Market Scenarios and Conjoint Analysis

CARLO HJELKREM

Carlo Hjelkrem is Senior Pricing Analyst, Telenor Norway, Consumer

The growing complexity of markets calls for different approaches when searching for knowledge of market dynamics. Conjoint analysis, also called trade-off analysis is such an approach, attempting to mimic respondents' purchase decision through ranking or choosing between levels of different attributes. The methodology allows the analyst to segment the market and feed the results into a market simulator. This simulator may be used to understand the importance of different product attributes, simulate demand elasticities, optimize product portfolios, estimate demand for a given product, make forecasts of the market dynamics, measure brand strength and measure the trade-off between attributes.

We give an introduction to the ideas behind Conjoint analysis and the various steps you need to go through to conduct a Conjoint analysis. A brief overview of the main methodologies of Conjoint, ie. Conjoint Value Analysis, Adaptive Conjoint and Choice Based Conjoint is given. We further give some examples of how Telenor uses Conjoint when modifying existing products, extending the product line or introducing new products.

1 What is Conjoint, What Can We Do With It?

Market researchers often explain the term Conjoint as a quantitative market research technique in which respondents CONsider JOINTly the features of products and services. More correctly, the word Conjoint comes from 'joined together' (to conjoin). Respondents are asked to rank, rate or choose among multiple products or services. Through statistical analysis of the trade-offs made by the respondents, we can estimate the relative importance of the different attributes of the products/services. Thus, it is also called 'trade-off-analysis'. Two terms are central to Conjoint analysis:

Utilities: A measure of the effect each attribute has on product choice, given the range of levels included in a questionnaire. Moreover, utilities help us understand which product attributes/levels influence the 'buy' or 'not buy' decision.

Preference shares: A measure of how consumers choose between different products in specific market situations. These are not to be confused with market shares, which reflect how costumers have chosen historically; in a Conjoint analysis we typically ask the customers to choose again, given the information in the Conjoint. Thus, a company's preference share and the market share may differ considerably in some cases.

Apart from this, Conjoint has numerous applications, such as:

- Optimizing product lines and estimate demand for a service/product under different scenarios
- Estimating price elasticities
- Measuring brand strength
- Segmenting customer bases
- Segmenting the market according to customer needs
- Understanding product preferences
- Forecasting market dynamics.

What Conjoint cannot help us with includes understanding brand image, brand loyalty or brand commitment. Further, it does not allow us to estimate the effects of time to market, distribution, out of stock conditions, advertising, effectiveness of sales force and awareness. All of which should be considered as elements when demand and market shares are issues.

2 Conjoint Analysis Step by Step

The aim of this Chapter is to describe the different phases in a typical analysis where Conjoint plays an important part. Thus, Conjoint is seen in relation to the answers we are seeking and not only as an isolated method. Such a situation could arise when a company wants to optimize its product line, exploit its brand strength or compensate for lack of such, choose new price-points for its existing products or find out what a new product should be like to gain additional market share. The analysis may be carried out by a team of experts, including a product manager with in-depth knowledge of product cost and pricing, a market analyst with in-depth knowledge of the market structures and an experienced Conjoint market researcher. Typically, the first two may be found within the company, while the latter is from an external market research bureau.

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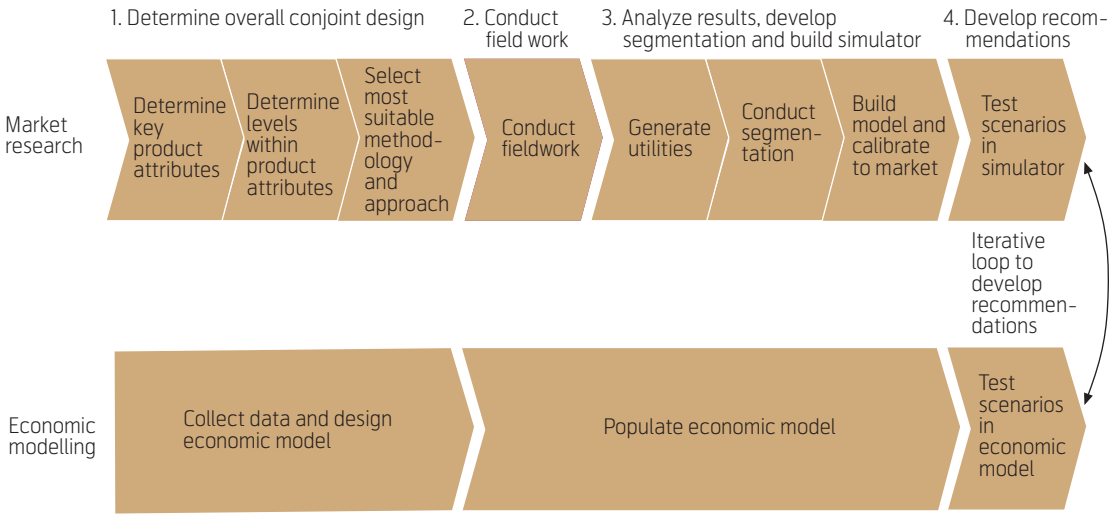

