Dynamic pricing of ski passes

How does crowdedness in slopes affect skiers' willingness-to-pay and the optimal price of a ski pass

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I would like to dedicate this thesis to my loving parents . . .

Declaration

I hereby declare that thesis is my own work and where specific reference is made to the work of others, the contents of this thesis are original and have not been submitted in whole or in part for consideration for any other degree or qualification in this, or any other university. This thesis is my own work except as specified in the text and Acknowledgements.

Torgeir Vikane Stemsverk
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Abstract

This thesis use choice experiment to value consumers willingness to pay (WTP) for ski passes and contribution maximizing prices for ski resorts in the Inland region of Norway. Respondents consisting of total 346 where asked to choose between hypothetical scenarios with different attributes and prices. Logit and conditional logit models where used to estimate the utility customers receive in ski resorts under different scenarioes. The receieved utility measures include different weather scenarios, crowdedness in slopes, weekday and different alpine ski resort. Using conjoint analysis these attributes determinate consumers preferences when purchasing a ski pass. Based on the part-worth utilities derived from the conjoint analysis a market simulation was run to obtain market share for different level of crowdedness and the studied ski resorts. We came up with data points that where representing a demand function. We used the logistic function to interpolate the demand function, and we where using explicit the logistic function to estimate demand for an particular price level. Using Solver in MS Excel we came up with recommended contribution maximizing prices under different levels of crowdedness for the three studied ski resorts.

Additionally, this thesis reveal characteristics that have significant effect on the willingness to pay for ski passes.

We find that, at parity with price and customers preferences, the average consumer is willing to pay NOK 262 less when it very crowded slopes compared to not crowded slopes. Additionally we see that customers are willing to pay NOK 118 less when visiting Skeikampen ski resort compared to Hafjell ski resort , and NOK 155 less when visiting Sjusjøen ski resort compared to Hafjell ski resort.

This thesis is a part of Innovative Pricing Approach in the Alpine Skiing industry (IPAASKI)[1], a research project studying how to develop and implement innovative pricing schemes in the Alpine skiing industry.

Keywords: Conjoint, Conditional logit, logit, Willingness to pay, Ski pass, optimization, discrete choice

[1] More information about the iPaaSki project can be found at www.ipaaski.com

Table of contents

List of figures

List of tables

Nomenclature

Roman Symbols

b_m Coeffcient of monetary variable

b_{nm} Coefficient of non-monetary variable

Greek Symbols

α Parameter a for logistic regression

β_n Coefficent of attribute

b Parameter b for logistic regression

Acronyms / Abbreviations

$MWTP$ Marginal willingness to pay

WTP Willingness to pay

BFGS Broyden–Fletcher–Goldfarb–Shanno algorithm

C Crowdedness

CBC Choice Based Conjoint

CV Contingent valuation

iPaaSki Innovative Pricing Approaches in the Alpine Skiing Industry

m/s Metre per second

MRS Marginal rate of substitution

NOK Norwegian Kroner

NSD Norwegian center for research data

PRF Price Response Function

Chapter 1

Introduction

1.1 Background

Europe is the largest market for alpine skiers with about 200 million skier days a year (Skistar, 2017). With millions of paying skiers every year, the skiing industry is a big business. In Norway we have over 200 ski resorts and more than 600 lifts (Vanat, 2019). From the smallest, who only have a few slopes to the largest ski resort, Trysil with 67 slopes. The majority of the biggest ski resorts income comes from the ticket sales of ski passes (Konu et al., 2011; Skistar, 2018). Most of the ski resorts in Norway are situated in the Inland region of Norway that accounts for approximately 18% of all ski resorts in Norway (Alpinanleggene, 2018).

Winter tourism contributes significantly to the Norwegian economy (Malasevska, 2017a). Still the alpine industry faces challenges that impact the profitability. Challenges such as less snowfall, temperature changes, changes in leisure preferences and a highly competitive environment can have a negative effect on the winter tourism generally, and alpine skiing in particular (Gonseth, 2013). Even though it is believed that snow making technology will be enhanced, snow making cost might increase over the next decades because of climate change (Steiger and Mayer, 2008). Because of these challenges ski resorts must invest in expensive snowmaking facilities and highly expensive ski lift infrastructure to meet the competitive environment. These expenses adversely affect the operation of the ski resorts and ski resorts must find other innovative ways to overcome these expenses. While there still have been an overall increase of skier visits the last four seasons in row (Vanat, 2019), nothing will last forever.

1.2 Problem statement

The employers of a firm could be pioneers in product development, marketing, finance an put strong emphasis into these fields, but they are missing important opportunity for value capture (Hinterhuber and Liozu, 2014). Competitive businesses are rapidly changing their strategies to win customers and be profitable. Firms experience a enhancing competitive environment and their interest to be more innovative has become more and more intense and serious. Especially after the evolution of internet we have seen new business models which has opened a range of possibilities using advance technology as a strategy to compete in the market. However, not all industries do explore all the benefits of how we can use this technology as a competitive tool and enhance customers. A much overlooked strategy tool is the use of innovative pricing as a competitive advantage (Hinterhuber and Liozu, 2014). For a firm, innovative pricing might be the most powerful tool as a competitive advantage, and those firm that actually taking innovative pricing seriously are the most successful companies that outperform competitors significantly (Hinterhuber and Liozu, 2014). Still innovation in pricing are neglected and there are just 5% that implement innovation in pricing (Hinterhuber and Liozu, 2014). The underlining driver for superior profitability and high level of customer satisfaction for one of the most disruptive companies in recent time is that these companies are applying innovation in pricing (Hinterhuber and Liozu, 2014). For a long time, ski resorts has changed their strategies entirely based on decisions from the management team. The management team do might not take pricing as serious as other activities, which can result in big losses for ski resorts in general. As a result of technological development, ski resorts might loose their competition if they maintain a price scheme that has been outdated.

Skiers skiing experience and satisfaction is an important factor that influences the overall decision of destination and intention to re-visit (Kozak and Rimmington, 2000). Long waiting times for lifts and crowdedness are major sources of dissatisfaction for skiiers and are also a reason why people do not visit ski resorts in the first place. Skiers wants to avoid waiting time for lifts and make the most out of their investment. The level of crowdedness in the slopes could be uncertain. One day, customers might experience highly crowded slopes which is not seen in advance.

Across ski resorts there may be several factors that influence the choice of the customer to choose that particular ski resort. There is expected that some characteristics may be more important than others at specific areas. For example, ski resorts that are located nearby big cities may be more applicable of dynamic pricing since people living nearby these resorts have the opportunity to ski on a day and still be able to return home before the evening (selling one-day passes). It is assumed that those people who are living within a 1h drive from the resorts might be more more willing to enhance their skiing if they where offered cheaper prices of ski passes compared to people living further away from the ski resorts.

We would like to study if price could be used as a tool to compensate for the dissatisfaction and increase the received utility, making skiiers more willing to revisit the resort and make more profit for the ski resorts in the long run. We would like to estimate how much we have to decrease the price for a ski pass to make levels of crowdedness indifferent from each other and therefore enhance loyal customers and their intent to re-visit.

1.3 Earlier research findings

Crowding and queues at ski resorts are something that matter for choosing a particular ski resort for a customer. Queue lines for lifts are important factors that determines people choices for choosing between ski resorts or attending other leisure activities. In ski resorts we can have to "types" of congestion. Queues and waiting time for lifts are a result from how many people who are trying to board the lift, while crowdedness is the experience of congestion people face while their make their way down from the mountain. There are several authors that have studied effect of the these types of congestion in ski resorts. For example, some authors such as (Hudson and Shephard, 1998; Won and Hwang, 2009) has studied the impact of queue lines on in ski resorts, while some authors (Fonner and Berrens, 2014; Walsh et al., 1983; Wyttenbach et al., 2012) have studied implicit on crowdedness in slopes. Even though some studies show that congestion is not strongly correlated with ski pass prices (Barro and Romer, 1987), other studies such as (Walsh et al., 1983) find that congestion is positively correlated with WTP for ski passes if customers are living further away from the relative ski resorts. The impact of crowding can either have a negative or a positive effect on the demand and so the impact of crowdedness on demand and profit is not fully understood.

Earlier research has examined how different ski resorts characteristics has as a affect on ski passes prices (Falk, 2008; Pawlowski, 2011; Wolff, 2014). Those studies have mainly studied major ski resorts in Europe and cannot directly be compared to the minor ski resorts in Norway which usually has limited capacity and ski runs (Malasevska, 2017b). There is studies that show that customers are willing to pay less to avoid crowdedness (Walsh et al., 1983). Moreover, it is expected that customers at some ski resorts are willing to pay more to avoid crowdedness at other ski resorts because of ski resorts characteristics. Study by Walsh et al. (1983) find that skiers at large ski resorts are more tolerant of crowdedness compared to smaller ski resorts. In this thesis we would like to study how we can use price as a tool to mitigate the crowding problem, both to increase the satisfaction and intend to visit and revisit. At ski resorts, queue is almost a norm and we have to expect waiting time. Still there can be relative empty slopes or vice versa. Earlier studies have used several different methods to measure congestion effect on demand. Such as measuring; skiers per acre or waiting time for lifts. Even though these can give some good results, they can be misleading of customers actual preferences. Some interesting study by Needham et al., 2004 reveal customer preferences towards crowdedness at ski areas using pictorial representation of the ski area. However, the study are in a summer setting and can not be generalized to winter time.

There are many studies of WTP for sports, recreation and leisure activities. Yet, there is limited research of WTP for alpine skiing activities. Some interesting research of WTP in alpine industry is done by Walsh et al. (1983) who have studied the WTP for new and expanded ski area and the effect on WTP for ski passes with crowdedness, (Falk, 2008) who have studied WTP for ski passes with different characteristics, (Malasevska, 2017a) who have estimated WTP for ski passes under different weather scenarios, and (Malasevska, Haugom, and Lien, 2017) that have estimated WTP for ski resorts with different characteristics. However, the use of choice based conjoint (CBC) analysis to estimate WTP in the skiing industry has been done in lesser extend.

A variety of past literature have studied the consumers preferences when buying ski passes. They have generally included attributes related to comfort, accessibility, price, and ski area characteristics. However there have been little research about how much value these attributes influence willingness to pay for ski passes under different conditions. Given the common participation that customers are willing to pay less when comfort are decreased, research is to be done to study if a more effective and dynamic pricing can help maintain or increase demand and profitability. There are different ways in which prices of ski passes can be made variable. Prices can differ in form of weather conditions, snow condition, crowdedness, waiting time, day of week and more. Yet, the price structure has been relative non-dynamic. Various conditions have various value for customers. It is therefore more likely for customers that willingness to pay (WTP) will differ under various occasions. The prevalence of unvarying pricing is possibly contributing to market inefficiency (Orbach and Einav, 2007).

1.3.1 Knowledge gap

Although its known that crowding is an important factor for customers satisfaction and experience, there is limited knowledge regarding how ski pass prices can be used as a tool to enhance experiences for the customer and profit for the ski resorts under different level of crowdedness.

Therefore, it would be interesting to study the consequences of dynamic pricing towards different level of crowdedness in more detail, in order to better understand the nature of the relationship between these two and under what kind of level of crowdedness does influence customers choices and give most profit to the ski resorts.

1.4 Research question

The main research question of this thesis is: *"How does crowdedness in slopes affect skiers' willingness-to-pay and the optimal price of a ski pass?*

I will examine this research question using data from three major ski resorts in the Inland region of Norway.

1.5 Purpose of research question

This research question is set out to better understand the relationship between crowdedness, prices and customers satisfaction. By first estimate what level of crowdedness customers prefer, we can estimate what prices customer prefer to each level of crowdedness.

The purpose of this thesis is to understand how new and innovative pricing strategies such as variable pricing would impact customers choice of ski resorts. The question is related to how the demand influences against variable pricing. As a result of implementing variable pricing we would like to understand how heavily the price would affect customers choices, and also how the customers are willing to change their habits and preferences as a result of implementing variable pricing.

For some, the most interesting outcome of this research will be to get to know which crowdedness level will give the most value to a customer and how much ski resorts should lower their ski pass prices to the different levels of crowdedness to give their customer a "fairer" price and at the same time enhance ski resorts profitability.

1.6 Organization of the paper

In chapter 1 the introduction of the thesis and the background information are introduced. In chapter 2 the theoretical framework is presented. Chapter 3 present and describe the methodology that is used in this thesis. Chapter 4 present descriptive statistics and results and discussion of the models that is used in analyzing the customers preferences and the optimal price. Chapter 5 provide limitations, conclusion and future directions.

Chapter 2

Theoretical framework

2.1 Review of litterature

The theoretical framework has intention to define the frame of existing theory I would like to use in this thesis. This chapter takes to account the theory linked to ski passes pricing. In this chapter we will address the basics of price optimization with price response functions and willingness to pay.

2.2 The market

For a firm it is important to know which market you are operating in. The market structure expresses the demand and competition a firm is situated in. In the Inland region of Norway we have several ski resorts that differ from each other. Some resorts are more preferred than others because customers own cabins that are close by and therefore make it an easier for them to access the resorts. While others might prefer particular ski resorts because of availability of public transport. Customers might have dozens of reasons to choose a particular ski resort.

2.3 Pricing theory

Determining the price of a product or service might not be a simple task. The price should not be so low that it will make losses for the provider, neither should it be so high that customers would ditch the offer because of the difference between received value and the price. The problem of giving the right price to the customer has led to several methods of pricing techniques.

Cost-plus pricing

One of the most common techniques of pricing is cost-plus pricing. Cost plus pricing is calculated by the cost of producing a product or providing a service and with added standard margin to make a profit of the sale. Some of the weakness with this method is that the cost of a unit changes accordingly with the volume that is produced. Even though the cost-plus pricing is perhaps the oldest and the simplest pricing technique, it does have several flaws. It does calculate price without taking into account what customers might or might not willing to pay for a good or service. Some of the firms still do feel comfortable using this approach because they do not have enough knowledge about the market demand and the marginal cost conditions (Hanson, 1992).

Market based pricing

The flaws of cost-plus pricing are widely recognized that it is not focused on the market conditions. Market-based pricing do set the price on what other firms in the market do. Businesses will then set the price according to the offered price of competitors prices. This is very popular in the commodity market, where the firms can set the price of a product e.g. 1$ lower than the competitor on the ability to sell more units (Phillips, 2005). Small firms that are entering a new market do also benefit from this strategy as they can introduce their prices always a percentage lower or higher than the competitors.

Value based pricing

Price should relate to what customers perceived value of a product. Therefore, understanding the customers perspective towards the product would be essential to find the answer on what the value of value of the product is for the customer. Value is the utility the customer receives from buying a good or a service. The creation of consumer surplus is created with the difference between the market price and the value of the product (Phillips, 2005). Value based pricing are usually used to estimate a price using methodology such as customer surveys, focus groups or conjoint analysis to estimate how much customer value a product with different characteristics (Phillips, 2005). Value based pricing could be defined as setting different prices based on the value the customer perceives when buying a product. Therefore, what each customer is willing to pay reflects the value derived from the offering. The intent of using value based pricing is to be more competitive and profitable than the use of simpler methods such as cost-plus pricing and market-pricing which do not pay sufficient attention to the customers needs and requirements (Hinterhuber, 2004). However, even though value based pricing is seen as superior to all other pricing strategies (Hinterhuber, 2004), the use of this method has been used in less extend in the tourism industry generally (Malasevska, 2017b).

Consumer behavior

As mention earlier the studying of WTP and customers behavior in buying ski passes has been covered in a lesser extent. The customer choice is depended on their ability to achieve maximum utility when choosing between alternatives. This corresponds with the theory of consumer behavior by the fact that customers would act rationally. Customers will almost always choose their alternative that would give them the highest surplus (Phillips, 2005). The utility may be different under different circumstances. Customers can receive different value under different circumstances and the provided service. For instance, different ski resorts offer different characteristic that would affect the perceived utility. For some, good weather and snow conditions may be in high value for a customer and will therefore influence the buying behavior of the customer. For others, they might value ski resorts characteristics such as available restaurants, family friendly areas, short queues and so one more highly. Identifying the consumer behavior and decision making is important to identify human preferences and understanding how pricing systems could enhance firms profitability.

2.3.1 Demand and price response functions (PRF)

Phillips (2005) define the price response function as *"demand for the product of a single seller as a function of the price offered by that seller."*

One of the fundamental inputs in pricing and revenue optimization is the demand and the price response function (PRF). Even though demand function and price-response-function are very similar, in the way that they both explain how the demand change accordingly to the changing of price, the demand curve shows us the change in price accordingly to the entire market. The price response function model on the other hand show us the change in demand in a market segment. Therefore, there will be only one market demand curve, but there can be several price response functions for each combination of product, segment and channel for the seller. Different quality of the product, provided service and marketing activities will have different PRF (Phillips, 2005).

The price-response function shows us how many more potential customers or sales a particular seller would have if price is lowered or how many sales customers would lose if the price is raised. In the perfect competitive market the price response is a vertical line at the market price. If the seller price his products above the market price, he would lose his demand for his products to 0. If the seller is pricing his products below the market price, his share would be equal to the whole market.

However, we do not live in a perfect competitive market. The demand for a product can be a result of decision made out of a thousand or perhaps millions of potential customers (Phillips, 2005). To some degree there are usually a smooth response of the price. As the price increase, demand would decline and would eventually reach zero at the satiating price level.

The price response function can directly be linked to customers willingness to pay. To understand the customers buying behavior we need to model their willingness to pay (WTP) for the specific product or service that is provided. The willingness to pay for a customer is the maximum price a customer has in mind to pay for a product (Phillips, 2005). E.g. a skier with WTP of NOK 350 for ski passes would pay up to NOK 350 for ski passes, but would withdraw from the purchase if the price is NOK 351 or above. If the price is far below WTP it would create consumer surplus and the firms profitability would diminish (Phillips, 2005). The willingness to pay distribution can be defined as $w(x)$ with the fraction of the potential population that has willingness to pay between $p1$ and $p2$:

$$\int_{p1}^{p2} w(x)dx \tag{2.1}$$

Where $w(x)$ can only have values ranging from 0-1. Indicating that the value $w(x) = 0$ describes a situation where no one would buy the product, and $w(x) = 1$ where everyone wants to buy the product at the given price x.

Given that the market size corresponds to the demand when a good or service is priced at zero, the PRF can be derived from the WTP distribution:

$$d(p) = D\int_{p1}^{p2} w(x)dx \tag{2.2}$$

Here we get the maximum available demand achievable. The function consists of two parts: (1) the market share or demand D, and (2) the willingness to pay distribution. We can derivate the price response function $d(p)$:

$$d'(p) = -Dw(p) \tag{2.3}$$

As a result, we get a nonpositive which is required for a downward-sloping demand curve. Vice versa we can derive the WTP distribution from the PRF function as:

$$w(x) = -d(x)/(0) \tag{2.4}$$

Stated preference

We can estimate WTP using several different methods. Breidert et al. (2006) divide the estimation methods into following categories: market data, experiments, direct surveys and indirect surveys. Each method has their own drawbacks and advantages. One method is to ask customers directly as an open-ended question, another method is using a more indirect approach such as choice based conjoint (CBC) analysis (Miller et al., 2011). When we are measuring willingness to pay it is important to collect data using the most realistic method as possible (Miller et al., 2011). CBC analysis is a method where people have to choose between realistic options of different products that could occur in daily life buying settings. In this thesis the WTP estimation has been done using indirect approach, CBC analysis. All methods have their advantages and disadvantages. Due the fact of monetary and time constrains, experimental methods would have been difficult in this research. Therefore, this research would only assess hypothetical measures of WTP for ski passes. CBC analysis is a popular method used to measure peoples WTP. The essential characteristics behind CBC analysis is that it facilitates to replicate a realistic situation that the respondent can choose between different options. CBC analysis draws out customers preferences for a product attributes and price by making customers choose between different options or no purchase option repeatedly. The option that the customers have chosen give us information that will make it possible to estimate customers utility of each attribute, the price and their willingness to pay (Gensler et al., 2012). Using this method, the respondents have to choose between several alternatives that gives them most utility. Even though none of the methods would be totally trustworthy because of technical and physiological reasons, Miller et al. (2011) argue that CBC analysis still can give us the right demand curves and pricing decisions. The intercept of the demand curve might be largely biased, but the slope is usually not, which indicate that the method still will give reliable results and consistent ranking of the attributes that is presented in this thesis.

Measuring WTP

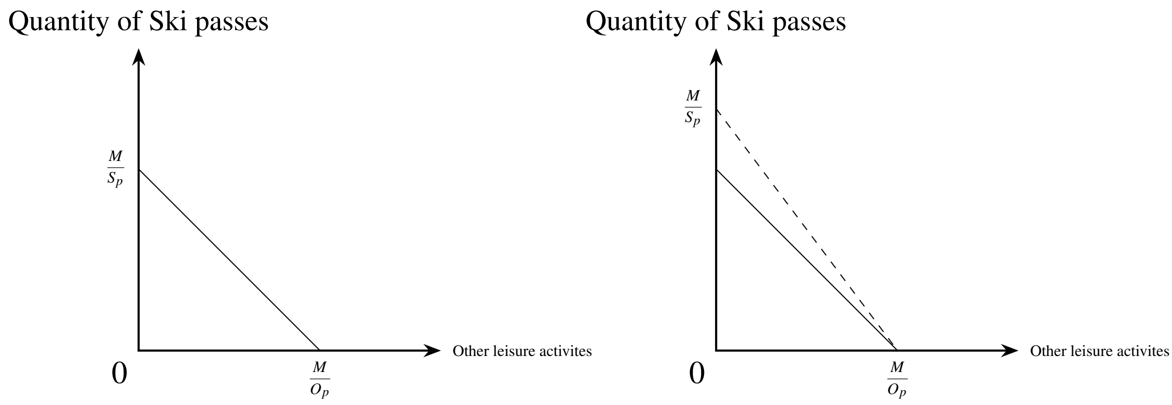
The contingent valuation method is telling us what customers hypothetically are willing to pay for a product, but this does not always correspond with the actual buying behavior. For example, in the use of contingent valuation method, respondents might say they are willing to pay for a good such as a ski pass when they will in fact not do so if they where in a real buying setting. The contingent valuation method has found to be poor in terms of valuating single attributes in a multi attribute good (Kuriyama and Ishii, 2000). However, this biases could been mitigated by providing more information and design experiments that mimics a real buying situation. Conjoint analysis is such a method where the respondent has to choose between alternatives that represent realistic situations. CBC analysis draws out customers preferences for a product attributes and price by making customers choose between different options or no purchase option repeatedly. The alternative that the customers have chosen give us information that will make it possible to estimate customers utility of each attribute, the price and their willingness to pay (Gensler et al., 2012).

Price response and WTP

Potential skiers would only buy ski passes if the ski pass price is below his maximum limit. If there are change in circumstances at ski resorts, WTP is believed to change. We can assume that a customer might be willing to pay less when there are more crowded slopes. As Phillips, 2005 mention that WTP assumes that customers are only doing a one single purchase. Even though this theory is reasonable assumption for durable goods and expensive products, this might not be the cause of ski passes because cheaper prices of ski passes could also cause customers to buy ski passes more frequently.

Budget constrains

Customers have limitations for using leisure activities which can be viewed in a budget. People have limited annual income, and we can assume that a customer would spend their money choosing between two alternatives; ski resort or other leisure activities. A customer can have an annual income of M and we can assume that the customer would like to use all their budget choosing between two activities. This can be illustrated with a budget line:



(a) Budget line (b) Decreased price of ski passes

Fig. 2.1 Budget lines

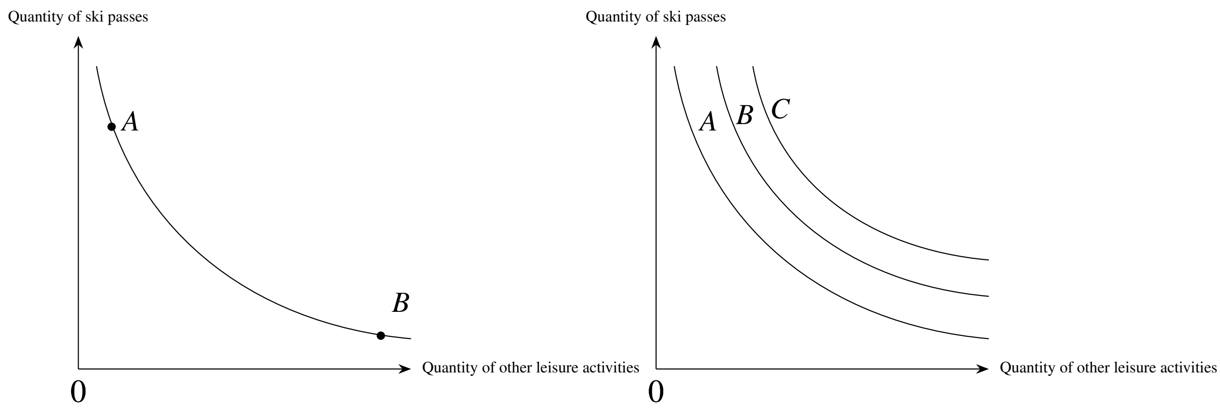
Customers budget constrains between buying ski passes or consuming other leisure activites.

Where M is the annual income, S_p is the price of ski passes, and O_p is the price of other leisure activities. This will give us a budget line that goes from $\frac{M}{S_p}$ to $\frac{M}{O_p}$ that is illustrated in Figure 2.1a. If we assume that the price of ski passes decrease, customers will be able to buy more units of S_p (ski passes) contributing to a steeper budget line as illustrated with dashed line in Fig. 2.1b. Notice that a change in income will also affect the budget line making the budget line shift towards right.

The logic in consumer behavior is that *"people choose the best things they can afford"* (Varian, 2014, p. 33). The complete list of what is involved in customers choice behavior can be a long list, and the features a leisure activity could offer can be viewed in a bundle of features. To maximize customers bundle, the bundle must be (1) located on the budget line and (2) give the most preferred combination between the activities. This would be the optimal choice or the market basket. Reducing the ski pass price would have two effects: The price of ski passes would be cheaper in relative to other leisure activities, and the cheaper price would make it possible to buy ski passes more frequently.

2.3.2 Indifference curve

The customer choice can be viewed in indifference curves. The indifference curve shows us a representation of all combinations that will give the same person the same satisfaction. The customer would have the same satisfaction if he has to choose between point A or B in Figure 2.2a. Point A gives more units ski passes, whereas point B gives more units of other leisure activities at the same level of satisfaction.



(a) Indifference curve (b) Indifference map

Fig. 2.2 Consumers choice: Indifference curves

The graph illustrates the different consumptions between ski resorts and other leisure activities. Crowdy slopes and bad weather are some unfavorable factors that are assumed to reduce the utility of skiing. By lowering the price of ski passes which can be done due to bad weather or crowded slopes, the ski resorts may be able to sell equal number of ski passes or more.

2.3.3 Indifference maps

Combination of a customer preferences can be viewed with a set of indifference curves called a indifference map. Figure 2.2b illustrate example of indifference curves *A*, *B* & *C*. The indifference map show us how change in quantity or type of selection between two goods may change the consumption pattern.

Customers would like to choose the indifference curve that will give them most satisfaction. The highest level of satisfaction is given to the curve that is most to the right and in this illustration is curve *C* in Figure 2.2b

2.4 Consumers choice

The consumers choice is based on the economic theory that tells us that people choose the best bundle they can afford (Varian, 2014). The professional description is described by Varian (2014, p.73) as *"consumers choose the most preferred bundle from their budget sets"* The budget set and consumers indifference curves can be illustrated in the same diagram. The intention is to find the bundle in a budget set that is on the highest indifference curve, which would give the customers the optimal choice. The optimal choice for a customer is when the indifference curve touches the budget line, this would be the best bundle that the customer can afford. Where the slope of the indifference curve is equal to the budget line is illustrated with point *A* in Figure 2.2b.

