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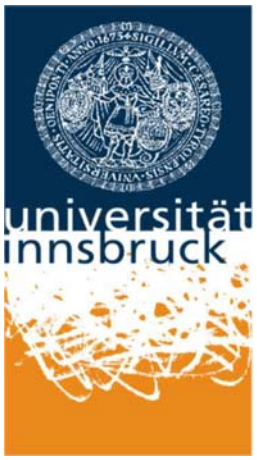

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Estimating the Option Value of Exercising Risk-taking Behavior with the Hedonic Market Approach

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Abstract

Within the last decades an increasing number of people practice risky sports in their leisure time. Although there exists a vast number of economic literature on risk-taking behavior, an estimation of the individual willingness to pay (WTP) for the option to exercise risk-taking is missing. Monetarized values could support private industries in design pricing schemes that set incentives to reduce risk-taking behavior as well as public policy-makers to develop alternative instruments to reduce the adverse effects of risk-taking activity (e.g. accidents). We use data of 69 Austrian Ski resorts and 3,637 reported ski accidents and apply the hedonic market method. Our results suggest that the individual WTP for a hypothetical increase in the possibility to undertake risk-taking activities lies between 11% and 25% of the price of a ski-lift-ticket.

Keywords: Hedonic market approach, individual risk-taking, sports

JEL classification: D81, L8, Q51

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1 Introduction

Choices involving the uncertainty of a potential negative outcome are an essential part in our daily live. People face risks by making an investment decision, walking across the street or deciding to do an outdoor sport. The decision of an individual in such situations depends in general on his attitude towards risk. The traditional theory, especially from an economic viewpoint, is based on the rational, risk-averse individual. There are cases, like investment decisions, where such behavior is generally observable. In other cases, like life-style or leisure activities, studies on the behavior of individuals towards risk have shown that people often have a distorted perception of risks. In the case of life-style risks, where the extent of the negative outcome is perceived to be more under control of the individual decision-maker, like smoking, drinking, car-driving or sky-diving, it is possible to observe that people willingly take the risk of a possible injury or illness in future for a present pleasure. Whereas in the industrialised countries the share of individuals doing life-style activities like smoking or drinking with their accompanying risks is decreasing, the tendency of the population for participating in thrill and adventure seeking leisure time activities has been constantly growing over the last decades. More and more people try to get away from daily routine through activities such rock-climbing, sky-diving or skiing. The share of people doing high-risk sports time can be related to two major driving forces: First, social acceptance of people who undergo risk-taking in their leisure activities have increased continuously in the last decades. Sport channels dedicate increasing airtime to events in rock-climbing, sky-diving or surfing. Commercials increasingly use either high-risk sportsmen or images of high-risk activity as an advertisement medium. Second, a remarkable series of technological improvements in medicine have reduced the expected individual costs of risk-taking substantially. In the view of risk, "extreme" sports today are not really so extreme than in former days (Johnston 2003). Figures on the number of people exercising high-risk sports underpin these findings in the literature and reveal the booming trend in risky sports: For example the number of active skydivers in the United States Parachuting Association

increased from about 20,250 in 1991 to about 34,000 in 2005, an increase of about 68%[1]. Experts estimate that in 1959 there were about 5,000 wave-riders worldwide. This number apparently escalated to about 2 million by 1962 and it is estimated that today there are about 17 to 23 million surfers worldwide[2].

From an economist's point of view, risk-taking increases individual utility and thus results in a positive demand for these "goods". This individual demand to feel excitement through risk-taking activities, however, can result in adverse side-effects. For example, around 60,000 accidents (resulting in some form of injury) on Austrian ski runs are recorded every year [3]. In comparison in the same season about 40,000 car accidents occurred on Austrians roads [4]. This shows the relevance of the external effects of risk-taking behavior and the accompanying issue on safety on Austrian ski runs. The growing number of participants in risky sports and its related negative effects have drawn a lot of attention from social sciences in general and economics in particular[5] on risk-taking behavior. One aspect faded out so far by the literature is the individual valuation of the option to satisfy one's need for risk-taking. Using traditional methods for the valuation of intangible goods allows us to estimate the willingness to pay for this option. Monetized option values might have implications for private industry and public policy-makers alike. Suppliers of the possibility to satisfy risk-taking (e.g. ski-resorts, sky-diving school) offer this product in a bundle with other features (e.g. comfortable cable-cars, scenic views). Knowledge about the individuals' willingness to pay for sensation-seeking can help companies to design pricing schemes that set incentives to reduce risk-taking behavior. Information on the willingness to pay (WTP) for the possibility to undergo risk-taking activity allows