Figure 1 A Conjoint analysis, step by step

Two activities should run in parallel: market research and economic modelling. The latter may be left out but is helpful in seeing the economic consequences of possible actions. This is because some changes may very well increase preference (and market share) of the company's products, and at the same time bring profits down, and vice versa. This may come as a result of the cost structure of the product line and changes suggested by different scenarios: migration from more profitable products to less profitable ones may reduce total profitability.

The first step of the market research is to determine the overall Conjoint design, see Figure 1. This involves a description of the key products and its attributes. For instance for cars, this may be the engine size, what fuel it runs on, brand, the size of the boot, the number of doors, the colour, the price, the age of the car, mileage, etc. This may turn out to be a long list, and at the end we may have to select the most important ones, or the ones that we want to focus on. The number allowed is to some extent limited by the focus of our analysis, the methodology we use, the number of respondents and the number of questions we can ask each respondent. See Chapter 3 for a brief discussion of some of these topics and see [1] for a more in-depth discussion of all of these topics.

Also, in this step we need to know the different levels of the attributes. The relation between attributes and levels is described in Figure 2. If colour is an important attribute for plastic spoons, levels could be white, yellow, blue and red. But if these are the existing colours and we for some reason want to see if eg. brown spoons could help our company gain market share, obviously brown should also be included.

In Chapter 3 we shall learn about the different methodologies of Conjoint and how to choose among them. Although in most cases they narrow down to three, there is no 'One Methodology' that may be used in all cases. Thus, an important step of the Conjoint analysis is to determine which methodology is the most suitable for the problem we are addressing.

In parallel with the Conjoint design an economic model may be designed. For most purposes the focus is on the company that carries out the analysis. This leads to an economic model of the products in question, describing the elements of fixed and variable cost. Connecting this to today's sales and prices will show profits 'as-is'. Simulating changes in different scenarios will reveal changes in profits.

Step 2 is to conduct the actual fieldwork. The questioning techniques of Conjoint are brought to the customers. This may be a representative sample drawn from a population, or a panel that a market research bureau may draw such a sample from. This is not discussed here. For a detailed description of this topic and the number of respondents required, see [1].

When a sufficient amount of respondents have finished the questionnaire, it is time for step 3: analyze the results, develop segmentation and build a simula-

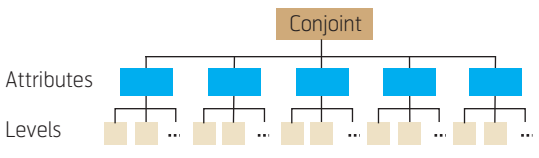

Figure 2 Attributes and levels of a Conjoint analysis

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Figure 3 Price simulations

tor. Here, the utilities and preference shares of Chapter 1 play an important part of the analysis.

The segmentation may be based on cluster analysis, unveiling what groups of respondents focus on when they make their choices. For example, in a Conjoint analysis of the Norwegian TV market, we found these clusters (the actual sizes of the clusters are left out):

- *Price:* This group focuses more on price than all the respondents do on average.
- *Functionalities:* This group focuses more on the equipment that comes with the TV (eg. set top boxes with recording possibilities) than all the respondents do on average.
- *Viewing Experience:* This group focuses more on the choice of channels than all the respondents do on average. They want channels that offer films and sports, the option to choose additional channels on a one to one basis, to order programs/films 'on-demand', and they want HD (High Definition) channels.
- *Value for Money:* This group is, more than the average, also sensitive to price. But at the same time they also want all the pleasures offered in the world of TV, such as those in 'Viewing Experience' and the 'Functionalities' segment. So they may be looking for bargains.
- *Everything in Focus:* This group has average focus on all attributes tested. Thus, it does not stand out in any sense.