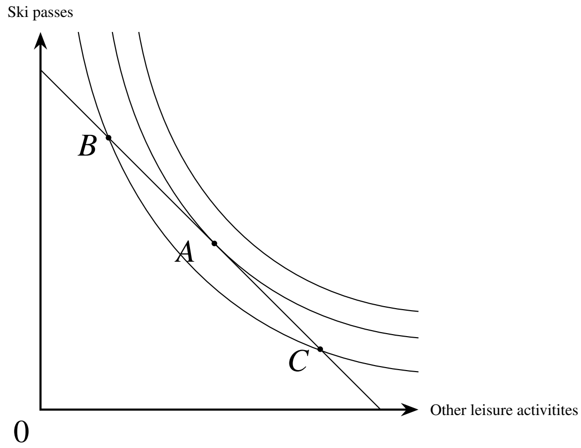


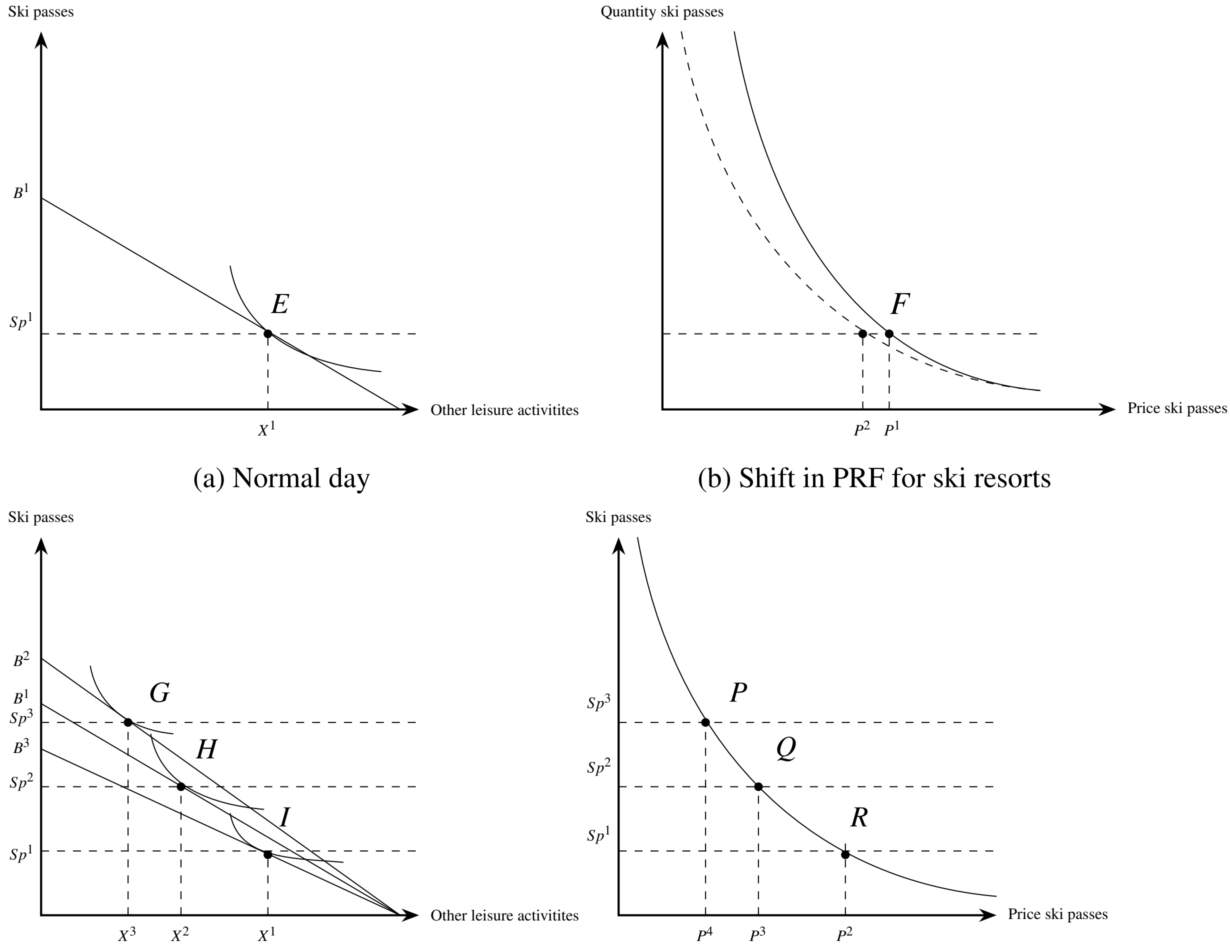
Fig. 2.3 Consumers choice: Indifference curves

Customers consuption choices between buying ski passes or consuming other leisure activites.

In Figure 2.3 point *A* is the preferred choice, point *B* or *C* is not the preferred choice because customers can receive higher utility choosing point *A*. The indifference curves can describe us how customers are willing to give up ski resorts internal and external characteristics such as good weather, crowdedness, size of ski area and so on in order to attend other leisure activities or other resorts if we assume those characteristics affect customer buying behaviour. A change in ski conditions could therefore make the customer choose a new market basket to maximize their utility.

Utility function

In the theory of preference, the utility function will give a formula that assign a value of each combination of bundles. We can have a bunde of ($x1$,$x2$) which is preferred over the bundle ($y1$, $y2$). The x bundle will therefore have a higher utility than the y bundle. The utility is a way of assigning a number of every possible consumption. An individual *i*´s utility from buying a ski pass at a certain ski resort (*Sr*) depends on the characteristics of the *Sr*. Some characteristics are known, and some are unknown for a researcher. If the Individual *i* is asked to choose between different scenarios with different level of attributes, *i* would always choose the the choice with the highest utility since he is assumed to maximize his utility.



(a) Normal day

(b) Shift in PRF for ski resorts

(c) Various prices

(d) PRF for ski resort

Fig. 2.4 Consumers choice: Indifference curves

Customers budget constrains between buying ski passes or consuming other leisure activites. Fundamentals of figure taken from (Malasevska, Haugom, and Lien, 2017)

Figure 2.4a illustrate that a customer would choose X^1 quantities of other leisure activities and Sp^1 quantities of ski passes. The customer intent is to maximize his utility and he will therefore choose the bundle that represent point E in Figure 2.4a where the indifference curve touches the budget line . If we assume that ski resorts characteristics such as bad weather or crowded slopes would affect customers received utility, we would experience a shift in the PRF towards left as illustrated in Figure 2.2b. The new dashed curve represent the quantity sold at different prices. We will by looking at the new curve see that at the fixed price we would sell less quantities of ski passes. To compensate for this and sell equal much ski passes ski resorts could possibly decrease the price to p^2 as illustrated in Figure 2.2b. On the other hand the figure illustrate that if we lower the price for ski passes we can sell equal or more quantity of ski passes. In Figure 2.4c it shows customers choice at different ski pass prices. A customer can either choose between point G, H or I respectively. The three different budget lines represent three different prices of ski passes. The points G, H and I where the indifference curves are tangent to the budget line reflect the customers optimal choices. For instance, at point G the customer can consume X^3 units of other leisure activities and Sp^2 units of ski passes.

Price response function

Dynamic pricing is when we can determine optimal prices where we frequently can adjust the prices easily to changing circumstances.

To estimate optimal prices that would give maximal contribution for ski resorts we have to estimate price response functions (PRF) for different characteristics that consist. If we look at Figure 2.4d we see that if we reduce the price of ski passes from P^1 to P^2 or P^3 we see that customers will buy more quantities of ski passes .The PRF illustrate how demand for a seller is effected as a function of the price that is offered (Phillips, 2005). Figure 2.4d illustrate that if price of ski passes decrease, demand of ski passes increase. Since we know that level of crowdedness are varying in some finite period of time, such as more crowdedness in weekends, holidays and so on. We have the opportunity to change prices according to the different level of crowdedness to sell more or equal many ski passes.

Price response function estimation

There are several price response functions; such as the linear, constant elasticity and the logit price function. However, there are one that outperform them others most of the times. According to (Phillips, 2005) the logit price response function are one of the most popular, robust and realistic among the PRFs that consist. The logit-PRF do represent a more realistic representation of a customer purchase behavior compared to the linear or constant elasticity price-response function(Phillips, 2005). The interesting logit price-response functions is given to us as:

$$d(p) = \frac{Ce^{-(a+bp)}}{1+e^{(a+bp)}} \tag{2.5}$$

Where C, a and b is the parameters to be estimated for defining the curve. According to Phillips (2005), C is the scale factor which represent the market size and b measures price sensitivity. Following Phillips (2005) there is restrictions that $C > 0$ and $b > 0$. Larger value of b represent greater price sensitivity. We can also estimate a point where demand is most sensitive to price by using parameters to solve the following formula: $\hat{P} = -(a/b)$. The estimated point of the parameters is called the "market price" and is the point where price has most effect on the demand (Phillips, 2005).

Maximum contribution

In most cases firms goal is to maximize their total contribution. The difference between what price we should sell a product for and its incremental cost is called unit margin and the sum of the unit margins that are sold in a period is called total contribution (Phillips, 2005). Generally we have the following formula for profit:

$$M(p) = (p-c)d(p) \tag{2.6}$$

Where m is the profit, d is the demand function that is depended on the price, c is the incremental cost. To find optimal conditions where we will have most contribution for ski resorts we take the derivative of $m(p)$ and setting it as equal to zero. The derivative of $m(p)$ is given to us by:

$$m'(p) = d'(p)(p-c) + d(p). \tag{2.7}$$

And the price for ski passes that maximize the total contribution, we set $m'(p) = 0$, or;

$$d'(p)(p-c) + d(p) = 0 \tag{2.8}$$

Thus when $P^\star$ is satisfying, we will get maximal contribution when:

$$d'(p^\star) = -d(p^\star)(p^\star - c) \tag{2.9}$$

To get the famous condition that is the optimal price when marginal cost equals marginal revenue, we can rewrite Equation 2.9 as:

$$p^\star d'(p^\star) + d(p^\star) = cd'(p^\star) \tag{2.10}$$

Which will give us the maximal total contribution. The contribution margin will be maximized by changing the price. Figure 2.5 illustrate the total contribution at different prices. The top of the peak is where we can achieve maximum contribution, and P^2 is the optimal price that maximize the total contribution. P^1 is where contribution cover incremental cost and from this point the firm is making profit. By looking at the figure we can see that a ski resort will loose money if they price its ski passes below P^1 or above P^3. If the ski passes price is too high (above P^3) the demand will drive towards zero, which will result in loosing money and if the ski passes price is too low (below P^1) earnings will not cover the incremental cost.

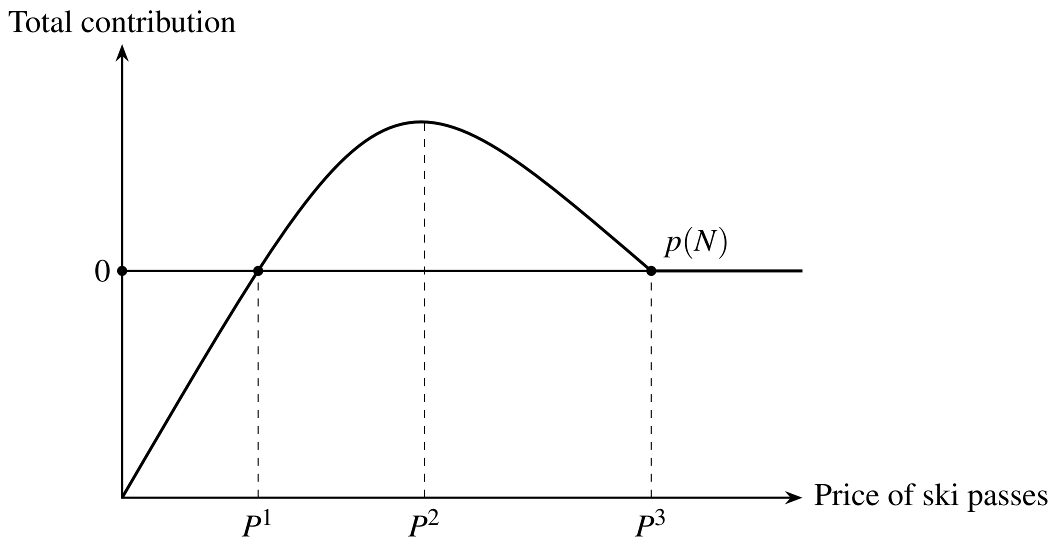


Fig. 2.5 Contribution as a function of price

Chapter 3

Methodology and data collection

"We shouldn't focus on a single scenario, or we will overestimate its probability. Let's set up specific alternatives and make the probabilities add up to 100%."
— Daniel Kahneman, Thinking, Fast and Slow

3.1 Purpose

This chapter describes the process of the design of questionnaires that was used in this thesis. First, we would describe why we choosed the conjoint analysis for this thesis. Seconly, we describe how the design of the survey specifically was composed. Thirdly, we outline the sections of the survey; (1) demographic questions, (2) Conjoint choice tasks and (3) sensitive questions. We will then talk about the questions and parts that are most relevant for this thesis.

3.2 Survey design

The design of the survey were done with cooperation with others in the iPaaSki project. To get more use of data collected in one survey all interested parts in the project had their objection on what questions to ask so that they could collect data of their interest. Much effort was placed in making the survey look appealing and being easily understood for the participants in this study.

Since there where several people that where interested to gather data from the same questionnaire, the work of developing the survey was divided between the parts. The interested parts where PhDs and other master students at the iPaaSki project.

It should be noted that because of the cooperation of several parts in the iPaaSki project, not all questions in the survey might be relevant for the research question about how crowdedness affect willingness to pay aand optimal prices for the ski resorts.

3.2.1 Choosing Choice Based Conjoint Analysis

The data needed for economic estimation of skiers choice behavior can basically be collected with two different methods; the revealed and the stated preference method. The revealed preference method is based on observation of the actual choice of a customer from the set of alternatives that gives customer utility. Whereas the stated preference method is based on information examined from choice experiments or interviews. The revealed preference method is based on observation of the actual choice of a customer from the set of alternatives that gives customer utility. Whereas the stated preference method is based on information examined from choice experiments or interviews. To answer research questions of this thesis there are used a (CBC) analysis.

Experimental design is among the most frequently method used for analyzing consumers preferences. There are some advantages to experimental CBC analysis compared to the conventional conjoint analysis. Green and Venkatachary Srinivasan (1978) state that choice tasks are more realistic than ranking or rating tasks and would therefore give more reliable results.

Conjoint analysis is a indirect method of the discrete method that is used to estimate customers utility function (Lebeau et al., 2012b). Conjoint analysis have been used in many different fields. Most known are the use of conjoint analysis in the marketing field to measure consumers acceptance for products with different characteristics (Patunru, 2019). In recent times the conjoint analysis as a research tool has been introduced to several new fields. However, the use of conjoint analysis to study the alpine skiing industry has been used in lesser extend. There are some studies, such as (Carmichael, 1996; Won and Hwang, 2009) that have studied skiers perceived utility and the influence on demand for skiers at ski resorts using conjoint analysis. These studies do examine how ski resorts characteristics will influence the demand for a ski resort, but it does not examine customers willingness to pay. Other studies in tourism that might share similarities with ski resorts are theme parks. There are several studies such as (A. D. Kemperman et al., 2000; A. Kemperman et al., 2003) where conjoint analysis has been used to predict people perceived utility of parks with different characteristics. Theme parks do share some characteristics to ski resorts such as crowdedness, queues, weather and so on that impact customers comfort and experience when visiting a theme park. There is therefore believed that some of the same characteristics might have the same influence on comfort and customers perceived experience at ski resorts.

The conjoint analysis reveals the overall preference the customers have for a good by choosing the product that will give them most utility (Green and Venkatachary Srinivasan, 1978). Analyzing attributes together as a bundle instead of asking for the perceived utility for one attribute can increase the reliability of the research because it is a more realistic representation of a buying situation (Green and Venkatachary Srinivasan, 1978).

A example of a CBC conjoint analysis task is illustrated in Table 3.2.[1] The CBC questionnaire included attributes that are listed in Table 3.1. The respondent where asked to imagine that they where in a actual buying situation where as they have to choose between different ski resorts with different characteristics. Respondent where asked to choose between a series of hypothetical alternatives. In order to capture respondents preferences based on the attributes listed in Table 3.1, they were asked to choose one combination of the level of attributes (one profile card) that they prefer most. It is assumed that respondents valuate the trade-off between price and the decreasing or increasing benefits of the characteristics that is presented with the different ski resorts. Estimates of willingness to pay includes characteristics that decrease or increase comfort, reduction in expenses as well as the opportunity to buy ski passes on weekdays. At each choice task respondent where asked how many more times they would go skiing if they where offered the price of that option they had chosen, as illustrated in Table 3.3. This information where useful to understand and see more specifically how discount in price would affect the demand of ski passes under various occasions.

[1] Or see Appendix A

Table 3.1 Attributes and levels used in conjoint study

Attribute	Levels
Weather	1. Sunny* 2. Cloudy 3. Fog 4. Precipitation
Wind	1. Calm 0-0.3 m/s* 2. Light air / light breeze 0.4-3.3 m/s 3. Gentle breeze / moderate breeze 3.4 - 7.9 m/s 4. Fresh breeze >8 m/s
Temperature	1. 5°C* 2. -2°C 3. -9°C 4. -16°C
Crowdedness	1. A little crowded* 2. Somewhat crowded 3. Crowded 4. Very Crowded
Weekday	1. Monday - Wednesday* 2. Thurday - Friday 3. Saturday 4. Sunday
Alpine Resort	1. Hafjell* 2. Skeikampen 3. Sjusjøen
Price	In 4 levels. NOK 250, 350, 450 and 550

* = reference level / baseline

3.2.2 Determine attributes

This section explain the attributes used in the choice experiment.

There is a variety of factors that influence a skiers destination choice. Therefore, determining attributes was essential decision in designing the survey. The chosen attributes which is listed in Table 3.1 are selected based on earlier studies about demand influencing skiers choice and what we believed skiers where taking most into considerations when buying a ski pass. The attributes where chosen collectively by us in the iPaaSki project. Attributes selected where both pull and push attributes that where intended to attract or dis-attract customers to ski resorts. We are going to describe the choices more profoundly under the descriptions of each attribute which is described in subsection 3.2.3.

Range of the attributes

The attributes where divided into four levels (attribute "ski resort" had 3 levels). There are several reasons why attributes levels should be constant. Both the range and the intermediate level of the attribute can increase the importance of the attribute (Wittink et al., 1990). It is important to ensure belivability, therefore the ranges and levels where chosen based on recommendations by Green and Venkatachary Srinivasan (1978), who points out that to ensure accuracy, the level of each attribute should be larger than reality, but not unrealistic. Both attributes levels with a too high range or a too low range would decrease the validity of the responses (Green and Venkatachary Srinivasan, 1978). It was therefore important to test this with a pretest and also ensure if the range of levels where far enough apart from each other. The range of the attributes where collectively decided by participants of the iPaaSki project.

Adding graphics

Most conjoint analysis that has been done are involving verbal descriptions of the products. There are several benefits of using realistic representations of outdoor conditions. Dijkstra et al. (1996), Green and Venkatachary Srinivasan (1978), Manning and Freimund (2004), and Olsen et al. (2012) describe some noticeable reasons to use realistic representations in conjoint studies;

1. Attributes might be difficult described in words
2. Images might increase the realism of the choice task
3. Respondents might better understand and appreciate the alternatives to be chosen.
4. More attributes can be meaningfully included in a profile card.
5. It might be more interesting and less fatiguing and make it easier for the respondents to chose an alternative.

6. Pictorial representations might lead to higher homogeneity of perceptions because it is less open to respondents interpretation than written descriptions.

7. Pictorial representations are important factor that influence validity.

In contrast of a conducting a standard study we had more opertunities choosing a conjoint study with imagery representations of the attributes. Therefore, a photorealistic representations of the slope was added for each different profile card. There are both advantages and disadvantages adding graphics to conjoint analysis. Pictures can generate a more realistic representation of the alternative to be chosen, but the graphics could also steal focus from attributes that are in format of written text (Jansen et al., 2009; Sethuraman et al., 2005). However, attributes such as weather and crowdedness might be difficult described in words and visualizing the weather and crowdedness, respondent may better understand the various options and thus make more reliable choices. Figure 3.5 represent the anticipated best to worst scaling for crowdedness and weather that are used in this thesis.[2]

The pictures that where used in this study differ and was intended to give faster and more reliable measurement of customers preference. The author of this thesis created and edited pictures using Adobe Photoshop® software. The pictures where manipulated photographs of a originated ski slope. Skiers where added according to the increase level of crowdedness and weather condition where manipulated showing different weather conditions. A total of 20 (4×5) different images where created, showing two attributes (4 levels of crowdedness and 5 different weather scenarios). The images where all modified versions of a "basic" image of a slope (see Figure 3.5a). The original photo where not included in the conjoint analysis because there was necessary to adjust the photos before they could be manipulated.

Studies by Dahan and Srinivasan (2000) and Vriens et al. (1998) show that attributes with visual contents such as pictures and icons are remarkable better than written subscriptions. It is likely that visual content magnifies attention and involvement, which amplify the importance of the attributes that are better illustrated visually rather than verbally. Since cloud cover and crowdedness where the only attributes presented with pictures, verbal attributes got additionally added icons to compensate for the potential loss of focus. Another purpose of icons where to shorten the time used to answer the questionnaire and to get more reliable results. We would describe the purpose more in detail for each attribute under the description of each attribute in the following subsections.

[2] See Appendix K for the whole collection of images used in survey.

3.2.3 Chosen attributes

Ski resort attribute

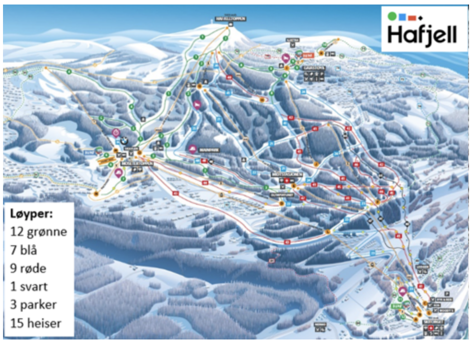
After conducting a pre-test of the survey we got more insight of what skiers would take into consideration when buying a ski pass. Some studies such as Morey (1984) and Morey (1981) do describe some possibilities that influences demand at particular ski sites with their characteristics. Based on earlier research, discussion and the feedback of the pre-test, the attribute "Ski resort" where added. The ski resort attribute where the only attribute with 3 levels, each level presented a different ski resort in the Inland region of Norway with its different characteristics. The ski resort differ in ski area size, number of pistes, variety of slopes, child friendliness and more.

A trail map and information of the resorts with some additional information where superimposed (see Figure 3.3). Description of number of pistes, number of parks, number of lifts as well as the difficulty of the pistes where added. The map of the mountainscape of the resorts made it possible for respondents to be able to see how the resort look like and how they differ.

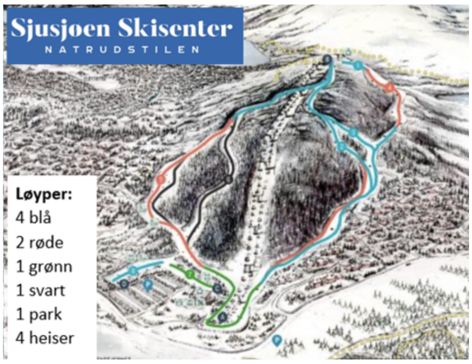
Fig. 3.1 Levels of ski resort

(a) (b) (c)

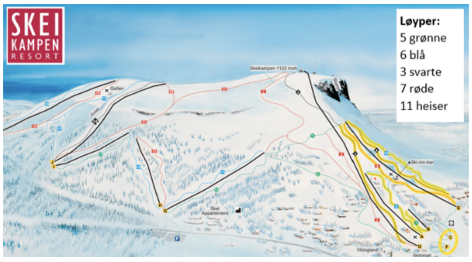
Fig. 3.2 Ski resort icons



(a) Hafjell



(b) Sjusjøen



(c) Skeikampen

Fig. 3.3 Resort map

Crowdedness attribute

Authors such as Fonner and Berrens (2014) and Zehrer and Raich (2016) addresses the importance of crowdedness in ski resort. The first problem with this attribute is how to measure customers preference towards crowdedness in advance. One way is to define on-slope crowdedness verbally and describe how many people that is in the slopes, for example; 500 skiers per acre, 750 skiers per acre etc. However, this method could be impractical since respondents could be unfamiliar with such a density measure. Another method is to verbally describe the crowdedness such as; "Not crowded", "Crowded" or "Very crowded". If we had used this method there is likely that respondent would have subjective meanings on how crowded it is when it is "not crowded" or "very crowded". There are some interesting studies such as Needham et al. (2004) who have studied ski area congestion using pictorial representation of the crowdedness to estimate customers preferences. However, the study was in a summer setting and cannot be compared directly with skiers preferences. Moreover, as mention earlier, there where determined to add pictorial representation of the crowdedness levels in our study. Additionally, crowdedness levels where expressed with stick mans, which where intended to make the attribute more actionable. Hence, the attribute does not cover all criteria of congestion in ski resort, as ski resorts could have pretty empty slopes and still have major waiting lines for lifts due to ineffective lift capacity.

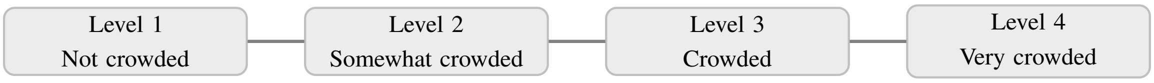
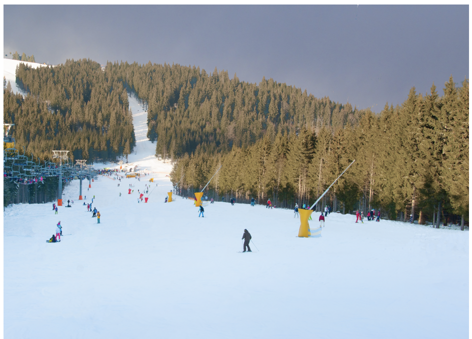


Fig. 3.4 Level of crowdedness

(a) Sunny, not crowded.



(b) Cloudy, somewhat crowded.

(c) Fog, crowded.

(d) Precipitation, very crowded.

Fig. 3.5 Examples of pictures added to profile cards

(a) (b) (c) (d)

Fig. 3.6 Crowdedness icons

Weather attributes

Several authors such as; Falk (2013), Malasevska, Haugom, and Lien (2017), Shih et al. (2009), and P. W. Williams et al. (1997) address the importance of weather at ski resorts on customers evaluations. However, skiers demand to weather conditions could consist of several parameters such as; temperature, snow depth, cloud cover, wind, visibility and more. Based on earlier studies we chosen applicable weather variables which consisted of total 3 subordinate attributes; cloud cover, wind and temperature. Both the range of the attribute "wind" and "temperature" where indicated with qualitative measures with a incremental increase (or decrease). One of the problems with these attribute is how to describe the weather scenarios. It is common in weather forecasting to use icons as weather imagery to assimilate a large amount of information that sometimes can be confusing and overwhelming. To provide more reliable weather information for each alternative, weather icons where added in to the study. Each weather icon (Figure 3.8a to Figure 3.8e) provides a visual representation of the weather when customers are buying their ski passes. Additionally, as mention earlier we had manipulated pictures that represented the different weather scenarios. A selection of with different cloud cover is illustrated in Figure 3.5 together with the attribute crowdedness.

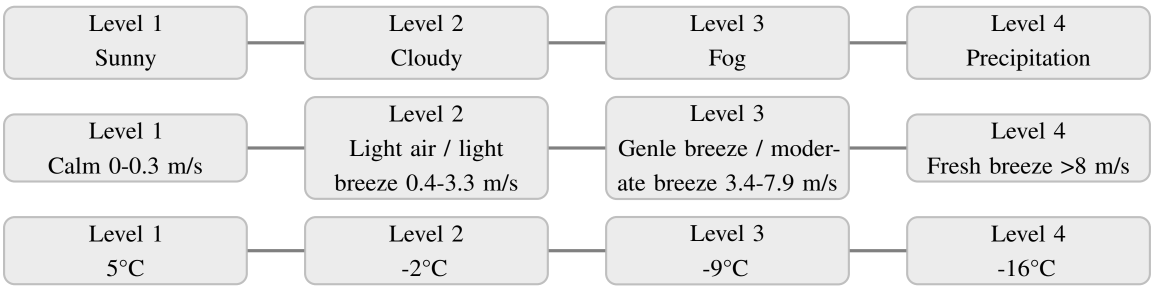


Fig. 3.7 Three attributes of weather; subdivided into cloud cover, wind and temperature.

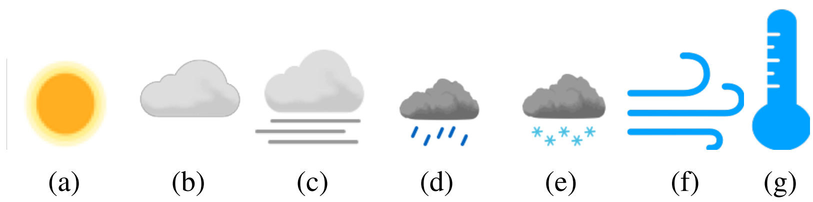


Fig. 3.8 Weather icons

Weekday attribute

Most of people have more leisure time on weekends compared to weekdays. This attribute where added so we could observe the difference of demand and preferences towards weekend compared to weekdays. The intend for some in the project was to use study how price could be used as a tool to enhance demand and profitability both on weekdays and weekends taken plausible cannibalization into account.

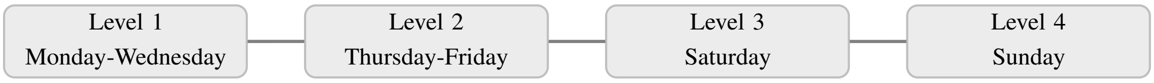


Fig. 3.9 Level of day in week

Fig. 3.10 Weekday icon

Cost attribute

The cost attribute where added so the respondents could state their WTP in monetary terms and let us be able to to measure WTP. The cost of skiing could consist of annual cost such as cost for; transportation to the ski resort, rent of equipment, cost of ski passes, food at the ski resort and so on. We would like to study the WTP for the ski passes. Therefore, the attribute represent purchase price of ski pass in particular.