[1] http://www.parapublishing.com/sites/parachute/resources/statistics.cfm

[2] http://www.fff.org/freedom/fd0607f.asp

[3] see Freizeitunfallstatistik 2006, Kuratorium für Verkehrssicherheit (Statistic of accidents in spare time 2006), http://www.kfv.at/

[4] see Verkehrsunfallstatistik 2006, Kuratorium für Verkehrssicherheit (Statistic of road accidents 2006), http://www.kfv.at/

[5] For a general overview see Zuckerman (1979); on the economic analysis of risk-taking behavior see for example Schoemaker (1993)

policy-makers or insurance companies to develop price-related instruments to possibly reduce the amount of adverse effects.

Most empirical studies that have tried to deal with risk-taking behavior have used stated preference methods (e.g. contingent valuation method CVM). However, elicited values could be biased (e.g. Carson, Flores & Meade 2001) in particular in our case. Therefore we approach this issue applying a revealed preference method, namely the hedonic market approach. We use data from 69 Austrian ski-resorts in the season 2005/2006 to estimate the WTP for the possibility to satisfy the need for sensation-seeking. As this study tries to make a first step into this rather unexplored field its main purpose is to open up a new area for future research. Therefore our estimated figures have a clearly explorative character and should be dealt with care.

The paper is structured as follows. Section 2 investigates the concept of risk taking from an economic and psychological perspective and gives a short overview on the hedonic pricing approach. The following section 3 introduces the empirical strategy and the data used to monetise the demand for risk-taking behavior. Section 4 presents the results and section 5 concludes.

2 The concept of Risk-Taking and the Relationship to Injuries

Risk-Taking behavior in the field of life-style risks is recognized to be a volitional behavior toward a risky choice or situation with a potentially negative outcome. On the one hand it can be seen as a socially unacceptable, potentially harmful behavior in which precautions are not taken (e.g. speeding, driving under influence). On the other hand risk-taking is acknowledged as a socially accepted behavior in which the possibility of a negative outcome is recognized and willingly taken (e.g. competitive sports, skydiving, skiing) (Turner, McClure & Pirozzo 2004). In the last decades of research in this area the focus lay mainly on the investigation of socially unacceptable risk-taking behavior, resulting in vast amounts of policy proposals for efficient regulation

[6]. Observing risk-taking behavior from a person's actual activities is a widely discussed subject in the scientific communities. In psychological theory, risk taking is considered to be context-dependent and determined by a function containing task, people's decision frames and their information processing strategies (Kahneman & Tversky 2000). In search for motives why people are deciding to do activities with a potential negative outcome the psychological literature provides a broad range of different approaches like the concept of counter-phobic and phobic personalities by Fenichel (1939), the concept of introverted and extroverted personalities by Esyneck (1973), the concept of sensation seeking by Marvin Zuckerman [7] and the concept of unrealistic optimism by Weinstein (1984) to cite only a few. In the economy theory the concept of risk-taking is mainly analyzed in relation to economic situations, like gambles, insurance and market behavior. Investigating the aspects of risk-taking in risky sports from an economic viewpoint is almost neglected in the literature. Based on the theory of expected utility by Von Neumann & Morgenstern (1979) and by Friedman & Savage (1952) traditional economists assume that risk-taking is specified by the underlying individual utility function, which can be seen as a trait that determines behavior in risky situations (Schoemaker 1993, Dohmen, Falk, Huffman, Schupp, Sunde & Wagner 2006). Recent economic literature provides an approach, which lies between these two viewpoints by accepting that risk taking differs across contexts, but that the contexts are strongly correlated (Weber & Milliman 1997, Dohmen et al. 2006). Decision analyst criticise the limiting assumptions of the expected utility theory that people act according to their underlying expected utility function. Markowitz (1952) proposed that the utility of an individual is defined by gains and loses and not by the final assets and noticed the importance of risk-taking by introducing utility functions which could be concave as well as convex. Later on Kahneman & Tversky (1979) published their seminal work about prospect theory where they emphasised again the importance of changes to define utility and that the weights of the decisions process do not coincide with the stated probabilities. This work deals with

