



Innovative Applications of O.R.

Lift ticket prices and quality in French ski resorts: Insights from a non-parametric analysis



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ABSTRACT

Using a unique data set with 168 ski resorts located in France, this paper investigates the relationship between lift ticket prices and supply-related characteristics of ski resorts. A non-parametric analysis combined with a principal component analysis is used to identify the set of efficient ski resorts, defined as those where the lift ticket price is the cheapest for a given level of quality. Results show that the average inefficiency per lift ticket price is less than 1.5 euros for resorts located in the Pyrenees and the Southern Alps. The average inefficiency is three times higher for ski resorts located in the Northern Alps, which is explained by the presence of large connected ski areas offering many more runs for a small surcharge.

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1. Introduction

With Austria and the United States, France is considered as being one of the premier ski destinations in the world, with modern lift equipment and many linked skiable areas. According to the last report “Indicateurs et analyses 2012” published by the [Domaines Skiables de France \(2012\)](#), France became the most popular destination for skiers worldwide during the 2011–2012 season, with 55.3 million skier days.¹ Several figures highlight the vitality of the ski industry in France. Ski resorts are visited by around 10 percent of the French population each year and they attracted two million foreign tourists last year. More than 120,000 people work in ski resorts every year, ski activities contribute around 2 billion euros to French exports and 300 million euros are invested in ski areas each year ([Domaines Skiables de France, 2012](#)).²

The mountainous space covers more than one-fifth of the French land mass, with six main mountain areas: the Northern Alps, the Southern Alps, the Pyrenees, the Massif Central, the Jura and the Vosges. France is the leading country in Europe in terms

of ski area, with around 30% of the total world ski area, and also in terms of ski lifts (more than 3300). The diversity of the ski resorts in France is undoubtedly one of the main attractions for tourists. There are more than 300 ski resorts in France which are either traditional mountain villages or purpose-built resorts. Over the last few years, some resorts have been linked together to create even bigger ski areas like Les Trois Vallées, l’Espace Killy or Paradiski, where skiers can explore a very high number of ski slopes.

French ski resorts differ widely both in their geographic and supply-side characteristics. The spectrum ranges from a few very large resorts built at high altitude, offering sufficient snow cover throughout the Winter and Spring seasons, to small resorts with low prices and limited ski runs, where skiing is possible only during the Winter season. In an intermediary position, there are medium-sized resorts which are more family-oriented, but also more sensitive to snow cover. These differences in quality are expected to explain differences in lift ticket prices across ski resorts. In this paper, I combine three different strands of literature to provide an innovative analysis of the price–quality relationship for a sample of French ski resorts.

Firstly, I rely on the literature of hedonic prices à la [Rosen \(1974\)](#) that has highlighted the role played by the characteristics of ski resorts on the selling price of ski passes in various countries ([Falk, 2008, 2011](#); [Pawlowski, 2011](#)). Number of slopes, length of slopes and number of lifts are examples of ski resort characteristics that will explain lift ticket price formation. Secondly, I turn to a principal component analysis (PCA hereafter) to construct a synthetic index of quality for each ski resort. The PCA explains the variance structure of a matrix of data through linear combinations of

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¹ This corresponds to an increase of 3% compared to the 2010–2011 season. Conversely, the United States and Austria have experienced drops in their daily visitor numbers (–15.8% and –2% respectively), essentially because of the economic crisis.

² All these figures are drawn from the report published by the [Domaines Skiables de France \(2012\)](#). For additional details, see <http://www.domaines-skiables.fr/downloads/uploads/Indicateurs-et-Analyses2012-Web.pdf>.

variables, which reduces the data to a small number of principal components (Jolliffe, 2002). Thirdly, following Ueda and Hoshiai (1997) and Adler and Golany (2001, 2002), a non-parametric analysis is combined with PCA to study the relative efficiency of ski resorts in the price–quality space.

I assume that the decision for a skier consists of selecting a combination of lift ticket price and resort quality. A ski resort is considered as efficient if a skier pays the lowest possible lift ticket price for a given quality, which includes attributes like number of runs or number of lifts. To identify the set of efficient ski resorts in the price–quality space, I assume that the production possibilities satisfy free disposability. This corresponds to the free disposal hull model (FDH hereafter) developed by Deprins, Simar, and Tulkens (1984). For each ski resort, the non-parametric approach allows me to determine the price paid in excess per lift ticket when skiing in an inefficient resort. An important assumption of my framework is that there are no externalities in selecting ski resorts. For instance, I leave aside the issue of housing accommodation or activities after ski in resorts. Also, I do not account for the possibility that skiers may not want to visit some large ski areas due to crowding or other factors.

Nowadays, there is high quality information on ski resorts available on the Internet, provided both by the resorts' own websites and by comparative websites. The data that I use on lift ticket prices and resorts' services was collected from the Ski Info website.³ Specifically, I constructed a unique data set covering 168 ski resorts for the 2010–2011 season. I consider a large number of ski resort attributes which are expected to affect the willingness to pay of skiers. For each ski resort, a synthetic indicator of quality is computed using a principal component analysis. This index is then used in the non-parametric analysis to identify the set of efficient ski resorts. My results show that the average inefficiency per lift ticket price is less than 1.5 euros for resorts located in the Pyrenees and the Southern Alps. The average inefficiency is three times higher for ski resorts located in the Northern Alps. All these results are robust to the definition of the quality variable.

