Passenger preferences in terms of timetable, comfort, and on-board service attributes on the X2000

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Rapport TRITA-IP AR 00-87
Foreword/ förord

The railway group at KTH is involved in a joint venture with other departments entitled "Efficient train systems". This work also involves studying the value rail passengers assign to different train properties and designs. Following a number of studies in the 1990s of the way rail passengers evaluate trains and travelling by train, I conducted a kind of summary study in the spring of 1998. The aims of this study were to include more factors than in previous studies and to test a method for avoiding what are known as "package effects" during stated preference experiments.

The completion of this report has taken longer than anticipated. During the intervening period, I have, for example, obtained my doctorate and a short presentation of this study is including in my dissertation (Evaluation of Passenger Train Concepts, KTH Traffic Planning FR 99-48).

I would like to thank SJ Resor for allowing us on this occasion to conduct our interviews on the X2000 express train. The Communication Research Board (KFB) was the principal financier.


Jag vill tacka SJ Resor som denna gång lät oss genomföra intervjuer i snabbtåget X2000. KFB, Kommunikationsforskningsberedningen har varit huvudfinansiär.

KTH, Stockholm september 2000

Karl Kottenhoff
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0. Summary in English and Swedish

Interviews were conducted on board X2000 trains between Malmö and Stockholm in March and April 1998. All the interviews contained two levels of preference questions, not counting the background variable questions. At the upper level, the pairwise-choice method was used. The value of three attribute packages was investigated; a timetable package, a comfort package and an on-board service package. At the lower level, trade-offs between the attributes in the individual packages were investigated. Price was only included as an attribute at the upper level. To make the respondents familiar with the various timetable, comfort and service attributes, the lower level was conducted first.

One objective was to test the so-called best/worst (B/W) conjoint method for the lower level, but only one package per interview type was used as a B/W experiment. The other two were used as "listings". The way listings were used in this study was as follows; respondents were asked to pick the best and second best from a list of five or seven attributes. To supplement this, they were also asked to pick the worst and second worst from the inverse level of the attributes.

The pairwise stated preference experiment had four factors: ticket price (3), timetable package (2), comfort package (2) and on-board service package (2), where the number of factor levels are shown in brackets. The packages each included five to seven attributes.

The first estimation determined the values of the packages. The valuations for the timetable, comfort and service packages were all higher than expected. The differences in parameters for the segments that were used, business, leisure trips and work+school, are fairly small. Calculations of the willingness to pay for the different segments reveal similar valuations. The value of the timetable package is 41% of the fare for business and also for work trips and 33% for leisure travellers. The comfort package is valued at 42% on average, a little higher for business and somewhat lower for the other two segments. On-board service is valued at 21%, but a little lower for work trips.

The next step divided these aggregate values into values or "part-worths" for the attributes included. The package values have been split up and the sub-values or part-worths have been allocated to the individual attributes. The valuations of the attributes are illustrated by the figure on the next page.

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1 This method of preference elicitation has some deficiencies and has been replaced by the full ranking of attributes in later studies.

/I figur – 10% travelling time inte travel time, journey inte jorney, Rigid timetable inte Stiff, shaking and vibration inte shakings and vibrations, Less/more inte do, Air conditioning inte Air condition, More/less luggage space inte Greater/smaller,
Most of the values have been compared with values from other KTH studies and with the results of Danish (DSB) studies\(^2\) of inter-regional and regional trains. The valuation levels are surprisingly similar.

Of the timetable attributes, avoiding one interchange and a certain amount of delay are highly valued, as anticipated. However, few stops also receive a high valuation, even higher than 10% travelling time, for example (which is valued at about 5% of the fare). The few stops attribute levels were formulated as: "Train stops at few stations (giving you an undisturbed journey)" and "Train stops at many stations (so that people can get on/off)".

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Of the comfort attributes, adjustable seatback, 10cm legroom and low levels of shaking and vibration received the highest values. The values are around or almost 10% of the fare. Catering is the most preferred on-board service attribute. Providing a table at seats is also a factor which is given a relatively high value.

As a whole the methodology has worked sufficiently good with interesting support for the rather high valuation levels obtained in earlier studies. The simplified methods used at the lower, attribute, level worked sufficiently well and can be further developed.
Sammanfattning


Ett syfte med denna studie var att testa den så kallade best/worst conjoint metoden på den lägre nivån, men bara ett av paketen genomfördes som B/W experiment i varje intervju. De två andra paketen utvärderades genom listor av attributnivåer. Sättet som dessa listor utvärderades i denna studie var som följer: Respondenterna omeddelat att markera det bästa och det näst bästa (viktigaste och näst viktigaste) attributen i varje paket om fem till sju attribut. Om komplement till detta ombads man att även markera det sämsta och näst sämsta av de inverterade attributen (t.ex. är 5 min längre restid det inverterade attributet mot 5 min kortare restid).

Stated preference experimentet på den övre nivån var av conjoint typ med parvisa val. Det hade fyra faktorer: biljettpris (3), tidtablappaket (2), komfortpaket (2) och servicepaket (2), där antalet nivåer för respektive faktor står inom parentes.


Nästa steg var att dela upp dessa aggregerade värden i värderingar av de inkluderade attributen. Paketvärderingarna har blivit uppdelade på del delvärden ("partworths") som allokerats till de attribut som ingått i respektive paket. Värderingarna framgår av figuren.
Figur. En grafisk illustration av värderingarna av de tre paketen och hur dessa värden fördelade sig på de inkluderade attributen. % betyder betalningsvilja i procent av biljettpriset.

De flesta värderingarna har jämförts med värden erhållna i tidigare KTH-studier och med resultat från danske (DSB) studier av regionala och interregionala tåg. Värderingsnivåerna är överraskande lika.

Bland tidtabellattributen fick; att undvika ett byte och en viss förseningsnivå, höga värderingar som väntat, men också få stopp fick hög värdering, till och med högre än 10% restid (som värderades till ca 5% av taxan). Attributet om få stopp hade två nivåer med följande formuleringar: "Tågen stannar på få stationer (så att man får en lugn resa)" och "Tågen stannar på många stationer (så att folk kan gå av och på)".

Bland komfortattributen värderades följande attribut högst: inställbara ryggstöd, 10cm benutrymme och litet skakningar och vibrationer. Värderingarna ligger upp mot 10% av biljettpriset.

Servering är det högst värderade service attributet. Att erbjuda bord vid sittplatsen är också en sak som värderas relativt högt.
1. Introduction

In recent years a number of stated preference (SP) studies with train passengers have been carried out at the division of Traffic & Transport Planning\(^3\). Each study has investigated the values of about three to ten passenger train related attributes.

Many of the investigated attributes have received values of about 5-10% of the ticket fare. It has been suspected that some of the attributes have received to high values. One reason may be the package effect, which accordingly was investigated in a master thesis\(^4\). This included a number of SP interviews with various designs.

The master thesis tested a method proposed by John Bates\(^5\) with attributes and packages of attributes at various levels to get around the package effect.

This study tests a simplified two level value estimation method which combines binary stated choice of (package) alternatives with choices of most important attributes and levels. The aim is to find a practical method where a rather big number of attributes can be evaluated without very long interviews. It is also the aim to considerably reduce the package effect. Therefore the attributes should not be over-valued but the trade-off between attributes in the same package may be approximate, because of methodological reasons.

![Self completed computer assisted interview (CASI) with pocket size computers on board a Swedish train (Y2, which is another train than the one in this study; X2000).](image)

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\(^4\) Schmidt, Lotta, *Värdeminskning vid värdering av tågkoncept*, KTH Traffic Planning TRITA-AR

\(^5\) Bates John,
2. Conducting the interviews

Interviews were made on-board X2000 trains between Malmö and Stockholm in March and April 1998. X2000 was chosen because it is a good example of a modern long distance train. The interviewing were made as computer assisted self interviewing (CASI). One CASI interview normally takes about 10-15 minutes.

A total number of 535 interviews were made. These were divided into three main types and a fourth type, which is a modification of type 1. The design of the various interview types will be described in chapter 3.

The response rate is not carefully counted but most people use to accept the computer interview. Of those having enough time, not getting of at next station for example, about 9 out of 10 of the train passengers usually accomplish the interview.

The number of interviews of the four types is shown in table 1. The proportion of men happened to be about 58%, when it in many other train interviews has been about 50%.

Table 1 No. of men and women in the four interview types

<table>
<thead>
<tr>
<th>No of</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
<th>Type 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>80</td>
<td>87</td>
<td>74</td>
<td>69</td>
</tr>
<tr>
<td>Women</td>
<td>61</td>
<td>50</td>
<td>60</td>
<td>54</td>
</tr>
<tr>
<td>Sum</td>
<td>141</td>
<td>137</td>
<td>134</td>
<td>123</td>
</tr>
</tbody>
</table>

A rather big proportion of the travellers during these interviews had not paid the tickets themselves. This is true for all interviews except type 4. The explanation for this difference is that type 1-3 interviews were made in parallel while type 4 interviews were made at the end of the interview period, when other people were travelling. (Table 2)

Table 2 Who paid the tickets

<table>
<thead>
<tr>
<th>Did you pay the ticket yourself?</th>
<th>Type 1-3</th>
<th>Per cent</th>
<th>Type 4</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (with my own money)</td>
<td>165</td>
<td>40 %</td>
<td>86</td>
<td>70 %</td>
</tr>
<tr>
<td>No, my employer has paid</td>
<td>177</td>
<td>43 %</td>
<td>21</td>
<td>17 %</td>
</tr>
<tr>
<td>No, the school has paid</td>
<td>1</td>
<td>0.2%</td>
<td>0</td>
<td>0 %</td>
</tr>
<tr>
<td>I have military ticket</td>
<td>11</td>
<td>3 %</td>
<td>6</td>
<td>5 %</td>
</tr>
<tr>
<td>I have free ticket</td>
<td>17</td>
<td>4 %</td>
<td>3</td>
<td>2 %</td>
</tr>
<tr>
<td>Other way of paying</td>
<td>41</td>
<td>10 %</td>
<td>7</td>
<td>6 %</td>
</tr>
</tbody>
</table>

The purposes of the journey were very different for the first interviews compared to number (type) 4. Almost half of the travellers who made on of the interviews type 1-3 were business when less than 10% were business for type 4. Usually the number of business travellers is somewhere between, say 20-25 %.
Table 3  Purpose of the journeys

<table>
<thead>
<tr>
<th>Purpose of the journey</th>
<th>Type 1-3</th>
<th>Percent</th>
<th>Type 4</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit friends or relatives</td>
<td>131</td>
<td>32 %</td>
<td>80</td>
<td>65 %</td>
</tr>
<tr>
<td>To/from own work</td>
<td>20</td>
<td>5 %</td>
<td>10</td>
<td>8 %</td>
</tr>
<tr>
<td>To/from school</td>
<td>13</td>
<td>3 %</td>
<td>3</td>
<td>2 %</td>
</tr>
<tr>
<td>Business journey</td>
<td>188</td>
<td>46 %</td>
<td>11</td>
<td>9 %</td>
</tr>
<tr>
<td>Other leisure</td>
<td>24</td>
<td>6 %</td>
<td>12</td>
<td>10 %</td>
</tr>
<tr>
<td>Other purpose</td>
<td>36</td>
<td>9 %</td>
<td>7</td>
<td>6 %</td>
</tr>
</tbody>
</table>

The travellers ages are shown by table 4. Travellers under 19 years of age are under-represented by will: Children are often not asked to make the interview. Senior citizens, over 65, are also underrepresented while they often reject.

