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Cloudy prospects in winter sport
How competitive are the Austrian winter sport destinations under conditions of climate change?

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1 ABSTRACT

In many regions in the Austrian Alps winter tourism is an important source of income. A possible Climate Change will modify the snow cover depth as well as the characteristic and quality of winter sport tourism and therefore change the prospects of the ski destinations. The ski destinations react with strong investments in artificial snow-making, extensions in higher altitudes and alternative attractions. Not only the supply side is reacting to the modified conditions but also the customers. Some of them have already experienced unsatisfying snow conditions. Others are sensitised by press and media reporting. They also have various adaption strategies. In spite of this fact, there are some surveys dealing with climate impact assessments, but only a few consider the impacts on the travel behaviour patterns of winter sport tourists and very few studies have a strong individual orientated approach.

This study focuses on the destination choice and the examination of individual behaviour in winter sport tourism under conditions of climate change. To find answers on the question how winter sport tourists change their destination choice and winter sport travel behaviour, an inquiry of active skiers and boarders is conducted. Method is a standardised questionnaire added by a Discrete Choice Experiment. By using a Discrete Choice Experiment, the stated preferences of individuals related to the destination choice in winter sport will be analysed. The results will be presented in a decision support system. Added by spatial data and the information of regional and local climate and snow scenarios the results of the Discrete Choice Experiment permits the conduction of regional development scenarios. This helps local decision makers to trade off future investments and planning guidance.

2 INTRODUCTION

Millions of winter sport enthusiasts dream of a white Christmas and solid winters to ski to the very bottom of the valleys. However, recently the reality often differs from the dream. At the end of the 1980'th, a period of several winters without heavy snow gave the alpine communities a first idea of what climate change could mean for regions dependent on winter sport tourism. While scientists offer different views about the magnitude and the exact effects of climate change, the fact that climate change is established in the meantime. Literature shows that the relationship between tourism and temperature is generally positive, except in winter sport regions. Snow is the most important resource and the base of skiing and snowboarding. In the European Alps winter sport is an important industry which was build up rapidly during the second half of the 20th century. In the meantime many rural alpine communities are economically havily dependent on winter sport tourism with a rising tendency. There is concern about whether or not winter sport tourism can remain a sustainable economy if climate change, especially a global warming, continues.

Because of the current developments, additional investments in snowmaking equipment and other supportive measures became necessary to meet the warming. But not all regions have the necessary financial resources for these adaptations, others have ecological constraints. Many of the Austrian ski destinations run their businesses already with minimum profitability. Especially against the background of the fact that the winter sport tourists' reactions on changing winter sport conditions are unsure, they need information in which infrastructure they should invest. Therefore this study focuses on attitudes, motivations, perception and preferences of winter sport tourists. The idea is to investigate the past visiting patterns of skiers, to analyse the individual destination choice and the preferences of skiers and boarders to estimate future trends in ski tourism as well as their consequences for the alpine skiing regions.

Observing tourists' and visitors' behaviour is a popular instrument to monitor the development in winter sport tourism, to evaluate the performance of an area, to investigate visitors' satisfaction and to forecast future demand. Most of observational data is confined to past behaviour. These surveys have more or less a descriptive heuristic character and are providing only underlying explanations of the revealed behaviour and the dominating factors of decisions (Haider 2002: 115). Behavioural research provides insights into various behavioural aspects explaining why people acting one-way or another, why they decide in favour for a destination or an activity or not, and tries to predict future behaviour. In case of winter sport tourism, the questions are why people choose one ski area and how their destination choice will change under the conditions of climate change. Therefore behaviour research is offering several instruments to investigate future choice and behaviour intentions. In this study a Discrete Choice Experiment (stated choice) is used as a multivariate method combined with a standardised questionnaire. During the inquiry various scenarios of winter sport destinations under different conditions of climate change are presented to the test persons. The scenarios are composed of several attributes and the probands are asked to choose the most favoured alternative. Discrete Choice Experiments (DCE) offers the possibility to map individual behaviour and decision making processes and shows the significance of single factors for individual actions.