According to Bateman et al. (2002) the price range need to be realistic and cover the range over what respondents can expect to have as preferences. Therefore, the price could not be so high that the respondent would never chose that option, it should neither be too low. If we have too low prices, the option will always be accepted and it will result in a small (or negative) price coefficient. The price of the corresponding ski resorts at the time of this reserach where; NOK 455, NOK 430 and NOK 390 at Hafjell, Sjusjøen and Skeikampen ski resort respectively. The price for ski passes across Norway differ widely. The most expensive ski pass prices are almost twice as expensive as the cheapest ones (OneTheSnow, 2019). We conducted two versions of pre-tests; first version with a low range between lowest price and highest price of ski passes, and the second version with a high range between lowest price and highest price of ski passes. It was expected that the importance of price will be lower in version 1, and more important in version 2 as the range where higher. In other words, the wider the range is, the more important the attributes will be. The first questionnaire had a price range between NOK 250-550, and the second questionnaire had a price range between NOK 200-650 as illustrated in Figure 3.11

By the results from the pre-test, and prices of the ski resorts across Norway we chosen a price span from NOK 250 to NOK 550 for the final questionnaire.

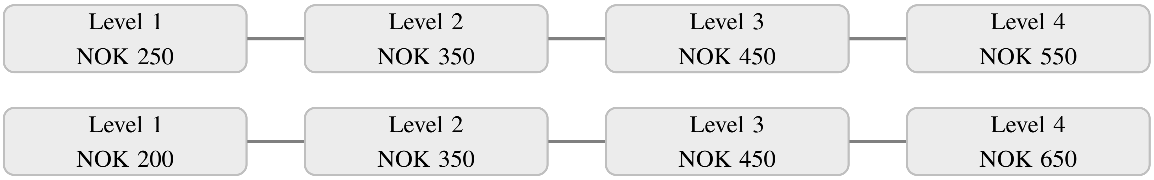


Fig. 3.11 Price span of pre-test version 1 and 2

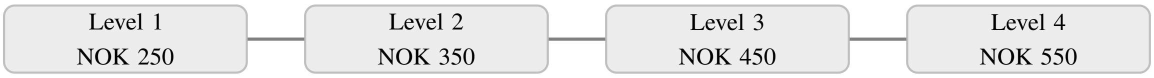


Fig. 3.12 Price span of final questionnaire

Fig. 3.13 Price icon

3.2.4 Construction of survey

Constructing efficient choice design

Before constructing profile cards profile sets need to be created. It is necessary to construct choice sets that are statistically efficient. Huber and Zwerina (1996) identify four important principles for designing a CBC analysis;

1. Orthogonality. The combination of the attributes and the level of attributes are uncorrelated in the choice sets.

2. Level balance. All the level of each attribute occur with equal frequency in the survey.

3. Minimal overlap. The attribute level should at minimal times repeat itself in the choice sets.

4. Utility balance. The utility of all the attributes in a choice set is equal.

In order to create efficient orthogonal design, the R software and the package DoE.Base where used by participants in the iPaaSki project. The number of possible choices increase drastically as attributes and level of attributes increases. In our study, a full factoral design of the study would create a total of 12 228 ($4^6 \times 3$) possible combinations of the attributes. Therefore orthogonal design are created to restrict the number of choice iterations in a experiment and still allow estimation with minimal errors. Doe.Base creates full factoral designs from orthogonal arrays that are designed using the R command oa.design. The arrays still provide orthogonality even though the number of profile sets is minimized. The profile sets that where created where exported to excel for further studying and checking that the scenarios where possible (see Appendix F). A total of 48 choice sets where created. However, 48 choice set were considered as too heavy for a respondent to handle. The orthogonal design make it possible for blocking the profile sets, which means that the respondent just answer a fraction of the choice tasks so that they would not be overly burden by having to answer too many questions. The 48 choice set where divided into 6 questionnaires with 8 different choice task. Because of blocking the questionnaire, we have to hand out 6 different questionnaires when conducting the study. We also had to ensure that it where approximately the same amount of collected answers divided by the questionnaires. The design output from the R-software had to be realistic and plausible. The author of this thesis checked the qualities of profile set output from the R software and checked if the output where realistic, there where competing alternatives and that the attribute levels repeated itself minimal times.

Design of choice set

Designing the arrays of the choice set is just one part of the design of choice sets. All the alternatives need to be implemented into a profile cards showing the attributes. Figure 3.14 is a representation of how a profile card is assembled. The hypothetical profile card have attributes where one level at each attribute is selected. Combining different icons and pictures the author of this thesis created a total of 145 ($48 \times 3 + 1$) different profile cards. Icons, pictures and verbal descriptions of the attributes where assembled into one profile card as seen in Figure 3.15 using MS PowerPoint.

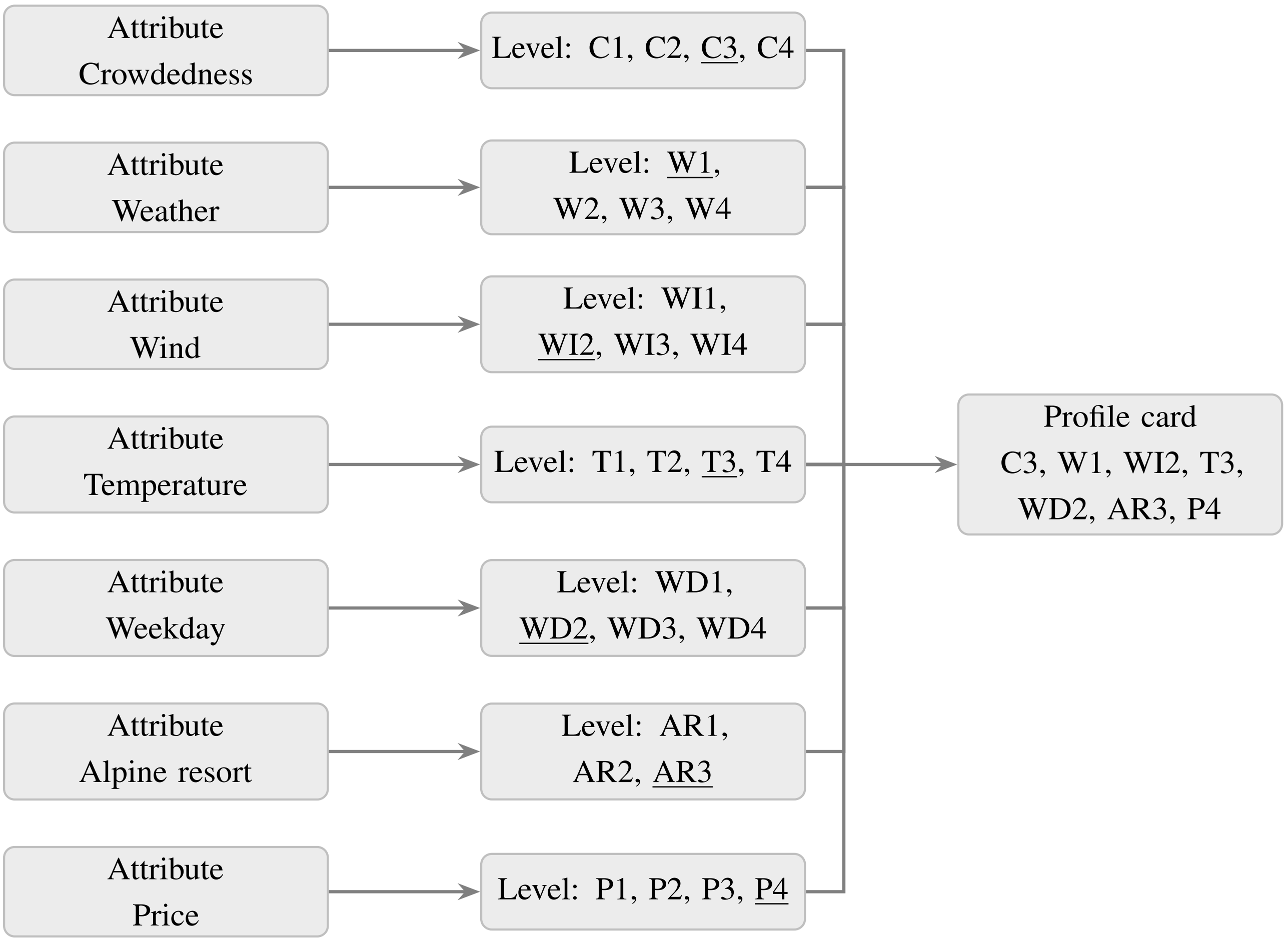


Fig. 3.14 Relationship between attributes, levels and profile card

Fig. 3.15 Example of profile card

Table 3.2 An example of choice task in CBC

Characteristics	Option 1	Option 2	Option 3	Option 4
Weather	Sunny	Cloudy	Fog	
Temperature	-16°C	5°C	-2°C	
Crowdedness	Somewat crowded	Crowded	Very crowded	None of these
Weekday	Monday-Wednesday	Thursday-Friday	Saturday	
Wind	Light air / light breeze 0.4-3.3m/s	Gentle breeze / moderate breeze 3.4-7.9m/s	Fresh breeze >8m/s	
Ski resort	Hafjell	Sjusjøen	Skeikampen	
Price	NOK 450	NOK 550	NOK 250	
Which ski pass would you buy, or would you rather not buy if this was the options? (Choose one option)	○	○	○	○

Table 3.3 Part 2/2 of a scenario task

Given the option you have choosen, how many times approximately would you ski during a season given the scenario presented on that option? (Mark only one oval)
1 ◯
2 ◯
3 ◯
4 ◯
5 ◯
6 ◯
>7 ◯ please specify...

3.2.5 No choice option

To scale the utilities of each attribute a base level is often added to each choice set. This base level could be a "no-choice" option where the respondent would rather not buy any of the products that is presented (see Table 3.2). The probability of the "no-choice" option would therefore be a indicator of the overall attractiveness of the scenarios that is studied. Hence, some of the disadvantages of the "no-choice" option is according to Elrod et al. (1992) that those respondent who choose the "no-choice" option gives us no information about the attributes, levels and why they did choose the "no-choice" option.

3.3 Data description

3.3.1 Sampling

In this research it has been used homogenous sampling approach. The main goal of this purpose is to focus on a particular characteristic of a population that are of interest. Our respondents' characteristics are mainly people that are living in the Inland region of Norway, who do not live far from one of the three examined resorts, and do not hold a seasonal ski pass. The data presented in this thesis were collected in the winter 2019 from February 19th till March 21th by online questionnaires. Respondents of the survey were recruited in three ways: (1) via online posts (Faceobok pages of the resorts). (2) via flyers accessible at each resort, and (3) via personal, face-to-face request at each of the three participating ski resorts. The survey was specifically designed to be answered online on a computer, tablet or mobile device. There are several advantages to internet surveys, which led to using this method as an addition. Internet based surveys are generally less expensive and time consuming as they involve fewer processing and administration procedures. The time saved on answering the questionnaire make it as well more convenient for both the researcher and respondent (Ho, 2014).

Collection of data at resort

A part of the data where collected at each of the three collaborative resorts by participants from the iPaaSki project. Survey where conducted both on weekdays, weekends and winter holiday. Data where collected where we joined the queue and sat beside people at the lift and asked if they would contribute to a relevant scientific research project. Respondents where answering while sitting on the lifts and participant could finish the survey easily until they arrived at the next lift. On the days sampled, all runs and trails where open.

3.4 Pretest of survey

According to Rao (2014) it is recommended to conduct a pretest of the survey to know if the respondents where not overly burdened by processing the given attributes. There is given variable recommendations of how many pieces of information a person can process at a given time (Rao, 2014), therefore a pretest of the survey was an important factor in this research.[3] The pretest were also introduced to test the quality of the questionnaire and that the questions where clear and understandable. When the respondent where at the end of the test the respondent where asked to comment at least one thing that could improve the survey. We also needed to assure that the questionnaire would technically work and that it would be able to be analyzed in the R software . There where conducted two versions of the pre-test. In one version, level 1 and 4 of the attribute "price" where changed so we would have a wider price-range. A wider range where intended to make the attribute more important. Because of the sample size of the pre-test, we could not prof this.

All together it was 98 respondents who completed the pretest. The respondents where friends who directly got the questionnaire link sent through social media and emails. The questionnaire was designed in google forms[4]. After the respondents completed the pretest, the structure of the questions was slightly changed. We modified the survey according to the respondent feedback and we discussed what we should change, and we could then procedure and repeat the questionnaire using internal participants. In the conjoint part of the survey we changed several things based on the respondents' feedback. Some difficult questions where identified, some questions where re-worded, some questions where shorten and revised, and some questions where added. Having a short questionnaire was highly desirable to make

[3] Pre-test questionnaire is attached to Appendix E.
[4] Google web based survey platform

sure the respondent was able to answer the questionnaire within the time of taking the lifts. Findings from the pretest generally made it possible to improve the questions and verify that the respondents were able to answer the questions.

After moderation of the pretest, the development of the new questionnaire was done. The new questionnaire where developed in “Nettskjema” who had a better user interface in our terms of illustrating the scenarios. The questionnaire where tested in different browsers and devices. It was important that the questionnaire worked well on mobile devices and tablets, because tablet devices were used to collect data in the field. Therefore, it was ensured that respondents could easily select drop-down menus, and clearly be able to see the illustrations on the devices.

3.5 Ethical considerations

Online surveys should be sensitive to ethical concerns such as other research methods and should hold respondents privacy confidently (Buchanan and Hvizdak, 2009). In terms of study ethics, a agreement in a consent form where put in place to ensure that the respondent where known about their confidentiality and their rights (see Appendix G). It did also inform them about consequences of participating in this research. There were assured to the participants that we would uphold confidentiality and anonymity. In the beginning of the survey the respondents were informed that their answer where anonymous and they have to thick of that they had read the agreement of use of their personal information. They were also informed about the purpose of this master thesis and the research project. Information about the research purpose could have an effect on the respondent answer.

“Nettskjema"[5] the questionnaire software we used to collect our questionnaire where an anonymous data collection software that treated respondents personal information confidentially and stored the data safely after the NSD [6] guidelines. However, the questions asked in survey has not been very sensitive, and the use of “Nettskjema” gave us no opportunity to identify respondents.

[5]Nettskjema is a data collection platform that students and universities uses to collect data for research projects.

[6]NSD is a research center in Norway, which assist researchers collect data, their issues with methodology, privacy and ethics about their research.

Chapter 4

Results and discussion

After preparing and conducting the study as described in previous chapter, we are now going to describe the results that has been generated. This chapter describe analytic models that are used in thesis. The structure of this chapter will follow the sequence of the questionnaire. First, the descriptive of the respondents are presented. Secondly, we are going to describe the results from the conjoint task in the survey. Thirdly, the frequency estimations of crowdedness are presented before we present the estimated $MWTP$, market share and optimal prices for the studied ski resorts.

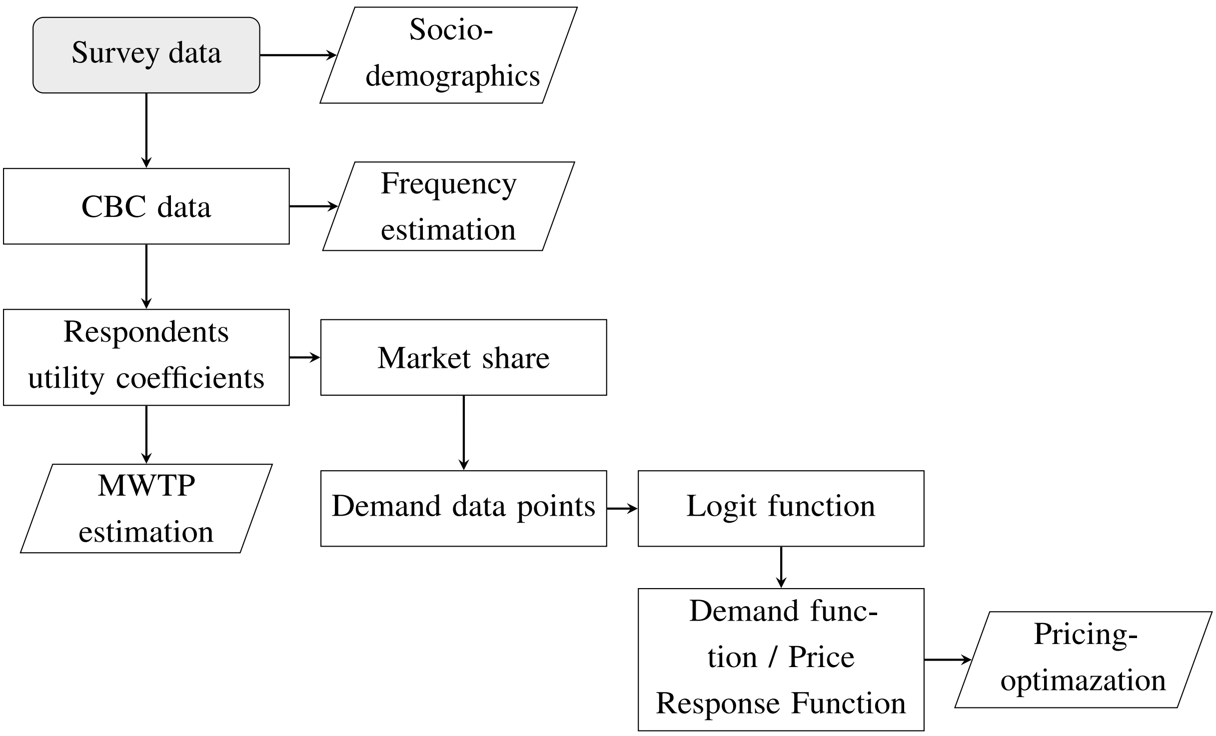


Fig. 4.1 How the results are derived

Figure 4.1 shows the way to the source for the results. Most of the results in this thesis are derived from the utility of the respondents which is obtained from the CBC data. The results that is presented here must be interpreted with caution, the aim is to detect tendencies and preferences within the sample which would give us indication of how ski resorts should price their ski passes.

4.1 Descriptive statistics

A total of 726 respondents completed the survey, whereas 346 where studied in this thesis. The first part of the questionnaire included socio-demographic questions, whereas sensitive questions where added to the last part of the questionnaire. Table 4.1 summarize the most important socio-demographic questions.

We see that the distribution between the genders are more or less proportionate even though it is more men (n=205, 55,1%) than females (n=167, 44,9%). The majority of the respondents are in a relationship and about a one-third is single.

Concerning the age we observe that the over half of the respondents are between the age of 16 to 35. This might be explained by the fact that survey were spread through the resorts Facebook page and younger adults are more social active and are using Facebook more frequently (Andrews et al., 2007; Duggan and Brenner, 2013). The average age of the respondents were 35.01. Moreover, we se a slight over-representation of students (n=77, 22.3%) compared to the average values of the Norwegian population (6.8%)[1]. Assuming that students earn less and are more price sensitive than the average population, such sample selection biases might result in an underestimation of WTP. Furthermore, we see that more than half of the respondents have a household income above NOK 600 000 which is more than the median household income in Norway (NOK 510 000) (SSB, 2019c) However, this correspond the fact that skiers do have a average higher household income than the rest of the population (Mulligan and Llinares, 2003).

To further ensure that answers where biased towards skiers and potential skiers, information about respondents skiing interest made it possible to exclude respondents that had no interest of skiing.

[1]Total students in Norway was 293 287 whereas population in Norway above age 16 is 4 330 608 (SSB, 2019a; SSB, 2019d)

Table 4.1 Socio-demographics

Socio-demographics	**Ranges**	**Frequency**	**Percentage**
Age group (years)	16-20	23	6.7%
	21-25	70	20.2%
	26-30	56	16.1%
	31-35	47	13.6%
	36-40	50	14.5%
	41-45	35	10.1%
	46-50	22	6.4%
	51-55	17	4.9%
	56-59	11	3.2%
	61-65	9	2.6%
	66-70	6	1.7%
Gender	Male	190	54.9%
	Female	156	45.1%
Marital Status	Single	99	28.6%
	Single with child	17	4.9%
	Couple	89	25.7%
	Couple with child	140	40.5%
	Other	1	0.3%
Occupation	Employed full time	229	66.2%
	Employed part time	21	6.1%
	Unemployed	1	0.3%
	Student	36	10.4%
	Student with part time job	41	11.8%
	Other	18	5.2%
Annual household income	Less than NOK 100 000	39	11.3%
	NOK 100 001 - 300 000	34	9.8%
	NOK 300 001 - 600 000	66	19.1%
	NOK 600 001 - 900 000	72	20.8%
	NOK 900 001 - 1 200 000	64	18.5%
	NOK 1 200 001 or more	47	23.6%
	Did not answer	24	6.9%

(n=346)

Demographic information

Table 4.2 Within range from particular ski resorts

	Within range of 20 KM from preferred ski resort	Percentage	Within range of 40KM from preferred ski resort	Percentage
Within	156	45,08%	194	56.06%
Not within	190	54.91%	152	43.93%
Within Hafjell	132	38.15%	155	44.79%
Not within Hafjell	214	61.84%	191	55.20%
Within SkeiKampen	0	0%	9	2.60%
Not within Skeikampen	346	100%	337	97.39%
Within Sjusjøen	8	2.31%	19	5.49%
Not within Sjusjøen	338	97.68%	327	94.50%

Table 4.2 show the range from the ski resorts for the participants. The table illustrate that a percentage of 45.08% of the respondents where living within range of 20 KM from their preferred ski resort, and a total of 56.06% of the respondents where living within range of 40 KM from their preferred ski resorts. Hafjell ski resort was the ski resorts with most nearby respondents, whereas Sjusjøen ski resort has fever respondents living nearby and Skei Kampen ski resort had the least amount of respondent living nearby their ski resort. It is plausible that this might be explained by the fact that Hafjell ski resort is the ski resort placed within shortest drive from the biggest town. It should be noted that all resorts are located within a range of 1h drive from Lillehammer [2], which attracts skiiers who wants to ski for the day and return home before the evening.

Table 4.3 Average KM from preferred ski resort.

	Hafjell	**Skeikampen**	**Sjusjøen**	**Other**
Preferred ski resort	223(64.45%)	18(5.2%)	23(6.6%)	82 (23.7%)
Average KM from preferred ski resort	45	75	42	130

Table 4.3 illustrate respondents average KM from their preferred ski resort. We see that respondents that have Sjusjøen ski resort as their preferred ski resort has the shortest

[2]Lillehammer is a city in Inland region of Norway with a population of approximately 28 023 (SSB, 2019b).

drive. While those who have Skei Kampen ski resort as their preferred ski resort has the longest drive and they must travel almost twice as far than those who prefer Sjusjøen ski resort. Additionally, those who has another preferred ski resort than Hafjell, Skeikampen or Sjusjøen are living on average 130KM from their preferred ski resort. It is plausible that those respondents might have a preferable ski resort outside the Inland region of Norway, even though they are living in the Inland region.

Table 4.4 Type of ski passes usually buying.

Usually buying type of ski pass	Number	Percentage frequency
1 days passes	250	72.25%
2 days passes	18	5.20%
3 days passes	5	1.45%
4 days passes	4	1.15%
5-8 days passes	2	0.57%
2-3 hours passes	45	13.00%
Afternoon and evening passes	22	6.35%
Total	346	100%

72.2% of the examinated respondents where usually buying 1 day ski passes. A summarized description of type of ski passes the respondents are usually buying are listed in Table 4.4. Since we would like to study on how to enhance the buying frequency of those who where skiing in less extend, respondents who hold a season pass where excluded.

Table 4.5 Seasonal skiing days at particular ski resort

	Hafjell	Skeikampen	Sjusjøen
Respondents who had vistited particular ski resort before	308 (89%)	172 (49.7%)	140 (40.5%)
Skiing days per season at particular ski resort (average)	3.98	1.22	2.00

Respondents where on average skiing 1.68 times per season. If respondents had visited Hafjell, Skeikampen or Sjusjøen ski resort they where asked additional questions about how many times they where usually skiing per season at that particular ski resort. The attendance per season to the particular ski resorts differ widely and is presented in Table 4.5. Respondent who had visited Hafjell ski resort before where on average visiting Hafjell ski resort **3.98** times per season. Additionally those who had visited SkeiKampen ski resort before where usually skiing **1.22** times on average at SkeiKampen ski resort per season and those who had visited Sjusjøen ski resort where usually skiing **2.00** times on average at Sjusjøen ski resort. We see that ski days attendance per season at Hafjell is almost twice as much compared to Sjusjøen and over three times compared to SkeiKampen ski resorts. To get the sense of how interested respondents where in skiing, questions about their skiing interest, included how many times they usually where skiing per season where asked. A total of 38 participants who stated they where not skiing where asked why they where not skiing (results are illustrated in Table 4.6). Witnessed by the fact that participation in skiing take a lot of time, most of the respondents stated they where not skiing because of time constrains. We can see that skiing is for some a social activity and for some a little frightening. One quarter of the non-skiers find skiing be too expensive. It should be noted that non-skiers who are convinced that skiing is too expensive might not think that ski passes in itself is expensive but the overall trappings that go with the ski experience, such as cost of equipment, and transportation to the resorts is expensive (P. Williams and Fidgeon, 2000).

Table 4.6 Why respondents where not skiing

Total 38 respondents	Number of respondents	Percentage
Too expensive	10	26.31%
Do not have the equipment	12	31.57%
Do not have friends who skiing	7	18.42%
Afraid of skiing	6	15.79%
Because of time constrains	16	42.10%
Other	16	42.10%
Total	38	

Population density

To get a more precise idea of how far away most of the respondents are living from the particular ski resorts, mapping software which illustrate the local population density where used. Two maps where created, one visualizing respondents distance to the nearest ski resort in Inland region particularly, and the second visualizing respondents residency distribution in southern Norway. The heat maps are created using respondents zip codes and Fusion tables[3]. Heat maps illustrate that the darker and more potent green/red color thus more respondents are living in that area. The maps illustrate the population surroundings around each ski area, which also illustrate the respondents travel range to each ski resort. The respondents within a radius of 200km to the studied ski resorts where seen as potential "one-day" skier who where able to ski on a day and return home to his resident before the evening.

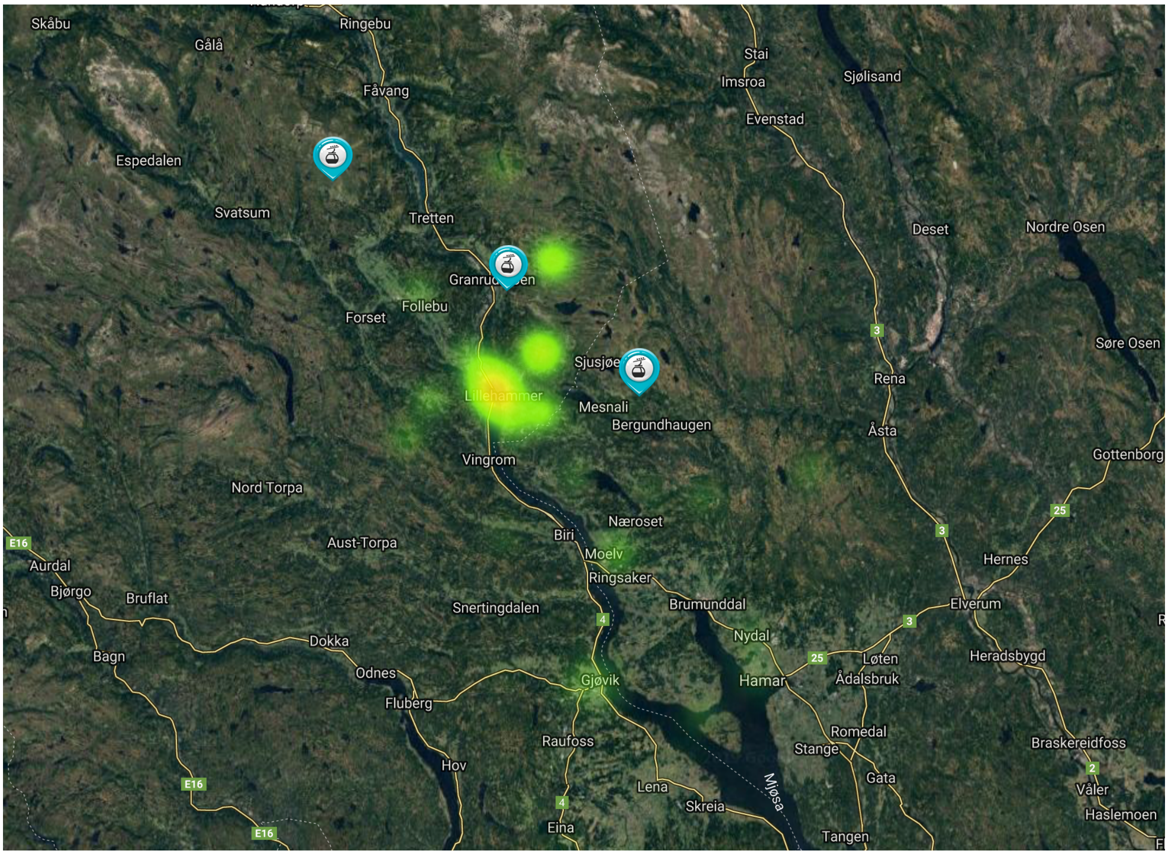


Fig. 4.2 Heatmap of Inland district of Norway

Pins show ski resorts locations from left; SkeiKampen, Hafjell and Sjusjøen ski resort respectievely.