Table 4  The ages of the respondents

<table>
<thead>
<tr>
<th>How old are you?</th>
<th>Type 1-3</th>
<th>Percent</th>
<th>Type 4</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>under 19 years</td>
<td>27</td>
<td>7 %</td>
<td>16</td>
<td>13 %</td>
</tr>
<tr>
<td>19 - 25 years</td>
<td>80</td>
<td>19 %</td>
<td>42</td>
<td>34 %</td>
</tr>
<tr>
<td>26 - 45 years</td>
<td>189</td>
<td>46 %</td>
<td>38</td>
<td>31 %</td>
</tr>
<tr>
<td>46 - 65 years</td>
<td>107</td>
<td>26 %</td>
<td>21</td>
<td>17 %</td>
</tr>
<tr>
<td>66 or older</td>
<td>9</td>
<td>2 %</td>
<td>6</td>
<td>5 %</td>
</tr>
</tbody>
</table>

Two questions about the respondents journey habits show that over half of the respondents were normally choosing train for "this journey" (table 5) and round 75 % go by train from one time per year to a few times per month. (table 6)

Table 5  Usually chosen mode

<table>
<thead>
<tr>
<th>By what mode do you usually do &quot;this journey&quot;?</th>
<th>Type 1-3</th>
<th>Percent</th>
<th>Type 4</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>By train in most cases</td>
<td>226</td>
<td>55 %</td>
<td>79</td>
<td>64 %</td>
</tr>
<tr>
<td>By air</td>
<td>22</td>
<td>5 %</td>
<td>6</td>
<td>5 %</td>
</tr>
<tr>
<td>By bus</td>
<td>9</td>
<td>2 %</td>
<td>5</td>
<td>4 %</td>
</tr>
<tr>
<td>By car</td>
<td>28</td>
<td>7 %</td>
<td>10</td>
<td>8 %</td>
</tr>
<tr>
<td>Mixed (modes)</td>
<td>46</td>
<td>11 %</td>
<td>11</td>
<td>9 %</td>
</tr>
<tr>
<td>I seldom do &quot;this journey&quot;</td>
<td>74</td>
<td>18 %</td>
<td>12</td>
<td>10 %</td>
</tr>
</tbody>
</table>

One reason for asking about the normally chosen mode is to see if it possible to detect different valuations for car users. In this case they may be too few to get any significant differences.
Table 6 Experience of train travelling

<table>
<thead>
<tr>
<th>How often do you go by train</th>
<th>Type 1-3</th>
<th>Percent</th>
<th>Type 4</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Many times per week</td>
<td>50</td>
<td>12 %</td>
<td>12</td>
<td>10 %</td>
</tr>
<tr>
<td>One/ a few times per month</td>
<td>134</td>
<td>33 %</td>
<td>33</td>
<td>27 %</td>
</tr>
<tr>
<td>One/ a few times per year</td>
<td>179</td>
<td>43 %</td>
<td>61</td>
<td>50 %</td>
</tr>
<tr>
<td>More seldom</td>
<td>49</td>
<td>12 %</td>
<td>17</td>
<td>14 %</td>
</tr>
</tbody>
</table>

The reason for asking about the experience of train travelling is about the same as for the previous question. We learn that over half of the respondents used to go by train only a few times per year or more seldom.
3. The design of the interviews

All interviews contained two levels of questions not counting the background variable questions. At upper level the value of three attribute packages were investigated; a timetable package, a comfort package and an on-board service package. At the lower level trade-offs between the attributes in respective package were investigated. Price was included as an attribute only at the upper level.

![Diagram](image)

Figure 2 The interview included valuation experiments at two levels

It is more important to use a well established method, as pairwise choices of alternatives, at the upper, package level than at the lower, "partworth" level. Doing so give some assurance for not exaggerating the value of the packages and thereby the sum of the values of the included attributes.

To make the respondents familiar with the various timetable-, comfort- and service- attributes the lower level was conducted first. When conducting the package SP the respondents were familiar with the content of the packages.
Figure 3  Illustration of the interview-levels and the order in which the questions were put.

One goal was to test the so called Best/Worst conjoint method for the lower level. As with ordinary pairwise conjoint (pairwise SP) it requires the respondents to make rather many choices, if a larger number of attributes should be evaluated. Therefore only one package per interview type were put forth as B/W experiment. The other two were put forth as "listings". These will be described next. The four versions of interviews or interview combinations are shown below. (All interviews had the same package SP, initial and final questions.)
Table 7  Design of lower level experiments ("games") in the four versions of interviews

<table>
<thead>
<tr>
<th>1. Lower level experiments</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
<th>Type 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timetable attributes</td>
<td>B/W experiment</td>
<td>Listing of attributes</td>
<td>Listing of attributes</td>
<td>B/W random experiment</td>
</tr>
<tr>
<td>Comfort attributes</td>
<td>Listing of attributes</td>
<td>B/W experiment</td>
<td>Listing of attributes</td>
<td>Listing of attributes</td>
</tr>
<tr>
<td>Service attributes</td>
<td>Listing of attributes</td>
<td>Listing of attributes</td>
<td>B/W experiment</td>
<td>Listing of attributes</td>
</tr>
</tbody>
</table>

In interview type 1 and 4, the trade-off between attributes included in the timetable package, the partworths, were investigated by the Best/Worst method. The other two attribute groups were investigated by a quicker and simpler "listing method". In type 2 the comfort attributes and in type 3 the on-board-service attributes were investigated by the B/W method.

There were also two versions of each Best/Worst experiment. One version (call it 1A, 2A or 3A) included a complete presentation of all attribute-levels as worst or best, when the other version (call it 1B, 2B or 3B) did not include all attribute-levels. In this version it was for example not asked if longer travelling time or less leg-room was the best attribute. It was supposed that the choice task would be easier this way and also that it would be taken more seriously.

The attributes and the packages of attributes

The interviews were conducted in Swedish so the original language is used to complement the English translation.

The idea about having two interview-levels is that the value of the packages should be estimated at one level and the partworths of the included attributes should be estimated at an other level. The authors' meaning is that it is more important to use a well established method, as pairwise choices of alternatives, at the package level than at the "partworth" level. Doing so give some assurance for not exaggerating the value of the packages and thereby the sum of the values of the included attributes.

The attributes that were included in a package were such attributes that were expected to have the same sign for most of the respondents. This applies to for example; shorter travelling time and less shakings and noise, but not for; train stops at many stations or sitting face-to-face. A mistake was made about the fare system attribute. It was expected that a majority would prefer a simpler fare system, but the listings and the B/W experiments showed that the preferences were mixed.
3.1 Alternative and attribute based SP experiments

Basing the experiment on alternatives composed of attributes and levels is also known as "conjoint" – the attributes are joined to form alternatives. In these alternative-based evaluations of attribute weights, the weights are indirectly evaluated by evaluating the alternatives.

![Figure 8 Alternative-based evaluation using composition and decomposition.](image)

Instead of these alternative-based preference elicitation procedures, the alternative of eliciting preferences directly for the attribute (levels) could be considered. An attribute-based evaluation method involves the respondents judging attributes directly and not via assessments of alternatives.

![Figure 9 Attribute-based evaluation. This figure is very simplified; the valuation estimation method may comprise several steps.](image)

It can be easier for the experimenter and for the respondents to use an attribute-based elicitation method. One drawback might be that interactions between attributes would be more difficult and perhaps impossible to detect. On the other hand, how often is this done in practice?
It may be easier for the experimenter and for the respondents to use an attribute-based elicititation method. One drawback could be that interactions between attributes might be more difficult and perhaps impossible to detect. On the other hand, how often is this done in practice?

3.2 The Best/Worst experiments

A short description of Best/Worst conjoint follows: Best/Worst is based on alternatives of attributes and levels. These are designed the same way as in ordinary conjoint (stated preferences) experiments. Instead of choosing, rating or ranking these alternatives, for each alternative respondents are asked to chose the best and the worst attribute. Often an attribute with a "high" level is chosen as best and an attribute that has a "low" level in that alternative is chosen as worst.

The design that was chosen in this study had 7 attributes at 2 levels. An orthogonal fraction contained 8 alternatives and because the interview computer only takes one answer at the time each alternative was showed two times, making a total of 16 presentations of alternatives per experiment.

The design is shown in table 12.

Table 8  7x2 conjoint design used in the Best/Worst experiments. Levels are coded -1 and 1.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Attr.1</th>
<th>attr.2</th>
<th>attr.3</th>
<th>attr.4</th>
<th>attr.5</th>
<th>attr.6</th>
<th>attr.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>-1</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>-1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
</tr>
</tbody>
</table>

The reason for the alternative 2 coming before alternative 1 in the table is that it was easier for the respondents to respond to the alternative on the second row first, while the first row has no 1-levels. What is the best of seven attributes at their "low" levels?

The second row, which was the first alternative presented to the respondents is shown as an example of a Best-question:
"Imagine that you are travelling with the following train:

1. Your travel time is longer: #TIME#
2. Delay about 15 minutes every fifth journey
3. The same number of trains as today
4. Trains leave at irregular times
5. You don't need to change train
6. The fare system is simplified but with fewer possibilities of fare reductions
7. Train stops at many stations (so that people can get on/off)

Which of the above conditions is BEST in your opinion?"

---

Figure 10 Example of Best/worst question.

All eight alternatives were presented as best-questions following each other, and then presented again as worst-questions following each other.

**3.2.1 Random assignment of levels**

Simulations has showed that always having the same number, here four, attribute-levels that are high in each alternative tends to give an underestimation of the lowered valued attributes (when counting part-worths). Therefore it was tested to assign level to each attribute in each alternative randomly. The probability for an attribute receiving -1- or 1-level was set to 50%.

**3.3 The listing experiments**

The listings experiments was a trial to simplify the respondents' elicitation process even more. Therefore all the presumed good or "high" levels of the attributes were grouped as an alternative. The question was than which of these good attributes was the most important, best or highest valued one. One could have continued to ask about a complete ranking of the seven presented attributes. But from evaluations of various SP methods is learned that the ranking method is not so good, because the lower order ranks are uncertain or unstable. Therefore it was chosen to ask only about rank one and two. These were complemented by the lowest and next lowest rank, rank seven and six, of all the "low" or assumed bad levels of the attributes.

An example of a listings question is:
"You will see a listing of factors. You have to judge which of the factors is most and second most important to you.

Which of the following factors do you value the highest?

1. Your travel time is shorter: #TIME#
2. Delays are rare
3. The number of trains are doubled
4. There is a train every hour on the same stroke of the clock
5. You don't need to change train
6. The fare system is simplified but with fewer possibilities of fare reductions
7. Train stops at many stations (so that people can get on / off)
   • Which of the above conditions is BEST in your opinion?
   • Which of the above conditions is second BEST in your opinion?"

