A C T A   U N I V E R S I T A T I S   L O D Z I E N S I S
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# A NEW WAY TO ANALYSE ATTRIBUTE RISKS IN PREFERENCE MODELS

## 1. Perceived Risk in Consumer Behavior - A Review

The concept of perceived risk has stimulated research since it was first introduced by B a u e r in 1960 [3]. This concept takes into consideration that consumer decisions - especially purchase decisions - are based mostly on inadequate information. More specifically, decisions often involve risky outcomes. The possible occurrence of unfavourable post-purchase consequences and the pre-purchase consequences uncertainty about those outcomes are object of the concept of perceived risk [7].

Before evaluating perceived risk models on the background of preference models a short review of the main research areas in the field of perceived risk is shown. Figure 1 shows the most relevant studies in that area except those from traditional decision theory [3,4,5]. In order to categorize the different risk models we introduce the terms: general risk category models and product-specific risk category models:

1. General risk category models are those which are identical for all products (and brands); they are based on general risk categories such as uncertainty and risky feeling.

2. Product specific risk category models are those which are product specific due to their product attribute-specific risk categories. For a product like e.g. any of the following attribute specific risks may be found: uncertain gas mileage, uncertain durability.

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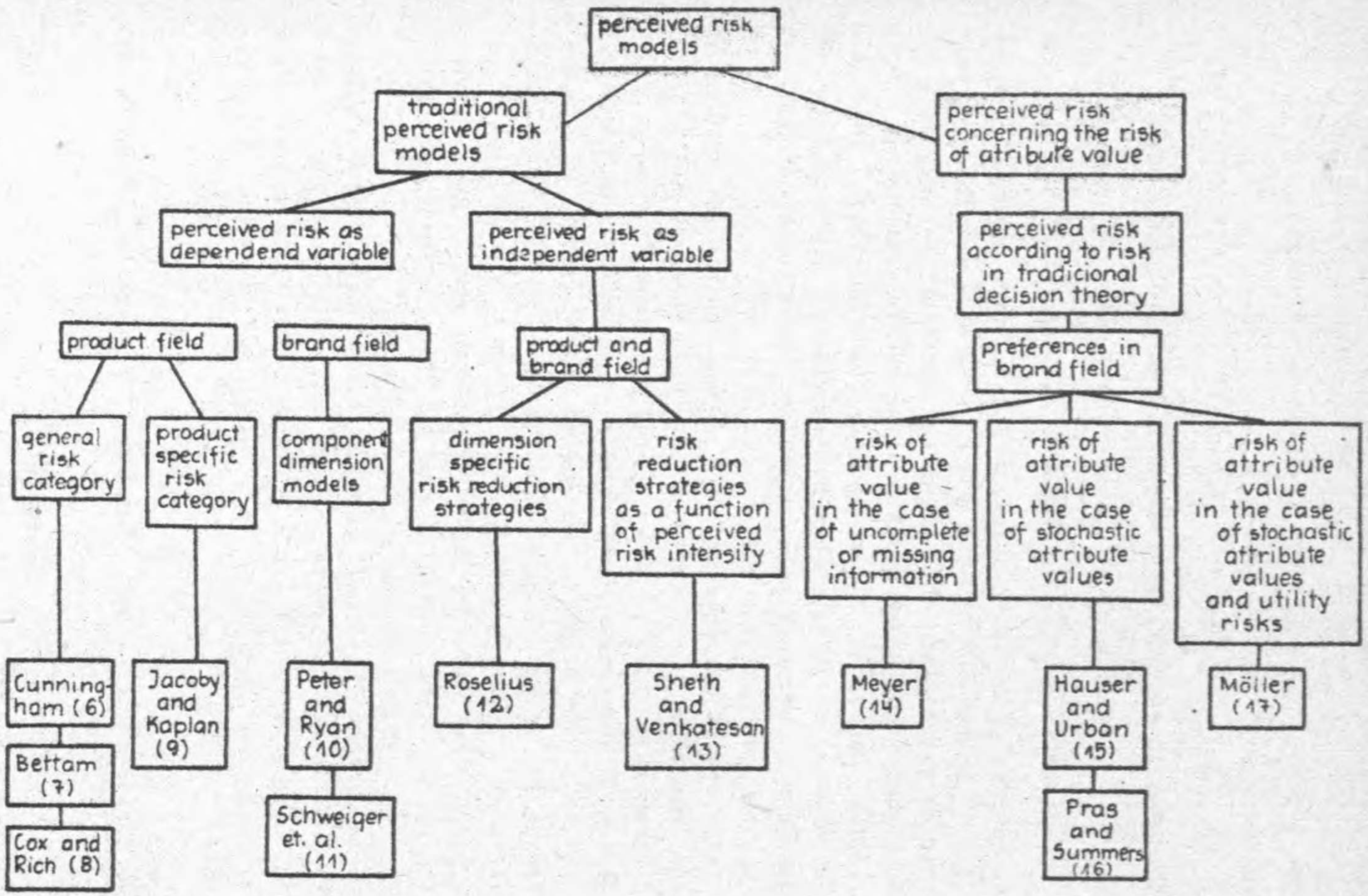