[6] see Turner et al. (2004) for a systematic literature overview

[7] see for example Zuckerman (1979)

an almost neglected part of risk-taking, namely with the socially acceptable one from an economic viewpoint that risk-taking differs across contexts, but that these contexts are strongly correlated.

Analysis of accidents have shown that a constellation of different conditions will lead to a specific hazardous situation, which may cause an individual accident or collision. In other words accidents never have a single cause, but they are influenced by a multidimensional system of different factors. In the literature on risk-taking behavior exists a consensus on the view that there is a causal relationship between individual differences in risk-taking and the occurrence of injuries. In general they come to the conclusion that more risk-taking increases the probability of an injury, but the main focus in research in this field lies in the examination of the link between risk-taking and road traffic crashes. In the field of high risk sport, especially in the case of alpine downhill skiing the findings are quite divergent. In a study in the field of accident analyses for the Swiss council for accident prevention Brüger, Walter and Sulc (2005) analyze the factors, which have an influence on the probability of having an accident while skiing and the severity of the injury. In their analysis they divide the occurrence of an accident into three phases: the phase before the accident, the actual damage or injury and the phase after the accident. For our purpose the phase before the accident is of special interest, because it analyzes the factors which leads to an accident whereas the other two phases deal with the factors which determines the severity of accident respectively injury. In the pre-accident phase the influencing factors are demography, i.e. male or female and adolescent or adult, experience and skill as well as coordination and fitness, external factors like equipment and environment and cognitive and behavioral factors. The later are described as riding at an excessive speed, the choice of difficult slopes and jumps or in other words risk-taking behavior. On the other hand there are studies with a stronger psychological background analyzing the relationship of risk-taking behavior and injuries (Bouter, Knipshild & Volovics 1998, Cherpitel, Meyers & Perinne 1998, Goulet, Regnier, Valois & Ouellet 2000). They have in common that they use data received from interview questions in a case-control setting and that they measure the individual willingness to undergo

risk-taking behavior by using the approach of sensation seeking based on the works of Zuckerman (1979). In their works they get to slightly divergent results. They find no positive relationship between the score on the sensation seeking scale and the probability to get injured while skiing. On the contrary their findings suggest that for a risk-taking skier with a higher sensation seeking score the probability to get injured is lower. They justify their results by showing that risk-takers in alpine skiing are normally more skilled riders than the other, which probably helps them to anticipate potential dangerous situations. Their conclusion is that injuries are not a factor of risk-taking, but they appreciate the weaknesses of their technique to measure the level of risk taking with the potential problem of biases by using interview questions. Furthermore they investigate the relationship between the decision of going skiing and risk-taking behavior again by using the concept of sensation seeking. Their findings show that the general skier has a higher score on the sensation seeking scale than the general non-skier. In other words the general skier wants to satisfy his demand for risk-taking when practicing his leisure activity. This fits to the work of Eitzinger & Wiedemann (2007), who analyse risk perceptions of alpine tourists in different contexts by using sorting techniques in an interview situation. They demonstrate that the probability of having a skiing accident is overestimated by the factor of 50. To conclude the possibility of having a ski accident is a common knowledge in the population. Individuals, who purchase a ski ticket, do this with the intension to satisfy their demand for risk-taking. Rephrased this means that the decision to purchase a ski lift ticket is the risk-taking action.

In this work risk-taking in the concept of socially accepted behavior serves as base for our hedonic price estimation for ski lift tickets. Assuming that the general skier is a risk-taker, as stated above, and the decision to buy a ski ticket for going skiing is a decision based on risk-taking behavior, then besides a couple of other characteristics the possibility to satisfy their risk-taking behavior is a determining factor in the hedonic price function for ski lift tickets. In the case of alpine skiing it is very difficult to observe risk-taking behavior directly. Interviewing skiers about their extent of risk-taking during their last run would easily be subject to strategic or social acceptable answers.