Figure 11 Most important or "best"-questions about "high" attributes

After two most-important questions followed two least-important questions:

"You now have to judge which of the factors is worst and second worst for you.

1. Your travel time is longer: #TIME#
2. Delay about 15 minutes every fifth journey
3. The same number of trains as today
4. Trains leave at irregular times
5. You need to change train
6. The fare system is as today
7. Train stops at few stations (giving you an undisturbed journey)
   • Which of the above conditions is WORST in your opinion?
   • Which of the above conditions is second WORST in your opinion?"

Figure 12 Worst-questions about "low" attributes

The examples are made with the timetable attributes to better show the correspondence between the Best/Worst and the listings method. Corresponding question designs were used for the elicitation of comfort and on-board service. As earlier mentioned there were three (plus one) types of questionnaires so no respondent had to answer both B/W and listings questions within the same group (timetable, comfort or service).
Attributes and levels for the timetable experiments

The timetable attributes and levels used in the B/W and listings experiments are shown by table 9.

Table 9 Attribute and level descriptions for the two level timetable attributes experiment

<table>
<thead>
<tr>
<th>Base level (level 0)</th>
<th>Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Restiden är längre: #TIDH#</td>
<td>Restiden är korfar: #TIDH#</td>
</tr>
<tr>
<td>The travel time is longer #TIME#</td>
<td>The travel time is shorter #TIME#</td>
</tr>
<tr>
<td>2. Försening ca 15 min var femte resa</td>
<td>Förseningar är sällsynta</td>
</tr>
<tr>
<td>Delay about 15 min every fifth journey</td>
<td>Delays are rare</td>
</tr>
<tr>
<td>3. Det går lika många tåg som idag</td>
<td>Det går dubbelt så många tåg</td>
</tr>
<tr>
<td>The same number of trains as today</td>
<td>The number of trains is doubled</td>
</tr>
<tr>
<td>4. Det går tåg på oregelbundna tider</td>
<td>Det går ett tåg varje timme på samma klockslag</td>
</tr>
<tr>
<td>Trains leave at irregular times</td>
<td>There is a train every hour on the same stroke of the clock</td>
</tr>
<tr>
<td>5. Ett tågbyte behövs</td>
<td>Inget tågbyte behövs</td>
</tr>
<tr>
<td>You need to change once</td>
<td>You don’t need to change train</td>
</tr>
<tr>
<td>6. Dagens biljettsystem</td>
<td>Biljettsystemet förenklas men färre rabattmöjligheter</td>
</tr>
<tr>
<td>Today’s fare system</td>
<td>The fare system is simplified but with fewer possibilities of fare reductions</td>
</tr>
<tr>
<td>7. Tågen stannar på få stationer (så att man får en lugn resa)</td>
<td>Tågen stannar på många stationer (så att folk kan gå av/på)</td>
</tr>
<tr>
<td>Train stops at few stations (giving you an undisturbed journey)</td>
<td>Train stops at many stations (so that people can get on/off)</td>
</tr>
</tbody>
</table>

The variation in travel time, #TIME#, for attribute 1 was constructed the following way:
a) raise (or lower) the respondents actual travel time by 5%
b) add (or subtract) 5 minutes from that time
c) round off the new time to the nearest 5 minutes before presentation on the screen

This algorithm gives a combination of relative and absolute time difference, to ensure realistic changes for long and short journeys.

Attribute 6 level 1 has been described with two aspects; both the presumably positive simplification but also with fewer possibilities to travel at reduced fare.

Please note that attribute 7 is about how many stations the train stops at, but some people may take into account that a trains that stops more seldom takes shorter time.
This means that attribute 7 and 1 (travel time) may overlap in some way, even though it has been the intention of separating these attributes.

Attributes and levels for the comfort experiments

The attributes and levels used in the B/W and listings experiments about comfort are shown by table 10.

<table>
<thead>
<tr>
<th>Base level</th>
<th>Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mera skakningar och vibrationer än i detta tåg</td>
<td>Mindre skakningar och vibrationer än i detta tåg</td>
</tr>
</tbody>
</table>

More shakings and vibrations than in this train

Less shakings and vibrations than in this train

2. Något mera buller än i detta tåg | Något mindre buller än i detta tåg |

Somewhat more noise than in this train

Somewhat less noise than in this train

3. 5 cm mindre benutrymme | Benutrymmet är 5 cm större |

Your legroom is 5cm bigger

4a. Stolarna står mitt emot varandra | Stolarna står mitt emot varandra |

Face-to-face seating

Face-to-face seating

4b. Plats där man sitter bakom varandra | Plats där man sitter bakom varandra |

Seat where the arrangement is face-to-back

Seat where the arrangement is face-to-back

5a. Luftkonditionering med kyld luft på sommaren | Luftkonditionering med kyld luft på sommaren |

Air conditioning with cooled air in summer time

Air conditioning with cooled air in summer time

5b. Ej luftkonditionering, öppningsbara fönster | Ej luftkonditionering, öppningsbara fönster |

No air conditioning, windows to open

No air conditioning, windows to open

6a. Full lysrörsbelysning i hela vagnen | Full lysrörsbelysning i hela vagnen |

Full light tube lighting in the entire coach

Full light tube lighting in the entire coach

6b. Dämpad takbelysning och egen läslampa | Dämpad takbelysning och egen läslampa |

Dimmed lighting and individual reading lamps

Dimmed lighting and individual reading lamps

7. Stolarnas ryggestöd går ej att ställa in | Stolarna har inställbara ryggestöd |

The backrests of the seats are fixed

The seats have adjustable backrests

Some comfort attributes, 4, 5 and 6 in the table above, have been presented with their both levels at both sides. That gave the respondents a possibility to chose one or the
other as their best or worst level. Some people may for example prefer face-to-back seating while others may prefer face-to-face. This design made it possible to have different signs for the utility of these attributes.

Attributes and levels for the service experiments

The on-board service attributes and levels used in the B/W and listings experiments are shown by table 11.

Table 11 Attribute and level descriptions for the two level on-board service experiment

<table>
<thead>
<tr>
<th>Base level</th>
<th>Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ingen servering ombord</td>
<td>Servering ombord</td>
</tr>
<tr>
<td>No food/coffee service on board</td>
<td>Food/coffee service on board</td>
</tr>
<tr>
<td>2. Inget bord vid din sittplats</td>
<td>Sittplatsen har ett bord</td>
</tr>
<tr>
<td>No table at your seat</td>
<td>Your seat has a table</td>
</tr>
<tr>
<td>3. Färre konduktörer arbetar ombord</td>
<td>Alltid personal ombord som kan hjälpa till</td>
</tr>
<tr>
<td>Fewer conductors on board</td>
<td>Always staff that can help you</td>
</tr>
<tr>
<td>4. Något mindre bagageutrymmen</td>
<td>Större bagageutrymmen i vagnarna än idag</td>
</tr>
<tr>
<td>Somewhat less room for luggage</td>
<td>More room for luggage than in today's coach</td>
</tr>
<tr>
<td>5. Inga musikuttag</td>
<td>Musik/radiouttag i varje stol för hörlurar</td>
</tr>
<tr>
<td>No music outlets</td>
<td>Music/radio outlets in each seat for earphones</td>
</tr>
</tbody>
</table>

The number of on-board service attributes happened to be fewer than the number of timetable and comfort attributes. In reality there are a great number of possible service improvements that could be tested.
3.4 The pairwise choice SP experiments

The DOS-program MINT from Hague Consulting Group was used to produce the stated preference pairwise choice experiment. This had as mentioned 1x3 levels + 3x2 levels. The attribute with three levels was the ticket price. MINT normally produces orthogonal designs and the chosen design is a reduction of the standard 4x3 levels option. Three of the four attributes have one level less. Each respondent had to make four choices.

A choice could look like this:

<table>
<thead>
<tr>
<th>LEFT ALTERNATIVE</th>
<th>RIGHT ALTERNATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fewer staff on board, somewhat less room for luggage</td>
<td>Big staff on board, food/coffee service, bigger room for luggage, table and music outlet at every seat</td>
</tr>
<tr>
<td>Travel time is shorter: #TIDL#, Double no of trains, same stroke every hour, no change, seldom delays, simple fare system</td>
<td>Travel time is shorter: #TIDL#, Double no of trains, same stroke every hour, no change, seldom delays, simple fare system</td>
</tr>
<tr>
<td>Lowered price: 140 kronor</td>
<td>Raised price: 250 kronor</td>
</tr>
<tr>
<td>More shakings and noise, no air cond., fixed seats, legroom -5cm, light tubes in the roof</td>
<td>Less shakings and noise, air conditioning, adjustable seats, legroom +5cm, reading lamps</td>
</tr>
</tbody>
</table>

Left (press 1) Equal (press 2) Right (press 3)

Please chose 1, 2 or 3!

Figure 13 Example of (about) how the screen looked in MINT for a pairwise choice.

Packages and their levels in the pairwise SP experiments

The pairwise stated preference experiment had four factors, one of them with three levels and the rest three of them with two levels. The price was attribute 1 and it had 3 levels:

1.1 Sänkt pris #PRICE# (minus 25% minus 10 kronor, rounded off to 10 kronor level)
   
   Lowered price #PRICE#

1.2 Dagens pris #PRICE#
   
   Today's price #PRICE#

1.3 Höjt pris #PRICE# (plus 20% plus 10 kronor, rounded off to 10 kronor level)
Raised price #PRICE#

The rest of the "attributes", the three packages, had two levels each. These are described by table 12.

Table 12 Attribute packages levels in the pairwise choice design. Attribute 2-4. Attribute 1 is the ticket price.

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Restiden är korfare: #TIDL#, Dubbelt antal tåg, samma klockslag varje timme, inget tågbyte, sällan förseningar, enkelt biljettsystem</td>
<td>Restiden är längre: #TIDH#, Lika många tåg, tågbyte, försening var femte resa, dagens biljettsystem.</td>
</tr>
<tr>
<td></td>
<td>Travel time is shorter: #TIDL#, Double no of trains, same stroke every hour, no change, seldom delays, simple fare system</td>
</tr>
<tr>
<td>3 Mindre skakningar och buller, luftkond., ställbara ryggstöd, benutrymme +5 cm, läslampor.</td>
<td>Mera skakningar och buller, ej luftkond., fasta ryggstöd, benutrymme -5 cm, lysrör i tak.</td>
</tr>
<tr>
<td></td>
<td>Less shakings and noise, air conditioning, adjustable seats, legroom +5cm, reading lamps</td>
</tr>
<tr>
<td>4 Gott om personal, servering, större bagageutrymmen, bord och musikuttag vid varje plats.</td>
<td>Färre konduktörer ombord, något mindre bagageutrymmen.</td>
</tr>
<tr>
<td></td>
<td>Big staff on board, food/coffee service, bigger room for luggage, table and music outlet at every seat</td>
</tr>
<tr>
<td></td>
<td>Fewer staff on board, somewhat less room for luggage</td>
</tr>
</tbody>
</table>

The attributes that were included in a package were such attributes that were expected to have the same sign for most of the respondents. This applies to for example; shorter travelling time and less shakings and noise, but not for; train stops at many stations or sitting face-to-face. A mistake was made about the fare system attribute. It was expected that a majority would prefer a simpler fare system, but the listings and the B/W experiments showed that the preferences were mixed.
4. The estimation methods and parameters

Estimation of the parameters, the weights, have to be done in different ways for the Best/Worst, the attribute listings and the pairwise choice of alternatives.