	Observed pref. shares in simulator before adjustments	Actual market shares	Resulting adj. factor
Company 1	32.0 %	39.9 %	1.25
Company 2	17.5 %	2.1 %	0.12
Company 3	24.1 %	20.3 %	0.84
Company 4	15.3 %	12.2 %	0.80
Company 5	11.1 %	25.5 %	2.29

Table 1 Calibrating preferences to market shares

Clusters like these and segments based on eg. socio-demographic information from the respondents and their households may be defined into a simulator for further analysis. And the simulator is the tool for any analysis mentioned in Chapter 1. Feeding the simulator with all relevant product information of a specific market, it can measure the preference for all the different products. If brand is an attribute, the preference of respective products may easily be allocated to each brand. By changing the value propositions, the simulator allows us to create scenarios and estimate changes in preferences. Figure 3 illustrates the case of a company's price plans: What price plan will attract most attention from the customers? Different price plans define different scenarios and the simulator will easily reveal the changes in preference shares of a company.

If we want to measure market shares instead of preferences, the preferences of the as-is scenario need to be calibrated to market shares. This is shown in Table 1. Assume Company 1 has a preference share of 32 after modelling a given market (all the products for all suppliers). However, when market shares are observed, Company 1 has a preference share of 39.9. Thus, all preferences of Company 1 should be multiplied by 1.25 to equal the observed market share. In a Conjoint simulator, this is done once and the software takes care of the calculations.

Alternatively, if we have information on the market shares of each product, adjustments should be done on product level.

A warning should be made in this context: High numeric values of adjustment factors may result in overreactions in market share changes when simulating different scenarios. This is because the elasticities of demand connected to each of the products (or brand) are multiplied by the corresponding adjustment factor. Thus, many researchers do not like the idea of calibration and market shares.

We are now ready to test different scenarios in the simulator. In parallel, the economic model mentioned above needs to be fed with all relevant information, leading up to profits for (all) the different products that are influenced by the assumptions of the simulated scenarios. Here too, the assumptions of an 'as-is' scenario is the basis, and the effects of other scenarios are measured as the change from the as-is scenario.

The way forward is now to test as many scenarios as necessary in search of optimal targets. See Chapter 4 for a case study of optimal targets.

3 Introduction to the Three Most Frequently Used Methodologies

Before we leap into the methodologies, it may be a good idea to examine the questioning techniques of Conjoint analysis. In nature, Conjoint analysis resembles any other market research built on questionnaires. But the way in which the questions are presented to the respondent is unique to the methodology. Figures 4 and 5 demonstrate the difference.

Suppose we want to find out how important air pollution is when passengers choose a flight. In a questionnaire, we may be tempted to do as in Figure 4: ask the respondent to state the importance of air pollution when choosing an airline on a scale from 1 to 5, where 1 is 'Not important' and 5 is 'Extremely important'. The result may be as in the bottom part of the figure (no scale shown). But, if we continue by asking how important low price is, we will most probably get a similar importance. The same goes for flight frequency. And so on. In fact, all attributes that affect your decision are in some sense important. Some may show up more important than others, but in most cases the difference of importance tends to be small.

What we need to do is ask the respondents to consider (the most) important attributes joined together (conjoined). In this way, we force them to make the difficult tradeoffs they usually do when they make their choices in reality. Such an example is shown in Figure 5. Here, we place the respondent in a practical situation: He/she is in Munich and needs to go to a meeting in Oslo on short notice. What airline will be chosen when there are three airlines; Golden Wings, Sky Line and Air Shuttle to choose from and their offer is different? Usually, price comes out much stronger in importance in such conjoined choices. And that is only naturally, since there is always a limit to what a person is willing to pay for all the other attributes.

In order to lure out the preferences of the respondents, we need to ask the questions in Figure 5 many times, changing the combination of the attribute levels. There are many ways of doing this, depending on the problem addressed. In fact, as shown in Figure 6 there are a whole host of Conjoint methodologies and combinations of methodologies to choose from. The lines in the lower part of Figure 6 indicate combinations of methodologies depending on the character of the problem we are trying to solve. Moreover, there is no 'one method' that may be used for every problem.

