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# Optimal prices for alpine ski passes

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## HIGHLIGHTS

- The price-demand relationship for alpine ski resorts is examined.
- Price response functions are estimated.
- Optimal prices for one-day ski passes are calculated.
- Total revenue and skiing demand can be increased substantially by offering variable prices.
- The most distinct effect is found when charging different prices across weekdays.

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## ABSTRACT

The purpose of this paper is to examine the relationship between price and demand and to determine the effect of variable pricing on ski resort revenues. We use data from a survey of existing skiers at three ski resorts in the inland region of Norway to estimate price–response functions, based on a number of characteristics, including day-of-week and distance to the resort. The various price–response functions are subsequently used to calculate optimal prices for each subset of skiers according to their differing characteristics. The results show that ski resorts have the potential to increase their total revenues substantially by adopting a more dynamic approach to pricing. Thus, our results provide academic support for the findings of ski resorts that have implemented such pricing strategies.



## 1. Introduction

Various pricing and revenue management techniques have been successfully applied within many areas of the tourism and hospitality industry over recent decades. Prime examples include airlines and hotels (traditional revenue management industries), cruise lines, golf clubs, and restaurants. However, the principles behind these techniques are equally applicable to other businesses within the tourism sector as long as a number of criteria are met. These criteria are: (1) varying and predictable demand, (2) relatively fixed capacity, (3) low costs of marginal sales, and (4) limited or no storage possibilities (Berman, 2005).

Alpine ski resorts exhibit all of the above-mentioned criteria and are therefore particularly interesting in terms of implementing a more dynamic approach to pricing. Moreover, revenues for ski resorts are primarily generated from the sale of ski lift tickets (Bartlett, Gratton, & Rolf, 2006; SkiStar, 2015; Thompson, 2012). Mostly, ski resorts use a competitor-based pricing approach (Pellinen, 2003). However, some resorts have started to experiment with using price as a means to increase operating profits (see e.g., Deprez, 2015). In addition, ski resorts face very variable demand; therefore, variable pricing can be a useful approach to reducing demand fluctuations and to maximizing revenues.

There are no previous studies that have formally examined the price–demand characteristics and the optimal pricing decisions within the ski resort industry, as we do in this paper. Specifically, we use data from a survey among existing skiers at three resorts in the inland region of Norway to: (1) estimate price–response functions using various techniques; and (2) calculate optimal prices based on cost characteristics and the estimated price–response

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functions.

Although the concept of variable pricing is well established in many industries within tourism, the possibilities and the practicalities of implementing such pricing strategies in the ski resort industry have not been well discussed except in social media contexts. Therefore, this paper contributes to the existing literature by providing academic evidence of the impact of a more dynamic pricing approach on ski resorts' financial performance. Practitioners of the alpine skiing industry can use the insights and analytical framework presented in this study to form new pricing strategies and implement these in their daily operations.

The main results of this study are that both the total revenue and the total skiing demand can be increased substantially by adopting a more dynamic approach to pricing. The most distinct effect is found when charging different prices within the week. Our analysis shows that it is optimal to lower the price of alpine ski passes, and particularly so for the midweek days. Such price reductions induce a substantial increase in skiing demand and in the total revenues of the ski resorts, particularly in the case of the midweek price reductions. In addition, we calculate separate price–response functions for other subsets of skiers according to their differing characteristics and show how ski resorts can optimize revenues by offering variable prices for different customer types.

The remainder of the paper is organized as follows. The next section provides a brief overview of the literature. Section 3 introduces the methodology, followed by a presentation of the questionnaire design and sample in Section 4. Section 5 presents the empirical results. Section 6 provides the conclusion with discussion, followed by managerial implications arising from our findings in Section 7.

## 2. Literature review

### 2.1. Review of pricing theory

A key element in any price and revenue optimization problem is the price–response function. In contrast to the concept of a market demand curve that describes how the entire market responds to changing prices, a price–response function specifies demand for a product or service of a single seller as a function of the price offered by that seller (Bodea & Ferguson, 2014). The distinction is critical because different firms competing in the same market face different price–response functions as a result of various firm-specific factors, including marketing activities, product and service range, different qualities of services provided, location, and more (Bodea & Ferguson, 2014; Phillips, 2005).