Fig. 1. Review of main studies in perceived risk

In perceived risk models "risk" is mostly not clearly defined, but just described in a phenomenological way. Looking carefully at risk and preference models one may distinguish the following types of risk:

1. Risk due to uncertainty of environmental conditions. As a consequence, the decision alternatives' outcomes are random variables (outcome risk). The risk is prior to any transformation of outcomes to utilities.

2. Risk due to vagueness of the utility function. Even if the outcome of a specific decision alternative is fixed, the referent utility of the outcome may be a random variable because of a fuzzy utility function caused by a vague goal system of the decision maker (utility risk).

General risk category models are usually built of two components such as (C u n n i n g h a m) [6]:

- the first component is the uncertainty that an unknown brand of a product works as well as the present brand;

- the second component builds upon the consequences of the use of any unknown brand of a product.

Thus, perceived risk is defined as the risk attached to the product as entity. This type of perceived risk models can be differentiated according to the area of application: products and brands within one product. E.g. J a c o b y and K a p l a n [9] developed the first type of perceived risks models and explained overall perceived risk by the "risk facets".

E.g. P e t e r and R y a n [13] developed the second type of perceived risk models as well. Risk reduction strategies based on the reasonable assumption that the decision maker is inclined to reduce perceived risk according to his risk tolerance by several strategies were mainly discussed by R o s e l i u s [15].

Just recently the traditional perceived risk models have been bound to preference theory constructs. Brand preference models have been introduced. Traditional preference models, especially the linear compensatory model, were enlarged enbodying outcome as well as utility risk aspects [8,11,12,14]. As regards the outcome risk it is normally supposed that a consumer has for each relevant attribute a subjective probability distribution which represents his uncertainty. Similiar approaches were made concerning utility risk. The traditional perceived risk models are directed toward generic are demand. They are not helpful to explain brand choice.

Preference models with risky attributes are quite reasonable, however they are often not operational because of having to ask for several probability distributions which people usually can't give you, at least valid ones. The procedure used is mostly too strenuous [18].

## 2. A New Approach

### 2.1. Objects of the Study

In traditional market research when persons have to judge objects they have to give unidimensional ratings of attributes of these objects no matter how their attribute specific risks are. Quasi-riskless attribute rates are put into traditional preference models. Starting with this point you get the main question: "Does the explicit consideration of the outcome risk increase internal and external validity of preference models?"

### 2.2. Selection of Preference Models

There are many formal preference models including risk aspects. Basically we are relying on the linear compensatory model where we incorporate risk modules. The basic linear compensatory model is:

$$u_s = \sum_{m=1}^{M} \cdot u_{sm}$$

with

- $s$ - object index,
- $m$ - attribute index ($m=1, \ldots, M$),
- $u_s$ - overall utility score (preference),
- $u_{sm}$ - attribute specific utility score ("partworth utility").