However, three Conjoint methodologies are used more frequently than others. Knowing these, the majority of Conjoint analyses can be solved.

Figure 4 Questioning techniques I

Conjoint Value Analysis (CVA): Consumers are asked to state their preference between two complete product bundles or to rank several bundles. It is used when products can be described by a few attributes, normally up to six. Because of the simplicity of this method, it may be performed without the aid of computers. In [2], CVA accounts for less than 10 % of methodologies surveyed.

Figure 7 illustrates how CVA works. In this case respondents are asked to express their preference between two computers. One is a Toshiba at a price of USD 1200. It has a Premium 3 processor (remember those?), a wide screen, can burn CDs and is lightweight. The other one is a Compaq at a price of USD 1500, with a Pentium 2 processor, a normal size screen, no option for CD burning and standard weight. Of course, the attributes and their levels should be described in detail, so that the respondents know what the difference is between a Pentium 2 and a Pentium 3. And a description of what is meant by 'Wide screen' as opposed to 'Normal size', etc. In this case the preference is done on a scale from 1 (strongly prefer the Toshiba) to 9 (strongly prefer the Compaq).

When respondents are forced to make difficult tradeoffs, we learn what they truly value

- You are in Munich
- You have a meeting in Oslo at 2:00 pm

→ Which airline will you choose?

Golden Wings	Sky Line	Air Shuttle
Flying every hour	Flying every hour	3 flights per day (6,10,19)
Normal seats	Broad seats	Small seats
Snacks	Complete meal	Snacks
Fast check in	Fast check in	Slow check in
€ 390	€ 490	€ 350
High pollution	Low pollution	Low pollution

Figure 5 Questioning techniques II

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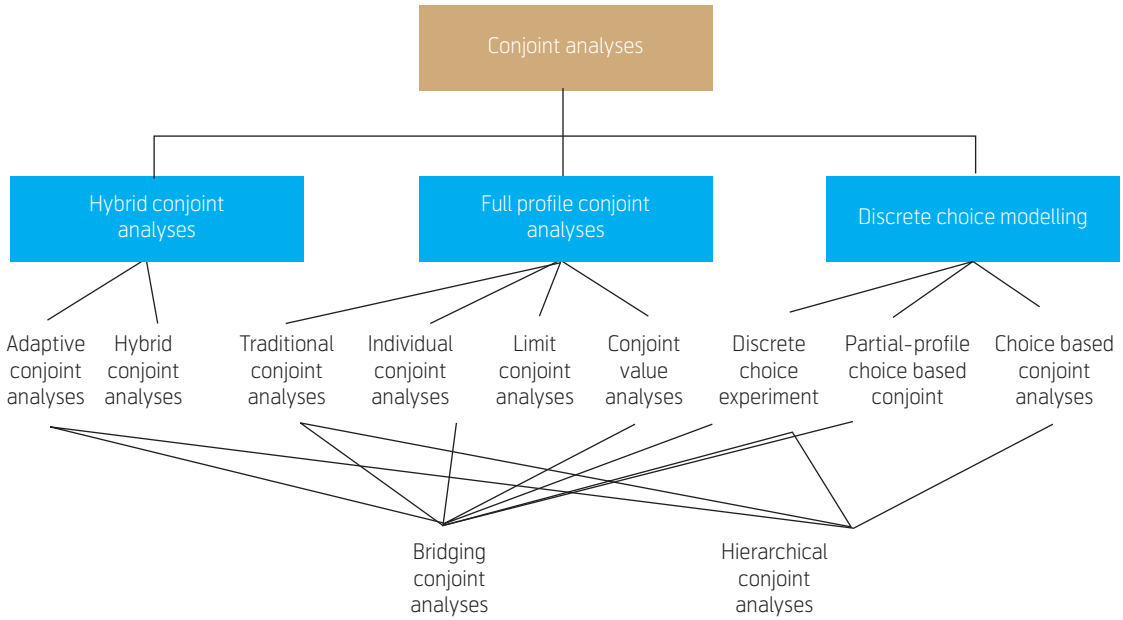