One possibility to evaluate risk-taking is via observed behavior by looking at on of the possible outcomes of individual risk-taking - ski-accidents.

3 Using a hedonic price model for ski lift tickets to evaluate risk-taking behavior

Every peak season in winter the ski resorts in Austria face the same phenomenon. Thousands of people, mostly ski enthusiast, surge in the small resorts to indulge theirs passion. The adverse effects are increasing density and heterogeneity of skills resulting in around 60.000 accidents on Austrian ski runs every year [8]. This makes alpine skiing next to other sports, like rock climbing or base jumping, to a high risk sport with an increased probability to get injured by practicing it. Concerning these facts the questions arise why people are deciding to go skiing and why the alpine ski sport has such popularity. One possible answer is that this risk makes the alpine ski sport next to other characteristic like scenery or the fresh healthy air so special and exiting. Bouter et al. (1998) show in their work that the risk-taking behavior of the general skier is higher than that of the general non-skier. This means that the skier seeks to find the thrill and adventure in his leisure time more than the general non-skier. It suggests that purchasing a ski ticket and going skiing with the intention to satisfy his demand for thrill and adventure, is a decision based on risk-taking behavior.

Ski Resorts in Austria differ in their characteristics like total length of their ski runs, altitude, transport capacity, types of transport facilities, level of difficulty of the ski area, snow conditions and scenery as well as driving distance to the next population centers, proximity of other ski resorts and the number and types of accommodations (Falk 2008). As the characteristics differ between the resorts, the price of a single day ticket does it as well. You can enjoy a day of skiing in one resort for 15 and in another resort you will pay 35 for the day [9]. This suggests that a skier when choosing a resort makes

[8] see Freizeitunfallstatistik 2006, Kuratorium für Verkehrssicherheit (Statistic of accidents in spare time 2006), http://www.kfv.at/

[9] prices of season 2005/2006

a decision based on the relationship between price and the quality of the ski resort. Here the quality of a ski resort comprises the characteristics stated above and the possibility to satisfy the individual need for thrill-seeking.

The hedonic pricing approach, based on the characteristic theory of value established by Lancaster (1966) and Rosen (1974), tries to explain the value of a commodity as a function of valuable characteristics (Hanley, Shogren & White 2001). Typically hedonic pricing is used to find the relationship between the levels of environmental services, like noise levels, urban air quality or scenic view, and the prices of the marketed goods, normally houses (Hanley & Spash 1993). In process of time the use of hedonic pricing to estimate the value of an environmental service by observing the change in price of the marketed good has extended in many other fields of interest. Nowadays it is used for instance to estimate the value of the "green premium" on environmentally-friendly consumer goods, the value of environmental risk on human health (Hanley & Spash 1993), in the field of tourism to estimate the value of tourist resorts (Papatheodorou 2002, Espinet, Saez, Coenders & Fluvia 2003) or to investigate the price-quality relationship of ski resorts (Mulligan & Llinares 2003, Falk 2008).

To get an accurate estimation using the hedonic pricing method the market has to be in equilibrium. In the case of ski resorts the market is in a monopolistic competition. This means that every single ski resorts is a unique entity forming a monopoly, which stands in competition with all the other monopolies. The occurrence of monopoly power in a market principally leads to inefficiency. But in the case of competing monopolies these inefficiencies normally are less. Barro & Romer (1987) show in their work about winter resort industry that in the case of ski resorts the occurrence of monopoly power does not lead to inefficiency. Assuming that the customer has no search and information costs, the lift ticket price can be described as function of all characteristics, which are on the one hand these used in the work of Falk (2008) and on the other hand the possibility to satisfy the demand for thrill and adventure.

In this paper we extend the work of Falk (2008), who estimated among others the marginal willingness to pay for various characteristics of ski resorts

in Austria. Here we examine the relationship between the price of a single day pass in a ski resort in Austria with the probability of having an ski accident there. For the reason that the hedonic pricing approach is indirect valuation method based on observed behavior it is not possible to examine risk taking behavior directly. So the occurrence of ski accidents serves as a proxy indicator for risk-taking behavior with the underlying assumption that risk-taking behavior is correlated with accidents.