The following risk models have been formalized (~: indicates a random variable):

$$\tilde{u}_{sm} = \alpha_{om} + \alpha_{1m} x_{sm} + \varepsilon \qquad (1)$$

$$\tilde{u}_{sm} = \alpha_{om} + \alpha_{1m}\mu_{sm} + \varepsilon \qquad (2)$$

$$\tilde{u}_{sm} = \alpha_{om} + \alpha_{1m}x_{sm} + \alpha_{2m}c_{sm} + \varepsilon \qquad (3)$$

$$\tilde{u}_{sm} = \alpha_{om} + \alpha_{1m}\mu_{sm} + \alpha_{2m}(\mu^2_{sm} + \sigma^2_{sm}) + \varepsilon \qquad (4)$$

$$\tilde{u}_{sm} = \alpha_{om} + \alpha_{1m}\mu_{sm} + \alpha_{2m}\tau_{sm} + \varepsilon \qquad (5)$$

$$\tilde{u}_{sm} = \alpha_{om} + \alpha_{1m}\mu_{sm} + \alpha_{2m}\lambda_{sm} + \varepsilon \qquad (6)$$

$$\tilde{u}_{sm} = \alpha_{om} + \alpha_{1m}\omega_{sm} + \varepsilon \qquad (7)$$

with

$x_{sm}$ - perception concerning the average outcome as regards attribute m and concerning object s,

$c_{sm}$ - perception concerning the outcome's variation as regards attribute m and concerning object s,

$\mu_{sm}$ - expected value of attribute m's outcomes as regards object s ($\mu_{sm} = E(\tilde{x}_{sm})$),

$\sigma^2_{sm}$ - variance of attribute m's outcomes as regards object s ($\sigma^2_{sm} = E(\tilde{x}_{sm} - \mu_{sm})^2$),

$\tau^2_{sm}$ - "negative variance" of attribute m as regards object s ($\tau^2 = \sum_{x<\mu}(x_{sm} - \mu_{sm})^2 p(x_{sm}); \sum_{x<\mu} p(x_{sm}) < 1$),

$\omega_{sm}$ - mode ($x_{sm}$),

$\lambda_{sm}$ - probability of loss ($\lambda = \sum_{x<\mu} p(x_{sm})$).

## 2.3. Experimental Design

In order to avoid the burden of interviewing on probability distributions a new way of questioning has been developed. The respondents had to judge objects described in terms of attribute-specific probability distributions (Fig. 2).

For each object presented in (Fig. 3) the respondents had to give an unidimensional rating per attribute, a quasiriskless perception. In addition, the respondents had to give preference ratings for all brands. The objects were synthetically put together using a fractional factorial design. Composed of two Greek--Latin factorial desings. The four factors presenting the two attributes were:

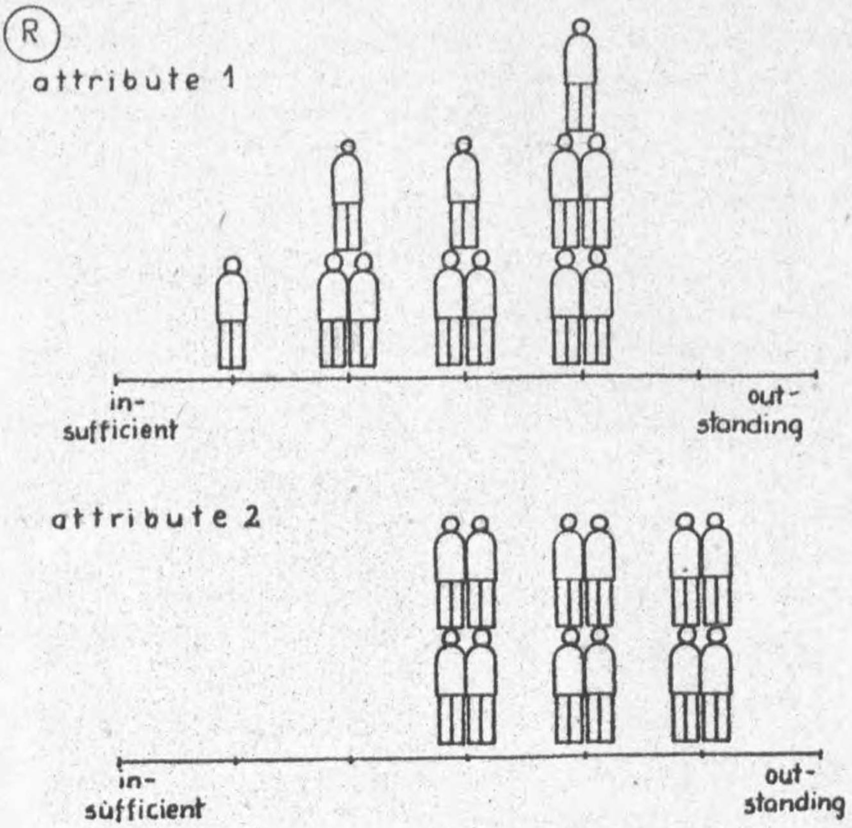



Fig. 2. Object presentation (on cards)

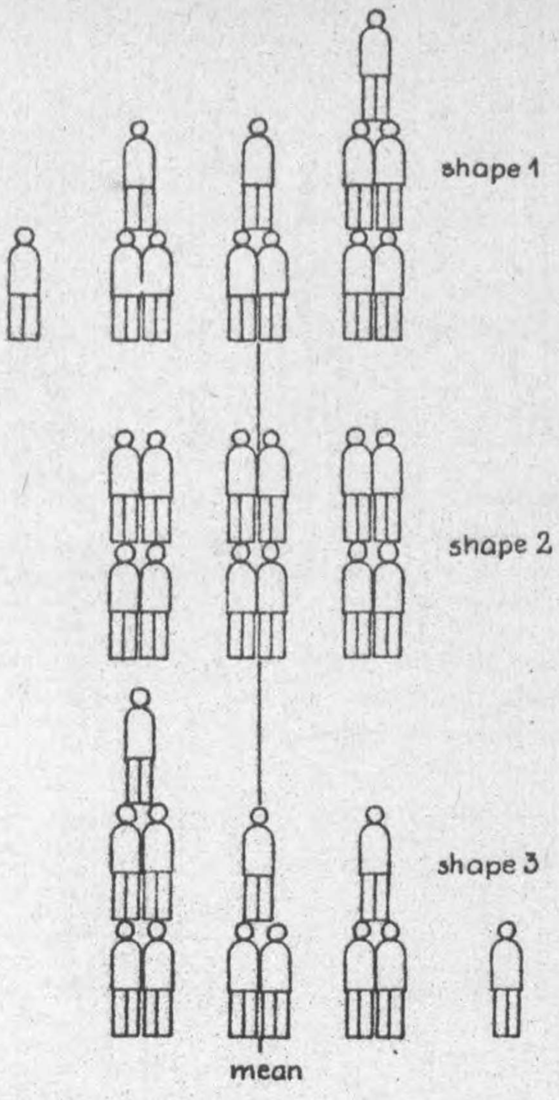
1: expected value of attribute 1 : 3 (=sufficient), 4.5 (=satisfying), 6 (=good);

2: type of the probability distribution of attribute 1:right steep rectangular, left steep;

3: expected value of attribute 2 : 3 (=sufficient), 4.5 (=satisfying), 6 (=good);

4: type of the probability distribution of attribute 2:right steep rectangular, left steep.

In Fig. 3 different probability distributions are shown.




g. 3. The probability distributions, all distributions have the same mean

In order to get an idea of the reliability of different sca-
ng procedures the probability distribution was offered in three
fferent ways, too (Fig. 4).