With respect to the existing literature, my contribution may be seen as complementary, but not redundant, to the econometric literature based on the hedonic price approach. Rather than focusing on the effect of quality on the average lift ticket price and providing implicit prices for each supply-related characteristics of ski resorts, I identify the set of resorts that should be preferred by skiers if they want to pay the lowest price for a given level of quality. A strength of my analysis is in calculating the money paid in excess for each inefficient resort. In doing so, I am able to highlight the best strategies for skiers to buy cheaper lift tickets for a given level of quality. In particular, I show that it is advantageous for skiers to ski on large connected ski areas as they offer many more runs for a small surcharge per lift ticket.

The remainder of this paper is organized as follows. In the next section, I briefly summarize the existing literature related to my research. I provide a description of the data set in Section 3, while Section 4 explains the construction a synthetic indicator of quality from the various resorts' attributes. In Section 5, I present a non-parametric framework to study the price–quality relationship. I identify the set of efficient ski resorts in France in Section 6 and show that inefficiency per lift ticket is much higher in the Northern Alps than in the Southern Alps and the Pyrenees. Finally, Section 7 concludes.

2. Literature review

The seminal economic paper on the winter resort industry is by Barro and Romer (1987). In their model, ski area consumers pur-

chase a ski lift ticket based on a future utility which depends on the number of lift rides. Both differences in quality and individual preferences will affect the willingness to pay for skiing. By focusing on the price–quality relationship, my contribution is more closely related to three distinct strands of literature.

The first one is hedonic pricing literature. Assuming that consumers value the utility of goods or services based upon their visible characteristics, “hedonic prices are defined as the implicit price of attributes and are revealed to economic agents from observed prices of differentiated products and the specific amounts of characteristics associated with them” (Rosen, 1974, p. 34). In the first-stage of the Rosen model, a regression analysis is used to obtain estimates of the contributory value of each characteristic to price.⁴ As emphasized in Falk (2008), the strong competition faced by the various ski resorts is such that differences in lift ticket prices are expected to be strongly correlated with quality characteristics and demand factors.

A few papers have investigated this issue over the last years. Using data on 344 resorts located in the United States, Mulligan and Llinares (2003) find that the adoption of detachable chairlifts is positively correlated with ticket price. Pricing also depends on location, vertical drop or number of local competitors. Using a dataset of 84 Austrian ski resorts, Falk (2008) examines to what extent supply-related factors affect lift ticket prices.⁵ Price dispersion is essentially explained by differences in lift capacities, ski runs and snow conditions, and attributes of ski resorts account for more than 60% of the variations in the ski lift ticket prices. In Italy, Alessandrini (2013) finds that willingness to pay is higher for the length of winter season than for transport or numbers of chairlifts and ski runs. Falk (2011) and Pawlowski (2011) propose comparative analyses using data from various European countries. Ski lift tickets tend to be significantly lower in France and Italy than in the other European countries net of the resorts' characteristics.

The second strand is related to the measurement of economic efficiency in production. As shown in the seminal contribution of Farrell (1957), a decision making unit can be inefficient either by obtaining less than the maximum output available from a given level of inputs (technical inefficiency) or by not purchasing the optimal combination of inputs given prices and marginal factor productivities (allocative inefficiency). Researchers have considered two different paradigms for analyzing production efficiency: stochastic frontier analysis and DEA.⁶ The DEA approach is a non-parametric method in which the efficient frontier is calculated from the sample observations in an empirical way. The efficient decision making units lie on the frontier envelopment surface obtained by solving a mathematical programming problem (Charnes, Cooper, & Rhodes, 1978) and an inefficiency score is calculated for each unit not on the frontier.

More recently, a few papers have investigated efficiency on markets using a non-parametric double-frontier methodology. This method was originally proposed by Lins, Novaes, and Legey (2005) to the case of real estate value assessment. The double perspective DEA framework combines the maximization of outputs and the minimization of inputs in a setting where inputs under one perspective are the outputs under the other perspective (and vice versa). This setting is especially well-suited to study efficiency of buyers and sellers in the price–quality space as shown in Mouchart

⁴ In the second stage, implicit prices are regressed as a function of quantities chosen by individuals in order to obtain the marginal willingness-to-pay (identification of the inverse demand curve).

⁵ Using data from Austrian ski resorts and reported ski accidents, Borsky and Raschky (2009) find that the individual willingness to pay for a hypothetical increase in the possibility to undertake risk-taking activities ranges from 11% to 25% of the price of a lift ticket.

⁶ For an overview of these methods, see the surveys of Greene (2008) and Murillo-Zamorano (2004) among others.

³ See <http://www.skiinfo.fr/>.

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