[3]Fusion tables are a data management application provided by Google. More information see Gonzalez et al. (2010).

The heat maps could also ensure that the sampling was correct and we got respondents mostly from the Inland region of Norway. The zip codes, and so the map correspond with the data illustrated Table 4.2.

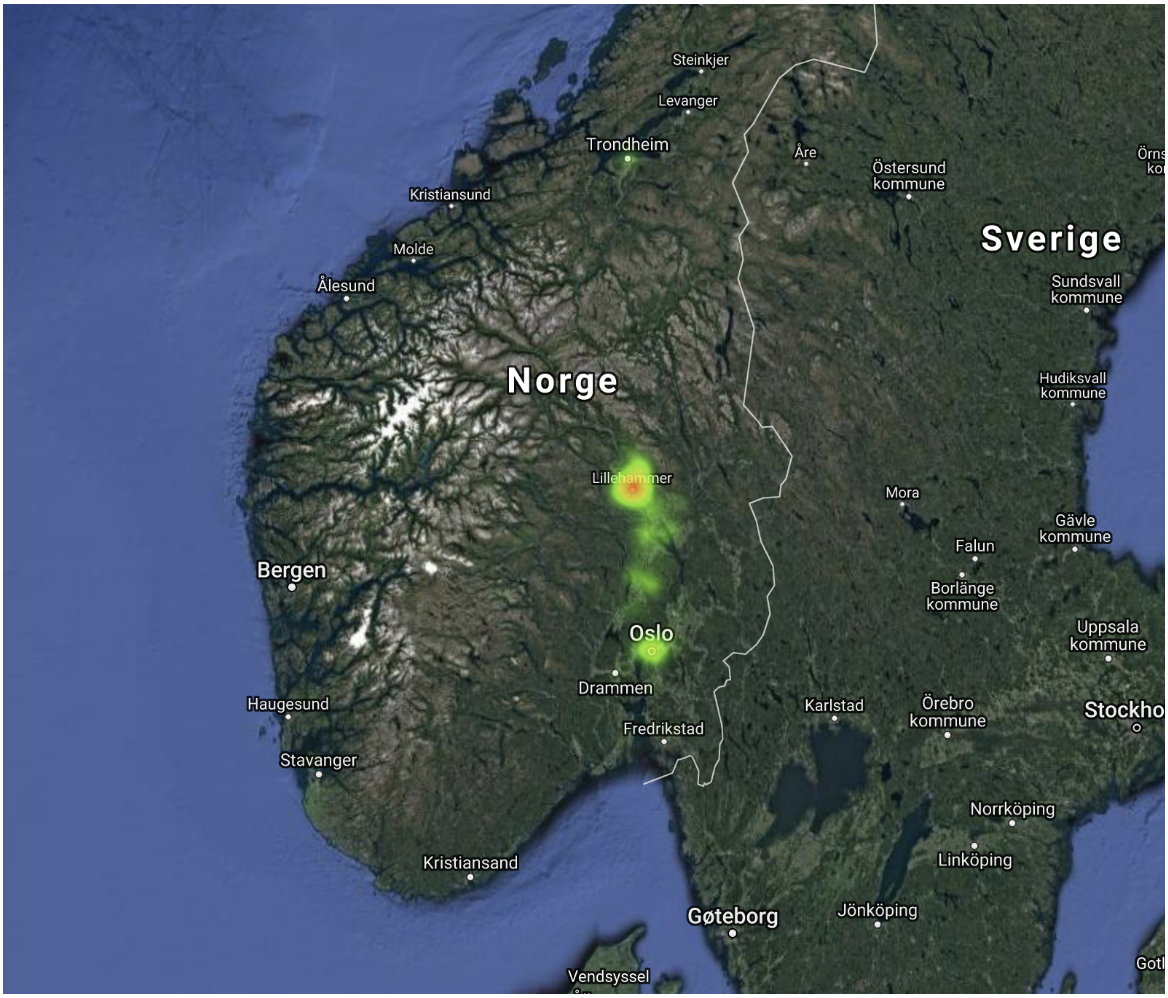


Fig. 4.3 Heatmap of respondents showing southern Norway

By putting the respondents on the map we can draw some conclusions. For instance, as seen in Figure 4.3 we see a high number of respondents living near the capital city. Most of the respondents are living in the urban areas, whereas Skeikampen is the ski resort which is located furthest away from urban and suburban areas, and so it visualize that number of respondents living nearby their resort is rather small. Walsh et al. (1983) found out that with an increase in 1.000 miles to the ski area the WTP increased with USD 0.37-1.04 to avoid congestion. In other words he founds that WTP is positively associated with the skiers distance to the ski area to avoid congestion. Therefore, it could be an assumption that since Skeikampen ski resort is further away from urban and suburban areas, people might have higher WTP to avoid congestion at that particular ski resort. There is therefore expected to be a positive relationship between WTP and the local population for those respondents who are potential "one-day" skiers. Moreover, since two of the resort are located near each other and are located in the suburban and urban we can expect some neighborhood effect.

4.2 The estimates of conjoint analysis

The analysis of the conjoint data are performed in R software (R Core Team, 2013). Since there was 6 questionnaires, the data where combined into one data set for studying. The preferences that respondents stated in the tasks are input for the conditional logit model that is used in this thesis.

According to Hoffman and Duncan (1988), the conditional logit model are preferable when we are estimating the choice among alternatives as a function of the characteristics of the alternatives. The conditional logit model has its origin from the random utility theory (Lancaster, 1966), which assumes that the utility of a respondent depend on the choices they make among a set of alternatives. Some of these choices can be explained, while some of them remains unexplained as we cannot posses the complete information among an individual decision. The conditional logit model are limited by their dichotomous variable; in the way that a respondent either select the alternative or they do not. In a conjoint analysis this means that respondents only can choose their "most preferred" alternative among choice set.

Coefficients

By the use of conditional logit model, we estimate respondents perceived utility. Respondents i where assumed to choose the alternative that would give them most utility. The utility function can be decomposed as:

$$U_{ij} = V_{IJ} + e_{ij} \tag{4.1}$$

Where V_{ij} is the utility respondent i receive from choosing alternative j, and e_{ij} is a stochastic component of utility (Aizaki, Nanseki, et al., 2013). The component of utility among our respondents i are described in the following function:

$$\begin{gathered} V_{ij} = ASC + b_{W2}Cloudy_2 + b_{W3}Fog_3 + b_{W4}Precipitation_4 + b_{WI2}Wind_2 + b_{WI3}Wind_3 + \\ b_{WI4}Wind_4 + b_{T2}Temp_2 + b_{T3}Temp_3 + b_{T4}Temp_4 + \\ b_{CR2}Crowdedness_2 + b_{CR3}Crowdedness_3 + \\ b_{CR4}Crowdedness_4 + b_{WE2}ThurFri_2 + \\ b_{WE3}Saturday_3 + b_{WE4}Sunday_4 + b_{R2}Skeikampen_2 + \\ b_{R3}Sjusjoen_3 + b_pPrice \end{gathered} \tag{4.2}$$

Where ASC is the alternative specific constant for each alternative relative to the "none of this option", meaning that ASC is 1 if respondent choose a alternative or 0 if he choose the "none of these" alternative. The *b* is the coefficients of the variables which is expressed by coding and receive a value of 1 if the alternative is chosen or zero otherwise. For instance, b_{W2} is the coefficient of the variable $Cloudy_2$ which would receive 1 if the respondent are choosing a alternative with cloudy weather or zero otherwise. b_P is the coefficient of the variable Price, which is the price of the alternative j.

Estimation of coefficients

Although the conditional logit have some constrains and it does not account for heterogeneity of preferences, it is still a widely method used in consumer research to estimate customers utility (Chen et al., 2013). The estimation of the function Equation 4.2 are summarized in Table 4.7. Following the guide described by (Aizaki and Nishimura, 2008) coefficient was obtained by using the module "clogit" in the "Survival" package in R(R Core Team, 2014).[4] A baseline reference level where set to all the attributes that where studied. The coefficients outputs therefore represent the marginal change in utility associated with the change in level 1 of the attribute. E.g. the coefficient of Crowdedness_2 is the value as a result of utility compared to level 1 of its attribute. For the attribute "Skeikampen_2" the attribute was "Hafjell_1".

Table 4.7 show the output of the results. The estimated coefficients in second column reveal the average odds for buying a ski pass with those characteristics; a positive value indicate a increased probability to buy a ski pass when the attribute level occur, whereas a negative value indicate a decrease in probability to buy a ski pass when the attribute level occur. Almost all attributes are significant at 0.01 level. The estimated model goodness of fit was indicated by McFadden´s adjusted pseudu-R^2 value of 0.135. We see that the attribute Thur_fri_2 is not significant which means that weekdays Thursday to Friday are not significant different from weekdays Monday to Wednesday. In other words, it means that customers do not see different in value between "Monday-Wednesday" and "Thursday-Friday".

We also see that Temp_3 (-9°C) is not significant different from 5°C, which means that customers do not see a different in value between -9°C and 5°C.

Hence, the output of the results are as expected; the comfort decreasing attributes are valued less by the respondents. The 7 attributes coefficients have expected signs. The positive value of Temp_2 and Temp_3 indicate that respondents prefer -2°C and -9°C over 5°C, but again 5°C is more preferable than -16°C (-2°C > -9°C > 5°C > -16°C), however, 5°C where not statistically significant. The positive values of Saturday_3 and Sunday_4 indicate that skiers are more likely to go skiing on weekends than weekdays. The coefficient of price

[4]Script of estimation is attached in Appendix E

variable are slightly negative, which indicate that customers prefer cheaper ski passes. The negative coefficient of price also indicate that utility of respondents will increase when there is cheaper ski passes. This results are logic and is consistent with the normal customer demand behavior (Hall and Hitch, 1939).

Table 4.7 Coefficients of attributes

	coef	exp(coef)	se(coef)	z	p
ASC (β0)	3.17	23.78	0.14	22.19	0.00***
Cloudy_2 (β1)	-0.24	0.78	0.07	-3.57	0.00***
Fog_3 (β2)	-0.53	0.59	0.07	-7.40	0.00***
Precipitation_4(β3)	-0.66	0.51	0.07	-9.20	0.00***
Wind_2 (β4)	-0.18	0.84	0.07	-2.53	0.01**
Wind_3 (β5)	-0.29	0.75	0.07	-3.96	0.00***
Wind_4 (β6)	-0.41	0.67	0.07	-5.64	0.00***
Temp_2 (β7)	0.34	1.41	0.07	4.89	0.00***
Temp_3 (β8)	0.07	1.07	0.07	0.91	0.37 ns
Temp_4 (β9)	-0.28	0.76	0.08	-3.63	0.00***
Crowdedness_2 (β10)	-0.19	0.82	0.06	-3.01	0.00***
Crowdedness_3 (β11)	-0.76	0.47	0.07	-10.66	0.00***
Crowdedness_4 (β12)	-1.25	0.29	0.08	-15.80	0.00***
Thur_fri_2 (β13)	-0.04	0.96	0.08	-0.54	0.59 ns
Saturday_3 (β14)	0.28	1.32	0.07	3.77	0.00***
Sunday_4 (β15)	0.26	1.29	0.07	3.41	0.00***
Skeikampen_2 (β16)	-0.56	0.57	0.06	-9.77	0.00***
Sjusjoen_3 (β17)	-0.74	0.48	0.06	-12.19	0.00***
Price (β18)	-0.00	1.00	0.00	-19.83	0.00***
Sum		39.11			

Asteriks indicate: *** Significance at 1% level,** Significance at 5% level, *Significance at 10%, n.s Not significant, Likelihood ratio test=55.82 on 19 df, p=< 2.2e-16 ,n= 11072, number of events= 2768, McFadden´s Pseudo R^2 = 0.135

Utility of customers

To estimate the utility a customer receives, the parth-worths estimates for each attribute was calculated (see Table 4.8). The total worth for skiers when visiting a ski resort can be estimated by the part-worths (sum of the attribute level parth-worths). For instance, based on the estimated parth-worths; the most preferred day at a ski resort is when the skier is at Hafjell ski resort on a Sunday and there is sunny weather, calm wind, -2 °C degrees and not crowded slopes. The total worth of this trip to the ski resort is estimated to be 21.3. Additionally, the least preferred day at a ski resort is when the skier is at Sjusjøen ski resort on a Monday, Tuesday or Wednesday, while there is precipitation, -16°C degrees, fresh breeze, and very crowded slopes which gives a worth of 15.18. However, directly comparison against the attributes makes no sense because all the attributes have their own unit. Comparison can only be done among the levels of the attributes.

Attribute importance

Given the utility range of each attribute that is estimated in Table 4.8, the relative importance of each attribute was obtained as the quotient of its utility range. Which is the difference between the maximum and minimum estimated part-worths divided on the sum of all the utility ranges. Note that price where not taken into calculation of the attribute importance since it was a dependent variable. Seen away from price, crowdedness was by far the most important of the studied attributes which received both the highest and lowest part-worth. The greater the difference between the maximum and minimum level of each attribute the greater importance of the attribute. Note that if all the levels of an attribute had the same utility, the attribute would not be important since it would have no influence on the overall attribute. The results confirm the fact that respondents are taking the aspects of ski resorts external and internal characteristics into consideration when making a choice. As illustrated in Table 4.8 not crowded slopes are valued most, whereas very crowded slopes gives the least perceived utility.

Table 4.8 Parth-worths and attribute importance

Attribute	Levels	Regression coefficients	Estimated parth-worths	Utility range	Attribute importance (%)
Weather	1. Sunny	$\beta 0$-$\beta 1$-$\beta 2$-$\beta 3$	4,60	2.09	20.39%
	2. Cloudy	$\beta 0$+$\beta 1$	2.93		
	3. Fog	$\beta 0$+$\beta 2$	2.64		
	4. Precipitation	$\beta 0$+$\beta 3$	2.51		
Wind	1. Calm 0-0.3 m/s	$\beta 0$-$\beta 4$-$\beta 5$-$\beta 6$	4.05	1.29	12.58%
	2. Light air / light breeze 0.4-3.3 m/s	$\beta 0$+$\beta 4$	2.99		
	3. Gentle breeze / moderate breeze 3.4 - 7.9 m/s	$\beta 0$+$\beta 5$	2.88		
	4. Fresh breeze 8 m/s	$\beta 0$+$\beta 6$	2.76		
Temperature	1. 5°C	$\beta 0$-$\beta 7$-$\beta 8$-$\beta 9$	3.04	0.62	6.04%
	2. -2°C	$\beta 0$+$\beta 7$	3.51		
	3. -9°C	$\beta 0$+$\beta 8$	3.24		
	4. -16°C	$\beta 0$+$\beta 9$	2.89		
Crowdedness	1. Not crowded	$\beta 0$-$\beta 10$-$\beta 11$-$\beta 12$	5.37	3.45	33.65%
	2. Somewhat crowded	$\beta 0$+$\beta 10$	2.98		
	3. Crowded	$\beta 0$+$\beta 11$	2.41		
	4. Very Crowded	$\beta 0$+$\beta 12$	1.92		
Weekday	1. Monday - Wednesday	$\beta 0$-$\beta 13$-$\beta 14$-$\beta 15$	2.67	0.76	7.4%
	2. Thurday - Friday	$\beta 0$+$\beta 13$	3.13		
	3. Saturday	$\beta 0$+$\beta 14$	3.45		
	4. Sunday	$\beta 0$+$\beta 15$	3.43		
Alpine Resort	1. Hafjell	$\beta 0$-$\beta 16$-$\beta 17$	4.47	2.04	19.90%
	2. Skeikampen	$\beta 0$+$\beta 16$	2.61		
	3. Sjusjøen	$\beta 0$+$\beta 17$	2.43		
Price	NOK 250, 350, 450 and 550	$\beta 0$-$\beta 18$	3.17	-	
Total				10.25	100%

4.3 Marginal willingness to pay

4.3.1 Estimating marginal willingness to pay

In our study, we had a price range between NOK 250-550, so we collect data only within this range. Samples that goes beyond this range is not taken into account. Once the utility are calculated using the conditional logit model, we can use the maximum likelihood method to calculate the marginal rate of substitution (MRS), which is defined as the negative ratio between two attributes. Since we are interested to the substitution between price and the other attributes, we can calculate marginal willingness to pay (MWTP) using the coefficients.

If we assume that the utility under different ski resorts characteristics is a function of price we can calculate the willingness to pay (WTP) for each attribute which is the ratio between the coefficient of the attributes and the coefficient of the stated price (Revelt and Train, 1998).

The total number of observations was 11 072 where a total of 346 respondents answered 8 choice task with 4 alternatives. The function of the estimation is illustrated in Equation 4.3 where b_{nm} is the coefficient of a specific attribute, and b_m is the coefficient of the price.

$$MWTP = -b_{nm}/b_m \tag{4.3}$$

The score of the WTP estimates for all the attributes are summarized in Table 4.9. The $MWTP$ is interpreted as the value decrease (or increase) when one of the attributes occur. The values should be seen as a average value, meaning that a linear utility function of all the respondents are assumed. The output in Table 4.9 shows us that negative values of $MWTP$ indicate that skiers are willing to pay less on that particular situation compared to level 1 of its attribute level. It should be noted that the the values in column 1 in Table 4.9 are all estimated compared to its attribute baseline (see Table 3.1). For instance, it was found that skiers are willing to pay on average NOK 40, 159 and 262 less thus higher levels of crowdednesss compared to level 1 of crowdedness which is the baseline. The difference between two levels in a attribute show how much (or less) more an average customer are willing to pay. For instance, the difference between Crowdedness_2 and Crowdedness_3 has a "gap" between these two levels with a value of NOK 119 ($159.48 - 40.50 = 119$). The "gap" between these two levels means that WTP for the average customer will increase with NOK 119 if the level of crowdedness goes from level 3 to 2.

Walsh et al. (1983) have estimated the decrease in WTP of an additional skier per acre to be between USD 0.09 and 0.22, which correspond with our results that WTP increases if there are more skiers in the slope. However, it should be noted that it is difficult to transform our results and compare the results more specific since we have another measurement of density. Walsh et al. (1983) also founds out that the WTP for congestion do depend on the average distance to the ski area. Those who where living further away where more affected and WTP less when crowdedness occur.

Different weather scenarios do also affect the willingness to pay. Moreover we see that mostly the comfort decreasing level of attributes such as strong wind and low temperature has a strong influence on the WTP.

We also see a difference in WTP for the different ski resorts. Skeikampen ski resort had a signifcantly lower WTP (-118.13; 95 % CI = -144.82.2, -93.17) compared to Hafjell ski resort. However, the WTP for Sjusjøen ski resort where also significantly lower (-154.89; 95 % CI = -182.12, -128.39) compared to Hafjell ski resort. This implies that WTP for ski passes at Hafjell ski resort is higher than Skeikampen ski resort, which in turn is higher than Sjusjøen ski resort.

However, there might be special reasons why respondent prefer a ski resort in relation to another. It might be partly explained by the fact that Sjusjøen and Skeikampen ski resort is smaller and offer less ski services. Another assumption for result of negative $MWTP$ for Skeikampen ski resort is that it is the ski resort are located furthest from the respondents residency (see Table 4.2). As (Falk, 2008) note that the further a ski resort is from a population where skiers live, they are less likely to visit, which might explain partly the values of WTP for Skeikampen ski resort. Authors, such as Walsh et al. (1983) found that WTP for ski passes could be explained by the distance to the next preferred ski area. Which might explain a possibly neighboring effect between Hafjell ski resort and Sjusjøen ski resort. Moreover, Walsh et al. (1983) found that demand declined with 0.21% with a 1% increase in distance to the resort, which might partly explain the negative $MWTP$ value of Skeikampen ski resort which is furthest away from the respondent resident.

Table 4.9 Estimation of Marginal willingness to pay in NOK

	MWTP	2.5%	97.5%
Cloudy_2	-51.36	-80.14	-22.33
Fog_3	-110.14	-141.33	-79.75
Precipitation_4	-139.30	-172.70	-108.38
Wind_2	-36.96	-66.28	-8.46
Wind_3	-60.31	-91.06	-30.81
Wind_4	-85.14	-116.09	-55.08
Temp_2	71.77	41.79	101.61
Temp_3	13.73	-17.02	44.09
Temp_4	-57.66	-90.24	-25.76
Crowdedness_2	-40.50	-67.23	-14.54
Crowdedness_3	-159.48	-191.79	-129.73
Crowdedness_4	-262.84	-302.16	-226.55
Thur_fri_2	-8.76	-40.36	23.08
Saturday_3	58.20	28.40	88.98
Sunday_4	53.53	22.28	85.34
Skeikampen_2	-118.13	-144.82	-93.17
Sjusjoen_3	-154.89	-182.81	-128.39

The two rows to right are 95% confidence interval which are obtained by the Krinsky and Robb method (Krinsky and Robb, 1986), 1$= 8.75 NOK June 2019.

4.3.2 Confidence interval MWTP

In order to derive the confidence interval around the $MWTP$, there have been used the "MWTP" command in the package "support.CEs" (Aizaki, 2012) in R. The confidence intervals around the $MWTP$ values where estimated using the Krinsky and Robb method. The Krinsky and Robb method is suggested to be used to examine the difference in mean-willingness to pay and confidence intervals for the WTP for non-market goods (Cameron, 1991; Park et al., 1991). Even though ski passes are sold in the market, the Kriskty and Robb approach is a good method to estimate how much less (or more) customers are valuing the different levels of the attributes. However, the Krinsky and Robb method would not give us a observable monetary value. In contrast it would give us the difference in the mean value of willingness to pay. However, the approach takes explicit into account all variability associated with the estimated coefficients from the conjoint analysis.

The WTP confidence interval for all the attributes are illustrated in Table 4.9. For instance, following Krinsky and Robb method; at 95% confidence interval, skiers have a positively probability to pay between NOK -67.23 and NOK -14.54 less when it is somewhat crowded slopes compared to not crowded slopes.

While the MWTP values that is presented in Table 4.9 provide useful information about how much customers are willing to pay for ski passes at the attributes differents levels, the measures could be very much higher if we could not measure its precision. Without confidence interval around the value of MWTP, we cannot ensure the validity of the $MWTP$. In other words without these confidence intervals, we cannot judge weather a change in crowdedness are statistically significant.

4.4 Frequency estimation of crowdedness

To further understand market impact of crowdedness we intended to see how much frequency differ by the level of crowdedness for each ski resorts. After every conjoint task, respondent where asked how many times they would go skiing at that specific chosen scenario (see Table 3.3). A summary of the attendance for each level of crowdedness by the different ski resort is illustrated in Table 4.10. On average, skiers would like to ski **4.71** times per season at Hafjell ski resort when it is not crowded level 1 (Not crowded) compared to **3.83** times per season at crowdedness level 4 (very crowded). In other words, the increase of crowdedness from level 1 to 4 will decrease the attendance from **4.71** to **3.83** (**-18.6%**) times per season for Hafjell ski resort. The increase of crowdedness from level 1 to 4 will decrease the attendance from **4.15** to **3.81** (**-8.9%**) times per season for Skeikampen ski resort, and the increase of crowdedness from level 1 to 4 will decrease the attendance from **4.06** to **3.47** (**-14.63%**) times per season for Sjusjøen ski resort.

However, the results differ by what we use as reference level or "how crowded it usually is when visiting the particular ski resort". For instance, If we use level 2 of crowdedness as a reference level, the result show that among the three ski resorts; Skeikampen ski resort will be most affected for customers attendance if there are more crowded slopes, followed by Sjusjøen Ski resort and Hafjell ski resort respectively. These results show that the increase of crowdedness from level 2 to 3 or 4 (Somewhat crowded to crowded and very crowded slopes) do have a substantial decrease in attendance for Skeikampen and Sjusjøen ski resort compared to Hafjell ski resort. However, the results show that perhaps surprising, Hafjell ski resort is the most affected when its "not very crowded slopes" which where respondent has stated they will attend most days when stated their attendance among the ski resorts. Moreover, If we use level 2 as the standard, we see that Hafjell is substantial affected by a increase in attendance when it is "not crowded" slopes but not otherwise. If we use level 1 as the standard, the result will flip for Hafjell at higher level of crowded slopes. Results show that level 2, 3 and 4 of crowdedness are generally more indifferent for Hafjell Ski resort in contrast of Skeikampen and Sjusjøen ski resort, which in other words might explain that Skeikampen and Sjusjøen ski resort are more sensitive to crowdedness at high levels.

Table 4.10 Stated frequency for different level of crowdedness

Ski resort	Crowdedness level	Average stated days per season	Percentage change from level 1	Percentage change from level 2
Hafjell	1 (Not crowded)	4.71	0%	21%
Hafjell	2 (Somewhat crowded)	3.90	-17%	0%
Hafjell	3 (Crowded)	4.05	-14%	-4%
Hafjell	4 (Very crowded)	3.83	-19%	-2%
Hafjell	All levels	4.17		
Skeikampen	1 (Not crowded)	4.15	0	3%
Skeikampen	2 (Somewhat crowded)	4.03	-3%	0%
Skeikampen	3 (Crowded)	3.27	-21%	-19%
Skeikampen	4 (Very crowded)	3.81	-8%	-5%
Skeikampen	All levels	3.91		
Sjusjøen	1 (Not crowded)	4.06	0%	12%
Sjusjøen	2 (Somewhat crowded)	3.61	-11%	0%
Sjusjøen	3 (Crowded)	3.31	-18%	-8%
Sjusjøen	4 (Very crowded)	3.47	-15%	-4%
Sjusjøen	All levels	3.67		
All resorts	1 (Not crowded)	4.35	0%	12%
All resorts	2 (Somewhat crowded)	3.88	-11%	0%
All resorts	3 (Crowded)	3.61	-17%	-7%
All resorts	4 (Very crowded)	3.73	-14%	-4%
All resorts	All levels	3.96		

4.5 Market share simulations

Market share is considered to be a portion of the quantity of a products sold relative to the category sales. Bell et al. (1975) specify that market share of a product equals the product attractiveness. Using the calculated parth-worth for each respondents we can the share of preference for each attribute in a given scenario. The market share show the percentage of the overall load that can be served from a ski resort for selling ski passes different prices.

If we calculate the share for a given scenario under various price levels we would get some data points for a demand function, which we will in subsection 4.6.2 define to a price response function. First, we would describe the market share estimation and results more profoundly.

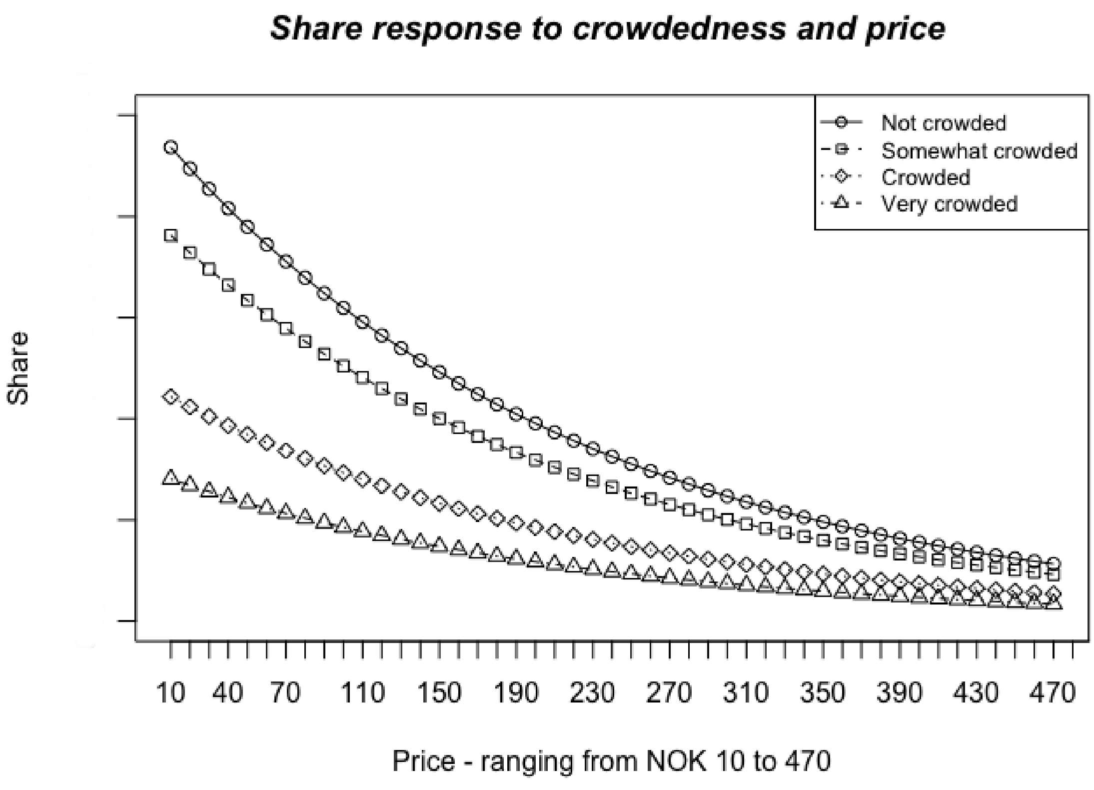


Fig. 4.4 Share response for crowdedness to price

Simulating the market share for each level of crowdedness towards each different ski resorts is a better way to illustrate how crowdedness and ski resorts combined are affecting consumers choice. The market share of one attribute is calculated by taking the attribute exponential utility and divide it on the sum of the other attributes exponential utility[5]. By this way we can estimate the market share for each level of crowdedness.