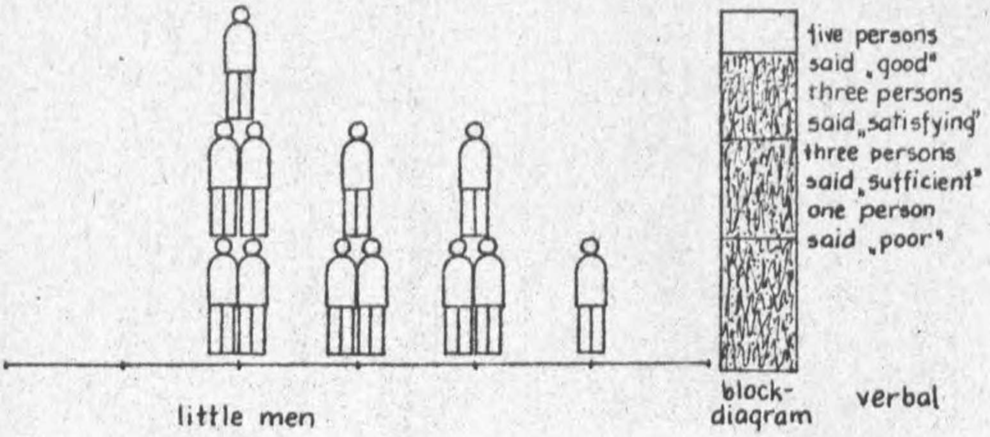



Fig. 4. Different modes to present the probability distribution

Each respondent had to judge three object categories with the probability distribution made evident in different ways. The interview design is given in Fig. 5.

| product | types of questionnaire | | | attributes | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 |
| used cars (A) | little men | verbal | block-diagram | gas milage | suscepti-bility of repairs |
| headache (B) remedies | block-diagram | little men | verbal | good nature | speed of aid |
| colour (C) televisions | verbal | block-diagram | little men | reproduction of colours. | durability |

Fig. 5. Design of questionnaires and used products/attributes

The sample of respondents is given in Fig. 6:

| main group | questionnaire of type | | | sum |
|---|---|---|---|---|
| | 1 | 2 | 3 | |
| student | 12(I) | 12(II) | 12(III) | 36 |
| non-student | 12(IV) | 12(V) | 12(VI) | 36 |

Fig. 6. Questionnaires/test persons design

Prior to the actual interview the respondents got a chance to get used to the interview procedure. The overall interview strategy (45 to 90 minutes) is given in Fig. 7.