4.1 Estimation of package weights from SP pairwise-choice experiments

The answers from the pairwise choices are evaluated by estimation with ALOGIT. This estimation procedure produces parameters for the attributes, in this case packages of parameters. ALOGIT uses maximum likelihood algorithm.

The parameters, t-values and number of observations are shown in table 15.

Table 15 Estimation results from the pairwise choice experiment for various segments.

<table>
<thead>
<tr>
<th></th>
<th>All respondents</th>
<th>Business trips</th>
<th>Leisure trips</th>
<th>Work trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (%)</td>
<td>-0.045 (23.4)</td>
<td>-0.041 (15.8)</td>
<td>-0.043 (16.5)</td>
<td>-0.035 (8.1)</td>
</tr>
<tr>
<td>Timetable</td>
<td>1.65 (16.9)</td>
<td>1.71 (15.2)</td>
<td>1.44 (12.9)</td>
<td>1.42 (7.8)</td>
</tr>
<tr>
<td>Comfort</td>
<td>1.91 (22.1)</td>
<td>1.93 (16.3)</td>
<td>1.64 (14.4)</td>
<td>1.36 (7.7)</td>
</tr>
<tr>
<td>Service</td>
<td>0.96 (13.6)</td>
<td>0.88 (9.5)</td>
<td>0.88 (8.7)</td>
<td>0.54 (3.5)</td>
</tr>
<tr>
<td>$r^2$</td>
<td>0.362</td>
<td>0.321</td>
<td>0.315</td>
<td>0.20</td>
</tr>
<tr>
<td>No. of observ.</td>
<td>3040</td>
<td>1606</td>
<td>1447</td>
<td>529</td>
</tr>
</tbody>
</table>

The differences in parameters for the used segments, business, leisure trips and work+school, is rather small. The parameter for money, for 1% of the ticket price, is very much the same. The difference is not bigger than 0.007 which they must be if the null hypothesis that the parameters are the same shall be rejected. (The t-values above are used and normal distribution is assumed.) The other parameters are not tested.

Trade-off is made by dividing the package parameters with the price parameter. This result is interpreted as willingness-to-pay or simply "valuation". These valuations are presented in section 5.

4.1.1 Estimation of time and price-dependent package parameters

As tested by Kottenhoff in some earlier studies new time and price dependent parameters can be estimated. These are created the following way.

In the utility functions each factor (attribute) is represented by three instead of one parameter. The first parameter is as it usually is multiplied by a dummy parameter (0/1) representing low and high level of one factor or attribute. It represents kr/journey when
divided by the cost parameter. The cost-parameter must in this case relate to absolute money (kronor).

The second parameter is multiplied by the dummy parameter (for the same factor) and by the travelling time the respondent has stated earlier in the interview. When dividing by the cost parameter we obtain the willingness to pay in kronor per minute.

The third parameter is multiplied by the dummy parameter and by the respondent's ticket cost. When dividing by the cost parameter we obtain the willingness to pay in kronor per kronor. This can be expressed as per cent of the fare.

This analysis has been done for the complete data file; all respondents, but also for the business, leisure and work trip segments separately.

A difficulty is that when keeping card holders in the estimation data, the absolute price parameter cannot be correctly estimated (as opposed to a relative price parameter). Therefore passengers with higher ticket price than 2000 kr has been omitted.

Table 16  Time and fare dependent estimation results from the pairwise choice experiment for various segments. T-values in brackets.

<table>
<thead>
<tr>
<th></th>
<th>All respondents</th>
<th>Business trips</th>
<th>Leisure trips</th>
<th>Work trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (SEK)</td>
<td>-0.077 (19.1)</td>
<td>-0.063 (13.3)</td>
<td>-0.090 (12.9)</td>
<td>-0.064 (6.5)</td>
</tr>
<tr>
<td>Timetable</td>
<td>0.81 (5.5)</td>
<td>0.94 (4.4)</td>
<td>0.59 (3.1)</td>
<td>0.44 (1.4)</td>
</tr>
<tr>
<td>Timetable•time</td>
<td>-0.02 (1.1)</td>
<td>-0.05 (1.5)</td>
<td>-0.02 (0.9)</td>
<td>-0.02 (0.5)</td>
</tr>
<tr>
<td>Timetable•price</td>
<td>0.18 (6.8)</td>
<td>0.16 (4.8)</td>
<td>0.23 (5.5)</td>
<td>0.23 (3.3)</td>
</tr>
<tr>
<td>Comfort</td>
<td>0.92 (6.3)</td>
<td>0.61 (2.9?)</td>
<td>0.97 (5.0)</td>
<td>-0.07 (0.2)</td>
</tr>
<tr>
<td>Comfort•time</td>
<td>-0.01 (0.3)</td>
<td>0.02 (2.6)</td>
<td>-0.01 (0.4)</td>
<td>0.04 (0.9)</td>
</tr>
<tr>
<td>Comfort•price</td>
<td>0.18 (7.1)</td>
<td>0.20 (5.7)</td>
<td>0.16 (4.1)</td>
<td>0.14 (3.6)</td>
</tr>
<tr>
<td>Service</td>
<td>0.25 (1.8)</td>
<td>-0.13 (0.7)</td>
<td>0.16 (0.8)</td>
<td>-1.00 (3.2)</td>
</tr>
<tr>
<td>Service•time</td>
<td>0.04 (2.3)</td>
<td>0.04 (1.4)</td>
<td>0.06 (2.4)</td>
<td>0.07 (1.7)</td>
</tr>
<tr>
<td>Service•price</td>
<td>0.08 (3.5)</td>
<td>0.13 (4.3)</td>
<td>0.05 (1.6)</td>
<td>0.21 (3.5)</td>
</tr>
<tr>
<td>$\rho^2$</td>
<td>0.326</td>
<td>0.305</td>
<td>0.272</td>
<td>0.183</td>
</tr>
<tr>
<td>No. of observ.</td>
<td>?</td>
<td>1507</td>
<td>1396</td>
<td>499</td>
</tr>
</tbody>
</table>

From the above table can for each segment be seen one parameter for price and three parameters each for the timetable, comfort and service packages. The second of these three parameters is related to the travel time and the third to the ticket price for each respondent. By studying the t-values for the trip, time and price related parameters one can get a first idea of the nature of these relations. If we for example look at the three parameters for comfort in the all respondents column we find that the trip and the price dependent parameters are significant while the time dependence is much lower and not significant at 5% level. The interpretation can be that all passengers value higher comfort positively but those paying more also value it higher.
4.2 Estimation of attribute part-worhts from Best/Worst experiments

The partworths of the attribute levels has been estimated by counting. The algorithm is to sum the number of times an attribute level has been chosen as Best and subtract the number of times it was chosen as Worst. To get the partworth for the difference of that attributes' two levels, these two sums are subtracted.

<table>
<thead>
<tr>
<th>Attribute is &quot;1&quot;</th>
<th>Best: multiply by 1</th>
<th>Worst: multiply by -1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attribute is &quot;0&quot;</td>
<td>Best: multiply by -1</td>
<td>Worst: multiply by 1</td>
</tr>
</tbody>
</table>

To normalise the weight the sum should be divided by the maximum number of times that an attribute level could have been chosen. In the case of seven attributes in two levels, presented as described above, each level occur in exactly half of the presented alternatives. The maximum number of times is then \((8/2 + 8/2) \times \text{number of respondents}\) = \(8 \times \text{number of respondents}\).

In the case of random assignment of levels, the number of times for each level must be counted separately.

Weights or parameters have also been estimated by the help of ALOGIT. Here parameters have been estimated both for the attribute weights and for the level weights.

**Table 13** Estimation results from B/W experiment, exemplified by timetable attributes

<table>
<thead>
<tr>
<th>Timetable attribute</th>
<th>B/W count</th>
<th>B/W logit estimation</th>
<th>Share of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel time is longer (+5% + 5min) instead of shorter (-5% - 5min)</td>
<td>12</td>
<td>5</td>
<td>0.05-0.12</td>
</tr>
<tr>
<td>Delays are rare instead of one 15min delay every fifth journey</td>
<td>30</td>
<td>27</td>
<td>0.27-0.30</td>
</tr>
<tr>
<td>There are twice as many trains as today (instead of same number)</td>
<td>7</td>
<td>12</td>
<td>0.07-0.12</td>
</tr>
<tr>
<td>There is one train every hour on the same minute instead of irregular service</td>
<td>8</td>
<td>12</td>
<td>0.08-0.12</td>
</tr>
<tr>
<td>No change of train instead of one</td>
<td>27</td>
<td>26</td>
<td>0.26-0.27</td>
</tr>
<tr>
<td>Simpler fare but fewer discount prices instead of today's fare</td>
<td>0</td>
<td>-1</td>
<td>≈ 0,00</td>
</tr>
<tr>
<td>The train stops at few stations instead of many stations</td>
<td>15</td>
<td>18</td>
<td>0.15-0.18</td>
</tr>
<tr>
<td>Total (sum)</td>
<td>99</td>
<td>99</td>
<td>1,00</td>
</tr>
</tbody>
</table>
Distribution of attribute valuations

Individual partworths of each attribute can be roughly estimated by counting number of choices. It is done the same way as described above, except for the division by the number of respondents.

The individual valuations can be shown in a histogram, which then shows the approximate distribution of individual attribute parameters.

Because of the limited number of attributes and choices each respondent make, the individual valuations only take on a few discrete numeric values.

4.2.1 Comparison of complete and not complete B/W attribute-levels

As described in chapter 2 there were two versions of B/W experiments for every group of attributes.

It was found that for some attributes the two versions gave different results. The complete version showed that there were some attributes were people reacted differently than was expected. One such case was the attribute "fare system". Respondents had the possibility to answer that a "simplified fare system" was best but not that "today's fare system" was the best (in one alternative). That gave an over estimation of the value of a simplified fare system.

It can be learned that it is dangerous to presume one or the other level as better.

4.3 Estimation of attribute part-worths from listings

Thurstone\(^7\) early showed that pairwise choices of attributes – every attribute with every other – give an approximate right valuation of the attribute value if the attribute values among people are normally distributed.

In this study a further approximation has been made: that only the best and the second best attribute will give a useful value. This assumption is tested in two ways: Parameters/values are compared to those from "full" B/W experiments and separate simulations have been made in Excel.

The parameters from the listings are calculated as the number of times an attribute and level is chosen as best or second best in relation to the number of times it could have been chosen. See table below.

The result from the latter, the simulations show that the use of only first and second choice results in an underestimation of low values and some overestimation of the high ones. This effect is strong if the variance among individuals is small, but not so severe if the variance is big. Big then means that the standard deviation is of the magnitude half of the parameter value.

