suggested modifications of the starting model (business).](image-url)
package. All the other components such as length of stay (2D), Hotel (5*) or destination category (AMS) exert less influence. For the leisure travelers the packages including an economy class seat (#8, #3, and #6) achieve the highest values. A bus or a train ride (unless lowest priced) seem to lead to poor overall

![Parameter Estimates](image)

Fig. 6. (a)–(g): Parameter estimates for the subject covariates (leisure). Destination: Amsterdam(AMS), Mode: Train/2nd class(T2), Economy class(EC), Length of Stay: 3 days(3D), 4 days(4D), Price: 372 Euro(P3), 482 Euro(P4); (level #1 of each trip attribute serving for reference is set to 0).
utilities (Table 4). The parameter values for the object covariates again give more distinct guidance about the role of the trip attributes. All the estimates in Table 5 and Fig. 3 have very small standard errors. For the leisure travelers, too, the mode of transport most strongly acts on the assessment of a city trip package. Switching from train 2nd class (T2) to an economy flight (EC) boosts the trip package more than twice as much as replacing train for bus. A variation of the package price is much more important in comparison with its effect among the business travelers (where only 10% had to pay for the trip out of their own pocket). Again, the attribute categories not shown represent zero values (i.e., mode: bus; price: 258 €; destination: Prague, Budapest or Munich; length of stay: 2 days).

3.2. Business traveler covariates

In the log–linear variant of the EBTM the relationships hypothesized in Fig. 1 are examined by analyzing the interaction terms involving the object and subject covariates. Only the main effects of each subject covariate on the objects are considered. Recall, however, that a ‘socio-economic status’ variable was formed by combining the two observables ‘level of education’ and ‘occupation’. Table 6 lists the $\chi^2$ values for the contingency tables supporting those main effects which survive the model selection. The $\chi^2$ values give the differences of deviances (i.e. the likelihood-ratio tests) for the final model and a model without the respective effect.

The substantial number of significant subject covariates demonstrates that the travelers are fairly heterogeneous in their assessing of a trip package and that the traveler characteristics proposed are appropriate for capturing quite a lot of this interpersonal variation.

The summary tables in the Appendix report on the parameter estimates thus showing the strength of the influence of the traveler characteristics (values for level #1 of each subject covariate set to zero). The socio-economic status (made up of education and occupation) proved to be an important factor. Judging from the parameter estimates it is particularly influential for the business travelers’ perceived part-worth of the mode of transport.

Each section of Fig. 4 exhibits the marginal means of the parameter estimates averaged over all other traveler covariates. Fig. 4 (b)–(d), e.g., visualizes the combined effect of education...
and occupation. With \([-0.2, 0.4]\) these scales span a larger interval than the scales for age (a), general mode preference (e), or travel experience (f). Clearly visible, the estimates for train/1st class plus sleeping compartment (marked with T1S), businesses (BC) and economy class (EC) vary significantly over the education/occupation levels. In terms of age only the 50+ travelers and regarding the general modal preference only the car lovers’ reaction is slightly different.

Fig. 5 summarizes the supported relationships proving that age and travel experience were overestimated in their expected influence on the business travelers’ evaluation of city trip packages. All part-worth utilities except ‘hotel category’ appear to be subject to the traveler’s educational and occupational background. The part worths attached to the mode of transport and to the price level are more strongly influenced by traveler characteristics than are destination, hotel category, or length of stay.

3.3. Leisure traveler covariates

According to Table 7 there is a significant influence of the leisure travelers’ personal characteristics on their valuation of trip attributes. Again, the socio-economic status composed of education and occupation interferes with all part-worth utilities. Unlike the business sub-sample, the leisure tourists’ age is not only important for valuing the mode of transport, but impacts on all trip components.

Turning to the strength of the interaction between the contribution of utility experienced from a trip attribute and the leisure travelers’ characteristics Fig. 6 (a)−(g) demonstrates the effect of these subject covariates. Level #1 of each object covariate again serves as the benchmark category. Comparing the scales for the education/occupation factor in (c)−(e) with the other single-criterion factors one recognizes a more diversified influence of the combined factor as the occupation groups show distinctly different patterns within each of the education classes. Hence, for the leisure travelers too, the socio-economic status emerges as a high-priority segmentation criterion when targeting city trip packages. Age (a) is also noticeable. Car ownership (b), general mode preference (f), and even travel experience (g) generate less pronounced effects.