Figure 6 Conjoint techniques

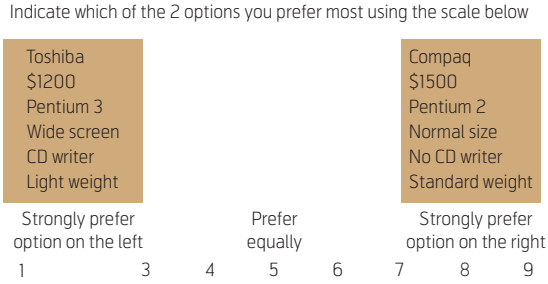

Figure 7 Conjoint value analysis – CVA

Now, intuitively it may seem that the Toshiba represents the best value, since it has a faster processor, a CD writer and is of light weight. But, for some customers Toshiba simply does not make it. They want a Compaq. Or maybe weight is what they value the most? At whatever cost? In a practical Conjoint setting, we also need to toggle around with as many combinations as possible. Not all combinations to all respondents, but enough for us to statistically derive how customers in a defined market make their choices. For more on this subject, see [1].

The CVA method was the first of the Conjoint methodologies, developed in the 1960s and the 1970s. It is simple to conduct, as no computer is needed. However, as the discussions went on, many researchers argued that the simplicity made it unrealistic compared to real situations. Thus, a new methodology called Adaptive Conjoin Analysis was developed.

Adaptive Conjoint Analysis (ACA): Consumers are asked to state their preference between the most important relevant attributes in bundles. It is used when a large number of attributes are needed. Depending on the complexity, up to 30 attributes may be included. According to [2], ACA accounts for less than 20 % of methodologies used.

Figure 8 illustrates the four steps of ACA:
Step 1: For each attribute the respondents are asked to rank different levels of this attribute in order of preference. If, as in Figure 8, the levels of the attribute 'Brand' are Sony, Nokia and Ericsson, the respondents must rank these brands. If another attribute is 'Price', all levels of price must be ranked. And so on for all attributes.

Step 2: The respondents are asked to state how important the difference between the top and bottom level is for each attribute. In Figure 8, a price span of USD 200 is tested for importance on a scale from 1 (very important) to 9 (not important at all). This is done for all attributes.

Steps 1 and 2 allow for the identification of the most important attributes and is used for further trade-off analysis.

Step 3: The respondents rate their preference between two bundled concepts – repeatedly for different bundles. In Figure 8, they are asked to state their preference between a large Nokia at the price of USD 50 and a small Ericsson at the price of USD 150 on a scale from 1 (strongly prefer #1) to 9 (strongly prefer #2).

Step 4: Finally, respondents are asked to indicate the likelihood of purchase for the winning product bundle.

Of all the Conjoint analyses listed in Chapter 4, the TV Market conjoint analysis was an ACA. Here,

Figure 8 Adaptive Conjoint analysis - ACA

price alone was of lesser importance than to gain understanding of the relative importance of 13 other attributes.

The method of ACA was developed in the 1980s. It is rather complex, but at the time this was easily overcome by researchers and academics with knowledge of statistics and computers. It quickly gained popularity over CVA because it was considered more true to real life with its ability to handle many attributes. However, it possesses a weakness regarding its ability to simulate prices and price changes: the importance (utility) of price as an attribute is underrated and thus it is not very well suited for simulating price and price changes. This led way to Choice Based Conjoint.

Choice Based Conjoint (CBC): Consumers choose between different complete product bundles. It is used when the relationship between price and other attributes is important and products can be described by relatively few attributes, normally up to eight (more attributes may be compensated by asking more questions to each respondent or by increasing the number of respondents). According to [2], CBC accounts for more than 70 % of methodologies used.

CBC is illustrated in Figure 9. Respondents are asked to choose their preferred product from a number of alternative product bundles. In this case, a number of cell phones at different prices and sizes. In a new window, other combinations are shown. The option 'I would not choose any' may or may not be used (this is actually debated, but we will not go further into the subject here). The methodology was developed in the 1990s, and as you may see, it resembles CVA. The difference is mainly in the estimation methodology, where CBC uses the powerful method of Hierarchical Bayes (HB) to estimate individual level models from discrete choice data. For more information, see [1]. To do this, powerful software to model CBC was developed.

Even if you cannot include many attributes, this method is considered the most realistic, has the most powerful estimation methodology and yields the best results when price is an important issue.

As price tends to be an important issue, all Conjoint analyses mentioned in Chapter 4 were CBC, except the one on the TV market.

Table 2 sums up the three methodologies.