3.1 Data

Our dataset comprises 69 ski-resorts in the Austrian regions of Tyrol and Vorarlberg. Our sample is thus smaller than the sample of our baseline study by Falk (2008). This reduction comes from limited data availability on transported persons and accidents. Data exists for a large amount of single ski-lifts but for a number (mayor) cable cars was not available and therefore we were not able to calculate the number of skiers transported for the sample at hand. Our independent variable is the price for a day-ticket. The mean price for a day pass is €29.80, the cheapest pass costs €15 and the most expensive day pass comes at €39.50.

The basic hedonic function is constructed in accordance to the specification by Falk (2008) and then augmented with additional risk-related variables. The share of chair and modern gondola lifts is on average 49 %. On average the ski-resorts in our sample are able to transport around 6,800 skiers upwards 1,000 metres per hour. The mean altitude difference is at about 1,108 metres. Our data sources are the Austrian Kuratorium fuer Alpine Sicherheit for the number of ski-accidents in each ski-resort. Data on the number of skiers transported and the ski-resort's transport capacity is obtained from the Austrian Federal Ministry of Transport, Technology and Innovation Cable Car Statistics for Tirol and Vorarlberg.

3.2 Empirical strategy

We commence by estimating a log-log hedonic price function for ski-lifts based on (Falk 2008) augmented by additional variables relevant for our analysis.

$$\begin{aligned} \text{Log}P_i = \beta_0 + \beta_1 \text{Log}ACC_i + \beta_2 \text{Log}DENS_i + \beta_3 \%CHAIR_i \\ + \beta_4 \%HARD_i + \beta_5 \text{Log}ALTDIFF_i + \beta_6 \text{Log}CAP_i + \nu_i \end{aligned} \tag{1}$$

where P_i is the price for a day pass in ski-resort i. Given our proposition that people have a positive WTP for the possibility to exercise their risk-seeking and that more risk-seeking results in more accidents, we expect the number of accidents per 1,000 skiers, ACC_i, to have a positive sign. The density on the ski runs, $DENS_i$, approximated by 1,000 visitors per kilometer of ski runs in resort i is assumed to have a negative affect on the price. As additional control for the demand for risk we included the fraction of hard pists, $\%HARD_i$, which we expected to deliver a positive sign. Regarding the different quality characteristics, we expect a positive effect of the fraction of modern chairlifts, $\%CHAIR_i$, the absolute altitude difference $ALTDIFF_i$ as well as the ski-resort lift transport capacity, CAP_i, to have a positive effect on the price. Additional robustness test are performed by controlling for the municipal tourism intensity and district fixed effects. A larger amount of tourists could be an indicator for a lower average level of skiing skills as well as a higher comsumption of alcoholic beverages in the resort. District fixed effects are used to control for the issue that ski-resorts with more accidents have led to more medical support facilities (e.g. hospitals) in the region in the past, which might increase the lift-prices.

Since the literature on hedonic pricing does not suggest a specific functional form, the decision on the optimal functional form is merely an empirical question. Cropper, Deck & McConnell (1988) have approached this issue systematically and compared the outcomes of various functional forms in a simulated hedonic housing function. In the case of some unobserved attributes Cropper et al. (1988) favor the simple linear functional form as

well as a Box-Cox function. The transformation of the linear function into a Box-Cox function takes the following form:

$$Y_i^{\theta} = \gamma_0 + \gamma_i X_i^{\rho_i} + \phi_i V_i + \epsilon_i \tag{2}$$

where

$$Y_i^{\theta} = \frac{Y_i^{\theta} - 1}{\theta}; X_i^{\rho_i} = \frac{X_i^{\rho_i} - 1}{\rho_i} \tag{3}$$

Y is the transformed dependent variable, in our case the price for a day pass, using θ. X_i is a vector of control variables transformed using ρ_i and V_i is a vector of other control variables not to be transformed, as they are not strictly positive. The parameters θ an ρ_i are estimated using an iterative maximum likelihood-process. γ_0, γ_i and ϕ_i are coefficients to be estimated and ϵ is the error term.