\(^7\) Thurstone, L.L., *The measurement of values*, The University of Chicago press, 1959
Table 14  Relative attribute weights, exemplified by timetable attributes

<table>
<thead>
<tr>
<th>Timetable attribute</th>
<th>Listing</th>
<th>Share of counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel time is longer (+5% + 5min) instead of shorter (-5% - 5min)</td>
<td>20</td>
<td>0.20</td>
</tr>
<tr>
<td>Delays are rare instead of one 15 min delay every fifth journey</td>
<td>31</td>
<td>0.31</td>
</tr>
<tr>
<td>There are twice as many trains as today (instead of same number)</td>
<td>7</td>
<td>0.07</td>
</tr>
<tr>
<td>There is one train every hour on the same minute instead of irregular service</td>
<td>6</td>
<td>0.06</td>
</tr>
<tr>
<td>No change of train instead of one</td>
<td>22</td>
<td>0.22</td>
</tr>
<tr>
<td>Simpler fare but fewer discount prices instead of today's fare</td>
<td>7</td>
<td>0.07</td>
</tr>
<tr>
<td>The train stops at few stations instead of many stations</td>
<td>7</td>
<td>0.07</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Factor analysis of the listing experiments

Factor analysis, in this case, indicates if there can be some underlying human factor or need that has influenced the choice of a group of attributes. For example a group of respondents may have high appreciation of reading lamps, reading salon and face-to-face seating and adjustable seat-backs. The reason may be that these people have a "reading factor" in common; their willingness or need to read during their journey.

Factor analysis has been used here to see which attributes that can be due to such underlying factors. The program used is an old version of StatWiew.

4.4  Comparison of estimations from the different methods

Ideally the weights from all methods used should be the same. This is of course not the case. On the other hand there seem to be a strong conformity between the estimates from most methods.

To make it easier to check equalities and differences, the estimation results from different ways of estimating B/W weights and listings weights are summarised in three diagrams, one each for timetable, comfort and on-board service attributes.
Figure 14  Relative weights or partworths of timetable attributes estimated by different methods.

From the diagram we note that there are differences in the attribute partworths especially between the listings method and the various BestWorst variants. Logit estimation also differs, especially for the travel time attribute.
For the comfort attributes the listings method still gives different partworths. They seem to be relatively lower for attributes with low partworths, for example lighting, and relatively higher for attributes that are more important, for example adjustable seat backs. This is understandable because the listings method used in this study only asked for the best and the second best attribute. A complete ranking of all attributes would probably have lowered this progressive effect.

The on-board service partworths were estimated by only two methods.
5. Results: valuations of attributes

As this study is designed with two levels, the first estimation is to determine the values of the packages. The next step is to divide these aggregate values into values or "partworths" for separate attributes.

5.1 Valuations of the packages

Valuations of the packages are presented as per cent of fare. Four models, for all, business, leisure trips and work trips are shown here.

Table 17 Valuation of packages in the pairwise choice experiment

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Valuation of level 1 in comparison to level 2 (% of the fare)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TIMETABLE-package</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel time is shorter: #TIDL#, Double no of trains, same stroke every hour, no change, seldom delays, simple fare system</td>
<td>Travel time is longer: #TIDH#, Same no of trains, change of train, delay every fifth journey, today's fare system</td>
<td>+ 37% average for all</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 41% for business</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 33% for leisure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 41% for work trips</td>
</tr>
<tr>
<td><strong>COMFORT-package</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less shakings and noise, air conditioning, adjustable seats, legroom +5cm, reading lamps</td>
<td>More shakings and noise, no air cond., fixed seats, legroom -5cm, light tubes in the roof</td>
<td>+ 42% average</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 47% business</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 38% leisure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 39% work trips</td>
</tr>
<tr>
<td><strong>SERVICE-package</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big staff on board, food/coffee service, bigger room for luggage, table and music outlet at every seat</td>
<td>Fewer staff on board, somewhat less room for luggage</td>
<td>+ 21% average</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 21% business</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 21% leisure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 16% work trips</td>
</tr>
</tbody>
</table>

If we first look at the average valuations for all respondents we find rather high levels for all three packages with timetable and comfort around 40 per cent of the fare and the on-board service package at the half of that. The valuations for the segments are all at about that level but slight differences can be noticed: Leisure travellers have somewhat lower willingness-to-pay for the timetable package (in per cent of their fare). Business travellers have higher valuation of comfort measures (in per cent of their fare). If we consider that most business travellers have more expensive tickets their valuation in absolute value (kronor) is even higher than the other segments' valuations.
Commuters (work trips) have relative their fare high valuations of timetable but lower valuation of on-board service. They value comfort about as highly as the average traveller.

5.1.1 Time and price dependence

Table 18 shows trip, time and price related valuations, in kronor (SEK) calculated from the estimated parameter values. There is one row each for the constant part of the values for the packages. This is showing the willingness to pay in SEK. The next presented valuations are the time dependent part, presented in SEK/hour. The third part shows the valuation's dependency on the fare paid, presented in SEK/100SEK (value/fare) or % of the fare.

<table>
<thead>
<tr>
<th>Package</th>
<th>All respondents</th>
<th>Business trips</th>
<th>Leisure trips</th>
<th>Work trips</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timetable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEK</td>
<td>105</td>
<td>150</td>
<td>65</td>
<td>68</td>
</tr>
<tr>
<td>SEK/hour</td>
<td>-3</td>
<td>-7</td>
<td>-2</td>
<td>-4</td>
</tr>
<tr>
<td>SEK/100SEK (%)</td>
<td>23</td>
<td>25</td>
<td>25</td>
<td>35</td>
</tr>
<tr>
<td><strong>Comfort</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEK</td>
<td>120</td>
<td>97</td>
<td>107</td>
<td>-11</td>
</tr>
<tr>
<td>SEK/hour</td>
<td>0</td>
<td>3</td>
<td>-1</td>
<td>6</td>
</tr>
<tr>
<td>SEK/100SEK (%)</td>
<td>24</td>
<td>32</td>
<td>18</td>
<td>37</td>
</tr>
<tr>
<td><strong>On-board service</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEK</td>
<td>33</td>
<td>-21</td>
<td>17</td>
<td>-155</td>
</tr>
<tr>
<td>SEK/hour</td>
<td>6</td>
<td>6</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>SEK/100SEK (%)</td>
<td>10</td>
<td>20</td>
<td>6</td>
<td>33</td>
</tr>
</tbody>
</table>

The levels of the numeric values in the table does not directly show the relative weights or importances. First the numeric SEK/hour must be multiplied by a specific travel time and the SEK/100SEK must be multiplied by a corresponding ticket price.

A few examples.

A business woman travelling with X2000 Stockholm-Linköping pays 400SEK for a 2 hour journey. Her valuations for the three packages are:

Timetable: \(150 \times (-7 \times 2 + 0.25 \times 400) = 150 \times (-14 + 100) = 236 \text{ SEK} \) (164)
Comfort: \[97 + 3 \times 2 + 0.32 \times 400 = 97 + 6 + 128 = 231 \text{ SEK (188)}\]

Service: \[-21 + 6 \times 2 + 0.20 \times 400 = -21 + 12 + 80 = 71 \text{ SEK (84)}\]

A leisure traveller travelling with X2000 Stockholm-Malmö pays 500SEK for a 4.5 hour journey. His valuations for the three packages are:

Timetable: \[65 - 2 \times 4.5 + 0.25 \times 500 = 65 - 9 + 125 = 181 \text{ SEK (165)}\]

Comfort: \[107 - 1 \times 4.5 + 0.18 \times 500 = 107 - 5 + 90 = 192 \text{ SEK (190)}\]

Service: \[17 + 7 \times 4.5 + 0.06 \times 500 = 17 + 32 + 30 = 79 \text{ SEK (105)}\]

The figures in brackets to the right of the resulting package valuations are the values resulting from just using the relative valuations presented in table .

It is noticeable that the time dependent part is very small in all packages except the service package for the leisure traveller.

The valuation of the service package by the commuters (work trips) is \[-155 + 12 / \text{hour} + 33\% \] of the fare paid, all in SEK. This result seem strange and one explanation can be that some card holders are included, by using the relatively high fare limit of 2000 SEK. The card holders may do short journeys despite having a high fare input in the data set.

5.2 Valuations of attributes

The value of separate attributes is investigated at the second level of this overall design. The valuations have been calculated by proportioning the value of a package due to the attributes' weights from listings and Best/Worst.

5.2.1 Timetable attributes

The value of the package of all included timetable related attributes is 37%. All estimation weights in the table below have been recalculated into shares of hundred (percent). For the B/W interview two different estimation methods are included; counting occurrences and logit estimation.

The value of 10% travel time, the difference between 5% shorter and 5% longer, came out differently with the B/W and the listings method. The weight also differed between counting and logit estimation of the B/W responses. Anyhow, the value lies between 2% and 7% of the fare. To check if this is reasonable we can think of a journey of one hour costing SEK 100 for second class. This implicates a value-of-time between 20 and 70 SEK/h. For passengers with more expensive tickets, business travellers, the implication of value-of-time is higher. A business ticket can cost 200-250 SEK per timetable hour. This implicates 50-150 SEK/h for business travellers. The results are somewhat low but reasonable.

Having few stops are about as important as 10% travelling time. This high importance again raises the question if at least some of the respondents have formed associations with travel time and construed and included a shorter travel time. If part of this attribute partworth in fact belongs to travel time the somewhat low time value would be higher and more at a normal level, while the fewer number of stops itself would be a little less
important. We have not asked the respondents about their associations and we can't know if this is so.

Two important attributes are change of train and delays, see table.

As usual double train frequency does not come out with a very high value when interviewing passengers already having chosen the train.

The fare type attribute is strictly not a timetable attribute and shouldn't have been grouped together with these. Anyhow the result was unexpected. The preference for a simpler fare type was close to zero, meaning that almost half of the passengers preferred today's fare system.

<table>
<thead>
<tr>
<th>Timetable attribute</th>
<th>B/W count</th>
<th>B/W logit estimation</th>
<th>In per-cent of fare (Σ 37%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel time is longer (+5% + 5min) instead of shorter (-5% - 5min)</td>
<td>12</td>
<td>5</td>
<td>2% - 7%</td>
</tr>
<tr>
<td>Delays are rare instead of one 15min delay every fifth journey</td>
<td>30</td>
<td>27</td>
<td>10% - 11%</td>
</tr>
<tr>
<td>There are twice as many trains as today (instead of same number)</td>
<td>7</td>
<td>12</td>
<td>3% - 4%</td>
</tr>
<tr>
<td>There is one train every hour on the same minute instead of irregular service</td>
<td>8</td>
<td>12</td>
<td>2% - 4%</td>
</tr>
<tr>
<td>No change of train instead of one</td>
<td>27</td>
<td>26</td>
<td>8% - 10%</td>
</tr>
<tr>
<td>Simpler fare but fewer discount prices instead of today's fare</td>
<td>0</td>
<td>-1</td>
<td>0% - 3%</td>
</tr>
<tr>
<td>The train stops at few stations instead of many stations</td>
<td>15</td>
<td>18</td>
<td>3% - 7%</td>
</tr>
</tbody>
</table>

5.2.2 Comfort attributes

The value for the package of the eight included comfort related attributes is 42%.