A few remarks should be made about the possible biases of Conjoint analysis. There are mainly two types of bias that occur:

- *Sampling error:* This is the error that occurs when samples of respondents deviate from the underlying population. For random samples it may be reduced by increasing the samples.

- *Measurement error:* This error occurs because none of the respondents answer all the questions/combinations. This error may be reduced by increasing the number of questions/combinations for each respondent.

In some cases a third error called estimation error may occur. This is the case if we try to estimate a continuous relationship between eg. price and demand based on the point estimates provided by a Conjoint analysis. In general, such errors may be reduced by increasing the number of observations that the estimation is based on. However, this is not possible after having conducted the Conjoint analysis.

Another way to measure the uncertainty of a Conjoint analysis, is to use so-called holdout-data; ie. to hold back a (small) group of respondents and try to predict their choices using the rest of the respondents. According to [1], a well-conducted Conjoint analysis can predict with a hit rate of 75 – 85 % on holdout-

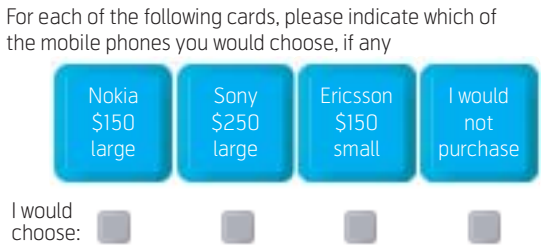

Figure 9 Choice-based Conjoint – CBC

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Methodology	Description	Most frequent use
Conjoint Value Analysis (CVA) 10%	Consumers are asked to state their preference between two complete product bundles or to rank several product bundles	• When Computer based interviewing is not possible • When products can be described by few attributes (up to six)
Adaptive Conjoint Analysis (ACA) 20%	Consumers are asked to state their preference between the most relevant attributes in bundles	• Large number of attributes requiring complex designs (up to 30, depending on complexity)
Choice-based Conjoint (CBC) ca 70%	Consumers choose between different complete product bundles	• When the relationship between price and other attributes is important. Normally up to eight attributes. Considered the most realistic regarding purchase situation

Table 2 Overview of main methodologies

data. Thus, linear extrapolations between point estimates are assumed.

4 Recent Conjoints Performed by Telenor

Telenor has run a series of Conjoint analyses over the past two – three years. Here are some examples, all from the consumer market.

- *Broadband market.* Carried out in the spring of 2006 and again in the fall of 2007. These CBCs were mainly used for repricing of broadband services and product line extensions.

- *Fixed telephony market.* Carried out in the summer of 2006. CBC used for repricing of fixed telephony services.

- *TV market.* Carried out in the spring of 2007. Performed as an ACA to learn about the importance of attributes and to shape Telenor's supply of TV packages

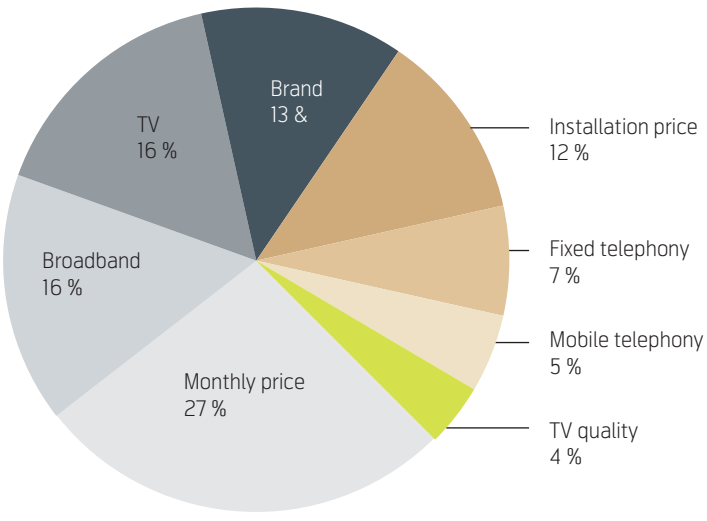

Figure 10 Importance (utilities) of attributes in 4Play Conjoint

- *4play Market.* Carried out in the spring of 2007. Performed as CBC to shape Telenor's 3play and 4play supply. The sample was to a large extent the same as in the Conjoint analysis of the TV market, which made it possible to use results from the TV market Conjoint analysis as input.