Table 4.11 show a summary of estimated market share under different level of crowdedness at different prices for the different ski resorts respectively. The table show predicted market reaction to changes in level of crowdedness and prices. Our results shows that, perhaps surprising market share change quite quickly as the prices and level of crowdedness changes.

For instance market share for Hafjell at NOK 450 jumps from 0.19 to 0.16 (decrease of 15%) when the crowdedness goes from level 1 to 2. We see that at price NOK 400 and level 2 of crowdedness Hafjell ski resort would achieve approximately the same amount of share as when the price is NOK 450 at level 1 of crowdedness. In other words, If price is dropped from NOK 450 to NOK 400 (-11%) at Hafjell ski resort, the market share will increase with 21% at the same level of crowdedness (crowdedness level 1).

The change of market share at different crowdedness levels which illustrate a jump either way illustrate that this attribute do have a effect on buying decision, especially when it comes to changing prices of ski passes. Further Table 4.11 show that small change in prices when different level of crowdedness occur can significantly change the market share, which we will later describe how it will affect the profitability of the ski resort.

Figure 4.4 illustate the respective response for market share for the respective crowdedness levels. A steeper slope reflect a higher price-sensitivity. We see that if we go from not crowded slopes towards more crowded slopes we experience a shift in the slope towards left which illustrate that the share demanded for ski passes will decrease when there are more crowdedness. To deal with this and achieve the same amount of share under different crowdedness circumstances the ski resorts could possibility set different prices to the level of crowdedness. Without decreasing the price of ski passes accordingly to crowdedness the ski resorts will loose market share. By looking at the shape of curve in Figure 4.4 we see that price sensitivity is higher when the slopes are little crowded compared to somewhat crowded, crowded and very crowded slopes.

However, market share that is estimated in a certain market is never exactly the same as real market share. The market share that is estimated from conjoint data is based on the assumption that customers are buying a particular ski pass based on the attributes that gives them most utility. It does not take to account other factors which is influencing the market share such as marketing tools or other sales factors (Lebeau et al., 2012a). Therefore, the estimated market share depicts a potential market share. However, the market simulations are able to explain the underlining reasons for the market share based on the influence of the

[5]Estimation of market share for each level of crowdedness are attached to Appendix C

estimated part-worth. We see that the studied Ski resorts with very crowded slopes have a overall low market share because that is the attribute customer prefer least. However, cheaper prices for ski passes can compensate for this and we find that ski resort can achieve more market share if they lower their prices accordingly to the level of crowdedness.

Market share in this study is estimated so that share is normalized to 1.00 at NOK 450. This means that we assume NOK 450 is the reference price for ski passes. For instance, if we normalize the share to 1.00 at NOK 400 instead of NOK 450 we would have higher share at lower prices, which could also have a impact on the estimated optimal prices.

Table 4.11 Market share by Price

Market share for ski passes under different level of crowdedness and prices in NOK

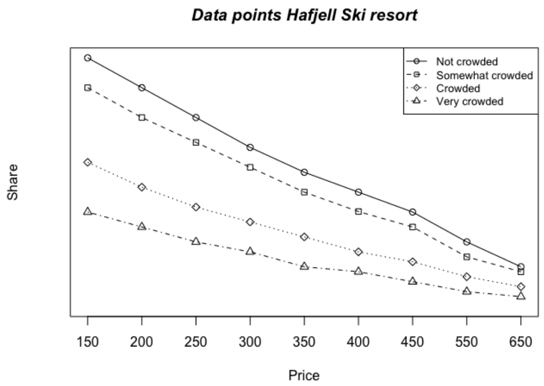
Ski resort	Crowdedness	150	200	250	300	350	400	450	550	650
Hafjell	Level 1	0.50	0.44	0.38	0.32	0.27	0.23	0.19	0.13	0.08
Hafjell	Level 2	0.44	0.38	0.33	0.28	0.23	0.19	0.16	0.10	0.07
Hafjell	Level 3	0.29	0.24	0.20	0.17	0.14	0.11	0.09	0.06	0.04
Hafjell	Level 4	0.19	0.16	0.13	0.11	0.08	0.07	0.05	0.03	0.02
Skeikampen	Level 1	0.34	0.29	0.24	0.20	0.16	0.13	0.11	0.07	0.05
Skeikampen	Level 2	0.29	0.24	0.20	0.17	0.14	0.11	0.09	0.06	0.04
Skeikampen	Level 3	0.18	0.15	0.12	0.10	0.08	0.06	0.05	0.03	0.02
Skeikampen	Level 4	0.12	0.10	0.08	0.06	0.05	0.04	0.03	0.02	0.01
Sjusjøen	Level 1	0.29	0.25	0.21	0.17	0.14	0.11	0.09	0.06	0.04
Sjusjøen	Level 2	0.25	0.21	0.17	0.14	0.12	0.09	0.08	0.05	0.03
Sjusjøen	Level 3	0.16	0.13	0.10	0.08	0.07	0.05	0.04	0.03	0.02
Sjusjøen	Level 4	0.10	0.08	0.06	0.05	0.04	0.03	0.03	0.02	0.01

4.6 Market data to PRFs

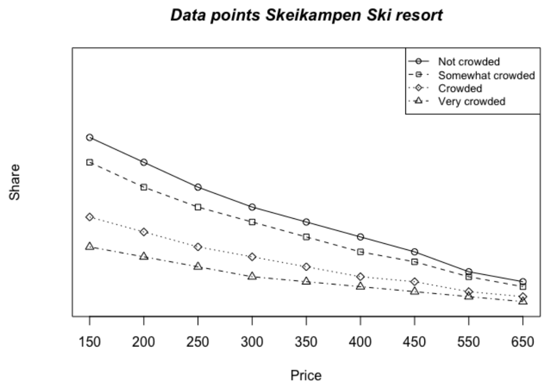
Estimating demand functions or PRFs from market share data is not widely been done by researchers. However, there are some few authors that have estimated PRFs and optimal prices on data perceived from a CBC analysis. For instance, (Pratikto, 2018) have estimated contribution-maximizing prices for mobile broadband services using part-worths utilities from a CBC analysis. In this section we are going to explain estimated demand function for ski passes under different level of crowdedness and for the different studied ski resorts.

4.6.1 Demand function

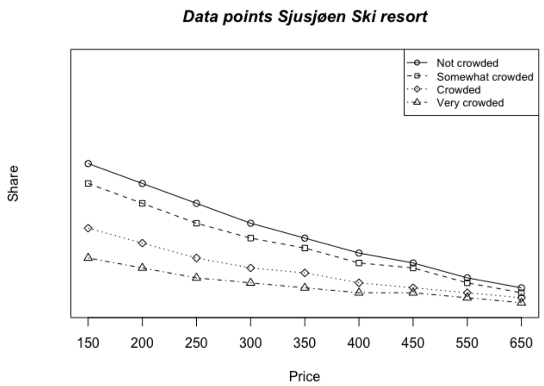
A decrease in price of ski passes is believed will change the demand of ski passes, which has a market share defined as a proportion of demand volume in the market. In a market there might be substitute products. In the case of ski resorts, this might be competitors or other leisure activities. In order to estimate the price effect on the different levels of crowdedness and at different ski resorts, we assume that prices of other leisure activities or ski passes at other ski resorts are held constant. The output from the market simulation is calculated by the aggregation of choice probability of each respondents. Since the market share simulation is run under various price levels, we have some data points (see Figure 4.5) for a function, which we will in subsection 4.6.2 interpolate to a demand function.



(a) Hafjell



(b) Skei Kampen



(c) Sjusjøen

Fig. 4.5 Data points

4.6.2 Interpolating the demand function

As there was simulated varied prices under varied levels of crowdedness and ski resorts, 9 datapoints where obtained from the simulation for the levels of crowdedness at each ski resort. However, it is very intuitive to assume that there will be a function that will fit all the data point that is derived. Based on the datapoints and following suggestion of Phillips (2005) the logit-price function where used in this study. Table 4.12 illustrate the data points at crowdedness level 1 for the ski resort. Additionally, all data points for the ski resorts at different level of crowdedness is illustrated in Table 4.11.

Table 4.12 Data points for not crowded slopes at Hafjell ski resort

Price	150	200	250	300	350	400	450	550	650
Hafjell									
Share	0.50	0.44	0.38	0.32	0.27	0.23	0.19	0.13	0.08
Skeikampen									
Share	0.34	0.29	0.24	0.20	0.16	0.13	0.11	0.07	0.05
Sjusjøen									
Share	0.29	0.25	0.21	0.17	0.14	0.11	0.09	0.06	0.04

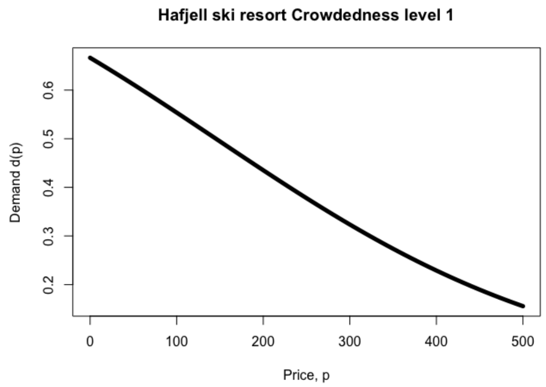
To estimate demand for those data points we used Solver in MS Excel which has it elementary function to minimize cells by changing other cells. By using that function we used Solver to minimize the squared residuals of an logistic function to get a output of parameters for a logistic function that would fit the data points. Estimated parameters of the logistic function for the different level of crowdedness at each ski resorts are listed in Table 4.13. Using this method we can predict the demand at a given value of the price. Figure 4.6 depict crowdedness level 1 demand curves that is interpolated with the data points. We assume that the ski resorts are in perfect segments, which means that there where no cannibalization between the ski resort or level of crowdedness, and we can create separate functions and get demand curves for each ski resort.

Table 4.13 Summary of parameters for PRF for various crowdedness levels.

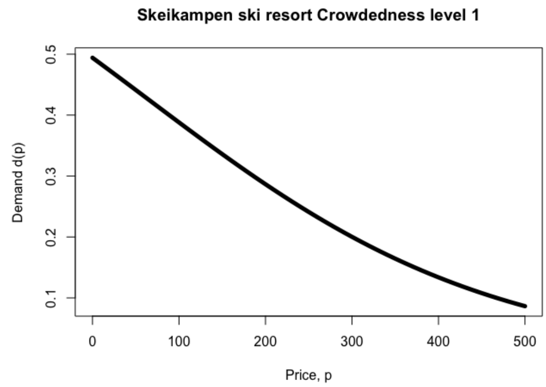
Parameter	**Value**
Hafjell crowdedness level 1	
C	0,99901563
b	-0,00477
α	0,695339737373019
R^2	0,9949
Hafjell crowdedness level 2	
C	0,999895899747954
b	-0,00477
α	0,460032267508882
R^2	0,9972
Hafjell crowdedness level 3	
C	0,74111463
b	-0,005025247
α	0,27109674818
R^2	0,9977
Hafjell crowdedness level 4	
C	0,53015164
b	-0,00538481458125066
α	0,248781661228102
R^2	0,9955
Skeikampen crowdedness level 1	
C	0,85359715
b	-0,00500183658534242
α	0,317792643510707
R^2	0.9982
Skeikampen crowdedness level 2	
C	0,87484947
b	-0,00486
α	0,013885
R^2	0.9424
Skeikampen crowdedness level 3	
C	0,57461843
b	-0,00523

Table 4.13 continued from previous page

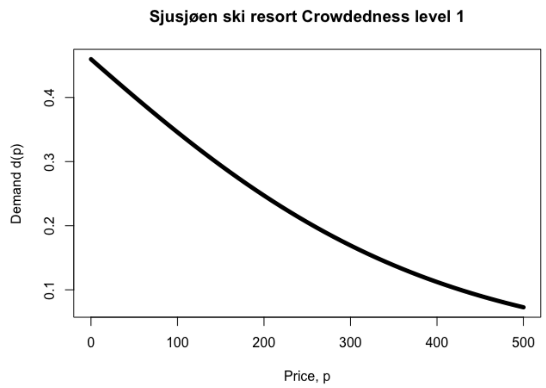
Parameter	**Value**
α	0,01378
R^2	0,9951
Skeikampen crowdedness level 4	
C	0,50195204
b	-0,00509
α	-0,43631
R^2	0,9927
Sjusjøen crowdedness level 1	
C	0,99799398
b	-0,00477
α	-0,15774
R^2	0.9978
Sjusjøen crowdedness level 2	
C	0,87078516
b	-0,0049
α	-0,16267
R^2	0.9971
Sjusjøen crowdedness level 3	
C	0,56145523
b	-0,00517
α	-0,17944
R^2	0.9942
Sjusjøen crowdedness level 4	
C	0,50060217
b	-0,00502
α	-0,64986
R^2	0.992



(a) Hafjell



(b) Skei Kampen



(c) Sjusjøen

Fig. 4.6 Demand crowdedness level 1

Price optimization

The main goal of most ski resort is to maximize their contribution. Maximal contribution can be obtained by maximizing the revenue (Phillips, 2005). To estimate the optimal prices for maximal contribution we used the following objective function for incapacitated pricing:

$$\max_{p} R(p) = d(p)(p) \tag{4.4}$$

Since we had the implicit parameters for for logit price response curve for each of the scenarios (4 different level of crowdedness at the 3 different ski resort), we could insert the parameters into the following logistic formula to estimate $d(p)$.

$$d(p) = \frac{Ce^{-(a+bp)}}{1+e^{(a+bp)}} \tag{4.5}$$

Where a, b and C are parameters that is estimated from the curve of the logit function (see Table 4.13). By inserting the parameters and using Solver in MS Excel we could solve the corresponding optimization problem. Because of uncertain in the price and the fact that $d(p)$ is a nonlinear transformation of the parameters, it could lead to sub-optimal results (Aravindakshan and Ratchford, 2011). Therefore, the estimation process where also estimated in R software by solving the minimization problem with the Broyden–Fletcher–Goldfarb–Shanno (BFGS) algorithm to see that the prices did not differ widely [6]. The BFGS algorithm is a popular and efficient algorithm to solve non-linear optimization functions and recommended for smooth functions (Manousopoulos and Michalopoulos, 2009; Xiang et al., 2013). Since the incremental cost is the cost for an additionally consumer (Phillips, 2005), the incremental cost for an ski resort could be very low. Lift in ski resorts are always running independent of the amount of customers, and preparing the ski slopes and producing artificial snow is been done independently by the number of customers. Therefore, we can assume that the incremental cost are almost close to zero. Malasevska and Haugom (2018) are some authors that have estimated the incremental cost for ski resorts to be approximately NOK 1.6 per skiing day. Therefore when solving the optimization problem we are assuming that the incremental cost is zero. Assuming the same incremental cost for ski passes, we came up with optimal prices for the different level of crowdedness for for the studied ski resort. For instance, we came up with a price of NOK 268, NOK 245 and NOK 240 for Hafjell, Skeikampen and Sjusjøen Ski resorts respectively when it is crowded slopes. The estimates of optimal prices at each ski resorts and for all levels of crowdedness are listed in Table 4.14. A selection of the total contribution as function of price for the different ski resort for crowdedness level 3 is illustrated in Figure 4.7.

[6]see Appendix D for R script of estimation.

Table 4.14 Optimal solution for dynamic pricing

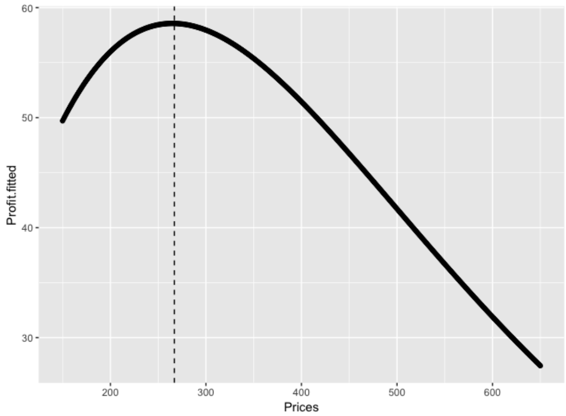
	Dynamic Price		Fixed price		
Crowdedness level and Ski resort	**Price**	**Profit**	**Price**	**Profit**	**ΔProfit (%)**
Cr=1 Hafjell	NOK 307	96.79	NOK 455	84.41	14.66%
Cr=2 Hafjell	NOK 283	82.17	NOK 455	69.52	18.19%
Cr=3 Hafjell	NOK 268	50.33	NOK 455	39.57	27.19%
Cr=4 Hafjell	NOK 248	33.17	NOK 455	24.03	38.03%
Cr=1 Skeikampen	NOK 271	60.51	NOK 390	54.41	11.21%
Cr=2 Skeikampen	NOK 263	50.64	NOK 390	45.06	12.38%
Cr=3 Skeikampen	NOK 245	30.91	NOK 390	26.08	18.51%
Cr=4 Skeikampen	NOK 235	19.28	NOK 390	15.96	20.80%
Cr=1 Sjusjøen	NOK 261	51.40	NOK 430	42.45	21.08%
Cr=2 Sjusjøen	NOK 254	43.51	NOK 430	35.09	23.99%
Cr=3 Sjusjøen	NOK 240	26.21	NOK 430	20.02	30.91%
Cr=4 Sjusjøen	NOK 232	16.26	NOK 430	12.22	33.06%

Cr= crowdedness level

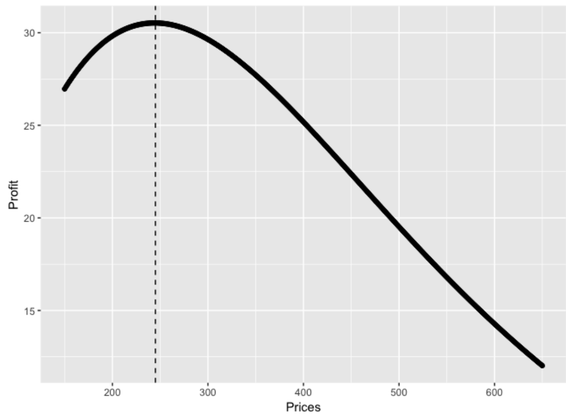
When it is crowded (at level 3 of crowdedness), Hafjell ski resort do have the highest contribution when they price their ski passes at NOK 268. The figure illustrate that pricing above or below this price at that condition might result in loosing profit. Figure also illustrate that Hafjell is the ski resort with most profit at their optimal price, followed by Skeikampen which is the second most profitable at their optimal price, and Sjusjøen which make the least amount of profit at their optimal price.

In Table 4.14 we observe in general the benefit of using dynamic pricing. If crowdedness (Cr) increases and prices adapt correspondingly, Δ profit increases in contrast to non-changing prices.

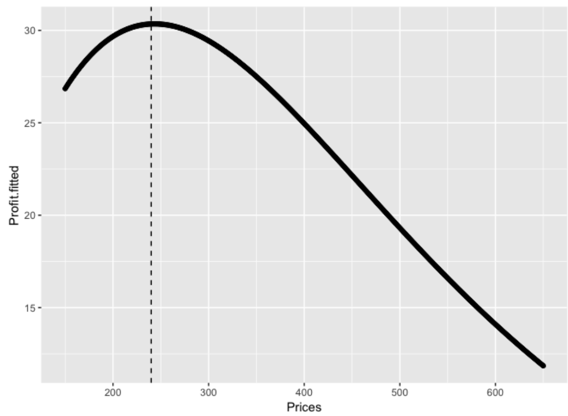
This results show that revenue could be increased if ski resorts lower (or increase) their prices to the optimal price according to the level of crowdedness in the slopes. The results show that when slopes are crowded (such as weekends and holidays), ski resorts could lower their prices to increase revenue. Hence, the prices can not be directly transformed to real customer behavior. But most interesting with this results are that we see a difference in customers choices among the ski resort and the level of crowdedness.



(a) Hafjell Crowdedness level 3.



(b) Skeikampen Crowdedness level 3



(c) Sjusjøen Sjusjøen level 3

Fig. 4.7 Optimization for Ski resort when crowded slopes

Selection of contribution as a function of price at crowdedness level 3 for all three ski resorts.

Chapter 5

Limitations, Conclusion and Future Directions

This chapter examine how the main objective were met by summarizing the findings of the study. Additionally, implications of the findings are discussed before conclusion and recommendations for future research are presented.

5.0.1 Summary

The main objective of this study was to better understand customers preferences for crowdedness for different ski resorts in the Inland region of Norway and see how negatively the crowdedness affected the WTP and how ski resort could adapt their prices accordingly to the level of crowdedness to increase their revenue.

A conjoint survey was administered winter 2018/2019 in the Inland district of Norway. Three ski resort from the region where studied. The targeted population where skiers in the Inland district in Norway who where at least 16 years old and did not hold a seasonal ski pass. A total of 346 respondents completed a survey where they evaluated different ski days scenarios. Information regarding customers preferences towards ski resorts characteristics where obtained from the chosen alternatives. The majority had a annual household income above NOK 600 000. The general results from the conjoint analysis indicate that there was an considerable decrease in the WTP when crowded slopes occur at the different studied ski resorts.

5.1 Limitations, validity and reliability

There are some factors that should be taken into account when interpreting the results, in order to draw any conclusion about the Inland region of Norway.

Rao et al., 2014 state that the reliability and validity results of conjoint analysis generally are very high. The number of respondent in this study was pretty high which played a big role.

The findings here are limited to three sites within the Inland region of Norway. The sampling of this thesis was people who where living within 200km from their preferred ski resort. The results may give indication of the Inland region of Norway, but might not be generalized to major ski destinations in other countries because we can assume the characteristics of ski resort in the Inland region of Norway differ widely from major ski resort in other countries. Therefore, we expect that WTP and preferences for crowdedness will differ between those who choose large destinations and those who are choosing small destination which is studied in this thesis. As for foreigners and people living further away from the ski resorts, they might have other preferences for choosing a ski destination.

The seven used attributes are based on literature and results of the pre-test. However, the consumers choices are complex. There was tested for 7 different attributes, but in reality there might be a dozens more attributes that customers are taking into considerations when making a choice. Therefore, this model that is studied can not account for what is not tested.

Furthermore, the respondents did not actually buy a ski pass, and one must take the value-action gap to consideration, in other words, the respondents real willingness to pay is not revealed. Therefore, we must assume there is some bias in our results (see for instance Murphy et al. (2005)). There will always be some degree of uncertainty in weather a preference represent a actual choice of the buyer because the magnitude of the hypothetical bias of the product is inconclusive.

Given the lack of research to applying a new dynamic pricing scheme and pricing towards crowdedness in slopes, the ability to compare most of the results presented here with other situations are limited.

There are also some groups within the sample that might are over represented, such as students and persons with high household income, which might have had a impact on the WTP and the results in general.

Face validity

The parth worths of each respondents in the conjoint analysis where checked if they "look right". However, this could only be done for the attributes we know gave a lower utility, such as high prices, much crowdedness or bad weather (if all other levels of an alternative where equal). Whereas it was not possible to check the face validity of the "ski resort" attribute since respondent might had special reasons why the prefer a ski resort instead of another.

Visual validity

This study used manipulated images and respondents where told to assume the conditions represented where at the site they chosen. An improvement, however, would have been to show backgrounds of the actual sites. Moreover, the manipulation of crowdedness levels was given by far the greatest rating among the attributes. However, it should be noted that the importance obtained from the CBC analysis are a function of the difference between the least and most favorable level of the attribute. Therefore, it could be argued that our least preferred level of crowdedness might have been rather "extreme".

Furthermore, it is difficult to compare this study with other studies specifically because of the use of different density measures.

The images depicted in this study where static and represented a "snapshot" of the conditions. For future studies there would have been interesting to use video techniques which may prove even more realistic representation of the conditions.

5.1.1 How the choice based analysis worked in this kind of study

One of the objective of this thesis was to see weather a choice based analysis where well suited to valuing each attribute that makes up a skiers decision when buying a ski pass. The conjoint method where both challenging and rewarding. Concerning the results, the conjoint analysis seemed to be well suited since it could answer the research questions. The estimated utility customers perceived where very specific, making it easier to draw conclusions. As it is hard for customer to state their preferences of crowdedness in for example a interview since customers have subjective meaning of what is "crowded" and what is "not crowded", the illustrations showed what we where meaning by the different crowdedness levels. Therefore, this conjoint analysis seem to be well suited to measure customers preferences towards crowdedness in advance.

5.2 Conclusion

The conclusion provide answer to the research question, which provided a guidance in this research process.

This thesis attempted to analyze skiers' preferences when choosing a ski resort, and elicit their MWTP of each of ski resorts attributes by the use of choice based conjoint analysis. The purpose of this thesis was to discuss and identify factors at each different ski resorts that affected WTP for ski passes and moreover examine how much crowdedness in particular had as an effect on optimal prices for studied ski resort. Study findings detect the importance of the attributes studied and the results show that respondents have the least willingness to pay for the highest level of crowdedness compared to the other attributes. The result that are presented here, with high significance for all the coefficients we can conclude that Norwegian people in the Inland region of Norway are highly interested in the prevalence of crowding when considering buying a ski pass.

Evidence are found that decreasing prices accordingly to the density of people in the slopes would pay off. Consumers do value "not crowded slopes" more than "crowded slopes" in a certain extend. There is found that skiers in the Inland region of Norway are willing to pay NOK 40 less when it is somewhat crowded slopes, NOK 159 less when it is crowded slopes and NOK 259 less when it is very crowded slopes. Additionally, the estimations revealed that participants where on average willing to pay more for skiing at Hafjell Ski resort than Skeikampen and Sjusjøen ski resort, and respondents where again on average willing to pay more for ski passes at Skeikampen ski resort than Sjusjøen ski resort. Moreover, there have been estimated price response functions from conjoint data. Using the conditional logit function and market share simulations we have obtained some data points that we interpolated to a logit price response function. We used the price response function to estimate optimal prices for the three studied ski resorts under different crowdedness levels. These results show that optimal prices under the condition of crowded slopes are estimated to be; NOK 268, 245 and 240 for Hafjell, Skeikampen and Sjusjøen ski resort in that order. The optimal prices that are estimated represent the prices where the ski resorts would have maximal contribution and revenue.

By these findings, this thesis show that these ski resort could enhance their profitability by changing their prices accordingly to the level of congestion in slopes. In the terms of offering new pricing schemes in the alpine skiing industry, the pricing approach could influence the market position and so the performance to the ski resorts. Therefore, the results presented in this thesis offer a useful frame- work for incorporating dynamic pricing in the alpine skiing industry as a result of new technological possibilities.

All in all, the conjoint analysis seemed to be a adequate method for evaluating preferences for ski resorts characteristics. The method accounts for complexity of characteristics in the slope and in the ski resort in particular. Therefore, these results improve insights about what skiers generally find to be preferable in ski resorts. Consist with earlier research, the findings show that customers attendance to ski resorts would decrease if there is more crowded slopes.

The last conclusion the author of this thesis would present, is that great effort to create such a survey would generate high response rate and thus would give significant estimates.

5.3 Future Directions

Applications of conjoint analysis with customers preferences among ski resorts have been few to date. And in the time of writing this, there have very few conjoint analysis that have used pictorial visualizations to estimate customers preferences in ski resorts. Because of the unique opportunities that virtual reality systems potentially offer, there would have been interested to see how this methodology could be used to measure people preferences to other leisure destinations to estimate optimal prices, by taking conjoint analysis into a completely new direction.

Further research in the Inland Region may explore different sets of attributes and attributes levels to show discrepancy between them. Further analysis is also needed to clarify the relationship between customers preferences, experiences and their crowding perception.

Research is also to be done to investigate the practical application and public reaction to dynamic pricing systems that uses technology to change prices based on shifting characteristics in the ski resorts. Additionally, there are research to be done on how to protect the value of those skiers who are usually buying a seasonal pass when dynamic pricing are implementing.

5.3.1 Recommendations to managers

It is difficult to know the level of crowdedness in advance. Therefore, the author of this thesis might suggest that ski resorts could possibly give customers discounts vouchers by the experienced level of crowdedness after they have visited the resort (for instance, discount on mobile app next time buying a ski pass based on perceived utility). By that intent ski resort might enhance loyal customers and enhance re-visits which will generate more profit in the long run. Especially since the internet makes prices easy accessible, hedonic pricing in general would be a good fit for ski resorts to enhance customers satisfaction and enhance customers frequency of skiing. The price should be in equilibrium to ski resorts internal and external characteristics. In other words the price should reflect ski resorts characteristics so it ensures that maximum $MWTP$ for a ski pass is equal to the minimum marginal price a customer is willing to pay for a ski pass at another occasion. The author of this thesis recommend that ski resorts should adapt their prices accordingly to their circumstances and characteristics to provide greater contribution in their terms and achieve more satisfied customers.