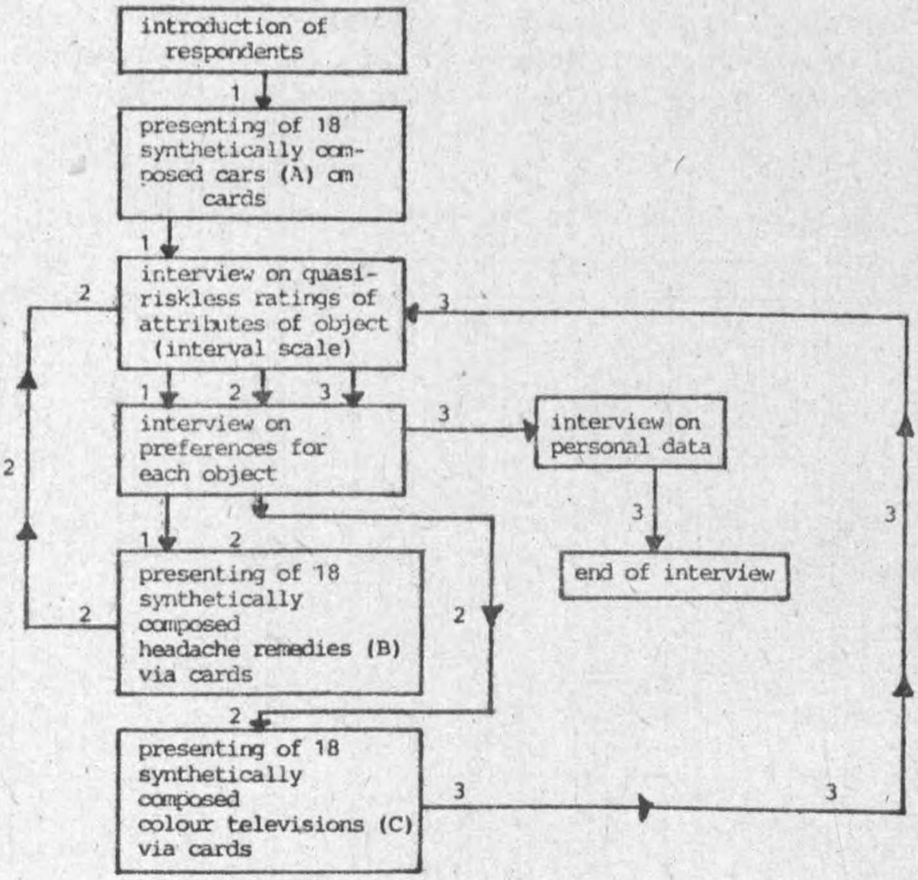



Fig. 7. Logical order of one interview

## 2.4. Analysis of Data

Before any further analysis of the data was carried out, their reliability was tested. Then the following hypothesis were tested:

H1: The quasi-riskless attribute score is identical with the corresponding mean.

H2: Why using explicit attribute risk distributions the external and internal validity is not higher than when using just the quasi-riskless attribute scores.

H3: The mode of probability distribution has no impact on the results.

H1 was tested by an dependent-sample-test-model where the hypothesis that $\sum(x_{sm} - u_{sm}) = 0$ could be rejected (p = 0,05).

Testing internal validity according to H2 the pairwise comparison of the models took place. The results are shown in Tab. 1.

Table 1

Results of the pairwise comparison of models - internal validity

| Groups | Model | | | | | |
|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 |
| I | 12 | 0 | 5 | 10* | 12 | 12 |
| | 12 | 0 | 7 | 12 | 12 | 12 |
| | 12 | 0 | 4 | 10 | 12 | 12 |
| II | 12 | 0 | 5 | 11 | 12 | 12 |
| | 12 | 0 | 4 | 12 | 12 | 12 |
| | 10 | 0 | 6 | 11 | 10 | 10 |
| III | 12 | 0 | 6 | 12 | 12 | 12 |
| | 12 | 0 | 5 | 12 | 12 | 12 |
| | 12 | 0 | 9 | 12 | 12 | 12 |
| IV | 12 | 0 | 7 | 11 | 11 | 11 |
| | 12 | 0 | 11 | 12 | 12 | 12 |
| | 12 | 0 | 10 | 12 | 12 | 12 |
| V | 12 | 0 | 8 | 11 | 11 | 12 |
| | 12 | 0 | 11 | 11 | 12 | 12 |
| | 12 | 0 | 9 | 12 | 11 | 10 |
| VI | 12 | 0 | 8 | 12 | 12 | 12 |
| | 12 | 0 | 8 | 12 | 12 | 12 |
| | 12 | 0 | 11 | 12 | 12 | 11 |

* Interpretation: model 1 led in 10 of 12 cases to higher internal validity than model 5 concerning product A internal validity.

The external validity was tested by estimating parameters only by the halve of the individual data which were as already mentioned, complete designs and forecasting the so gained preferences. Table 2 shows the results of the analysis analogue to Tab. 1.

Table 2

Results of the pairwise comparison of models - external validity

| Groups | Model | | | | | |
|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 |
| I | 12 | 8 | 7 | 12 | 12 | 10 |
| | 9 | 8 | 5 | 11 | 10 | 11 |
| | 11 | 8 | 3 | 11 | 11 | 10 |
| II | 12 | 6 | 8 | 12 | 12 | 12 |
| | 12 | 7 | 2 | 12 | 12 | 12 |
| | 11 | 8 | 10 | 12 | 11 | 12 |
| III | 12 | 7 | 6 | 12 | 12 | 12 |
| | 12 | 5 | 5 | 12 | 12 | 12 |
| | 12 | 8 | 9 | 12 | 12 | 12 |
| IV | 12 | 5 | 7 | 11 | 11 | 11 |
| | 12 | 8 | 11 | 12 | 12 | 12 |
| | 12 | 7 | 10 | 12 | 12 | 12 |
| V | 11 | 7 | 8 | 11 | 12 | 11 |
| | 12 | 2 | 5 | 12 | 12 | 11 |
| | 10 | 8 | 7 | 11 | 10 | 12 |
| VI | 12 | 10 | 10 | 12 | 12 | 12 |
| | 12 | 6 | 8 | 12 | 12 | 12 |
| | 12 | 5 | 8 | 12 | 12 | 12 |

Table 3 shows the results concerning H3. No significant impact of the models of representation of the distribution functions was found.