The estimation results show that all the included comfort attributes are important to passengers even though some are more important. Among the attributes being highly valued are the existence of reclining seatbacks, low shakings and vibrations and 10cm legroom. These are all valued at 8% of the fare or more. Then comes the existence of air condition and low noise level. Dimmed lighting and reading lamps is not so highly valued as the others, but is on the other hand a cheap feature to offer.

Regarding face-to-back or face-to-face seating people have different opinions. Therefore the value of face-to-back in relation to the opposite has come out with a low value in this study.
### Table 20  Relative values of specific comfort attributes in this study

<table>
<thead>
<tr>
<th>Comfort attribute</th>
<th>B/W count</th>
<th>B/W logit estimation</th>
<th>Listing</th>
<th>In per-cent of fare (Σ 42%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your legroom is 5cm greater instead of 5cm smaller</td>
<td>19</td>
<td>18</td>
<td>19</td>
<td>8%</td>
</tr>
<tr>
<td>Face-to-back instead of face-to-face seating</td>
<td>6</td>
<td>7</td>
<td>3</td>
<td>1% - 3%</td>
</tr>
<tr>
<td>Your seatback is adjustable instead of not adjustable</td>
<td>20</td>
<td>19</td>
<td>28</td>
<td>8% - 12%</td>
</tr>
<tr>
<td>More instead of somewhat less shakings and vibrations than in this train</td>
<td>20</td>
<td>19</td>
<td>23</td>
<td>8% - 10%</td>
</tr>
<tr>
<td>Somewhat more instead of somewhat less noise than in this train</td>
<td>11</td>
<td>12</td>
<td>12</td>
<td>5%</td>
</tr>
<tr>
<td>Air condition with cool air in the summer time instead of no air condition but windows to open</td>
<td>17</td>
<td>17</td>
<td>11</td>
<td>5% - 7%</td>
</tr>
<tr>
<td>Dimmed lighting and reading lamps instead of full tube lighting</td>
<td>9</td>
<td>10</td>
<td>4</td>
<td>2% - 4%</td>
</tr>
</tbody>
</table>

### 5.2.3 On-board service attributes

Only five attributes were included in the on-board service package and the package value is 21%.

The most highly valued service attribute is the existence of catering on-board which receives a value of 8% of the fare. After that follows table at your seat.

### Table 21  Relative values of on-board service attributes in this study. (A logit estimation has not been made so far.)

<table>
<thead>
<tr>
<th>On-board service attribute</th>
<th>B/W count</th>
<th>B/W logit estimation</th>
<th>Listing</th>
<th>In per-cent of fare (Σ 21%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is catering on-board instead of no catering on-board</td>
<td>36</td>
<td>37</td>
<td></td>
<td>8%</td>
</tr>
<tr>
<td>Greater luggage space instead of somewhat smaller than today</td>
<td>13</td>
<td>12</td>
<td></td>
<td>3%</td>
</tr>
<tr>
<td>Music/radio outlets at each seat instead of no outlets</td>
<td>4</td>
<td>7</td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>Always staff on-board who can help you instead of fewer staff</td>
<td>21</td>
<td>13</td>
<td></td>
<td>3% - 4%</td>
</tr>
<tr>
<td>Table at your seat instead of no table at your seat</td>
<td>26</td>
<td>31</td>
<td></td>
<td>5% - 7%</td>
</tr>
</tbody>
</table>
An interesting result is that music/radio outlets is receiving a very low value, only 1% of the fare. The reason for this may be that many passengers don't care at all about this feature.

5.2.4 Distribution of attribute valuations

The Best/Worst and listings methods are both based on the fact, or very strong assumption, that peoples preferences differ; different individuals have different preferences. So the valuations of attributes for a number of individuals have some sorts of statistical distributions. The forms of these distributions have been investigated by calculating individual valuations for attributes and then making histograms. The valuations are calculated from individual B/W partworths.

The resulting distributions can be close to or far from the normal distribution. My assumption is that hard attributes like cost and travel time are more close to normal distribution than many of the softer comfort and service attributes.

The distribution shape look very much the same for a number of attributes. Therefore only a few examples will be presented below. The first example is an attribute with a somewhat skewed "normal" distribution. It is the distribution of the weights of one interchange.

![Histogram of interchange weights](image)

*Figure 17 Histogram of interchange weights*

The second example is an attribute with a very skewed distribution, far from normal. It is the distribution of the weights of travel time.
A somewhat surprising finding is that so many respondents weight time close to zero. Of course we must remember that only marginal time changes were presented and that these was compared to other important attributes.

The third histogram shows the weights of fixed timetable. This distribution form is shared by a few other attributes as well.

The histogram has a shape that suggests that it may be the aggregate of two distributions. In this case it may be one skewed distribution on the positive side, for those who like fixed timetable and another skewed distribution for those who dislike this attribute.

The next example is an attribute where people obviously have opposite opinions. It is the distribution of the weights of seat arrangement.
A few people have very strong preferences, here represented by weights, for one or the other arrangement. The average weight is a little higher than zero, meaning that in average people preferred face-to-back seating. The histogram also shows that many passengers had low weights for seat arrangements. These may be called "doesn't matter seaters". The last example is an attribute with two modes. It is the distribution of the weights of on-board staff.

It seems like many people have moderate weights for staff but a distinct segment has high weight for having staff at hand. These may be elderly, but this assumption has not been checked.
5.2.5 Valuations for travelling purpose segments

Weights/valuations have been segmented into work/school, leisure and business travellers.

![Diagram showing valuations for different attributes across work, leisure, and business segments]

**Figure 22** Valuation of the included attributes by different journey purpose segments

Many attributes receive similar valuations, in % of the fare, from the three segments. A few distinct differences can be seen for the valuation of timetable attributes. Work-trip travellers seem to value travel time lower and frequency and few stops higher than the
other types of travellers. Catering is of course also of less interest for work-trippers. Business travellers have the highest relative valuations of comfort attributes but the work-trippers do also pay much attention to comfort attributes.

5.2.6 Factor analysis of the listing experiments

Factor analysis have been conducted on the listings data. Four factors have been used for the seven timetable and for the seven comfort attributes. Three factors have been used for the service attributes. This number of factors imposes that one or two factors will be singular, which is quite uninteresting. Therefore only a selection of factors is presented.

For timetable two factors and the factors' score weights are presented:

Timetable factor 1: Frequency (0.45) and number of stops (0.61).

Timetable factor 2: Delays (0.67) and fixed timetable (0.56).

One can reason about this. There seems to be a factor (1) behind the wish of high frequency and few stops during the journey. It feels to me like some sort of easiness of travelling. The second factor (2) may be interpreted as a need for reliability.

For comfort three factors and the factor score weights are presented:

Comfort factor 1: Shakings and vibrations (0.50) and noise (0.47).

Comfort factor 2: Legroom (0.68) but not air condition (-0.57).

C. factor 3: Dimmed light + reading lamps (0.73) but not face-to-face seating (-0.48).

The first factor reveals that shakings and vibrations and noise belong together. They could preferably be aggregated to one factor in future SP experiments. The second factor has found a factor that influences the individual to like big legroom but at the same time having less interest of air condition. This seems odd to me. The last factor is easier to understand. It may be a factor representing reading and/or resting – to be able to read or rest.

Two on-board service factors are presented here:

Service factor 1: Table at the seat (0.63) but less need for staff (-0.63).

Service factor 2: Music outlets (0.74) but no need for bigger luggage space (-0.61).

It is more difficult to find reasons about this. There seems to be a factor (1) behind the wish of a table at seat but less need for staff. It could represent a type of person. The second factor (2) may be inherent for flexible people carrying a little when travelling.

5.3 Summary of valuations and comparisons with earlier studies

The valuations of the timetable, comfort and service packages were all higher than expected. Earlier findings have shown that the "package effect" reduces the value quite a lot. For example can the valuation of a separate comfort attribute decrease by 50% or more when included in a package. The levels estimated in this study are as high or almost as high as the values that have been estimated in studies with separate attributes.
The valuation results from this study is summarised in the diagram at the next page.

Figure 23 Diagram showing the three package values and how these are divided into specific attribute valuations.

The three packages are valued as 37, 42 respectively 21% of the fare. (These valuations happens to summarise to 100% but this is just a coincidence!) The diagram easily shows what the highest valued attribute swings are, for example "delays are rare instead of
15 min every fifth journey", "not one interchange" (no interchange instead of one inter-
change), "adjustable seatbacks" and "catering on board".

The valuations of the attributes are also shown below.
Table 22 Valuation results from this study with comparisons with other studies.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>This study</th>
<th>Other KTH studies</th>
<th>DSB studies</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timetable</strong></td>
<td>37%</td>
<td>2-7%</td>
<td>6-10%</td>
<td>4-11% Package value</td>
</tr>
<tr>
<td>10%( +10 min) travelling time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No change of train instead of one change</td>
<td>8-10%</td>
<td>9-13%</td>
<td>16-18%</td>
<td></td>
</tr>
<tr>
<td>Double train frequency</td>
<td>3-4%</td>
<td>4%</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>Delays are rare instead of one 15-min delay</td>
<td>10-11%</td>
<td>16%</td>
<td>14-19%</td>
<td></td>
</tr>
<tr>
<td>Regular departure times</td>
<td>2-4%</td>
<td>1-3%</td>
<td>15-21%</td>
<td></td>
</tr>
<tr>
<td>(There is one train every hour at the same time instead of an irregular service)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simpler fare but fewer discount prices instead of today's fare</td>
<td>0-3%</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>The train stops at few stations instead of many stations</td>
<td>3-7%</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td><strong>Comfort</strong></td>
<td>42%</td>
<td>6%</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>10cm legroom (Your legroom is 5 cm larger instead of 5 cm smaller)</td>
<td>8%</td>
<td>6%</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>More instead of somewhat less shaking and vibration than in this train</td>
<td>8-10%</td>
<td>11%</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Somewhat more instead of somewhat less noise than in this train</td>
<td>5%</td>
<td>8%</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Air conditioning (Air conditioning with cool air in the summer time instead of no air conditioning, but windows that open)</td>
<td>5-7%</td>
<td>=10%</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Face-to-back instead of face-to-face seating</td>
<td>1-3%</td>
<td>0-2%</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Your seatback is adjustable instead of not adjustable</td>
<td>8-12%</td>
<td>6-11%</td>
<td>11-13%</td>
<td>DSB study: including comfort</td>
</tr>
<tr>
<td>Dimmed lighting and reading lamps instead of full fluorescent lighting</td>
<td>2-4%</td>
<td>4/11%</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td><strong>On-board services</strong></td>
<td>21%</td>
<td>5-11%</td>
<td>14%</td>
<td></td>
</tr>
<tr>
<td>There is catering onboard</td>
<td>8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music/radio outlets at your seat</td>
<td>1%</td>
<td>2-5%</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>There is always staff to help instead of somewhat less staff than today</td>
<td>3%</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>More instead of less luggage space in the coach</td>
<td>3%</td>
<td>1%</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>There is a table at your seat</td>
<td>5-7%</td>
<td>2%</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>
Most of the values are compared with values from other KTH studies. A few results from the Danish (DSB) studies\(^8\) of interregional and regional trains are also summarised in the table.