As a summary consider Fig. 7 which exhibits the modified model from the point of view of the leisure travelers. (Note that the hotel category was uniformly set to 4 stars, where the business travelers had 4 and 5 stars among their set of choice alternatives.) Two of the hypothesized relationships remained unconfirmed (experience → price; car ownership → price). Not expected beforehand, the leisure tourists as well as their business counterparts seem to make their evaluation of an urban destination dependent on a general preference for a mode of transport. The major difference regarding subject covariates occurs for age, which plays a prominent role for leisure while staying largely irrelevant for business.

4. Discussion

The research findings provide evidence that business and leisure travelers make different assessments of the trip product elements bundled together in a city trip package. Moreover, both groups are internally heterogeneous regarding their assessments and a number of covariates seem to account for this heterogeneity. Pondering on the empirical results one must not overlook the limitations of this study. There are geographical and temporal restrictions, and, not to forget, the sample consists of air travelers; so one cannot expect a balanced view of the alternative modes of transport. An equivalent survey sponsored by rail and bus for their passengers would be desirable to learn about the bias provoked by the respective consumption situation. One may rightly expect such a bias as the general preference for a mode of transport turned out to influence the assessment of the trip components mode and price in both sub-samples.

The present study does not claim to confirm an explanatory model of city trip package evaluation. The analysis follows a model selection scheme guided by an initial set of hypothesized relationships. The final versions (Figs. 5 and 7) result from a series of likelihood ratio tests gradually simplifying the model by removing nonsignificant \((p>0.05)\) subject effects (i.e. subject main effects* objects covariates interactions) as common practice in backward-elimination strategies. The versions surviving the model selection process would have to be exposed to new data for being conclusively tested. Working on the contingency tables the EBTM as all log–linear models requires a fairly large sample. There were not plenty of cases in this study, therefore, making provision for a hold-out sample was not considered.

Despite of all these caveats there are a few lessons to learn for future hypothesizing. With so much emphasis on the marketing of destinations the importance of the mode of transport may have been underrated until the market success of the low-cost carriers began to tell otherwise. On the other hand, tour operators have always offered a set of catalogues sorted by the means of transport (city flights, rail tours, bus tours). This seems natural for predetermined modal choice. But, at second glance, it does not facilitate the traveler’s understanding of a higher price due to the value-enhancing function of transport speed and convenience. Finally, socio-economic status (for business and leisure) and age (for leisure only) should be among the candidates for market segmentation criteria. These characteristics seem to act on the assessment of all components in the product bundle.

In terms of methodology the EBTM proved its ability of handling fairly complex systems of relationships involving rating data and many categorical variables. One tempting refinement of the methodology relates to the order information in the ratings. The transforming of the observed ratings into paired comparisons ignores the number of rating points stretching between a respondent’s judgments of two alternatives. At least ordinal information may hide behind these differences and may remain unexploited after the downgrading of the level of measurement. Actually, the EBTM lends itself for further extensions that account for the rank differences in the preference data (cf. Dittrich et al., 2004). Tentatively, this was tried for the present data set and no remarkable effects on the parameter estimates were detected. But this is another story pointing to future research.
### Levels of the subject covariates (business)

| Education | Travel experience (# of trips) |
|-----------|-------------------------------|
| 1) Some high-school | N=54 | 1) <=-1 |
| 2) high-school | N=137 | 2) 4–9 |
| 3) college | N=345 | 3) 10–24 |
| | | 4) >=25 |

| Occupation | |
|------------|---|
| 1) Self-employed | N=58 | 1) <=29 |
| 2) Manager | N=122 | 2) 30–39 |
| 3) Employed | N=336 | 3) 39–49 |
| 4) Other | N=20 | 4) >=50 |

| General mode preference | Car ownership (# in household) |
|-------------------------|-------------------------------|
| 1) None | N=275 | 1) None |
| 2) Air | N=197 | 2) 1 |
| 3) Train | N=37 | 3) 2 |
| 4) Car | N=27 | 4) >=2 |

### Levels of the subject covariates (leisure)

| Education | Travel Experience (# of trips) |
|-----------|-------------------------------|
| 1) Some high-school | N=165 | 1) <=-1 |
| 3) high-school | N=173 | 2) 2 |
| 4) college | N=161 | 3) |
| | | 4) >=3 |

| Occupation | Age: |
|------------|-----|
| 1) Self-employed | N=44 | 1) <=29 |
| 2) Manager | N=17 | 2) 30–39 |
| 3) Employed | N=243 | 3) 39–49 |
| 4) Other | N=195 | 4) >=50 |

| General mode preference | Car ownership (# in household) |
|-------------------------|-------------------------------|
| 1) None | N=265 | 1) None |
| 2) Air | N=187 | 2) 1 |
| 3) Train | N=23 | 3) 2 |
| 4) Car | N=24 | 4) >=2 |