- *Mobile broadband.* Carried out in the spring of 2007. Performed as CBC to shape Telenor's supply of broadband services via the cellular network.

5 Examples

In this chapter we give a few examples from some of the Conjoint analyses listed in Chapter 4.

Figure 10 shows the importance of the attributes in the 2007 4play market Conjoint. In this Conjoint, four services where included: Broadband, TV, Fixed Telephony and Mobile Telephony. These services account for 44 % (Broadband 16 %, TV 16 %, Fixed Telephony 7 % and Mobile Telephony 5 %) of the importance when customers buy a 'package' including these services. Prices account for 39 % (monthly price 27 % and installation price 12 %).

Figure 11 describes some of the results of the 2006 Telenor broadband market Conjoint analysis. The target was to increase the speeds of ADSL accesses and make the portfolio more profitable.

The left bar of the graph shows the situation in a base case, before any speed increases. The different colours of the graph are assigned to the different accesses (Mini, Basis, Pluss, Extra and Max). The first step is to increase the download speed of the Mini access from 750 kbit/s to 1000 kbit/s, the download speed of the Basis access from 2000 kbit/s to 2500 kbit/s and the download speed of the Pluss access from 3500 kbit/s to 4000 kbit/s. All other elements unchanged, these actions will increase preference share (from 48.1 to 53.2) and the contribution

(profits) is increased by NOK 4.6 million. The next step was to further increase the download speed of the Mini access to 1500 kbit/s. This will create downwards migration from the Basis access to the Mini access, and is therefore a less attractive financial alternative, even if it increases overall preference share. The third step was to further increase the download speed of the Basis access to 3000 kbit/s. This increases the overall preference share but is also a less attractive financial alternative. Of course, these effects are based on the assumptions that no counter moves are made from any competitor. Also they show the full annual effect of the described speed changes. In practice, a transition period calls for more dynamic modelling.

The 2006 Telephony Conjoint Analysis carried out a simulation of the fixed telephony market (not shown). The target was set as follows: change the price of installation fee, monthly fee, per minute fee and per call fee in such a way that profits are increased but has minimum impact on market shares. And the recommendations based on simulations proved this was feasible and not 'mission impossible' (detailed information withheld).

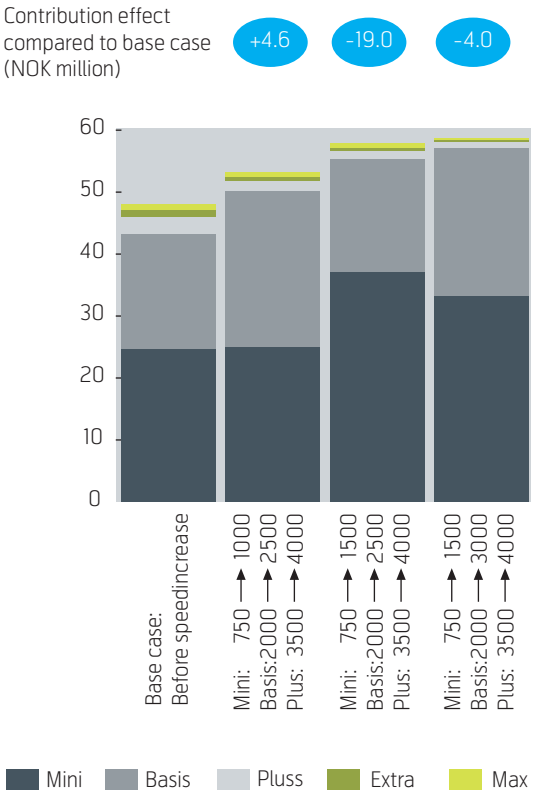

Figure 11 2006 broadband speed example

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Carlo Hjelkrem is a Senior Pricing Analyst, working in the Pricing Group at Telenor Norway, Consumer. His work has since the late 1980s been related to forecasting in the telecom sector. Among other things, he has been responsible for broadband access demand forecasting. Currently, he is concentrating on strategic pricing and the demand effects of different price structures. Before joining Telenor, he worked for Bell Canada and Norwegian Telecom in various capacities. He has published several articles in the area of forecasting in the telecom market. He has made presentations at various conferences and holds a Master of Economics from the University of Oslo.

carlo.hjelkrem@telenor.com

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