The valuation levels are surprisingly similar to those achieved in other KTH-studies in which secondary comfort and service attributes were estimated as separate attributes. Some of the differences in valuation levels may be caused by different attribute descriptions. For example, the noise and vibration attributes described by both "less" and "more", the difference between them, while in the other studies the comparisons have been between "more" and "as today".

The valuations in Sweden and Denmark look similar, with a few exceptions. The small differences for most attributes can be explained by "random" circumstances such as differences in SP design, attribute descriptions, population sampling, travel purposes, length of journeys and so on. The attribute that really differs is the fixed interval timetable. In Denmark, people are used to having this scheduling, when the train travellers in Sweden have been used to checking the timetable before travelling.

\(^8\) Steer, Davies & Gleeve Ltd, *Research to evaluate passenger investment priorities*, (about InterCity services) prepared for DSB June 1986 and *Research to evaluate passenger investment priorities for regional services*, prepared for DSB 1987.
6. Methodological results and discussion

In an earlier KTH study by Lotta Schmidt\textsuperscript{9} various reasons for package effects have been investigated and tested in SP experiments with train passengers. This study supported the existence of package effects and pointed at reasons for them.

The design of this study was made to reduce package effects; the over-valuation normally achieved when using separate attributes. But the result shows almost as high values of the attributes as before. The values of the timetable, comfort and service attribute packages showed up to be high. This made me surprised and a little confused.

So it is not self evident if the result is "good" or "bad". The result supports the old high values, which may be good, but it contradicts the findings made about strong packaging effects, at least for comfort attributes.

The division of the package values on separate attributes were made with different methods, both for collection of the data and for estimation of weights. For most attributes the levels of the weights are similar for the various methods. There is one great exception; the weight for travel time. In this case the B/W collection method combined with logit estimation gave the lowest value (0.05). Then came B/W counting method (0.12) and at the other end the listings method (0.20).

In the other cases there seem to be an expected tendency: The listings method used here gave the widest range, the highest and the lowest values. Especially low weights were underestimated. The logit estimation for B/W data gives values with the lowest range.

The listings method should be modified, for example by letting respondents rank all or most of the attributes in a listing. Than it would closely correspond to the method proposed by Thurstone.

Ordinary pairwise choice SP probably works better with packages than when using them for direct estimation of secondary "soft" attributes. This is otherwise a problem with unlabelled designs. It is probable that the use of packages causes taste variations which approaches normal distribution.

As a whole the methodology has worked sufficiently good with interesting support for two things:
- The earlier obtained rather high valuation levels for comfort and service attributes is supported.
- It should be possible to use simplified methods similar to this one when one want to estimate the value or part-worths for a number of secondary attributes.

\textsuperscript{9} Schmidt, L., Värdeomskning vid värdering av tågkoncept,
The computer interview text, version 1 (in Swedish)

This is the text that was used in the MINT interview system. There were more versions and this is version 1, where the timetable attributes are of Best/Worst type and the onboard service and the comfort questions are of "listings" type.

*FJÄRRTEG - UNDERSÖKNING Stockholm-Malmö (Alvesta)
* studie: "överlappande" faktorer
* ------------------------------------------------------------------------
Q 3 VARIANT
F 0 1
*
Q 0 INTRO
Välkommen till vår intervju om tåg.
Du kommer att få svara på frågor på egen hand
Du svarar med en siffra och trycker på <ENTER>
Utgå från den resan som Du gör just nu.
Tryck <ENTER> för att fortsätta
>
Q 1 KÖN

Är Du ...
A man
A kvinna
>
Q 1 BILJETT
Har du betalat biljetten själv?
A Ja (med egna pengar)
A Arbetsgivaren har betalat
A Skolan har betalat
A Militärbiljett
A Fri biljett
A Annat sätt
>
Q 5 TAXA
Hur mycket kostar biljetten, enkel resa, inklusive ev. platsbiljett?
(Månads/ Årskort: skriv kortpriset)
L 20
H 24000
>
Q 6 RESTID
Hur lång är din restid ombord på tåget?
(alla tåg under resan om Du byter)
OBS!
Tryck <ENTER> efter antalet timmar

L 30
H 1440
>
* Beräkningar av plus och minus attribut
*
*V 5 PRISH
*M PRISH = #TAXA#
*M PRISH P 107
*
*V 5 PRISL
*M PRISL = #TAXA#
*M PRISL P 93
*
V 6 TIDH
M TIDH = #RESTID#
M TIDH P 105
M TIDH +5
M TIDH N 10
*
V 6 TIDL
M TIDL = #RESTID#
M TIDL P 95
M TIDL -5
M TIDL N 10
*
*
*Best-Worst Intervju--------------------------------------
Q 0 BWINTRO
Nu kommer en speciell typ av frågor.
Vi visar ett antal alternativ för tågtrafiken.
*Du ska för varje alternativ svara vad du tycker
*är BÅSrespektive SÄMSmed det alternativet.
Fortsätt- Tryck ENTER!
>
Du ska för de första 8 frågorna svara vad som är
BÄST och för resterande 8 frågor vad som är SÄMST
*Sammanlagt 8 sådana alternativ kommer att presenteras,
*du väljer alltså 16 gånger
Fortsätt- Tryck ENTER!
>*
Q 0 BÄST
Här kommer de åtta frågor där du ska tala
om vad som är BÄST
Tryck <enter> för att fortsätta
>
Q 1 B1
Tåg 1
Tänk dig att du åker med nedanstående tåg:
1.Restiden är längre: #TIDH#
2.Försening ca 15 min var femte resa
3.Det går lika många tåg som idag
4.Det går ett tåg varje timme på samma klockslag
5.Inget tågbyte behövs
6.Biljettsystemet förenklas men färre
   rabattmöjligheter
7.Tågen stannar på många stationer (så att folk
   kan gå av/på)
Vilket av ovanstående tycker du är BÄST?
A längre restid
A förseningar
A lika ofta
A varje timme
A ej tågbyte
A enklare biljetter
A många stopp
>
Q 1 B2
Tåg 2
Tänk dig att följande gäller:
1. Restiden är längre: #TIDH#
2. Försening ca 15 min var femte resa
3. Det går lika många tåg som idag
4. Det går tåg på oregelbundna tider
5. Ett tågbyte behövs
6. Dagens biljettsystem
7. Tågen stannar på få stationer (så att man får en lugn resa)

Vilket av ovanstående tycker du är BÄST eller minst dåligt/ ger mest nytta för dig?

A restiden
A förseningar
A lika ofta
A oregelbundna tider
A ett tågbyte
A dagens biljetter
A få stopp

> Q 1 B3
Tåg 3

Tänk dig att du åker med nedanstående tåg:

1. Restiden är längre: #TIDH#
2. Förseningar är sällsynta
3. Det går dubbelt så många tåg
4. Det går tåg på oregelbundna tider
5. Ett tågbyte behövs
6. Biljettsystemet förenklas men färre rabattmöjligheter
7. Tågen stannar på många stationer (så att folk kan gå av/på)

Vilket av ovanstående tycker du är BÄST?

A längre restid
A sällan försening
A fler tåg
A oregelbundna tider
A tågbyte
A enklare biljetter
A många stopp
>
P
Q 1 B4
Tåg 4
Tänk dig att du åker med nedanstående tåg:
1.Restiden är längre: #TIDH#
2.Förseningar är sällsynta
3.Det går dubbelt så många tåg
4.Det går ett tåg varje timme på samma klockslag
5.Inget tågbyte behövs
6.Dagens biljettsystem
7.Tågen stannar på få stationer (så att man får en lugn resa)
Vilket av ovanstående tycker du är BÄST?
A längre restid
A sällan försening
A fler tåg
A varje timme
A ej tågbyte
A dagens biljetter
A få stopp
>
Q 1 B5
Tåg 5
Du åker med nedanstående tåg:
1.Restiden är kortare: #TIDL#
2.Försening ca 15 min var femte resa
3.Det går dubbelt så många tåg
4.Det går tåg på oregelbundna tider
5.Inget tågbyte behövs
6.Dagens biljettsystem
7.Tågen stannar på många stationer (så att folk kan gå av/på)
Vilket av ovanstående tycker du är BÄST?
A kortare restid
A förseningar
A fler tåg
A oregelbundna tider

53
A ej tågbyte
A dagens biljetter
A många stopp

Q 1 B6
Tåg 6
Du åker med nedanstående tåg:
1. Restiden är kortare: #TIDL#
2. Försening ca 15 min var femte resa
3. Det går dubbelt så många tåg
4. Det går ett tåg varje timme på samma klockslag
5. Ett tågbyte behövs
6. Biljettsystemet förenklas men färre rabattmöjligheter
7. Tågen stannar på få stationer (så att man får en lugn resa)
Vilket av ovanstående tycker du är BÄST?
A kortare restid
A förseningar
A fler tåg
A varje timme
A tågbyte
A enklare biljetter
A få stopp

Q 1 B7
Tåg 7
Du åker med nedanstående tåg:
1. Restiden är kortare: #TIDL#
2. Förseningar är sällsynta
3. Det går lika många tåg som idag
4. Det går tåg på oregelbundna tider
5. Inget tågbyte behövs
6. Biljettsystemet förenklas men färre rabattmöjligheter
7. Tågen stannar på få stationer (så att man får en lugn resa)
Vilket av ovanstående tycker du är BÄST?
A kortare restid
A sällan försening
A lika ofta
A oregelbundna tider
A ej tågbyte
A enklare biljetter
A få stopp

> 
Q 1 B8

Tåg 8

Du åker med nedanstående tåg:
1. Restiden är kortare: #TIDL#
2. Förseningar är sällsynta
3. Det går lika många tåg som idag
4. Det går ett tåg varje timme på samma klockslag
5. Ett tågbyte behövs
6. Dagens biljettsystem
7. Tågen stannar på många stationer (så att folk kan gå av/på)

Vilket av ovanstående tycker du är BÄST?

A kortare restid
A sällan försening
A lika ofta
A varje timme
A tågbyte
A dagens biljetter
A många stopp

> 
Q 0 SÄMST

T

Nu kommer lika många frågor igen, men denna gång frågar vi efter vad som är SÄMST

Tryck <enter> för att fortsätta

> 
Q 1 W1

Tåg 1

Tänk dig att du åker med nedanstående tåg:
1. Restiden är längre: #TIDH#
2. Försening ca 15 min var femte resa
3. Det går lika många tåg som idag
4. Det går ett tåg varje timme på samma klockslag
5. Inget tågbyte behövs
6. Biljettsystemet förenklas men färre rabattmöjligheter
7. Tågen stannar på många stationer (så att folk kan gå av/på)

Vilket av ovanstående tycker du är SÄMST?