2.1 Climate Change in the European Alps

With about 50 Mio. skier days in the season 2004/05 Austria is next to France the most important ski destination in Europe. 90% of the winter sport visitors are motivated primarily by snow (Fachverband der Seilbahnen 2005). Snow is the most important resource for winter sport tourism and the physical basis of skiing. In the last years the discussion about a possible climate change arose to an important topic in press, media and science. Several teams of scientists are conducting climate and especially snow cover scenarios. Broadly discussed is the global warming caused by the glasshouse effect with a concentration of the warming in winter times and the shift of precipitation from winter to warmer periods. The consequences are - besides others - less days of assured snow and a temporal shift of precipitation to spring (Breiling 1993). A small group of scientists discuss the phenomenon of global dimming, which is caused by the increased contamination of the atmosphere especially by CO2, aerosols and water vapour and a reduction of the global radiation (Cohen 1993, Stanhill & Shabtai 2001).

Abegg (1996) gave a comparative overview of snow models designed with the purpose to assess the possible loss of snow for winter tourism under consideration of a warming. The models were conducted for Switzerland, Canada and Australia. Not any of these models are valid for particular destinations or small regions. They lead to the conclusion that a warming would be accompanied by a loss of snow cover. Ski destinations in lower altitude would be more affected by the loss of snow than higher areas. Swiss meteorologist expect that the altitude for sure snow cover will rise from 1,200 to 1,500m (Föhn 1990).1

A view in the snow statistics of the last 60 years shows that there always have been periods rich of snow and poor of snow in the Austrian Alps. The analysis of long term data illustrates that the amount of snow is a varying parameter (Föhn 1990, Brand 1991, Rohrer 1992, Beniston et al. 1994). Föhn (1990) lined out that there are winters poor of snow every three to six years. The scientists came to the conclusion that snow cover duration can hardly be used as an indicator of climate change. In contrast to the situation in the Alps, Pfister (1994) was able to deduce a clear tendency for the midlands of Switzerland. His data shows that from the end of the 17th until the end of the 19th century there have been on the average 60 days of snow cover duration a year. The number of days with snow coverage decreased to an average of 46 days a year for the period 1895-1987 and further to an average of 20 days a year in the period 1988-1994.

This accords to the result of a survey that was conducted in Austria. Hantler et al. (2000) identified regions in an elevation of 500 to 1,500m as extremly sensitive to decreasing seasonal snow cover duration under conditions of increasing temperatures. The snow models forecast for that areas decreases by 34-46% in snow cover duration, corresponding to a decrease of 31 days per season in winter and 42 days per season in spring. The authors have published this results with the addition that the results should not be over interpreted because of limitations of the methods and of the data analysis (Hantler et al 2000: 638).

The loss of assured snow in many winter sport regions is expected to get an important reason for declining visitor numbers especially in the lower areas of the alpine space. The use of artificial snow can only extenuate the circumstances. The production of artificial snow is also limited to specific temperatures in wintertime (average at least -3°C). Additional artificial snow is incriminated with a negative image especially at people coming from outside the alpine space (Pröbstl 2000) and its strong ecological impacts (e.g. consumption of resources and impacts on growing seasons). Therefore the scientists forecast a further spatial concentration of winter sport tourism in higher mountain areas with many days of snow including a intensive competition by prices and capacities (Abegg 1996, Bürki 2000, Bachleitner and Aigner 1998).

2.2 Winter sport under conditions of Climate Change

Winter sport tourism has some special characteristics, which distinguish it from other types of tourism. According to Jülg (2004: 249ff) these distinguishing marks are:

the comparativly short cyclical course of action,

the high creation of monetary value in a short period of time and

the strong temporal and spatial concentration and dependence on special spatial needs.

The development of the last decades shows some significant trends in winter sport tourism. The constancy of chosen destinations and the duration of stay decreases. The tourists are willing to travel further to holiday destinations that are assured of snow and have high quality of accommodation and entertainment.

The increasing skill levels of users, their ever increasing demands on quality, and their increasing travel expertise, combined with improved transportation infrastructure have increased the mobility of winter sport tourists to unprecedented levels.