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Appendix A

Questionnaire in Norwegian

IPAASKI - SKJEMA 1 APPENDIX A

INNOVATIVE PRICING APPROACHES IN THE ALPINE SKIING INDUSTRY

Dette spørrreskjemaet er en del av forskningsprosjektet iPaaSki. Formålet med prosjektet er å kartlegge ski-/snowboardkjøreres preferanser i alpinbakken og komme frem til nye og innovative måter å prise heiskort på. Prosjektet inngår i avhandlinger på bachelor-, master- og doktorgradsnivå. Noen av resultatene som fremkommer vil også blit benyttet i undervisning ved Handelshøgskolen Innlandet.

Spørreskjemaet tar omtrent 5 minutter å gjennomføre og alle svarene vil være anonyme. Vi setter stor pris på din deltagelse!

*

Informasjon

I dette informasjonsskrivet kan du lese mer om hva det innebærer å delta i denne undersøkelsen.

☐ Jeg bekrefter at jeg har lest og godtatt informasjonsskrivet

Kjønn *

Velg …

Alder *

Velg …

Bosted *

Vennligst velg land:

Velg …

Hva er ditt postnummer? *

Hvilket alpinanlegg fortrekker du per i dag mest? *

Velg …

Dersom valg av "Annet" vennligst spesifiser *

Omtrent hvor mange km bor du fra alpinanlegget du foretrekker mest? *

Vennligst svar i km

Hvor ofte står du på ski/snowboard? *

Velg den påstanden som passer deg best

- ◯ Jeg står på ski én eller flere ganger i løpet av en sesong
- ◯ Jeg står ikke på ski/snowboard, men ønsker å gjøre det
- ◯ Å stå på ski/snowboard er ikke aktuelt for meg

Omtrent hvor mange dager kjører du alpint i en typisk vintersesong? *

Velg …

Vennligst skriv omtrent antall ganger du står på ski/snowboard i en typisk vintersesong *

Hvilket heiskort kjøper du vanligvis eller hvilket tror du at du vil kjøpe ved besøk i et alpinanlegg? *

- 1 dagerskort
- 2 dagerskort
- 3 dagerskort
- 4 dagerskort
- 5-8 dagerskort
- 2-3 timerskort
- Ettermiddag eller kvelskjøringskort
- Sesongkort

Hvem er det som normalt tar avgjørelsen på om du skal stå på ski/snowboard en gitt dag? *

- Meg
- Venner
- Foreldre/foresatte

- Andre familiemedlemmer
- Annet

Vennligst spesifiser *

Hvem er det som vanligvis betaler for heiskortet ditt? *

- Jeg betaler for heiskortet mitt selv
- Foreldre/foresatte
- Andre familiemedlemmer
- Arbeidsgiver
- Annet

Vennligst spesifiser *

Hvilket utstyr foretrekker du? *

- Ski
- Snowboard

○ Annet

Dersom du valgte "Annet" vennligst beskriv: *

Hvorfor står du ikke på ski/snowboard? (Flere kryss mulig) *

- [ ] Heiskort er for dyrt
- [ ] Jeg har ikke utstyr
- [ ] Jeg har ingen venner eller familie som står på ski/snowboard
- [ ] Jeg er redd for å stå på ski/snowboard
- [ ] På grunn av tidsbegrensninger
- [ ] Annet

Dersom valg av "Annet": vennligst beskriv: *

Hva ville motivert deg til å stå på ski/snowboard? (Flere kryss mulig) *

- [ ] Rabatter/lavere pris på heiskort

- ☐ Pakkepris for nybegynnere (heiskort, utstyr og instruktør inkludert)
- ☐ Markedsføringskampanjer
- ☐ Venner og familie som også står på ski/snowboard
- ☐ Annet

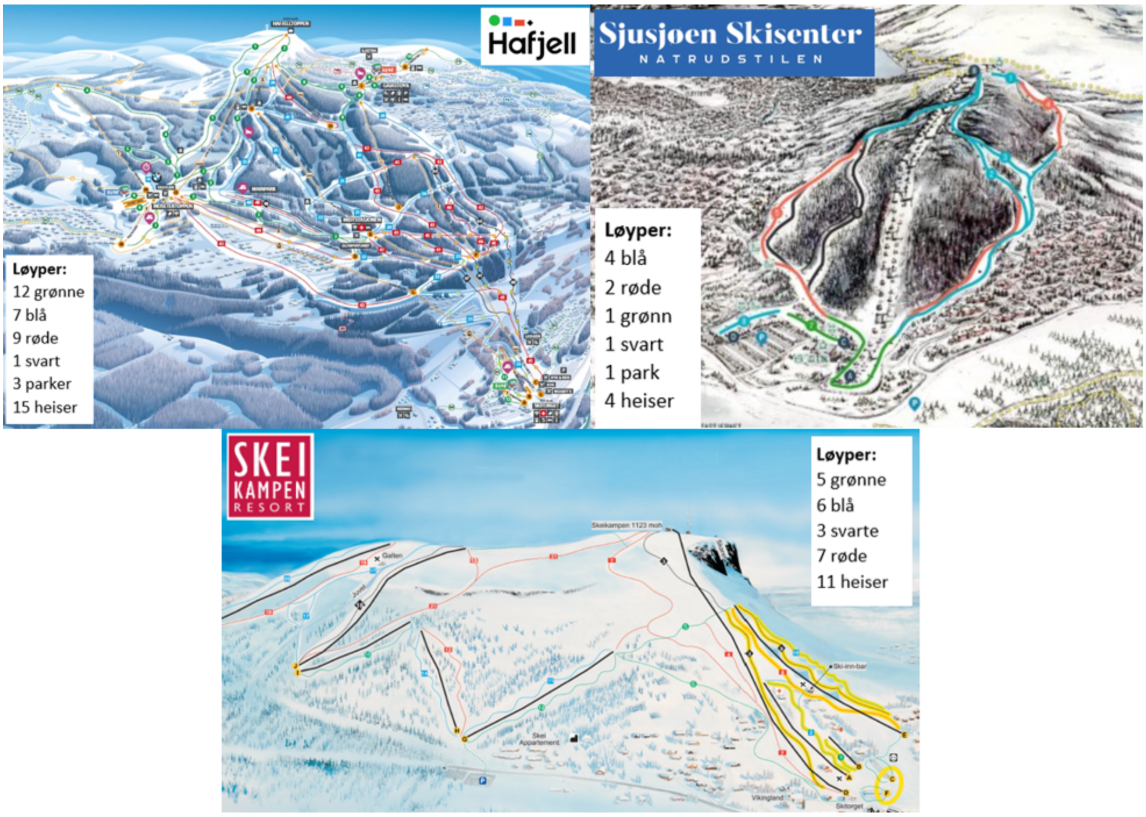
Dersom valg av "Annet": vennligst beskriv: *

Hva ville motivert deg til å stå på ski/snowboard? (Flere kryss mulig) *

- ☐ Rabatter/lavere pris på heiskort
- ☐ Pakkepris for nybegynnere (heiskort, utstyr og instruktør inkludert)
- ☐ Markedsføringskampanjer
- ☐ Venner og familie som også står på ski/snowboard
- ☐ Annet

Dersom valg av "Annet": vennligst beskriv: *

Nedenfor ser du illustrasjoner av tre forskjellige alpinanlegg: Hafjell, Sjusjøen og Skeikampen. Alpinanleggene er av ulik størrelse og har forskjellig antall utfordrende løyper som angitt på illustrasjonsbildene. Ta dette i betraktning når du svarer på spørsmålene i neste del.



Hvilke av disse alpinanleggene har du besøkt tidligere? *

- ☐ Hafjell
- ☐ Skeikampen
- ☐ Sjusjøen

- [ ] Sjusjøen
- [ ] Ingen av disse

Hvor mange ganger besøker du Hafjell Alpinanlegg i løpet av en typisk vintersesong? *

Hvor mange ganger besøker du Skeikampen Alpinanlegg i løpet av en typisk vintersesong? *

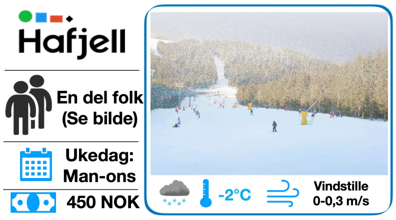
Hvor mange ganger besøker du Sjusjøen Alpinanlegg i løpet av en typisk vintersesong? *

Hvilket av disse tre alpinanleggene foretrekker du per i dag? *

Velg …

Nedenfor presenteres forskjellige skidag-scenarioer. Scenarioene tar utgangspunkt i forskjellige værforhold, dag i uken, type alpinanlegg, mengde folk i bakken og pris. Velg det alternativet som du foretrekker mest. Dersom du ikke ville ha stått på ski/snowboard i noen av scenarioene velger du: "Ingen av alternativene" *

Av de 4 scenariene nedenfor, hvilket vil du foretrekke?



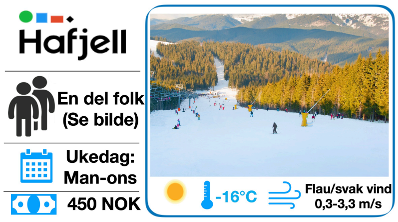
Ingen av alternativene

Hvor mange ganger ville du stått på ski/snowboard ved valgt scenario i løpet av en sesong? *

Velg …

Vennligst spesifiser antallet *

CS2: Velg det alternativet som du foretrekker mest. Dersom du ikke ville ha stått på ski/snowboard i noen av scenarioene velger du: "Ingen av alternativene" *



○

○

○

Ingen av alternativene

○

Hvor mange ganger ville du stått på ski/snowboard ved valgt scenario i løpet av en sesong? *

Velg …

Vennligst spesifiser antallet *

CS3: Velg det alternativet som du foretrekker mest. Dersom du ikke ville ha stått på ski/snowboard i noen av scenarioene velger du: "Ingen av alternativene" *

Ingen av alternativene

Hvor mange ganger ville du stått på ski/snowboard ved valgt scenario i løpet av en sesong? *

Velg …

Vennligst spesifiser antallet *

CS4: Velg det alternativet som du foretrekker mest. Dersom du ikke ville ha stått på ski/snowboard i noen av scenarioene velger du: "Ingen av alternativene" *

○

○

○

Ingen av alternativene

○

Hvor mange ganger ville du stått på ski/snowboard ved valgt scenario i løpet av en sesong? *

Velg …

Vennligst spesifiser antallet *

CS5: Velg det alternativet som du foretrekker mest. Dersom du ikke ville ha stått på ski/snowboard i noen av scenarioene velger du: "Ingen av alternativene" *

Ingen av alternativene

Hvor mange ganger ville du stått på ski/snowboard ved valgt scenario i løpet av en sesong? *

Velg …

Vennligst spesifiser antallet *

CS6: Velg det alternativet som du foretrekker mest. Dersom du ikke ville ha stått på ski/snowboard i noen av scenarioene velger du: "Ingen av alternativene" *

○

○

○

Ingen av alternativene

○

Hvor mange ganger ville du stått på ski/snowboard ved valgt scenario i løpet av en sesong? *

Velg …

Vennligst spesifiser antallet *

CS7: Velg det alternativet som du foretrekker mest. Dersom du ikke ville ha stått på ski/snowboard i noen av scenarioene velger du: "Ingen av alternativene" *

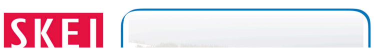
Ingen av alternativene

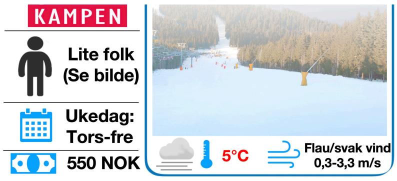
Hvor mange ganger ville du stått på ski/snowboard ved valgt scenario i løpet av en sesong? *

Velg …

Vennligst spesifiser antallet *

CS8: Velg det alternativet som du foretrekker mest. Dersom du ikke ville ha stått på ski/snowboard i noen av scenarioene velger du: "Ingen av alternativene" *





Ingen av alternativene

Hvor mange ganger ville du stått på ski/snowboard ved valgt scenario i løpet av en sesong? *

Velg …

Vennligst spesifiser antallet *

Hva er din nåværende arbeidssituasjon? *

- Fulltidsansatt
- Deltidsansatt
- Arbeidsledig
- Student

- Student med deltidsjobb
- Annet

Dersom valg av "Annet" vennligst beskriv: *

Familiestatus *

Velg …

Dersom valg av "Annet" vennligst beskriv: *

Omtrent hvor mye er husholdningens samlede nettoinntekt? *

- Under NOK 100 000
- NOK 100 001 - NOK 300 000
- NOK 300 001 - NOK 600 000
- NOK 600 001- NOK 900 000
- NOK 900 001- NOK 1 200 000
- Mer enn NOK 1 200 000
- Ønsker ikke å svare

Appendix B

Pre-test questionnaire in English

Preference in ski resorts - Questionnaire 1

This survey is a part of a research project (IPAASKI) and master thesis at Eastern Norway Research Institute and Inland Norway University of Applied Sciences. The aim of this research is to enhance our understanding of skiers' preferences when visiting ski resort.
This survey should take 3-4 minutes to complete. All answers you provide would be kept confidential. We highly appreciate your response.

* Required

Preference in ski resort

1. **What is your gender?** *

   Mark only one oval.

   - Female
   - Male
   - Other

2. **How old are you?** *

   Mark only one oval.

   - <15
   - 16
   - 17
   - 18
   - 19
   - 20
   - 21
   - 22
   - 23
   - 24
   - 25
   - 26
   - 27
   - 28
   - 29
   - 30
   - 31
   - 32

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- 51
- 52
- 53
- 54
- 55
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- 57
- 58
- 59
- 60
- 61
- 62
- 63
- 64
- 65
- >66

3. **What is your place of residence** *
Mark only one oval.

- Austria
- Denmark
- Finland
- Germany
- Iceland
- Netherlands
- Norway
- Poland
- Russia
- Sweden
- Switzerland
- United Kingdom
- Other

4. **What is your ZIP/Postal code?** *

5. **If you are living in Norway, approximately how far from this or your prefered ski resort do you live?**
in KM

What is your skiing experience?

6. **Which statement fits you best?** *
Mark only one oval.

- I ski one or more times each season
- I do not ski , but I would like to do it
- Skiing is not relevant for me

7. **How many days do you approximately ski during a season?** *
Mark only one oval.

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- >12

8. **What kind of alpine equipment do you prefer?** *
Mark only one oval.

- Ski
- Snowboard
- Other: ______________________

Skip to question 13.

If not..

9. **Why do you not ski?** *
Check all that apply.

- [ ] Ski passes are too expensive
- [ ] I do not have the equipment
- [ ] I do not have any friends or familiy members who skiing
- [ ] I am afraid of skiing
- [ ] Because of time constraints
- [ ] Other: ______________________

10. **What would motivate you to start skiing?** *
Check all that apply.

- [ ] Discounted ski passes
- [ ] Packages for beginners (ski pass, ski equipment and ski instructor included)
- [ ] Marketing campaign focusing on alpine skiing as a fun activity enjoyable by all social and age groups
- [ ] Friends or family members who are skiing
- [ ] Other: ______________________

Skip to question 30.

If not..

11. **Why do you not ski?** *
Check all that apply.

- [ ] Ski passes are too expensive
- [ ] I do not have the equipment
- [ ] I do not have any friends or familiy members who skiing
- [ ] I am afraid of skiing
- [ ] Because of time constraints
- [ ] Other: ______________________

12. **What would motivate you to start skiing?** *
Check all that apply.

- [ ] Discounted ski passes
- [ ] Packages for beginners (ski pass, ski equipment and ski instructor included)
- [ ] Marketing campaign focusing on alpine skiing as a fun activity enjoyable by all social and age groups
- [ ] Friends or family members who skiing
- [ ] Other: ______________________

Skip to question 14.

Choice of ski pass

13. **What kind of ski pass do you usually buy when you go skiing?** *

Mark only one oval.

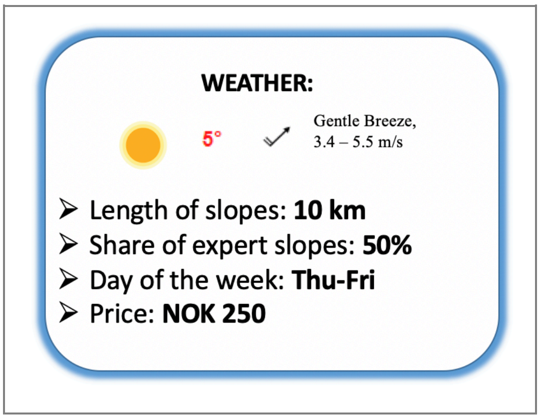
- 1 Day pass
- 2 Day pass
- 3 Day pass
- 4 Day pass
- 5-8 Day pass
- 3 Hours pass
- Afternoon or night pass
- Season Pass

Choose one option

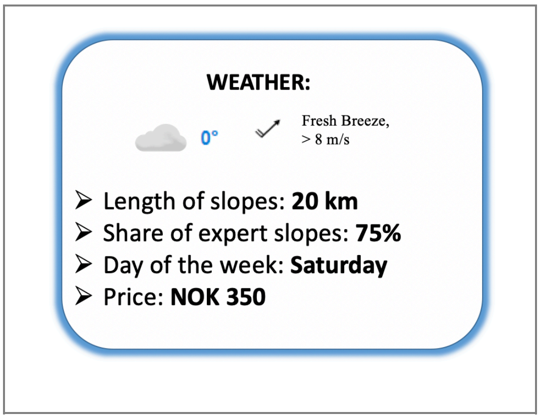
Below we present three different skiing day scenarios. The scenarios differ in terms of weather, length of slopes, share of expert slopes, day of the week, and price. We ask you to evaluate each of the scenarios and choose the alternative you would prefer. If you do not want to go skiing in any of the three scenarios you choose the "none of the alternatives" option.

14. **Choose one option 1/8** *

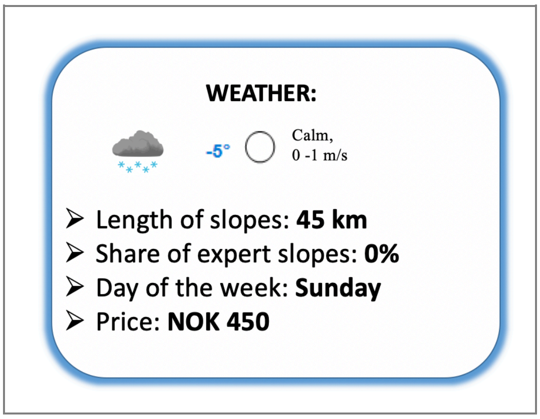
Mark only one oval.



- Option 1



Option 2



Option 3

Option 4 *Skip to question 16.*

15. **Given the option you have just chosen, how many times approximately would you ski during a season given the scenario presented on that option?** *

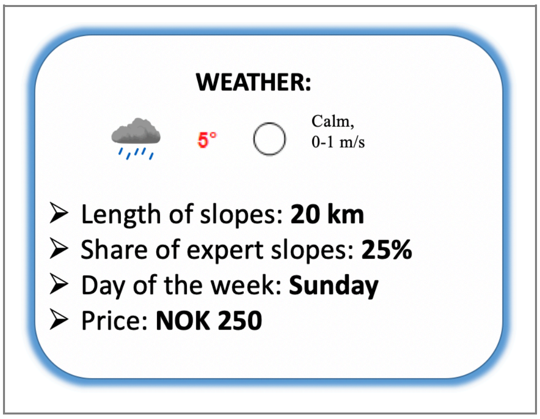
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- >7

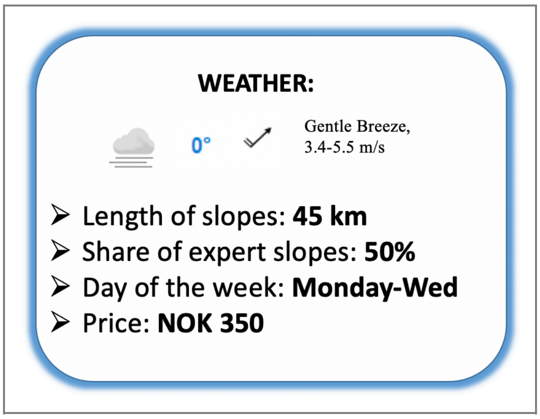
Choose one option

16. **Choose one option 2/8** *

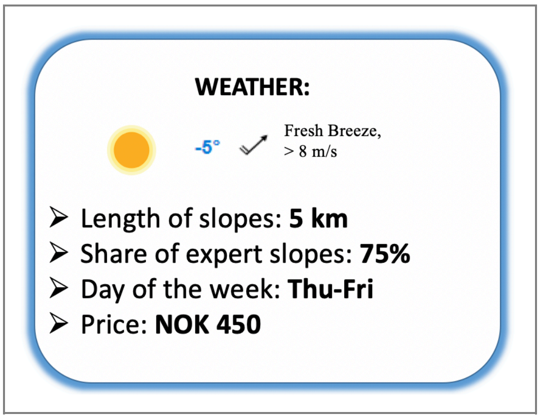
Mark only one oval.



- Option 1



- Option 2



Option 3

Option 4 *Skip to question 18.*

17. **Given the option you have choosen, how many times approxiamately would you ski during a season?** *

Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- >7

Choose one option

18. **Choose one option 3/8** *

Mark only one oval.

WEATHER:

0° Gentle Breeze, 3.4-5.5 m/s

- Length of slopes: **5 km**
- Share of expert slopes: **25%**
- Day of the week: **Sunday**
- Price: **NOK 250**

Option 1

WEATHER:

-5° Fresh Breeze, >8 m/s

- Length of slopes: **10 km**
- Share of expert slopes: **50%**
- Day of the week: **Monday-Wed**
- Price: **NOK 350**

Option 2

WEATHER:

-15° Calm, 0 -1 m/s

- Length of slopes: **20 km**
- Share of expert slopes: **75%**
- Day of the week: **Thu-Fri**
- Price: **NOK 450**

Option 3

◯ Option 4 *Skip to question 20.*

19. **Given the option you have just chosen, how many times approximately would you ski during a season given the scenario presented on that option?** *

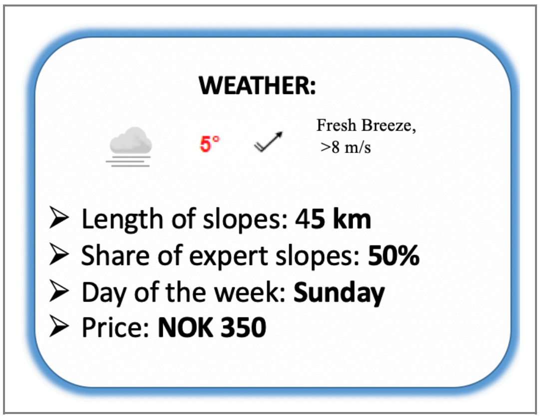
Mark only one oval.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ >7

Choose one option

20. **Choose one option 4/8** *

Mark only one oval.



◯ Option 1

WEATHER:

0° Calm, 0 – 1 m/s

- Length of slopes: **5 km**
- Share of expert slopes: **75%**
- Day of the week: **Monday-Wed**
- Price: **NOK 450**

Option 2

WEATHER:

-5° Calm, 0 -1 m/s

- Length of slopes: **10 km**
- Share of expert slopes: **0%**
- Day of the week: **Thu-Fri**
- Price: **NOK 550**

Option 3

None of the alternatives

Option 4 *Skip to question 22.*

21. **Given the option you have just chosen, how many times approximately would you ski during a season given the scenario presented on that option?** *

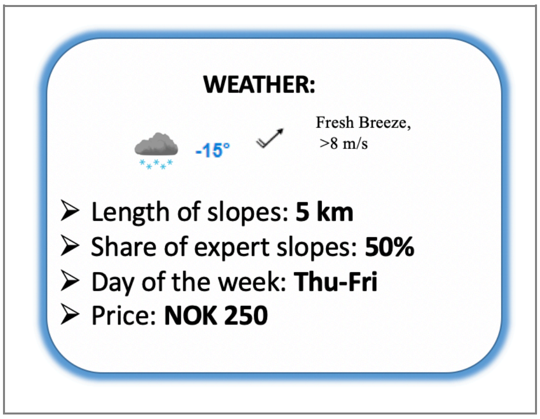
Mark only one oval.

- ( ) 0
- ( ) 1
- ( ) 2
- ( ) 3
- ( ) 4
- ( ) 5
- ( ) 6
- ( ) >7

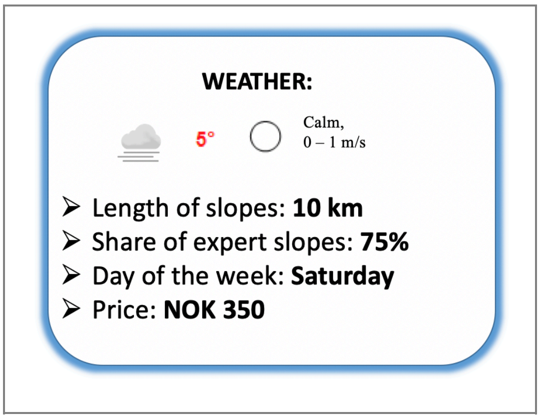
Choose one option

22. **Choose one option 5/8** *

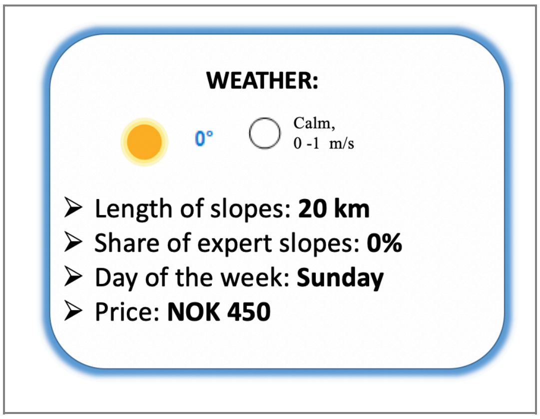
Mark only one oval.



- ( ) Option 1



- ( ) Option 2



Option 3

Option 4 *Skip to question 24.*

23. **Given the option you have just chosen, how many times approximately would you ski during a season given the scenario presented on that option?** *

Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- >7

Choose one option

24. **Choose one option 6/8** *

Mark only one oval.

WEATHER:

5° Calm, 0-1 m/s

- Length of slopes: **5 km**
- Share of expert slopes: **0%**
- Day of the week: **Mon-Wed**
- Price: **NOK 250**

Option 1

WEATHER:

0° Gentle Breeze, 3.4-5.5 m/s

- Length of slopes: **10 km**
- Share of expert slopes: **25%**
- Day of the week: **Thu-Fri**
- Price: **NOK 350**

Option 2

WEATHER:

-5° Fresh Breeze, > 8 m/s

- Length of slopes: **20 km**
- Share of expert slopes: **50%**
- Day of the week: **Saturday**
- Price: **NOK 450**

Option 3

Option 4 *Skip to question 26.*

Untitled Section

25. **Given the option you have just chosen, how many times approximately would you ski during a season given the scenario presented on that option?** *

Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- >7

Choose one option

26. **Choose one option 7/8** *

Mark only one oval.

WEATHER:

 0° ○ Calm, 0-1 m/s

- Length of slopes: **10 km**
- Share of expert slopes: **25%**
- Day of the week: **Thu-Fri**
- Price: **NOK 350**

○ Option 1

WEATHER:

 -5° Gentle Breeze, 3.4-5.5 m/s

- Length of slopes: **20 km**
- Share of expert slopes: **50%**
- Day of the week: **Saturday**
- Price: **NOK 450**

○ Option 2

WEATHER:

 -15° Fresh Breeze, > 8 m/s

- Length of slopes: **45 km**
- Share of expert slopes: **75%**
- Day of the week: **Sunday**
- Price: **NOK 550**

○ Option 3

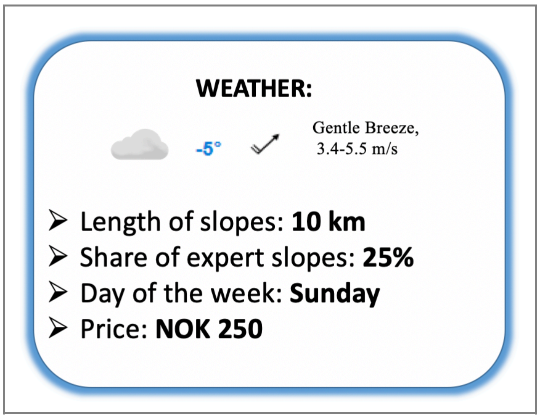
Option 4 *Skip to question 28.*

27. **Given the option you have just chosen, how many times approximately would you ski during a season given the scenario presented on that option?** *
Mark only one oval.