To what degree a company can use price as a means to achieve higher profits depends on the shape of the price–response function for the product or service of interest. In the special case of a perfectly competitive market, the price–response function would be completely horizontal. In such a case, the company would be a *price taker* and could not change the price without either (1) losing all demand or (2) needing to satisfy all market demand (which the single company does not have capacity to handle). However, perfectly competitive markets are more the exception than the rule in reality.

Numerous models have been developed to examine the relationship between price and consumer demand and to investigate a company's optimal price decision (for a review, see Huang, Leng, & Parlar, 2013). Several studies have examined the suitability of different functional forms when estimating demand, however the best-fitting functional forms may vary from industry to industry (Huang et al., 2013). Although many of the previous studies examined the relationship between price and market demand, the insights from such studies are still useful when the focus is on estimating the price–response functions of a single product/service offered by a single company. This is because the methodological problem, providing the best possible fit to a scatter plot, is identical.[2]

### 2.2. Willingness-to-pay

The price–response function specifies the change in demand for a specific product or service for a given price change. Hence, there is an assumption about customer behaviour underlying the price–response function. Specifically, the price–response function can be directly linked to an assumption regarding the consumers' willingness-to-pay (WTP). It is useful to understand the relationship between the two factors to evaluate whether the price–response function is based on assumptions appropriate for the specific application (Phillips, 2005).

WTP is usually referred to as the maximum price a customer is willing to pay for a product or service. In the case of alpine skiing, a given customer may have, for example, a WTP of 300 Norwegian kroner (NOK) for a one-day ski pass. This customer would visit the resort if the price is NOK 300 or less, but would not visit if the price is NOK 301. If we define $\boldsymbol{w}(\boldsymbol{x})$ as the WTP distribution across the population, the fraction of the population with a WTP between $\boldsymbol{p}_1$ and $\boldsymbol{p}_2$ is then given by:

$$\int_{\boldsymbol{p}_1}^{\boldsymbol{p}_2} \boldsymbol{w}(\boldsymbol{x})\boldsymbol{dx}. \tag{1}$$

For example, if $\boldsymbol{p}_1$ is NOK 200 and $\boldsymbol{p}_2$ is NOK 250, and the expression inside equation (1) is 0.2, this means that 20% of the population has a maximum WTP of between NOK 200 and NOK 250. Moreover, if $\boldsymbol{D}$ is the maximum demand (the demand when the price is zero), the demand function can be derived directly from the WTP distribution (Phillips, 2005), as follows:

$$\boldsymbol{d}(\boldsymbol{p}) = \boldsymbol{D}\int_{\boldsymbol{p}_1}^{\boldsymbol{p}_2} \boldsymbol{w}(\boldsymbol{x})\boldsymbol{dx} \tag{2}$$

Different methods are used to estimate WTP and they can be divided into the following categories: market data, experiments, direct surveys, and indirect surveys (Breidert, Hahsler, & Reutterer, 2006). All methods have both advantages and disadvantages when it comes to obtaining accurate, reliable, and time- and cost-efficient data on price and demand. However, the contingent valuation method (CVM) is one of the most commonly used methods to measure consumer WTP (Drayer & Shapiro, 2011; Reynisdottir, Song, & Agrusa, 2008; Wicker & Hallmann, 2013). The CVM requires respondents to state their WTP directly (open-ended contingent valuation) or to make single or repeated choices of whether they would buy a good at a given price (closed-ended contingent valuation) (Wertenbroch & Skiera, 2002). Steiner and Hendus (2012) confirmed that direct survey approaches are predominantly used from the practitioners' perspective as well.

A number of studies exist on WTP for different kinds of sport and recreation activities (e.g., natural attractions (Reynisdottir et al., 2008), marathon events (Wicker & Hallmann, 2013), sports clubs (Wicker, 2011), and team sports (Drayer & Shapiro, 2011)). However, to our knowledge, there are very few studies on WTP for alpine skiing activities. The only example we could find in the

[2] We will return to this issue and provide more details concerning the method and estimation in the next section.