The strong dependence of many regions on winter sport tourism and the strong power of the winter sport tourism related actors led to high investments that even overtop the benefits in the past. The alp media information service published the following statistic about the investments in French ski destinations on 23.01.2005:

"In 2004 France's winter sport resorts invested 348 million euros - more than ever before - in refurbishment and upgrade measures. In the last ten years, such investments have increased by about 200 percent compared with only 50 percent for ski area turnover. The number of skier days per season is now stagnating at 63 million" (http://www.alpmedia.net/d/index3.asp?newsdetail.asp?NewsID=1543&Sprache=1|2|navi.asp?0|1 at 23.01.2005).

The total annual turnover of Austrian cable car companies was 907 Mio. € in 2004/05. In addition to the running costs they invest 512 Mio. € in the season 2005/2005 again (Fachverband der Seilbahnen 2005). The daily expenditure of the cable car companies for each guest is € 18,50. Additional they have investments of about € 9,00 per guest and day. According to the Fachverband Seilbahnen Österreichs, Austria has the best costs-benefits relation in Europe (Fachverband der Seilbahnen 2005). But the cable car companies are already working at their profitability limits. The condition of a warming would require investments in the extension of ski areas in higher altitudes and in the further infrastructure for artificial snow making. In addition to the investments it would call for higher expenditure for artificial snowmaking itself. Already at the beginning of this winter, the discussion arose whether the cable car companies have to bear with the increasing costs on their own or with any support by other profiting winter tourism industries. They pointed out, that they cannot transfer the additional costs for artificial snow making to the customers by higher lift fares anymore (Der Standard, 07.11.2005).

It is sure that a climate change would affect the Austrian ski destinations in different ways. According to Breiling (1993) especially the ski destinations in lower regions of the Alps would have to bear with negative effects concerning their snow and ski quality.

1 There are some definitions, when a destination is called sure of snow. Widmer (1978) defines four levels of snow sureness based on the share of days between December and March with a snow cover of at least 30cm.

Scientists are expecting a spatial and temporal concentration of ski activities for the future (Abegg 1996, Bürki 2000, Bachleitner and Aigner 1998). The adaptation strategies of the winter sport related industries are diverse. The measures of the cable car companies to guarantee ski sport range possibilities from the extension of ski infrastructure to higher altitudes, the expansion in glacier areas to the investment in artificial snow making. Representatives of the regional tourist branch are discussing snow independent substitutes, investment in 4-season-tourism and further strategies to connect customers with the region (figure 1). Many practical and scientific projects are dealing with effectiveness and feasibility assessment.