Similar to the study by Falk (2008) we also apply a linear spline function with a single knot as an additional way to account for non-linearity.

3.3 Empirical Results

The results of our regressions are presented in tables 2, 3 and 4. We first perform a baseline regressions without our main variable of interest, the proxy for risk-taking. The estimates in column 2.1 suggest that a resort's capacity and it's equipment with chair-lifts are the main explanatory factors for the price of the ski-ticket. Variables that indicate the riskiness of a ski-resort, the density on the pists and the share of difficult pists, are not significant. Less skilled skiers will select themselves into not so difficult pists and still be able to experience a certain amount of excitement. Therefore, we included our proxy for overall risk-taking, the number of accidents per 1,000 skiers (column 2.2) and the number of severe accidents per 1,000 skiers (column 2.3). The coefficients for both proxies are positive and significant. The regression on the number of severe accidents presents an even larger coefficients and confirms our idea that a greater possibility to undertake risk-taking results in a higher WTP. The results are robust to the inclusion of district fixed effects as well

as tourism intensity (columns 2.4 and 2.5). The R^2s are large and range between 0.77 and 0.88.

Table 3 presents the estimation results for a linear and quadratic functional functional form. The results show a similar trend in the sign of the coefficients and are even significant at the 1%-level. Table 4 summarizes the results of the Box-Cox transformation and the spline estimates.

4 Monetarization of Risk-Taking

The number of accidents per thousand visitors serves as a proxy for risk-taking behavior. Therefore we cannot directly interpret the coefficient as the individual WTP for risk-taking behavior. However, an alternative way to monetize the individual option value for risk-taking, VRT, is to calculate a relative relationship between different levels of risk-taking behavior. If the assumption that accidents are a linear function of risk-taking behavior holds, a greater possibility to exercise one's risk-taking demand should thus result in a) a higher WTP and b) more severe accidents.

In a second step we estimate the effects of the amount of seriously and life-threatening accidents on the price for ski-passes. The probability of having a ski-accident in our sample is about 1:416 where the probability to have a seriously or even life-threatening accident is about 1:1,444

$$VSRT = \frac{WTP}{\Delta P} \tag{4}$$

If someone bears skiing at a high risk level, he already bears the risk of having an accident $P(ACC = 1)$. In order to obtain the change in probabilities we have to calculate the probability of having a severe accident $P(ACC_S = 1)$ conditional on the general probability of having an accident:

$$P\left(ACC_s|ACC\right) = \frac{P\left(ACCs \cap ACC\right)}{P\left(ACC\right)} \tag{5}$$

The conditional probability of having a severe accident $P\left(ACCs|ACC\right)$ $=1:3.48$. Taking equation 3 and replacing WTP by $\beta_s - \beta_t$, where β_s is the

coefficient of the amount of severe accidents and β_t is the coefficient for overall amount of accidents, allows us to calculate the VRT. Table 5 summarizes the results. Given the mean price for a day pass in our sample of EUR 29.79 and depending on the functional form, the VRT lies between €3.41 ($\approx$ 11.44% of the day pass) and €7.49 ($\approx$ 25.16% of the day pass).

5 Concluding Remarks

To the best of our knowledge this is the first attempt to determine the willingness to pay for the possibility to satisfy risk-taking behavior in risky sports, i.e. willingness to pay for socially accepted risk-taking behavior. In the associated literature measurement of risk-taking behavior is based on two methods. The first and mainly chosen method is to construct a scale in a questionnaire format to measure risk-taking behavior. The validity of the results of this method suffers from the general bias-problems of interview questions and from the potential risk of a misclassification of exposure data. The second method is to use proxy indicators to measure risk-taking. The advantage of this method is that risk-taking can be measured from observed behavior, what minimizes the risk of biases and misclassification of the data. The difficulty of this method is to find reliable proxy indicators for risk-taking behavior (Turner et al. 2004). In this study we have chosen ski accidents as a proxy indicator for risk-taking behavior based on the assumption that alpine skiing is a risk-taking behavior which cause accidents and that more risk-taking leads to more severe ski accidents. In our opinion this serves for a qualified indicator to measure risk-taking.