A längre restid
A förseningar
A lika ofta
A varje timme
A ej tågbyte
A enklare biljetter
A många stopp

Q 1 W2
Tåg 2

Tänk dig att du åker med följande tåg:
1. Restiden är längre: #TIDH#
2. Försening ca 15 min var femte resa
3. Det går lika många tåg som idag
4. Det går tåg på oregelbundna tider
5. Ett tågbyte behövs
6. Dagens biljettsystem
7. Tågen stannar på få stationer (så att man får en lugn resa)

Vilket av ovanstående tycker du är SÄMST?

A längre restid
A förseningar
A lika ofta
A oregelbundna tider
A tågbyte
A dagens biljetter
A få stopp

Q 1 W3
Tåg 3
1. Restiden är längre: #TIDH#
2. Förseningar är sällsynta
3. Det går dubbelt så många tåg
4. Det går tåg på oregelbundna tider
5. Ett tågbyte behövs
6. Biljettsystemet förenklas men färre rabattmöjligheter
7. Tågen stannar på många stationer (så att folk kan gå av/på)

Vilket av ovanstående tycker du är SÄMST?
A längre restid
A sällan försening
A fler tåg
A oregelbundna tider
A tågbyte
A enklare biljetter
A många stopp

Q 1 W4
Tåg 4
1. Restiden är längre: #TIDH#
2. Förseningar är sällsynta
3. Det går dubbelt så många tåg
4. Det går ett tåg varje timme på samma klockslag
5. Inget tågbyte behövs
6. Dagens biljettsystem
7. Tågen stannar på få stationer (så att man får en lugn resa)

Vilket av ovanstående tycker du är SÄMST?
A längre restid
A sällan försening
A fler tåg
A varje timme
A ej tågbyte
A dagens biljetter
A få stopp

Q 1 W5
Tåg 5
1. Restiden är kortare: #TIDL#
2. Försening ca 15 min var femte resa
3. Det går dubbelt så många tåg
4. Det går tåg på oregelbundna tider
5. Inget tågbyte behövs
6. Dagens biljettsystem
7. Tågen stannar på många stationer (så att folk kan gå av/på)

Vilket av ovanstående tycker du är SÄMST?
A kortare restid
A förseningar
A fler tåg
A oregelbundna tider
A ej tågbyte
A dagens biljetter
A många stopp

Q 1 W6
Tåg 6
1. Restiden är kortare: #TIDL#
2. Försening ca 15 min var femte resa
3. Det går dubbelt så många tåg
4. Det går ett tåg varje timme på samma klockslag
5. Ett tågbyte behövs
6. Biljettsystemet förenklas men färre rabattmöjligheter
7. Tågen stannar på få stationer (så att man får en lugn resa)

Vilket av ovanstående tycker du är SÄMST?
A kortare restid
A förseningar
A fler tåg
A varje timme
A tågbyte
A enklare biljetter
A få stopp

Q 1 W7
Tåg 7
1. Restiden är kortare: #TIDL#
2. Förseningar är sällsynta
3. Det går lika många tåg som idag
4. Det går tåg på oregelbundna tider
5. Inget tågbyte behövs
6. Biljettsystemet förenklas men färre rabattmöjligheter
7. Tågen stannar på få stationer (så att man får en lugn resa)

Vilket av ovanstående tycker du är SÄMST?

A kortare restid
A sällan försening
A lika ofta
A oregelbundna tider
A ej tågbyte
A enklare biljetter
A få stopp

Q 1 W8
Tåg 8
1. Restiden är kortare: #TIDL#
2. Förseningar är sällsynta
3. Det går lika många tåg som idag
4. Det går ett tåg varje timme på samma klockslag
5. Ett tågbyte behövs
6. Dagens biljettsystem
7. Tågen stannar på många stationer (så att folk kan gå av/på)

Vilket av ovanstående tycker du är SÄMST?

A kortare restid
A sällan försening
A lika ofta
A varje timme
A tågbyte
A dagens biljetter
A många stopp

> *

Q 0 SERINTRO
Nu kommer en annan sorts frågor.
Här nedan kommer en lista med
servicefaktorer.
Fortsätt- Tryck <enter>
>
Q 0 SEINTRO2
Först ska du tala om vilka två faktorer som är viktigast för dig och sedan kommer en ny lista där du ska tala om vilka två faktorer som är minst viktiga för dig.
Fortsätt- Tryck <enter>
>
Q 0 SERFORT
Det vi menar med viktigast är det som du skulle ha mest nytta av på en tågresa som denna.

Vi vill alltså veta vad du värderar högst och vad du värderar näst högst av följande faktorer.
Fortsätt- Tryck <enter>
>
Q 1 LS1
Lista 1
1. Servering ombord
2. Sittplatsen har ett bord
3. Alltid personal ombord som kan hjälpa till
4. Större bagageutrymmen i vagnarna än idag
5. Musik/radiouttag i varje stol för hörllurar
Vilken av ovanstående faktorer värderar du högst?
A servering ombord
A bord
A mycket personal
A större bagageutrymme
A musikuttag
>
Q 1 LS2
Vilken av ovanstående faktorer värderar du näst högst?
A servering ombord
A bord
A mycket personal
A större bagageutrymme
A musikuttag

> Q 0 SERSAMS
Nu vill vi veta vilken faktor du
tycker är sämst och vilken du tycker
är näst sämst.
Fortsätt- Tryck <enter>

> Q 1 LS3
Lista 2
1. Ingen servering ombord
2. Inget bord vid din sittplats
3. Färre konduktörer arbetar ombord
4. Något mindre bagageutrymmen
5. Inga musikuttag
Vilket av ovanstående är sämst för dig?
A ingen servering
A inte bord
A mindre personal
A mindre bagageutrymme
A ej musikuttag

> Q 1 LS4
Vilket av ovanstående näst sämst
för dig?
A ingen servering
A inte bord
A mindre personal
A mindre bagageutrymme
A ej musikuttag

> Q 0 KOMINTRO
Nu kommer en ny lista. Den här
gången är det en lista med
komfortfaktorer.
Precis som med förra listan ska
du först tala om vad som är
viktigast för dig.
Fortsätt- Tryck <enter>

> Q 1 LK1
Lista 1
1. Mindre skakningar och vibrationer
   än i detta tåg
2. Något mindre buller än i detta tåg
3. Benutrymmet är 5 cm större
4. Stolarna står mitt emot varandra
5. Plats där man sitter bakom varandra
6. Luftkonditionering med kyld luft på
   sommaren
7. Ej luftkonditionering, öppningsbara fönster
8. Full lysrörbsbelysning i hela vagnen
9. Dämpad takbelysning och egen läslampa
10. Stolarna har inställbara ryggstöd
Vilken av ovanstående faktorer värderar
    du högst?
   A mindre skakningar
   A mindre buller
   A mer benutrymme
   A motsittning
   A bakom varandra
   A luftkonditionering
   A ej luftkond.
   A lysrörbsbelysning
   A dämpad belysning
   A ställbara ryggstöd

> Q 1 LK2
Vilken av ovanstående faktorer värderar
    du näst högst?
   A mindre skakningar
   A mindre buller
Nu vill vi veta vilken faktor du tycker är sämst och vilken du tycker är näst sämst.

Vilket av ovanstående är sämst för dig?
A mer skakningar
A mera buller
A mindre benutrymme
A motsittning
A bakom varandra
A luftkonditionering
A ej luftkond.
A lysrörsbelysning
A dämpad belysning
A ställbara ryggstöd
A dämpad belysning  
A fasta ryggstöd

>  
Q 1 LK4

Vilket av ovanstående är näst sämst för dig?
A mera skakningar  
A mera buller  
A mindre benutrymme  
A motsittning  
A bakom varandra  
A luftkonditionering  
A ej luftkond.  
A lysrörsbelysning
A dämpad belysning 
A fasta ryggstöd

>  

*---------------------------------------------------------

Q 0 PAKINTRO

Nu kommer ytterligare en ny sorts frågor. 
Den här gången ska Du värdera olika "paket" 
av komfort, service- och 
tidtabellsförbättringar. 
Fortsätt- tryck <enter>

>  
Q 0 PAKINTR2

För varje fråga som kommer upp får du två rutor 
bredvid varandra. I vardera rutan finns det en 
alternativ resa.  
Din uppgift är att jämföra de två resorna 
och sedan tala om ifall den vänstra är bäst, 
den högra är bäst eller de båda resorna 
är likvärdiga. 
Tryck <ENTER> för att fortsätta

>  
Q 0 SPELINTRO1
G B 2 SPEL1
G C 4
G L 1 3
V 5 PRIS1
M PRIS1 = #TAXA#
M PRIS1 P 75
M PRIS1 N 10
M PRIS1 - 10
G L 2 2
G 2 1 1 Restiden är kortare: #TIDL#
G 2 1 2 Dubbelt antal tåg, samma klockslag
G 2 1 3 varje timme, inget tågbyte, sällan
G 2 1 4 förseningar, enkelt biljettsystem
* 
G L 3 2
G 3 1 1 Mindre skakningar och buller,
G 3 1 2 luftkond., ställbara ryggstöd,
G 3 1 3 benutrymme +5 cm, läslampor.
* 
G 2 2 1 Restiden är längre: #TIDH#
G 2 2 2 Lika många tåg, tågbyte,
G 2 2 3 förskning var femte resa,
G 2 2 4 dagens biljettsystem.
* 

65
G 3 2 3 benutrymme -5 cm, lysrör i tak.
*
*
G L 4 2
G 4 1 1 Gott om personal, servering,
G 4 1 2 större bagageutrymmen,
G 4 1 3 bord och musikuttag vid varje plats.
*
G 4 2 1 Färre konduktörer ombord,
G 4 2 2 något mindre bagageutrymmen.
*
*
G X 1 Vänster(1)
G X 2 Höger(3)
G R 3
G Y 1 Vänster (tryck 1)
G Y 2 Likvärdiga (tryck 2)
G Y 3 Höger (tryck 3)
G Z 1 1
G Z 2 0
G Z 3 2
*
G O 1 5
G O 2 2
G O 3 2
G O 4 2
*
G M 0
G M 1
G M 2
G M 3
G M 4
*
G H 0
*
*G E 0 1 0 0
*
G >
*-----------------------------------------------------
Nu kommer ytterligare några frågor...
Tryck <ENTER> för att fortsätta

>  
Q 1 ÅLDER  
Din ålder, ca  
A under 19 år  
A 19-25 år  
A 26-45 år  
A 46-65 år  
A 66 år eller äldre  

>  
Q 1 ÄRENDE  
Vilket är resans huvudsakliga ändamål?  
A besöka släkt eller vänner  
A till/från eget arbete  
A till/från skolan  
A tjänsteresa  
A annan fritidsresa  
A annat  

>  
Q 1 OFTA  
Hur ofta åker Du tåg?  
A flera gånger per vecka  
A en/några gånger i månaden  
A en/några gånger om året  
A mer sällan  

>  
Q 1 BRUKAR  
Hur brukar Du göra denna resa?  
A Oftast med tåg  
A Oftast med flyg  
A Oftast med buss  
A Oftast med bil  
A Blandat  
A Gör sällan "denna resa"  
A Annat svar  

>  
Q 0 SLUT  
Tack för din medverkan!
Meddela intervjuaren att Du är klar!