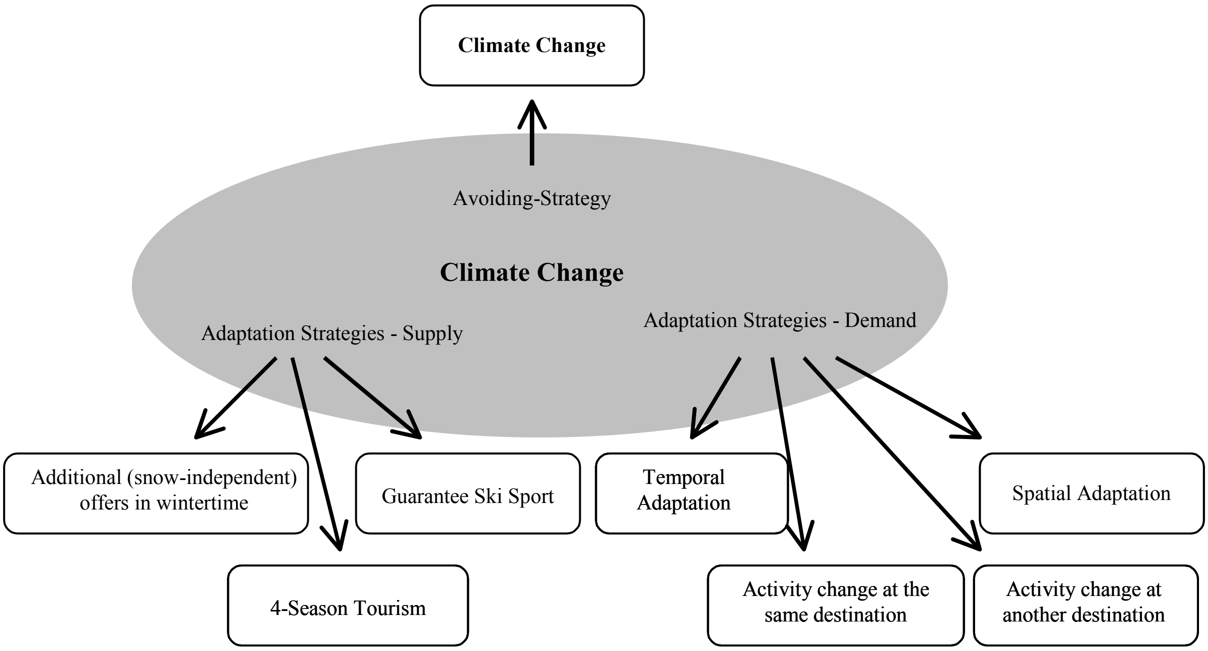

Figure 1: Adaptation strategies in winter sport tourism under conditions of Climate Change (according to Bürki & Elsasser 2003)

2.3 Characteristics of winter sport tourists

There are only few surveys about reactions and adaptation strategies of winter sport tourists and the topic what will happen, if the conditions are changing for example under conditions of a warming. How will the skiers and boarders react?

One of these surveys is conducted by Bürki (2000). He investigated the hypothetical behaviour of winter sport tourists by asking them, where and how often they would go skiing, if there are sequences of five winters lacking snow. The respondents could choose between standardised answers.

30% would haunt the same location with the same frequency and 11% would haunt the same location but less often.

28% would haunt locations that have a longer duration of snow coverage with the same frequency and 21% would go there less often.

4% would stop skiing and 6% did not know (www.ch-forschung.ch/index.php?artid=126 am 10.01.2005).

The association of Austrian cable car companies is regularly conducting costumer satisfaction surveys. The results of these surveys show, that the skiers are very satisfied with the skiing conditions in Austria. This is also proved by the high share of regular customers of 47%. According to an analyse of the market research company MANOVA the main motive of winter sport tourist to come to Austria is “Mountain and Snow” (MANOVA 2002).

But they also figured out, that snow doesn’t mean the same to all winter sport tourists. The decision for the type of activity and the place where it takes place bases generally on a complex system of values. For winter sport it is a mixture of sport, fun and challenge, communication, entertainment and nature, landscape and recreation. The combination of this motives has strong impacts on the activity and destination choice of the tourists and therefore a strong relation to their adaptation strategies under conditions of climate change.

MANOVA (2002), for example, identified at least nine types of winter sportsmen out of a group of 6,300 active skiers:

Entertainment orientated winter sportsmen - they focus on the restaurant, Après Ski and nightlife (19% of the 6.300 test persons),

Snowboarders – they expect additional infrastructure on the slopes as well as nightlife and entertainment (7%),

Classic Skiers – for them the quality of slopes, cable cars and gastronomy is most important (12%),

Recreation orientated skiers – they focus on composition of the whole destination, including landscape, slopes, gastronomy but also prices (13%),

Sun & Fun Skiers – they often travel in groups and prefer sunny ski-runs and high quality gastronomy (7%),

Athletic nature orientated Skiers – they prefer an intact beautiful landscape and ski-runs of high quality (13%), Nature Connoisseurs – they want to experience an intact landscape, nice views and safe ski-runs of high quality (19%).

These motives influence the decision making process. According to an inquiry of MANOVA 56% of the visitors made their decision for a ski destination because of the snow situation in this destination. A share of 55% mentioned the size of the area as the strongest argument. Only 20% argued with the prices.