Using the hedonic pricing approach, which provides the possibility to quantify implicit prices from established markets, serves as a reliable instrument to measure the willingness to pay for the possibility to satisfy the demand for thrill and adventure in risky sports. As powerful as this approach is, it suffers from restricting conditions, e.g. a market to be in equilibrium. We have minded these conditions and have tried to work with as little assumptions as possible. A further problem is our limited dataset. We were only able to get data, specially the amount of skiers transported, for 71 ski

resorts. The aim of this work is to make a first step in a nearly unexplored field and to show the way for further research. Therefore our estimated figures have a clearly explorative character. They should show that a positive willingness to pay exists and that for the individual the possibility to satisfy the demand for thrill and adventure is an economic good with a positive value. To estimate the exact option value of this good, a bigger dataset is needed. Therefore we see much potential for further research.

The experience of thrill and adventure in leisure time is an important issue of more and more people. The costs of the potential negative outcomes of the consumption of this "economic good" have fallen, because of improvements in medicine and protective equipment in the last decades. Thus we can expect demand to continue to increase in future. Our results of this work shed more light on individual demand for this particular good. To know the willingness to pay for this good helps to make marketing campaigns more customer-oriented and to design more efficient policy instruments to reduce the related adverse effects of risk-taking behavior.

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Table 1: Descriptive statistics

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Price of day pass (€)	29.79	5.26	15.00	39.50
Total Number of accidents per 1.000 visitors	2.36	1.68	0.10	8.35
Number of severe accidents per 1.000 visitors	0.68	0.56	0.00	2.69
Density 1.000 skiers per km of pist	0.42	0.20	0.16	1.32
Share of chairlifts, cable cars and funitels	0.49	0.19	0.00	1.00
Share of difficult (hard) pists	0.14	0.09	0.00	0.35
Transport capacity (*unit*)	6,764.46	7,515.42	242.00	34,024.00
Altitude difference (meters)	1,114.64	425.996	300.00	1,942.00
Tourism intensity	132.80	135.24	1.00	574.00

Table 2: Hedonic estimates of risk-taking

	2.1	2.2	2.3	2.4	2.5
Log(Accidents)		0.058**		0.072**	
		(0.025)		(0.029)	
Log(Severe Acc.)			0.093**		0.101**
			(0.039)		(0.046)
Log(Density)	−0.057	−0.057*	−0.058*	−0.046	−0.050
	(0.034)	(0.034)	(0.033)	(0.031)	(0.033)
Share of chair lifts	0.221**	0.179**	0.215**	0.126	0.161*
	(0.090)	(0.082)	(0.082)	(0.079)	(0.081)
Share of diff. pists	0.220	0.246	0.261*	0.348**	0.358**
	(0.143)	(0.147)	(0.146)	(0.138)	(0.139)
Log(Altitude difference)	−0.060	−0.060	−0.061	0.027	0.025
	(0.044)	(0.041)	(0.041)	(0.037)	(0.040)
Log(Capacity)	0.144***	0.137***	0.134***	0.108***	0.108***
	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)
Log(Tourism intensity)				0.019*	0.017
				(0.010)	(0.010)
Constant	2.401***	2.414***	2.446	2.060***	2.097***
	(0.231)	(0.229)	(0.231)	(0.208)	(0.223)
District FE	No	No	No	Yes	Yes
R^2	0.767	0.783	0.785	0.876	0.872
BIC	−79.352	−79.923	−80.499	−76.529	−74.340
Prob>F	0.000	0.000	0.000	0.000	0.000
Obs.	69	69	69	69	69

Notes: OLS estimates; Dependent variable: Log of the price for a day pass in ski resort i, LogP_i; Robust standard errors are given in parenthesis. ***, **, * indicate significance at the 1, 5 and 10%.