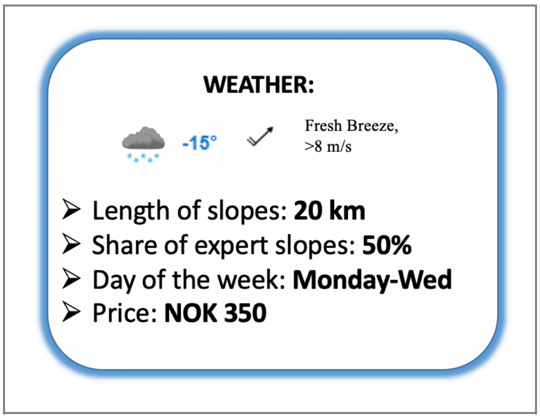
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- >7

Choose one option

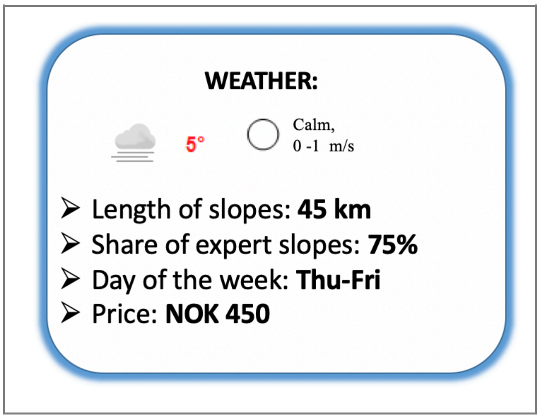
28. **Choose one option 8/8** *
Mark only one oval.



Option 1



Option 2



Option 3

Option 4 *Skip to question 30.*

Untitled Section

29. **Given the option you have just chosen, how many times approximately would you ski during a season given the scenario presented on that option?** *
Mark only one oval.

- ( ) 0
- ( ) 1
- ( ) 2
- ( ) 3
- ( ) 4
- ( ) 5
- ( ) 6
- ( ) >7

Background

30. **What is your current occupation?** *
Mark only one oval.

- ( ) Working full time
- ( ) Working part time
- ( ) Unemployed
- ( ) Student
- ( ) Student with a part time job
- ( ) Other: ____________

31. **What is your familiy status?** *
Mark only one oval.

- ( ) Single
- ( ) Single with children
- ( ) Couple
- ( ) Couple with children
- ( ) Other: ____________

32. **What is your household´s approximate yearly income?** *
Mark only one oval.

- Below 100 000 NOK
- 100 000 - 300 000 NOK
- 300 001 - 600 000 NOK
- 600 001 - 900 000 NOK
- 900 001 - 1 200 000 NOK
- More than 1 200 000 NOK
- Prefer not to answer

Validation of form

33. **Please comment at least one thing that could improve this survey - Vennligst kommenter minst en ting som kan forbedre dette spørreskjemaet.** *

Appendix C

R script - Calculating Share response for level of crowdedness

```
library(support.CEs)
library(survival)
library(mlogit)




## coef OUTPUT FROM MLOGIT (CLOGOUT1)
## THIS SHARE ESTIMATION IS FOR NOK 200.., I.E. TO ESTIMATE SHARE
## FOR NOK 250, CHANGE "Share_Price" to 250 (Share_Price <- 250)

#coef              exp(coef)   se(coef)        z         p
#ASC              3.1689650 23.7828567  0.1427866  22.194  < 2e-16
#weather_2      -0.2449367  0.7827541  0.0686072  -3.570 0.000357
#weather_3      -0.5253167  0.5913681  0.0709509  -7.404 1.32e-13
#weather_4      -0.6643531  0.5146063  0.0722218  -9.199  < 2e-16
#wind_2         -0.1762934  0.8383720  0.0695498  -2.535 0.011252
#wind_3         -0.2876267  0.7500415  0.0726294  -3.960 7.49e-05
#wind_4         -0.4060733  0.6662613  0.0720135  -5.639 1.71e-08
#temp_2          0.3422722  1.4081436  0.0700232   4.888 1.02e-06
#temp_3          0.0655028  1.0676958  0.0723628   0.905 0.365360
#temp_4         -0.2750126  0.7595626  0.0757054  -3.633 0.000281
#crowdedness_2 -0.1931797  0.8243338  0.0642337  -3.007 0.002634
```

```
#crowdedness_3 -0.7606330  0.4673705  0.0713623 -10.659  < 2e-16
#crowdedness_4 -1.2535711  0.2854835  0.0793409 -15.800  < 2e-16
#thur_fri_2    -0.0417690  0.9590913  0.0768850  -0.543 0.586946
#sat_3          0.2775663  1.3199136  0.0736247   3.770 0.000163
#sun_4          0.2552995  1.2908481  0.0749325   3.407 0.000657
#Skeikampen_2  -0.5634048  0.5692675  0.0576928  -9.766  < 2e-16
#Sjusjoen_3    -0.7387052  0.4777321  0.0606106 -12.188  < 2e-16
#price         -0.0047693  0.9952420  0.0002406 -19.825  < 2e-16
Crowdedness1<-0
Crowdedness2<--0.1931797
Crowdedness3 <--0.7606330
Crowdedness4 <--1.2535711
price<--0.0047693
Hafjell1<-0
Skeikampen2<--0.5634048
Sjusjoen3<--0.7387052
Share_Price <- 200

## # Market shares for different ski resorts for
##different crowdedness levels at the different
##price levels (other attributes at base level) -
#Market share Crowdedness 1_ Ski_resort 1 NOK 200 -
market_F1_A1<-exp(Crowdedness1+Hafjell1+Share_Price*price)/+
(exp(Crowdedness1+Hafjell1+Share_Price*price)++
exp(Crowdedness2+Hafjell1+450*price)++
exp(Crowdedness3+Hafjell1+450*price)++
exp(Crowdedness4+Hafjell1+450*price)+
exp(Crowdedness1+Skeikampen2+450*price)++
exp(Crowdedness2+Skeikampen2+450*price)+
exp(Crowdedness3+Skeikampen2+450*price)++
exp(Crowdedness4+Skeikampen2+450*price)+
exp(Crowdedness1+Sjusjoen3+450*price)++
exp(Crowdedness2+Sjusjoen3+450*price)+
exp(Crowdedness3+Sjusjoen3+450*price)++
exp(Crowdedness4+Sjusjoen3+450*price))
market_F1_A1
#Market share Crowdedness 2_ Ski_resort 1 NOK 200-
market_F2_A1<-exp(Crowdedness2+Hafjell1+Share_Price*price)/+
(exp(Crowdedness1+Hafjell1+450*price)++
```

```
exp(Crowdedness2+Hafjell1+Share_Price*price)+
exp(Crowdedness3+Hafjell1+450*price)++
exp(Crowdedness4+Hafjell1+450*price)+
exp(Crowdedness1+Skeikampen2+450*price)++
exp(Crowdedness2+Skeikampen2+450*price)+
exp(Crowdedness3+Skeikampen2+450*price)++
exp(Crowdedness4+Skeikampen2+450*price)+
exp(Crowdedness1+Sjusjoen3+450*price)++
exp(Crowdedness2+Sjusjoen3+450*price)+
exp(Crowdedness3+Sjusjoen3+450*price)++
exp(Crowdedness4+Sjusjoen3+450*price))
market_F2_A1
#Market share Crowdedness 3_ Ski_resort 1 NOK 200  -
market_F3_A1<-exp(Crowdedness3+Hafjell1+Share_Price*price)/+
(exp(Crowdedness1+Hafjell1+450*price)++
exp(Crowdedness2+Hafjell1+450*price)+
exp(Crowdedness3+Hafjell1+Share_Price*price)++
exp(Crowdedness4+Hafjell1+450*price)+
exp(Crowdedness1+Skeikampen2+450*price)++
exp(Crowdedness2+Skeikampen2+450*price)+
exp(Crowdedness3+Skeikampen2+450*price)++
exp(Crowdedness4+Skeikampen2+450*price)+
exp(Crowdedness1+Sjusjoen3+450*price)++
exp(Crowdedness2+Sjusjoen3+450*price)+
exp(Crowdedness3+Sjusjoen3+450*price)++
exp(Crowdedness4+Sjusjoen3+450*price))
market_F3_A1
#Market share Crowdedness 4_ Ski_resort 1 NOK 200-
market_F4_A1<-exp(Crowdedness4+Hafjell1+Share_Price*price)/+
(exp(Crowdedness1+Hafjell1+450*price)++
exp(Crowdedness2+Hafjell1+450*price)+
exp(Crowdedness3+Hafjell1+450*price)++
exp(Crowdedness4+Hafjell1+Share_Price*price)+
exp(Crowdedness1+Skeikampen2+450*price)++
exp(Crowdedness2+Skeikampen2+450*price)+
exp(Crowdedness3+Skeikampen2+450*price)++
exp(Crowdedness4+Skeikampen2+450*price)+
exp(Crowdedness1+Sjusjoen3+450*price)++
exp(Crowdedness2+Sjusjoen3+450*price)+
```

```
exp(Crowdedness3+Sjusjoen3+450*price)++
exp(Crowdedness4+Sjusjoen3+450*price))

market_F4_A1
#Market share Crowdedness 1_ Ski_resort 2 NOK 200-
market_F1_A2<-exp(Crowdedness1+Skeikampen2+Share_Price*price)/+
(exp(Crowdedness1+Hafjell1+450*price)++
exp(Crowdedness2+Hafjell1+450*price)+
exp(Crowdedness3+Hafjell1+450*price)++
exp(Crowdedness4+Hafjell1+450*price)+
exp(Crowdedness1+Skeikampen2+Share_Price*price)++
exp(Crowdedness2+Skeikampen2+450*price)+
exp(Crowdedness3+Skeikampen2+450*price)++
exp(Crowdedness4+Skeikampen2+450*price)+
exp(Crowdedness1+Sjusjoen3+450*price)++
exp(Crowdedness2+Sjusjoen3+450*price)+
exp(Crowdedness3+Sjusjoen3+450*price)++
exp(Crowdedness4+Sjusjoen3+450*price))
market_F1_A2
#Market share Crowdedness 2_ Ski_resort 2 NOK 200-
market_F2_A2<-exp(Crowdedness2+Skeikampen2+Share_Price*price)/+
(exp(Crowdedness1+Hafjell1+450*price)++
exp(Crowdedness2+Hafjell1+450*price)+
exp(Crowdedness3+Hafjell1+450*price)++
exp(Crowdedness4+Hafjell1+450*price)+
exp(Crowdedness1+Skeikampen2+450*price)++
exp(Crowdedness2+Skeikampen2+Share_Price*price)+
exp(Crowdedness3+Skeikampen2+450*price)++
exp(Crowdedness4+Skeikampen2+450*price)+
exp(Crowdedness1+Sjusjoen3+450*price)++
exp(Crowdedness2+Sjusjoen3+450*price)+
exp(Crowdedness3+Sjusjoen3+450*price)++
exp(Crowdedness4+Sjusjoen3+450*price))
market_F2_A2
#Market share Crowdedness 3_ Ski_resort 3 NOK 200-
market_F3_A2<-exp(Crowdedness3+Skeikampen2+Share_Price*price)/+
(exp(Crowdedness1+Hafjell1+450*price)++
exp(Crowdedness2+Hafjell1+450*price)+
exp(Crowdedness3+Hafjell1+450*price)++
```

```
exp(Crowdedness4+Hafjell1+450*price)+
exp(Crowdedness1+Skeikampen2+450*price)++
exp(Crowdedness2+Skeikampen2+450*price)+
exp(Crowdedness3+Skeikampen2+Share_Price*price)++
exp(Crowdedness4+Skeikampen2+450*price)+
exp(Crowdedness1+Sjusjoen3+450*price)++
exp(Crowdedness2+Sjusjoen3+450*price)+
exp(Crowdedness3+Sjusjoen3+450*price)++
exp(Crowdedness4+Sjusjoen3+450*price))
market_F3_A2
#Market share Crowdedness 4_ Ski_resort 2 NOK 200-
market_F4_A2<-exp(Crowdedness4+Skeikampen2+Share_Price*price)/+
(exp(Crowdedness1+Hafjell1+450*price)++
exp(Crowdedness2+Hafjell1+450*price)+
exp(Crowdedness3+Hafjell1+450*price)++
exp(Crowdedness4+Hafjell1+450*price)+
exp(Crowdedness1+Skeikampen2+450*price)++
exp(Crowdedness2+Skeikampen2+450*price)+
exp(Crowdedness3+Skeikampen2+450*price)++
exp(Crowdedness4+Skeikampen2+Share_Price*price)+
exp(Crowdedness1+Sjusjoen3+450*price)++
exp(Crowdedness2+Sjusjoen3+450*price)+
exp(Crowdedness3+Sjusjoen3+450*price)++
exp(Crowdedness4+Sjusjoen3+450*price))
market_F4_A2
#Market share Crowdedness 1_ Ski_resort 3 NOK 200-
market_F1_A3<-exp(Crowdedness1+Sjusjoen3+Share_Price*price)/+
(exp(Crowdedness1+Hafjell1+450*price)++
exp(Crowdedness2+Hafjell1+450*price)+
exp(Crowdedness3+Hafjell1+450*price)++
exp(Crowdedness4+Hafjell1+450*price)+
exp(Crowdedness1+Skeikampen2+450*price)++
exp(Crowdedness2+Skeikampen2+450*price)+
exp(Crowdedness3+Skeikampen2+450*price)++
exp(Crowdedness4+Skeikampen2+450*price)+
exp(Crowdedness1+Sjusjoen3+Share_Price*price)++
exp(Crowdedness2+Sjusjoen3+450*price)+
exp(Crowdedness3+Sjusjoen3+450*price)++
exp(Crowdedness4+Sjusjoen3+450*price))
```

```
market_F1_A3
#Market share Crowdedness 2_ Ski_resort 3 NOK 200-
market_F2_A3<-exp(Crowdedness2+Sjusjoen3+Share_Price*price)/+
(exp(Crowdedness1+Hafjell1+450*price)++
exp(Crowdedness2+Hafjell1+450*price)+
exp(Crowdedness3+Hafjell1+450*price)++
exp(Crowdedness4+Hafjell1+450*price)+
exp(Crowdedness1+Skeikampen2+450*price)++
exp(Crowdedness2+Skeikampen2+450*price)+
exp(Crowdedness3+Skeikampen2+450*price)++
exp(Crowdedness4+Skeikampen2+450*price)+
exp(Crowdedness1+Sjusjoen3+450*price)++
exp(Crowdedness2+Sjusjoen3+Share_Price*price)+
exp(Crowdedness3+Sjusjoen3+450*price)++
exp(Crowdedness4+Sjusjoen3+450*price))
market_F2_A3
#Market share Crowdedness 3_ Ski_resort 3 NOK 200-
market_F3_A3<-exp(Crowdedness3+Sjusjoen3+Share_Price*price)/+
(exp(Crowdedness1+Hafjell1+450*price)++
exp(Crowdedness2+Hafjell1+450*price)+
exp(Crowdedness3+Hafjell1+450*price)++
exp(Crowdedness4+Hafjell1+450*price)+
exp(Crowdedness1+Skeikampen2+450*price)++
exp(Crowdedness2+Skeikampen2+450*price)+
exp(Crowdedness3+Skeikampen2+450*price)++
exp(Crowdedness4+Skeikampen2+450*price)+
exp(Crowdedness1+Sjusjoen3+450*price)++
exp(Crowdedness2+Sjusjoen3+450*price)+
exp(Crowdedness3+Sjusjoen3+Share_Price*price)++
exp(Crowdedness4+Sjusjoen3+450*price))
market_F3_A3
#Market share Crowdedness 4_ Ski_resort 3 NOK 200-
market_F4_A3<-exp(Crowdedness4+Sjusjoen3+Share_Price*price)/+
(exp(Crowdedness1+Hafjell1+450*price)++
exp(Crowdedness2+Hafjell1+450*price)+
exp(Crowdedness3+Hafjell1+450*price)++
exp(Crowdedness4+Hafjell1+450*price)+
exp(Crowdedness1+Skeikampen2+450*price)++
exp(Crowdedness2+Skeikampen2+450*price)+
```

```
exp(Crowdedness3+Skeikampen2+450*price)++
exp(Crowdedness4+Skeikampen2+450*price)+
exp(Crowdedness1+Sjusjoen3+450*price)++
exp(Crowdedness2+Sjusjoen3+450*price)+
exp(Crowdedness3+Sjusjoen3+450*price)++
exp(Crowdedness4+Sjusjoen3+Share_Price*price))
market_F4_A3


## Choosing a base case: vaer_1. vind_1, temp_1, folkemengde_1, ukedag_1, a
## Level 1 of the attributes

share_P10 <- exp(2.9184582 - 0.0046010*10) /
(exp(2.9184582 - 0.0046010*10) + exp(2.9184582 - 0.0046010*20)
+ exp(2.9184582 - 0.0046010*30) + exp(2.9184582 - 0.0046010*40)
+ exp(2.9184582 - 0.0046010*50) + exp(2.9184582 - 0.0046010*60)
+ exp(2.9184582 - 0.0046010*70) + exp(2.9184582 - 0.0046010*80)
+ exp(2.9184582 - 0.0046010*90) + exp(2.9184582 - 0.0046010*100)
+ exp(2.9184582 - 0.0046010*110) + exp(2.9184582 - 0.0046010*120)
+ exp(2.9184582 - 0.0046010*130) + exp(2.9184582 - 0.0046010*140)
+ exp(2.9184582 - 0.0046010*150) + exp(2.9184582 - 0.0046010*160)
+ exp(2.9184582 - 0.0046010*170) + exp(2.9184582 - 0.0046010*180)
+ exp(2.9184582 - 0.0046010*190) + exp(2.9184582 - 0.0046010*200)
+ exp(2.9184582 - 0.0046010*210) + exp(2.9184582 - 0.0046010*220)
+ exp(2.9184582 - 0.0046010*230) + exp(2.9184582 - 0.0046010*240)
+ exp(2.9184582 - 0.0046010*250) + exp(2.9184582 - 0.0046010*260)
+ exp(2.9184582 - 0.0046010*270) + exp(2.9184582 - 0.0046010*280)
+ exp(2.9184582 - 0.0046010*290) + exp(2.9184582 - 0.0046010*300)
+ exp(2.9184582 - 0.0046010*310) + exp(2.9184582 - 0.0046010*320)
+ exp(2.9184582 - 0.0046010*330) + exp(2.9184582 - 0.0046010*340)
+ exp(2.9184582 - 0.0046010*350) + exp(2.9184582 - 0.0046010*360)
+ exp(2.9184582 - 0.0046010*370) + exp(2.9184582 - 0.0046010*380)
+ exp(2.9184582 - 0.0046010*390) + exp(2.9184582 - 0.0046010*400)
+ exp(2.9184582 - 0.0046010*410) + exp(2.9184582 - 0.0046010*420)
+ exp(2.9184582 - 0.0046010*430) + exp(2.9184582 - 0.0046010*440)
+ exp(2.9184582 - 0.0046010*450) + exp(2.9184582 - 0.0046010*460)
+ exp(2.9184582 - 0.0046010*470) + exp(2.9184582 - 0.0046010*480)
+ exp(2.9184582 - 0.0046010*490) + exp(2.9184582 - 0.0046010*500)
+ exp(2.9184582 - 0.0046010*510) + exp(2.9184582 - 0.0046010*520)
```

```
+ exp(2.9184582 - 0.0046010*530) + exp(2.9184582 - 0.0046010*540)
+ exp(2.9184582 - 0.0046010*550) + exp(2.9184582 - 0.0046010*560)
+ exp(2.9184582 - 0.0046010*570) + exp(2.9184582 - 0.0046010*580)
+ exp(2.9184582 - 0.0046010*590) + exp(2.9184582 - 0.0046010*600)
+ exp(2.9184582 - 0.0046010*610) + exp(2.9184582 - 0.0046010*620)
+ exp(2.9184582 - 0.0046010*630) + exp(2.9184582 - 0.0046010*640)
+ exp(2.9184582 - 0.0046010*650) + exp(2.9184582 - 0.0046010*660)
+ exp(2.9184582 - 0.0046010*670) + exp(2.9184582 - 0.0046010*680)
+ exp(2.9184582 - 0.0046010*690) + exp(2.9184582 - 0.0046010*700))
```

Appendix D

R script - Estimating optimal price and profit

```
##Example crowdedness 3 Sjusjoen Ski resort
# Objective functions for optimization
demand_objective = function(par, p, d) +
sum((d - logistic(p, par[1], par[2], par[3]))^2)
price_objective = function(p, alpha, c, p0) +
(exp(-alpha*(p-p0))*(alpha*(p-c)+1) + 1)^2

# We would like to minimize:
price_objective2 = function(p, c, alpha, C, p0) +
-logistic(p, C, alpha, p0)*(p-c)

# Data -  plot in parameters from logit function

#Insert parameters in logisitic(p, C, b, b/a)
#cost/c, set to zero as there are no incremental costs
#p=price range
#Po= inflection point, calculated by taking parameter b / a


p <- seq(150,650)
c <- 0
d <- logistic(p, 0.561455232, -0.005172047, -0.028822562) +
rnorm(sd = 0, length(p))
profit <- d*(p-c)
```

```
d
# Demand fitting to price
par.start = c(max(d), 0, mean(d)) # initial guess

demand_fit = optim(par = par.start, fn = demand_objective, +
method = 'BFGS',
p = p, d = d)

par = demand_fit$par # estimated parameters for demand function
demand.fitted = logistic(p, c = par[1], alpha = par[2], p0 = par[3])
profit.fitted = demand.fitted*(p - c)

# Pricing Optimization,  B r o y d e n FletcherGoldfarbShanno  algorithm
price_fit = optim(mean(p), price_objective, method = 'BFGS',
alpha = par[2], c = c, p0 = par[3])

# or this method can be used, :

price_fit2 = optim(mean(p), price_objective2, method = 'BFGS',
c = c, C = par[1], alpha = par[2], p0 = par[3])

# choose one of the methods,  results shhould be almost identical
p.max.profit = price_fit$par
p.max.profit
p.max.profit
# Graphics
df.logistic = data.frame('Prices' = p, 'Demand' = d, +
'Demand.fitted' = demand.fitted,
'Profit.fitted' = profit.fitted, 'Profit' = profit)


##Plotting graphs
ggplot(select(df.logistic, Prices, Demand)) +
aes(x = Prices, y = Demand) +
geom_point() +
geom_line(data = df.logistic, aes(x = Prices, y = Demand.fitted), +
color = 'blue')

ggplot(select(df.logistic, Prices, Profit)) +
```

```
aes(x = Prices, y = Profit) +
geom_point() + geom_vline(xintercept = p.max.profit, lty = 2)

ggplot(select(df.logistic, Prices, Profit.fitted)) +
aes(x = Prices, y = Profit.fitted) +
geom_point() + geom_vline(xintercept = p.max.profit, lty = 2)
```

Appendix E

R script clogit model and estimation of MWTP conjoint

```
library(support.CEs)
library(survival)
library(mlogit)
library(xtable)
setwd("~/Prosjekter␣R-STUDIO/ANALYSE␣CONJOINT␣-␣1")

cjDF <- data.frame(read.csv(file="analyse_v8.csv", +
header=TRUE, sep = ";"))


## descriptive statistics

xtabs(RES ~ pris, data = cjDF)

xtabs(RES ~ vaer_1, data = cjDF)


## logit modell

clogout1 <- clogit(RES ~ ASC + vaer_2 + vaer_3 + vaer_4
+ vind_2 + vind_3 + vind_4
```

```
+ temp_2 + temp_3 + temp_4
+ folkemengde_2 + folkemengde_3 + folkemengde_4
+ ukedag_2 + ukedag_3 + ukedag_4
+ alpinanlegg_2 + alpinanlegg_3
+ pris + strata(STR), data = cjDF)
clogout1
x$mwtp.table

##For export to tex table - booktabs coefficients
xtable(clogout1, booktabs = TRUE)

##For export to tex table - booktabs MWTP
xtable(x$mwtp.table,booktabs = TRUE)

## WTP for Crowdedness levels

wtp_f2 <- coef(clogout1)["folkemengde_2"]/-coef(clogout1)["pris"]
wtp_f3 <- coef(clogout1)["folkemengde_3"]/-coef(clogout1)["pris"]
wtp_f4 <- coef(clogout1)["folkemengde_4"]/-coef(clogout1)["pris"]

wtp_f2
wtp_f3
wtp_f4

## MRS calculations for Crowdedness levels
MRS_f2_R2 <- coef(clogout1)["folkemengde_2"]/+
-coef(clogout1)["alpinanlegg_2"]
MRS_f2_R3 <- coef(clogout1)["folkemengde_2"]/+
-coef(clogout1)["alpinanlegg_3"]
MRS_f2_R2
MRS_f2_R3
#marginal wtp calculations

x <- mwtp(output = clogout1, monetary.variables = c("pris"),
nonmonetary.variables = c("vaer_2", "vaer_3", "vaer_4",
"vind_2", "vind_3", "vind_4",
"temp_2", "temp_3", "temp_4",
"folkemengde_2", "folkemengde_3", "folkemengde_4",
"ukedag_2", "ukedag_3", "ukedag_4",
```

```
"alpinanlegg_2", "alpinanlegg_3"),
percentile.points = NULL,
confidence.level = 0.95,
seed = NULL)


mwtp(output = clogout1, monetary.variables = c("pris"),
nonmonetary.variables = c("vaer_2", "vaer_3", "vaer_4",
"vind_2", "vind_3", "vind_4",
"temp_2", "temp_3", "temp_4",
"folkemengde_2", "folkemengde_3", "folkemengde_4",
"ukedag_2", "ukedag_3", "ukedag_4",
"alpinanlegg_2", "alpinanlegg_3"),
percentile.points = NULL,
confidence.level = 0.95,
seed = NULL)




mwtps <- x$mwtps
mwtps
```

Appendix F

Choice set arrays

Quest ID	Choice set	Alternative ID	Weather	Wind	Temperature	Price (NOK)	Crodedness	Weekday	Ski resort
1	1	1	Cloudy	Fresh breeze	-16	250	Very_crowded	Sat	Skeikampen
		2	Fog	Strong wind	+5	350	Not crowded	Sun	Sjusjøen
		3	Precipitation	Calm	-2	450	Somewhat_crowded	Mon-wed	Hafjell
	2	4	Sun	Light breeze	-16	450	Somewhat_crowded	Mon-wed	Hafjell
		5	Cloudy	Fresh breeze	+5	550	Crowded	Thur-fri	Skeikampen
		6	Fog	Strong wind	-2	250	Very_crowded	Sat	Sjusjøen
	3	7	Precipitation	Light breeze	-9	550	Crowded	Mon-wed	Sjusjøen
		8	Sun	Fresh breeze	-16	250	Very_crowded	Thur-fri	Hafjell
		9	Cloudy	Strong wind	+5	350	Not crowded	Sat	Skeikampen
	4	10	Cloudy	Calm	-9	250	Somewhat_crowded	Sun	Hafjell
		11	Fog	Light breeze	-16	350	Crowded	Mon-wed	Skeikampen
		12	Precipitation	Fresh breeze	+5	450	Very_crowded	Thur-fri	Sjusjøen
	5	13	Sun	Fresh breeze	-2	550	Not crowded	Thur-fri	Sjusjøen
		14	Cloudy	Strong wind	-9	250	Somewhat_crowded	Sat	Hafjell
		15	Fog	Calm	-16	350	Crowded	Sun	Skeikampen
	6	16	Cloudy	Light breeze	-2	450	Crowded	Sat	Sjusjøen
		17	Fog	Fresh breeze	-9	550	Very_crowded	Sun	Hafjell
		18	Precipitation	Strong wind	-16	250	Not crowded	Mon-wed	Skeikampen
	7	19	Precipitation	Calm	-2	450	Somewhat_crowded	Mon-wed	Skeikampen
		20	Sun	Light breeze	-9	550	Crowded	Thur-fri	Sjusjøen
		21	Cloudy	Fresh breeze	-16	250	Very_crowded	Sat	Hafjell
	8	22	Fog	Light breeze	+5	550	Not crowded	Thur-fri	Skeikampen
		23	Precipitation	Fresh breeze	-2	250	Somewhat_crowded	Sat	Sjusjøen
		24	Sun	Strong wind	-9	350	Crowded	Sun	Hafjell
	9	25	Fog	Fresh breeze	-9	250	Not crowded	Mon-wed	Skeikampen
		26	Precipitation	Strong wind	-16	350	Somewhat_crowded	Thur-fri	Sjusjøen
		27	Sun	Calm	+5	450	Crowded	Sat	Hafjell
	10	28	Sun	Calm	+5	450	Crowded	Sat	Skeikampen
		29	Cloudy	Light breeze	-2	550	Very_crowded	Sun	Sjusjøen
		30	Fog	Fresh breeze	-9	250	Not crowded	Mon-wed	Hafjell
	11	31	Fog	Strong wind	-2	550	Crowded	Mon-wed	Hafjell
		32	Precipitation	Calm	-9	250	Very_crowded	Thur-fri	Skeikampen