All these dynamics cause spatial and temporal fluctuations of tourists, which in turn lead to impacts on the economic and social development of the ski regions. But soever ecological impacts should not be neglected, which are consequences e. g. of intensive use of preferred ski regions, increasing utilisation of natural resources for technical snowmaking and shortening of growing seasons because of longer snow coverage by technical snow. Examples from Germany, Switzerland and Austria from the 1990ies show also that the shut down of ski services and the deconstruction of ski infrastructure offers new potentials for renaturation and groundwater protection (e.g. Dobratsch, Austria and Gschwender Horn, Germany). These impacts are of strong relevance for spatial planning. For an effective resource management, a foresighted spatial planning detailed information about actual and future preferences of people are needed as well as an instrument that facilitates the trade offs in decision making. The share of almost 50% of winter sport tourists who would change the ski destinations under conditions of less snow (Bürki 2000) emphasises the importance of further research on the changes in destination choice and the preferences of of skiers and boarders. The various intensions and values of winter sportsmen, which lead to the decision for an activity and the location, where it takes place, make it difficult to foresee the adaptation processes of winter sport tourists under conditions of climate change.

3 METHODS OF INVESTIGATION

Therefore this project is following an individual orientated approach trying to find out how people react on changes in winter sport conditions and to estimate the consequences for the alpine regions dependent on winter sport tourism. An adequate method for that approach is the Discrete Choice Experiment (DCE), which allows to ask for preferences and choices in hypothetical situations. Discrete Choice Experiments have been successfully applied to spatial consumer choice behaviour (Timmermans et al. 1992), to tourism and recreation issues (see Louviere & Timmermans 1990, Haider & Ewing 1990), to resource economics (Swallow et al. 1994, e.g. willingness to pay) and for comparison of stated and revealed preferences (Boxall et al. 1996). In this survey the DCE is combined with a standardise questionnaire. The samples consists of 600 active skiers and boarders, who are living in Vienna. To map the decision making process and the trade-offs between different ski destinations as close to reality as possible, the probands will be interviewed at their origins. Usually the destination choice is made at the place of residence. The interview of customers on site – in a ski destination – may overlap some important, the decision affecting determinants by liaising with the actual whereabouts.

The inquiry is conducted by an internet-based questionnaire. This instrument is offering some advantages. On one hand it is a cost-effective way to reach a high amount of test persons and allows to outread the data directly into a data base. On the other hand it offers comfortable options of visualisation the choice sets for the Discrete Choice Experiment and the individual adaptation of the questionaire.

In the first part of the questionnaire the test persons are asked about their former and current skiing behaviour. The aim is to find out:

the key aspects related to the skiing biographies, e.g. where the persons started skiing, which destinations they mainly visited

the reasons why they sometime changed their ski destination,

the amount of trips in former and current seasons,

the salient determinants for the destination choice respectively the individual important criteria for the quality of a ski destination,

the associations and own experiences with climate change and their adaptations in travel behavior in case of winters with lack of snow.

In the second part of the questionnaire the Discrete Choice Experiment is conducted. The Discrete Choice Experiment is chosen to model future hypothetical shifts in travel behaviour and destination choice under conditions of climate change (stated choice). It gives an idea of the contingent reactions and destination choices of tourists and helps to identify the dominant determinants for decisions. As modelling destination choice is the main purpose of this project, the method of multi-attribute-preference research is explained in the following.

In multi-attribute preference research it is necessary to distinguish between at least two approaches.

1. revealed preference/choice
2. stated preference

The approach of revealed preferences infers the importance of salient variables influencing the decisions by statistical analysis from actual behaviour. Discrete Choice Models relying on revealed preferences are successfully applied in transportation research, spatial analysis and recreation (Ben-Akiva 1985, Train 1986, Wrigley 1985, Stynes & Peterson 1984). According to the approach of stated preferences the survey respondents evaluate hypothetical questions. Among the stated preference approaches there is a distinction between compositional and decompositional methods (Timmermann 1984).

The compositional approach such as the theory of reasoned action (Ajzen & Fishbein 1980) assumes that each aspect, in this case of the destination performance, prices, snow cover duration and travel conditions is evaluated separately. Thereafter the researcher calculates the overall utility value for hypothetical alternatives by combining the attributes of each alternative. Decompositional models define alternatives as combinations of a set of attributes and the respondents evaluate each set separately and as it whole. Each alternative profile is different to the others.