Table 3: Hedonic estimates of risk-taking with varying functional forms

	3.1	3.2	3.3	3.4
Accidents	0.857***	1.504***		
	(0.224)	(0.535)		
Accidents^2		−0.090		
		(0.056)		
Severe Acc.			2.309***	3.655**
			(0.653)	(1.654)
Severe Acc.^{2}				−0.622
				(0.614)
Density	−0.871	−1.036	−1.292	−1.301
	(1.789	(1.703)	(1.929)	(1.909)
Share of chair lifts	3.851	3.263	5.291*	5.055*
	(2.574)	(2.595)	(2.667)	(2.709)
Share of diff. pists	12.359***	12.053**	12.395***	12.466***
	(4.372)	(4.539)	(4.426)	(4.501)
Altitude difference	2.557*	2.596**	2.649*	2.559*
	(1.272)	(1.232)	(1.324)	(1.322)
Capacity	0.189***	0.180***	0.177**	0.172**
	(0.069)	(0.066)	(0.069)	(0.068)
Tourism intensity	0.013***	0.013***	0.012***	0.011***
	(0.004)	(0.004)	(0.004)	(0.004)
Constant	20.130***	21.213***	21.786***	21.565***
	(2.595)	(2.512)	(2.349)	(2.369)
District FE	Yes	Yes	Yes	Yes
R^2	0.818	0.823	0.809	0.811
BIC	−49.784	−47.379	−46.333	−42.991
Prob>F	0.000	0.000	0.000	0.000
Obs.	69	69	69	69

Notes: OLS estimates; Dependent variable: Price for a day pass in ski resort i, P_i; Robust standard errors are given in parenthesis. ***, **, * indicate significance at the 1, 5 and 10%.

Table 4: Hedonic estimates of risk-taking - Box-Cox-Transformation and Spline functions

	Box-Cox[a]		Spline[b]	
	4.1	4.2	4.3	4.4
Accidents	0.600***		0.132**	
	(0.185)		(0.060)	
Severe Acc.		2.111***		0.154**
		(0.336)		(0.063)
Density	−0.533	−0.126	−0.046	−0.050
	(1.472)	(0.167)	(0.031)	(0.033)
Share of chair lifts	3.431*	3.660	0.126	0.161*
	(1.993)	(2.918)	(0.010)	(0.081)
Share of diff. pists	9.548***	12.779***	0.348**	0.358**
	(3.380)	(4.124)	(0.139)	(0.139)
Altitude difference	2.057**	3.417***	0.027	0.025
	(1.010)	(1.100)	(0.037)	(0.040)
Capacity	0.136**	0.124*	0.108***	0.108***
	(0.054)	(0.055)	(0.019)	(0.019)
Tourism intensity	0.050***	0.000***	0.019*	0.017*
	(0.013)	(0.000)	(0.010)	(0.010)
Constant	16.484***	28.309***	2.067***	2.097***
	(1.908)	(2.158)	(0.209)	(0.223)
District FE	Yes	Yes	Yes	Yes
R^2	0.820	0.809	0.876	0.872
BIC	−50.591	−46.631	−74.340	−76.529
Prob>F	0.000	0.000	0.000	0.000
Obs.	69	69	69	69

Notes: OLS estimates; [a] Dependent variable: Transformed price for a day pass, linear base function; [b] Dependent variable: Log of the price for a day pass, LogP_i, log-log base function; Robust standard errors are given in parenthesis. ***, **, * indicate significance at the 1, 5 and 10%.

Table 5: Willingness to pay for individual option value for risk-taking

Mean Price of day pass (in €)		29.79
Functional Form	Absolute (in €)	In percent
Log-Log	3.59	12.04%
Linear	5.06	16.98%
Quadratic	7.49	25.16%
Box-Cox	5.23	17.54%
Spline	3.41	11.44%

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Estimating the Option Value of Exercising Risk-taking Behavior with the Hedonic Market Approach

Abstract

Within the last decades an increasing number of people practice risky sports in their leisure time. Although there exists a vast number of economic literature on risk-taking behavior, an estimation of the individual willingness to pay (WTP) for the option to exercise risk-taking is missing. Monetarized values could support private industries in design pricing schemes that set incentives to reduce risk-taking behavior as well as public policy-makers to develop alternative instruments to reduce the adverse effects of risk-taking activity (e.g. accidents). We use data of 69 Austrian Ski resorts and 3,637 reported ski accidents and apply the hedonic market method. Our results suggest that the individual WTP for a hypothetical increase in the possibility to undertake risk-taking activities lies between 11% and 25% of the price of a ski-lift-ticket.

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