Table 3

Results of the comparisons of correlations in view of the different methods of presentation of the probability functions

| Groups | Model | | | | | | |
|---|---|---|---|---|---|---|---|
| Students: | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| I-II A | 5 | 6 | 6 | 6 | 8 | 8 | 7 |
| B | 7 | 4 | 7 | 6 | 5 | 5 | 4 |
| C | 6 | 4 | 5 | 8 | 7 | 4 | 5 |

Tab. 3 (contd.)

| Groups | | Model | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | A | 4 | 5 | 4 | 6 | 8 | 7 | 6 |
| I-III | B | 6 | 7 | 5 | 5 | 5 | 7 | 6 |
| | C | 5 | 4 | 5 | 7 | 5 | 5 | 6 |
| | A | 4 | 5* | 5 | 6 | 7 | 3 | 5 |
| II-III | B | 6 | 8 | 5 | 6 | 7 | 7 | 7 |
| | C | 5 | 7 | 6 | 5 | 3 | 7 | 7 |
| Non-students: | | | | | | | | |
| | A | 6 | 6 | 6 | 9 | 8 | 6 | 8 |
| IV-V | B | 6 | 7 | 6 | 4 | 4 | 6 | 6 |
| | C | 6 | 8 | 6 | 6 | 8 | 7 | 8 |
| | A | 5 | 6 | 5 | 7 | 9 | 5 | 7 |
| IV-VI | B | 5 | 7 | 6 | 4 | 5 | 6 | 6 |
| | C | 4 | 7 | 4 | 4 | 6 | 7 | 7 |
| | A | 5 | 5 | 5 | 4 | 7 | 6 | 6 |
| V-VI | B | 5 | 6 | 5 | 6 | 6 | 6 | 6 |
| | C | 5 | 4 | 4 | 4 | 4 | 7 | 5 |

* Interpretation: when pooling the results of group II and III concerning model 2, 5 results of group II belonged to the higher half 5 of 12; total - 12 + 12 = 24

## 2.5. Conclusions

The main result of this study is that assuming the used models it is not necessary nor adequate to question whole probability distributions to predict preferences if people have attribute specific risks in the assumed form. The use of quasi-riskless attribute ratings, in other words neglecting explicit consideration of this type of risk, is not harmful to the results. Secondly, there could be shown a new way of analysing attribute risks by a conjoint measurement approach and the use of reasonable manners of presentation of the attributes in a form of probability distributions.

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## NOWY SPOSÓB ANALIZY RYZYKA W MODELACH PREFERENCJI

Koncepcja percepcji ryzyka wynika z faktu, iż prawie każda decyzja w życiu zawiera ryzyko. Koncepcja ryzyka została też od niedawna wprowadzona do tradycyjnej analizy preferencji. Rozszerzenie tej analizy spowodowało powstanie szeregu studiów empirycznych w dziedzinie badania rynku. Wiele z tych studiów empirycznych nie jest jednak wiarygodne z uwagi na problemy gromadzenia danych za pośrednictwem wywiadów.

Powyższe badanie stanowi odpowiedź na pytanie czy bezpośrednie wprowadzenie rozkładu ryzyka do modeli preferencji wywiera wpływ na wewnętrzną i zewnętrzną wartość tych modeli. Okazuje się iż dla celów przewidywań, przy badaniu preferencji respondentów, nie jest konieczne przyporządkowywanie poszczególnym cechom specyficznego rozkładu ryzyka.