### Parameter estimates for the object-subject interactions (business)

| Subject: | Object: | AMS | BC | EC | T1S | 2D | P6 |
|----------|---------|-----|----|----|-----|----|----|
|          |         | est | s.e. | sig | est | s.e. | sig | est | s.e. | sig | est | s.e. | sig |
| GenPref (2) | -0.0774 | 0.0133 | *** | -0.0034 | 0.0172 | 0.0046 | 0.0168 | -0.0340 | 0.0134 | * |
| GenPref (3) | -0.0134 | 0.0262 | *** | 0.0539 | 0.0338 | 0.0356 | 0.0326 | -0.0626 | 0.0264 | * |
| GenPref (4) | -0.0384 | 0.0298 | *** | 0.0864 | 0.0389 | * | 0.1381 | 0.0387 | *** |
| TravelExperience (2) | -0.0340 | 0.0134 | * | 0.0554 | 0.0242 | * | -0.0297 | 0.0191 | * |
| TravelExperience (3) | -0.0626 | 0.0264 | * | -0.0196 | 0.0224 | 0.0231 | 0.0179 | * |
| TravelExperience (4) | -0.0815 | 0.0299 | * | 0.0004 | 0.0232 | -0.0538 | 0.0186 | * |
| Cars (2) | -0.0272 | 0.0255 | * | 0.0714 | 0.0257 | * | 0.0956 | 0.0264 | *** |
| Cars (3) | 0.0379 | 0.0261 | * | 0.1410 | 0.0307 | *** |
| Cars (4) | 0.0662 | 0.0304 | * | 0.1410 | 0.0307 | *** |
Parameter estimates for the object-subject interactions (leisure)

| Subject: | AMS | 3D | 4D | P3 | P4 | T2 | EC |
|----------|-----|----|----|----|----|----|----|
| Edu (1).Occup (2) | -0.3033 | 0.0847 | -0.3175 | 0.1393 | * | 0.2547 | 0.1374 | 0.2365 | 0.1639 | 0.1919 | 0.1177 | -0.1390 | 0.0840 |
| Edu (1).Occup (3) | 0.0250 | 0.0625 | -0.0180 | 0.1005 | 0.0256 | 0.0985 | 0.0945 | 0.1230 | 0.1211 | 0.0874 | -0.1998 | 0.0629 | ** |
| Edu (1).Occup (4) | 0.1294 | 0.0793 | -0.0044 | 0.1271 | 0.0493 | 0.1249 | 0.3820 | 0.1571 | 0.3174 | 0.1118 | ** | -0.2361 | 0.0793 | ** |
| Edu (2).Occup (1) | -0.0043 | 0.0690 | 0.2511 | 0.1133 | * | 0.2410 | 0.1092 | * | 0.1156 | 0.1360 | 0.1611 | 0.0971 | -0.0087 | 0.0692 |
| Edu (2).Occup (2) | -0.1180 | 0.0682 | -0.2373 | 0.1093 | * | -0.3581 | 0.1079 | *** | -0.1707 | 0.1353 | -0.0840 | 0.0962 | -0.1011 | 0.0688 |
| Edu (2).Occup (3) | 0.0173 | 0.0594 | 0.1087 | 0.0957 | 0.1102 | 0.0934 | 0.0856 | 0.1171 | 0.0993 | 0.0833 | -0.1073 | 0.0596 |
| Edu (2).Occup (4) | -0.0482 | 0.0748 | 0.0952 | 0.1218 | 0.1926 | 0.1218 | 0.1277 | 0.1482 | 0.1481 | 0.1056 | -0.1283 | 0.0751 |
| Edu (3).Occup (1) | -0.0414 | 0.0623 | 0.0357 | 0.1001 | 0.0023 | 0.0277 | 0.0616 | 0.1226 | 0.1057 | 0.0872 | -0.1123 | 0.0626 |
| Edu (3).Occup (2) | 0.0251 | 0.0593 | 0.1434 | 0.0956 | 0.1052 | 0.0933 | 0.2004 | 0.1171 | 0.2182 | 0.0834 | ** | -0.1222 | 0.0595 | * |
| Edu (3).Occup (3) | -0.0127 | 0.0585 | 0.1272 | 0.0942 | 0.1301 | 0.0920 | 0.1244 | 0.1154 | 0.1730 | 0.0821 | * | -0.1277 | 0.0587 | * |
| Edu (3).Occup (4) | 0.0022 | 0.0923 | 0.0525 | 0.1486 | -0.0752 | 0.1457 | 0.0886 | 0.1830 | -0.1004 | 0.1307 | -0.2711 | 0.0937 | ** |

sig. level: *= .10 **= .05 ***= .01.

sig. level: *= .10 **= .05 ***= .01.

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