		33	Sun	Light breeze	-16	350	Not crowded	Sat	Sjusjøen
	12	34	Precipitation	Light breeze	-9	250	Very_crowded	Sat	Sjusjøen
		35	Sun	Fresh breeze	-16	350	Not crowded	Sun	Hafjell
2		36	Cloudy	Strong wind	+5	450	Somewhat_crowded	Mon-wed	Skeikampen
	13	37	Fog	Light breeze	+5	350	Very_crowded	Mon-wed	Skeikampen
		38	Precipitation	Fresh breeze	-2	450	Not crowded	Thur-fri	Sjusjøen
		39	Sun	Strong wind	-9	550	Somewhat_crowded	Sat	Hafjell
	14	40	Cloudy	Light breeze	-2	550	Very_crowded	Sun	Skeikampen
		41	Fog	Fresh breeze	-9	250	Not crowded	Mon-wed	Sjusjøen
		42	Precipitation	Strong wind	-16	350	Somewhat_crowded	Thur-fri	Hafjell
	15	43	Precipitation	Strong wind	-16	350	Somewhat_crowded	Thur-fri	Skeikampen
		44	Sun	Calm	+5	450	Crowded	Sat	Sjusjøen
		45	Cloudy	Light breeze	-2	550	Very_crowded	Sun	Hafjell
	16	46	Fog	Fresh breeze	-9	350	Somewhat_crowded	Thur-fri	Sjusjøen
		47	Precipitation	Strong wind	-16	450	Crowded	Sat	Hafjell
		48	Sun	Calm	+5	550	Very_crowded	Sun	Skeikampen
	17	49	Precipitation	Fresh breeze	+5	550	Somewhat_crowded	Sat	Hafjell
		50	Sun	Strong wind	-2	250	Crowded	Sun	Skeikampen
		51	Cloudy	Calm	-9	350	Very_crowded	Mon-wed	Sjusjøen
	18	52	Precipitation	Calm	-2	250	Crowded	Thur-fri	Skeikampen
		53	Sun	Light breeze	-9	350	Very_crowded	Sat	Sjusjøen
		54	Cloudy	Fresh breeze	-16	450	Not crowded	Sun	Hafjell
	19	55	Cloudy	Fresh breeze	-16	450	Not crowded	Sun	Skeikampen
		56	Fog	Strong wind	+5	550	Somewhat_crowded	Mon-wed	Sjusjøen
		57	Precipitation	Calm	-2	250	Crowded	Thur-fri	Hafjell
	20	58	Fog	Calm	-16	450	Very_crowded	Thur-fri	Sjusjøen
		59	Precipitation	Light breeze	+5	550	Not crowded	Sat	Hafjell
3		60	Sun	Fresh breeze	-2	250	Somewhat_crowded	Sun	Skeikampen
	21	61	Precipitation	Strong wind	-16	550	Very_crowded	Sun	Hafjell
		62	Sun	Calm	+5	250	Not crowded	Mon-wed	Skeikampen
		63	Cloudy	Light breeze	-2	350	Somewhat_crowded	Thur-fri	Sjusjøen
	22	64	Cloudy	Calm	-9	550	Not crowded	Thur-fri	Hafjell
		65	Fog	Light breeze	-16	250	Somewhat_crowded	Sat	Skeikampen
		66	Precipitation	Fresh breeze	+5	350	Crowded	Sun	Sjusjøen

	23	67	Fog	Strong wind	-2	450	Not crowded	Sun	Hafjell
		68	Precipitation	Calm	-9	550	Somewhat_crowded	Mon-wed	Skeikampen
		69	Sun	Light breeze	-16	250	Crowded	Thur-fri	Sjusjøen
	24	70	Cloudy	Fresh breeze	-16	550	Crowded	Mon-wed	Sjusjøen
		71	Fog	Strong wind	+5	250	Very_crowded	Thur-fri	Hafjell
		72	Precipitation	Calm	-2	350	Not crowded	Sat	Skeikampen
4	25	73	Precipitation	Calm	-2	350	Not crowded	Sat	Sjusjøen
		74	Sun	Light breeze	-9	450	Somewhat_crowded	Sun	Hafjell
		75	Cloudy	Fresh breeze	-16	550	Crowded	Mon-wed	Skeikampen
	26	76	Sun	Calm	+5	550	Very_crowded	Sun	Sjusjøen
		77	Cloudy	Light breeze	-2	250	Not crowded	Mon-wed	Hafjell
		78	Fog	Fresh breeze	-9	350	Somewhat_crowded	Thur-fri	Skeikampen
	27	79	Fog	Fresh breeze	-9	450	Crowded	Sat	Hafjell
		80	Precipitation	Strong wind	-16	550	Very_crowded	Sun	Skeikampen
		81	Sun	Calm	+5	250	Not crowded	Mon-wed	Sjusjøen
	28	82	Sun	Fresh breeze	-2	250	Somewhat_crowded	Sun	Sjusjøen
		83	Cloudy	Strong wind	-9	350	Crowded	Mon-wed	Hafjell
		84	Fog	Calm	-16	450	Very_crowded	Thur-fri	Skeikampen
	29	85	Fog	Light breeze	+5	250	Somewhat_crowded	Sun	Sjusjøen
		86	Precipitation	Fresh breeze	-2	350	Crowded	Mon-wed	Hafjell
		87	Sun	Strong wind	-9	450	Very_crowded	Thur-fri	Skeikampen
	30	88	Precipitation	Strong wind	-16	250	Not crowded	Mon-wed	Sjusjøen
		89	Sun	Calm	+5	350	Somewhat_crowded	Thur-fri	Hafjell
		90	Cloudy	Light breeze	-2	450	Crowded	Sat	Skeikampen
	31	91	Cloudy	Strong wind	+5	350	Not crowded	Sat	Sjusjøen
		92	Fog	Calm	-2	450	Somewhat_crowded	Sun	Hafjell
		93	Precipitation	Light breeze	-9	550	Crowded	Mon-wed	Skeikampen
	32	94	Sun	Strong wind	-9	350	Crowded	Sun	Skeikampen
		95	Cloudy	Calm	-16	450	Very_crowded	Mon-wed	Sjusjøen
		96	Fog	Light breeze	+5	550	Not crowded	Thur-fri	Hafjell
	33	97	Fog	Calm	-16	350	Crowded	Sun	Sjusjøen
		98	Precipitation	Light breeze	+5	450	Very_crowded	Mon-wed	Hafjell
		99	Sun	Fresh breeze	-2	550	Not crowded	Thur-fri	Skeikampen
	34	100	Sun	Fresh breeze	-2	350	Very_crowded	Mon-wed	Skeikampen

5		101	Cloudy	Strong wind	-9	450	Not crowded	Thur-fri	Sjusjøen
		102	Fog	Calm	-16	550	Somewhat_crowded	Sat	Hafjell
	35	103	Sun	Calm	+5	250	Not crowded	Mon-wed	Hafjell
		104	Cloudy	Light breeze	-2	350	Somewhat_crowded	Thur-fri	Skeikampen
		105	Fog	Fresh breeze	-9	450	Crowded	Sat	Sjusjøen
	36	106	Sun	Light breeze	-16	250	Crowded	Thur-fri	Hafjell
		107	Cloudy	Fresh breeze	+5	350	Very_crowded	Sat	Skeikampen
		108	Fog	Strong wind	-2	450	Not crowded	Sun	Sjusjøen
	37	109	Cloudy	Light breeze	-2	350	Somewhat_crowded	Thur-fri	Hafjell
		110	Fog	Fresh breeze	-9	450	Crowded	Sat	Skeikampen
		111	Precipitation	Strong wind	-16	550	Very_crowded	Sun	Sjusjøen
	38	112	Cloudy	Strong wind	+5	250	Crowded	Thur-fri	Skeikampen
		113	Fog	Calm	-2	350	Very_crowded	Sat	Sjusjøen
		114	Precipitation	Light breeze	-9	450	Not crowded	Sun	Hafjell
	39	115	Fog	Calm	-16	550	Somewhat_crowded	Sat	Skeikampen
		116	Precipitation	Light breeze	+5	250	Crowded	Sun	Sjusjøen
		117	Sun	Fresh breeze	-2	350	Very_crowded	Mon-wed	Hafjell
	40	118	Sun	Strong wind	-9	450	Very_crowded	Thur-fri	Sjusjøen
		119	Cloudy	Calm	-16	550	Not crowded	Sat	Hafjell
		120	Fog	Light breeze	+5	250	Somewhat_crowded	Sun	Skeikampen
6	41	121	Cloudy	Strong wind	+5	450	Somewhat_crowded	Mon-wed	Sjusjøen
		122	Fog	Calm	-2	550	Crowded	Thur-fri	Hafjell
		123	Precipitation	Light breeze	-9	250	Very_crowded	Sat	Skeikampen
	42	124	Sun	Light breeze	-16	350	Not crowded	Sat	Hafjell
		125	Cloudy	Fresh breeze	+5	450	Somewhat_crowded	Sun	Skeikampen
		126	Fog	Strong wind	-2	550	Crowded	Mon-wed	Sjusjøen
	43	127	Precipitation	Fresh breeze	+5	450	Very_crowded	Thur-fri	Hafjell
		128	Sun	Strong wind	-2	550	Not crowded	Sat	Skeikampen
		129	Cloudy	Calm	-9	250	Somewhat_crowded	Sun	Sjusjøen
	44	130	Sun	Strong wind	-9	550	Somewhat_crowded	Sat	Skeikampen
		131	Cloudy	Calm	-16	250	Crowded	Sun	Sjusjøen
		132	Fog	Light breeze	+5	350	Very_crowded	Mon-wed	Hafjell
	45	133	Precipitation	Fresh breeze	+5	350	Crowded	Sun	Hafjell
		134	Sun	Strong wind	-2	450	Very_crowded	Mon-wed	Skeikampen

		135	Cloudy	Calm	-9	550	Not crowded	Thur-fri	Sjusjøen
	46	136	Cloudy	Calm	-9	350	Very_crowded	Mon-wed	Hafjell
		137	Fog	Light breeze	-16	450	Not crowded	Thur-fri	Skeikampen
		138	Precipitation	Fresh breeze	+5	550	Somewhat_crowded	Sat	Sjusjøen
	47	139	Precipitation	Light breeze	-9	450	Not crowded	Sun	Skeikampen
		140	Sun	Fresh breeze	-16	550	Somewhat_crowded	Mon-wed	Sjusjøen
		141	Cloudy	Strong wind	+5	250	Crowded	Thur-fri	Hafjell
	48	142	Fog	Strong wind	-2	250	Very_crowded	Sat	Hafjell
		143	Precipitation	Calm	-9	350	Not crowded	Sun	Skeikampen
		144	Sun	Light breeze	-16	450	Somewhat_crowded	Mon-wed	Sjusjøen

Weather	Wind	Temperature	Price (NOK)	Crowdedness	Weekday	Ski resort
Sun	Calm	+5	250	Not crowded	Mon-wed	Hafjell
Cloudy	Light breez	-2	350	vhat_crowded	Thur-fri	Skeikampen
Fog	Fresh breez	-9	450	Crowded	Sat	Sjusjøen
Precipitation	Strong win	-16	550	Very_crowded	Sun	

Appendix G

Consent form in Norwegian

Vil du delta i forskningsprosjektet

"Innovative Pricing Approaches in the Alpine Industry - iPaaSki"?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å *kartlegge ski- og snowboardkjøreres preferanser*. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål
Formålet med prosjektet er å kartlegge ski-/snowboardkjøreres preferanser i alpinbakken og komme frem til nye og innovative måter å prise heiskort på.

Eksempler på problemstillinger vi ønsker å besvare er for eksempel: (1) hva er optimal pris under ulike værforhold? (2) Hva er optimal pris når man tar hensyn til ulike kjennetegn/attributter i anlegget (som lengde på preparerte løyper, andel svarte løyper, osv).

Prosjekt inngår både på bachelor-, master- og dr.gradsnivå.

Noen av resultatene som fremkommer vil også kunne benyttes i undervisning ved Handelshøgskolen Innlandet.

Hvem er ansvarlig for forskningsprosjektet?
Høgskolen i Innlandet – Handelshøgskolen. Vi samarbeider med: Sjusjøen Skisenter, Hafjell Alpinsenter, Skeikampen, Beitostølen Skisenter.

Hvorfor får du spørsmål om å delta?
Du får spørsmål om å delta fordi vi først og fremst ønsker å spørre folk som er interessert i alpin skikjøring (eller snowboard). Dersom du ikke er en av dem kan du ha fått spørsmål om å delta for å kartlegge hvor mange i populasjonen som er potentielt interessert / ikke aktuelle. Utvalget skal trekkes mest mulig tilfeldig og vi ønsker en representativ sammensetning som gjenspeiler populasjonen (alle skikjørere i anleggene som er aktuelle) best mulig.

Dersom du har fått tilsendt spørreskjemaet via e-mail har vi fått tilgang til kontaktopplysningene til deg via ett av de samarbeidende skisentrene i prosjektet.

Hva innebærer det for deg å delta?

- «Hvis du velger å delta i prosjektet, innebærer det at du fyller ut et spørreskjema. Det vil ta deg ca. 5 minutter. Spørreskjemaet inneholder spørsmål om hvilke valg du ville tatt gitt ulike scenarier. I tillegg spør vi om noe bakgrunnsinformasjon for å kunne kjøre delanalyser på undergrupper senere. Dine svar fra spørreskjemaet blir registrert elektronisk»

- Dersom du er under 18 år kan en av foreldrene dine få se spørreskjemaet på forhånd.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykke tilbake

uten å oppgi noen grunn. Alle opplysninger om deg vil da bli anonymisert. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger
Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

- Vår leverandør/databehandler er «Nettskjema» som Høgskolen i Innlandet har en databehandleravtale med. Dette sikrer at personopplysninger blir behandlet i samsvar med regelverket.
- Ved behandlingsansvarlig institusjon vil prosjektgruppen bestående av studenter ved Høgskolen i Innlandet og veiledere ved Høgskolen ha tilgang til dataene.
- Det vil ikke bli innhentet sensitive personopplysninger i denne undersøkelsen, men for å hindre at uvedkommende får tilgang til opplysninger generelt vil dataene bli lagret på maskinvare/servere fra institusjonen hvor innlogging er påkrevet.
- Ingen deltakere vil kunne bli identifisert i analysene eller senere publikasjoner.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?
Prosjektet skal etter planen avsluttes 31.12.2022. Dersom noe av dataene da ikke er anonymisert, vil dette bli gjort da. Videre lagring av dataene kan forekomme for mulige oppfølgingsstudier og for eventuell replikasjon av opprinnelige funn. Disse dataene vil da ikke inneholde noen personopplysninger som gjør at man vil kunne identifisere noen av respondentene i undersøkelsen.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg,
- å få rettet personopplysninger om deg,
- få slettet personopplysninger om deg,
- få utlevert en kopi av dine personopplysninger (dataportabilitet), og
- å sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra Høgskolen i Innlandet har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?
Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:

- *Høgskolen i Innlandet* ved Erik Haugom (erik.haugom@inn.no)
- Vårt personvernombud: Hans Petter Nyberg (hans.nyberg@inn.no)
- NSD – Norsk senter for forskningsdata AS, på epost (personvernombudet@nsd.no) eller telefon: 55 58 21 17.

Med vennlig hilsen

Prosjektansvarlig
Erik Haugom

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet Innovative Pricing Approaches in the Alpine Skiing Industry - iPaaSki, og har fått anledning til å stille spørsmål. Jeg samtykker til:

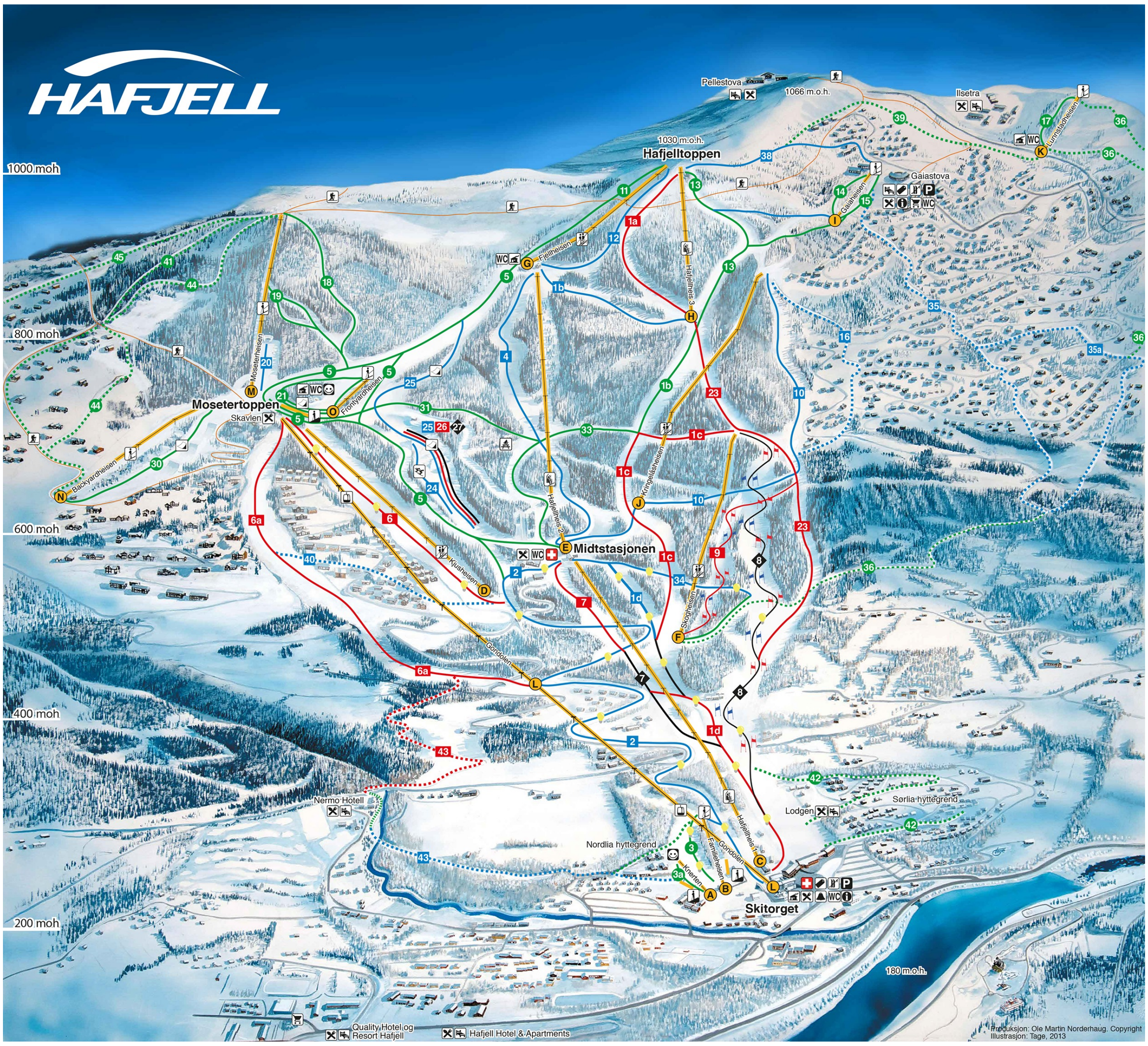
- ☐ å delta i *(sett inn aktuell metode, f.eks. intervju)*
- ☐ å delta i *(sett inn flere metoder, f.eks. spørreskjema) – hvis aktuelt*
- ☐ *at lærer kan gi opplysninger om meg til prosjektet – hvis aktuelt*
- ☐ *at mine personopplysninger behandles utenfor EU – hvis aktuelt*
- ☐ *at opplysninger om meg publiseres slik at jeg kan gjenkjennes (beskriv nærmere) – hvis aktuelt*
- ☐ *at mine personopplysninger lagres etter prosjektslutt, til (beskriv formål) – hvis aktuelt*

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, ca. 31.12.2022

(Signert av prosjektdeltaker, dato)

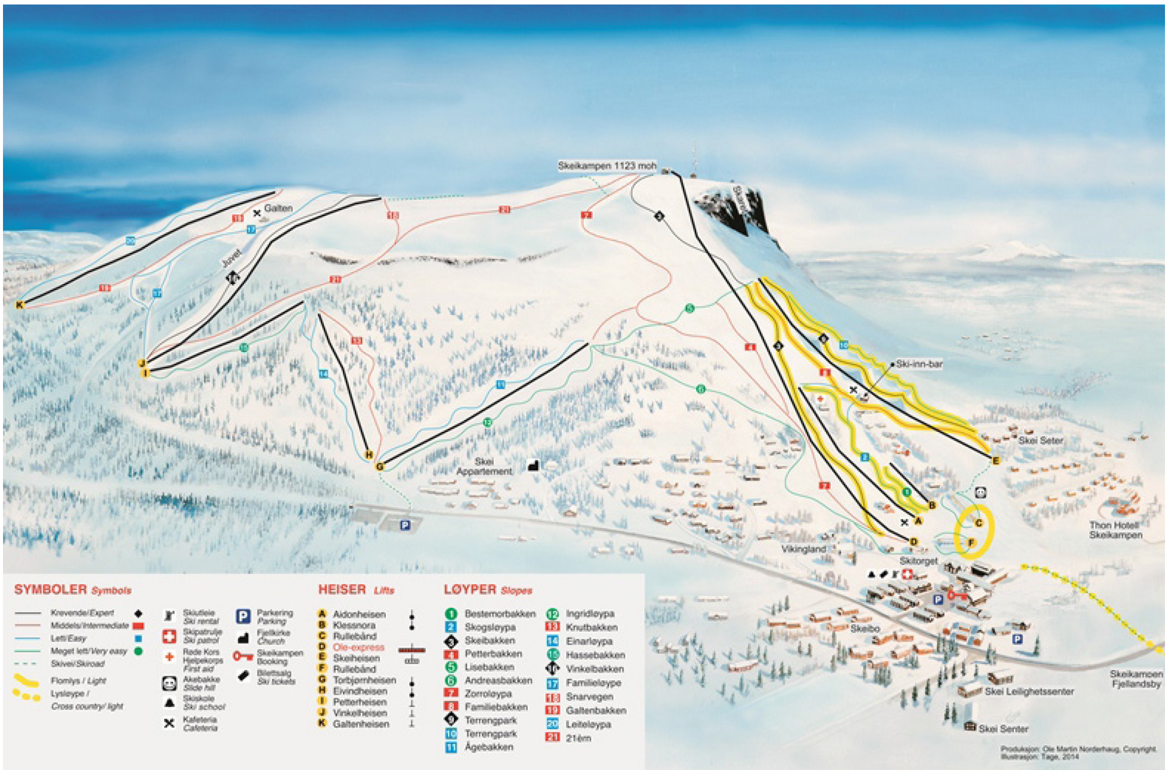
Appendix H

Trail map of Hafjell ski resort



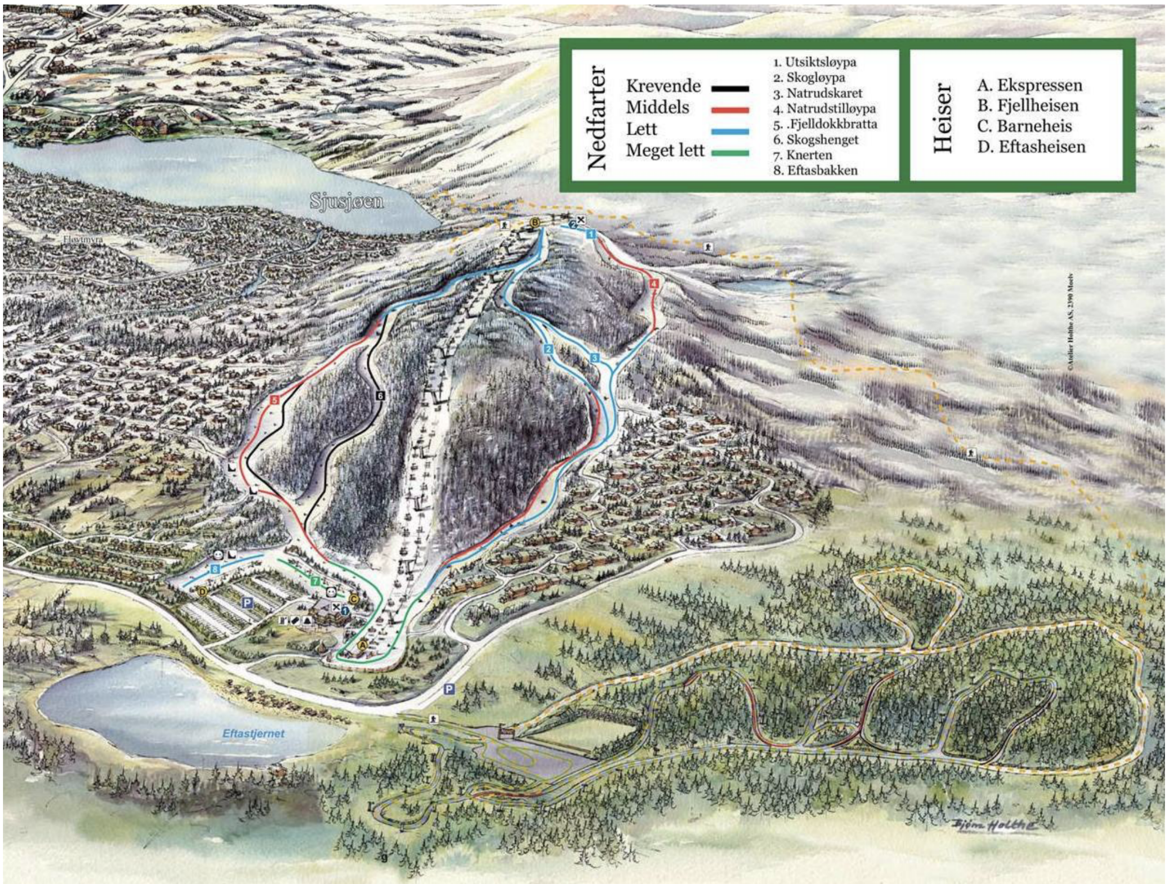
Appendix I

Trail map of Skei Kampen ski resort



Appendix J

Trail map of Sjusjøen ski resort



Appendix K

Manipulated Images

Sun - Not Crowded

Sun - Somewhat Crowded

Sun - Crowded

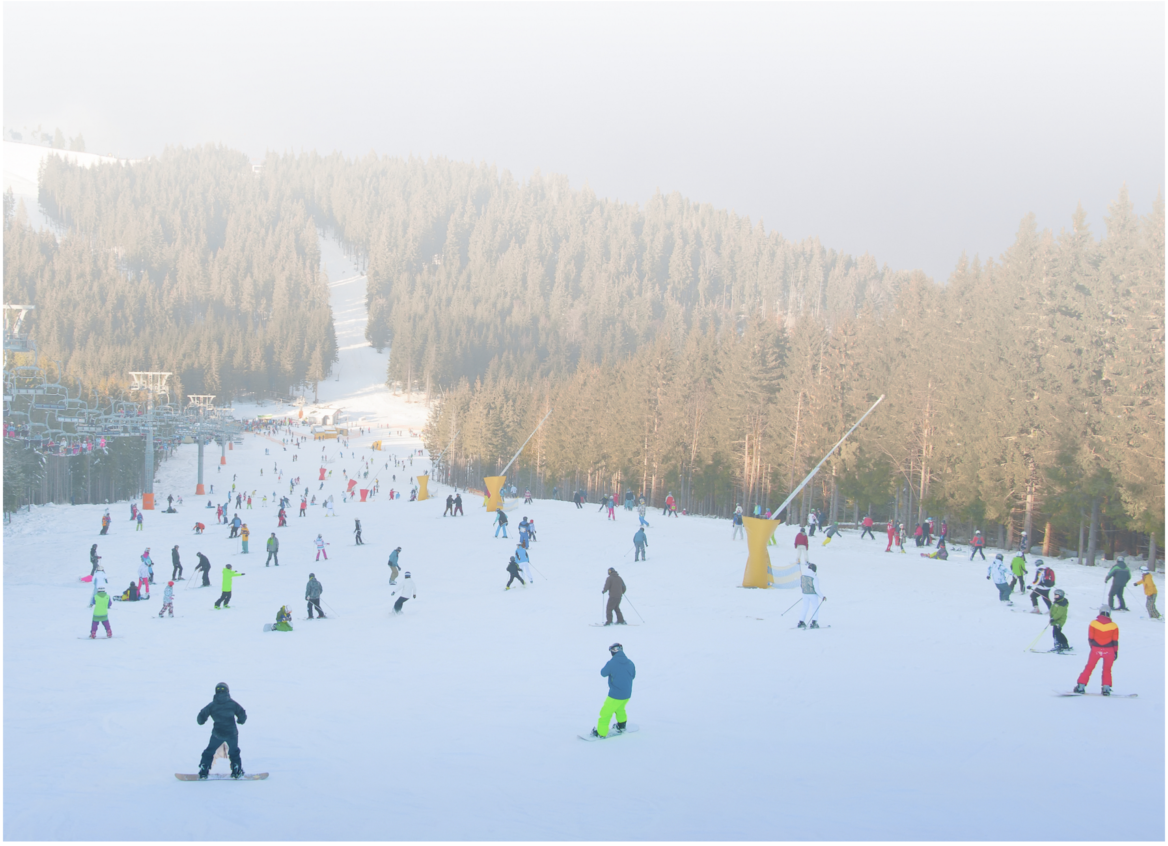
Sun - Very Crowded

Fog - Not Crowded

Fog - Somewhat Crowded

Fog - Crowded

Fog - Very Crowded



Rain - Not Crowded

Rain - Somewhat Crowded

Rain - Crowded

Rain - Very Crowded

Snow - Not Crowded

Snow - Somewhat Crowded

Snow - Crowded

Snow - Very Crowded

Cloudy - Not Crowded

Cloudy - Somewhat Crowded

Cloudy - Crowded

Cloudy - Very Crowded