This approach takes the multi-attribute nature of destination choice into account and allows also an exploration of non-existing alternatives that supports the scenario conduction (Haider 2002, Timmermans 1984, Timmermans & Golledge 1990). The construction of the alternative profiles bases on a fractional factorial design (Raktoe 1981). The method of ranking and rating a full profile is usually referred to the conjoint analysis (Haider 2002, Green & Srinivasen 1978).

Advantage of the DCE as an multi-attribute decompositional approach is that the analysis of choice is closer to actual behaviour than ranking and rating tasks of other surveys. The attributes are considered in the context of each other. The theoretical discussion about the different approaches shows that the approach of stated preferences and decompositional approaches is a suitable approach to survey future hypothetical behaviour of people. The destination choice is dependent on the characteristics of the alternatives and of the preferences of the travellers. The DCE integrates both and it also takes to complex nature of the survey question in to account to deal with both an unknown future according to the climate change, the former and current experiences with winter sport activities and the hypothetical adaptation processes of individuals.

Construction of a Discrete Choice Experiment

In a Discrete Choice Experiment (DCE) one or more hypothetical profiles are combined to choice sets. Each profile is described by some attributes and their levels. From each choice set the respondents have to chose the most preferred alternative (Louviere & Woodworth 1983, Louviere et al. 2000). For the analysis a multinomial logit regression model is used. According to Haider (2002) the DCE combines "the analytic elegance of the random utility model (see McFadden 1974) and the experimental rigour of conjoint analysis".

The construction of a DCE is basically organised in at least three steps:

1. Defining the attributes and attribute levels is the most important aspect in conducting DCE. The existing literature gives a lot of hints, what relevant attributes might be. Further information about relevant attribute is gained by interviews with experts of market and tourism research. Relevant attributes and attribute levels in case of this survey considering the destination choice of winter sport tourist are the following:

Attributes	**Attributes levels**	
Share of ski runs over 1.500m		
	10%	0
	50%	1
	70%	2
Total length of ski-runs in km		
	up to 50 km ski-runs	0
	50 to 120 km ski-runs	1
	more than 120 km ski-runs	2
Share and amount of days with guaranteed snow in the 90 days of the main season		
	50% (up to 45 days)	0
	66% (up to 60 days)	1
	90% (up to 81 days)	2
Share of ski runs with infrastructure for artificial snowmaking		
	30%	0
	60%	1
	90%	2
Waiting time at Gondola Peak Time		
	more than 25 min	0
	10 to 25 min	1
	less than10 min	2
Fares for Ski-Lift per day		
	€55	0
	€40	1
	€30	2
The ski destination has an Environmental Certificate.		
	yes	0
	no	12
Travel distance between Place of Residence and Ski Destination		
	less than 250 km	0
	250 to 500 km	1
	500 to 650 km	2

Table 1: Attributes and attribute levels of the first sequence of choice sets

Profiles or alternatives have to be defined by the combination of sets of attributes. The profiles of this experiement consists of nine attributes. Each attribute has two to three levels. Because of the high number of attributes and attributes' levels a fractional factorial design is applied, even if not all interactions may be estimable.

2. The hypothetical profiles are combined to a choice sets by following the factorial design plan (see Louviere & Woodworth 1983, Louviere 2000).

In this survey a design with two sequences is used (see figure 2). In the first step we show the test persons a choice set of two profiles of winter sport destinations. There is no base alternative in the first sequence, so the respondents are forced to decide for the most preferred alternative from the set they are asked to evaluate. In the next step a new frame is shown, where a third alternative is presented. It is comparable to the chosen one in almost all attributes but in sureness of snow, travel distance and costs. The third alternative destination is absolutely sure of snow but the costs and travel distances of this journey are much higher than of the already chosen destination. According to a rota system we also show the first choice and the snow sure alternative in the second sequence.

But this time the destination of the first choice is characterised by some excellent snow independent infrastructures like indoor- and outdoor-sport and leisure facilities, wellness, cultural programme, gastronomy and entertainment. In both cases the respondents have to decide whether they keep the first choice or turn to the new alternative. The idea of this design is to find out how the respondents evaluate the sureness of snow respectively the existence of snow independent substitutes.

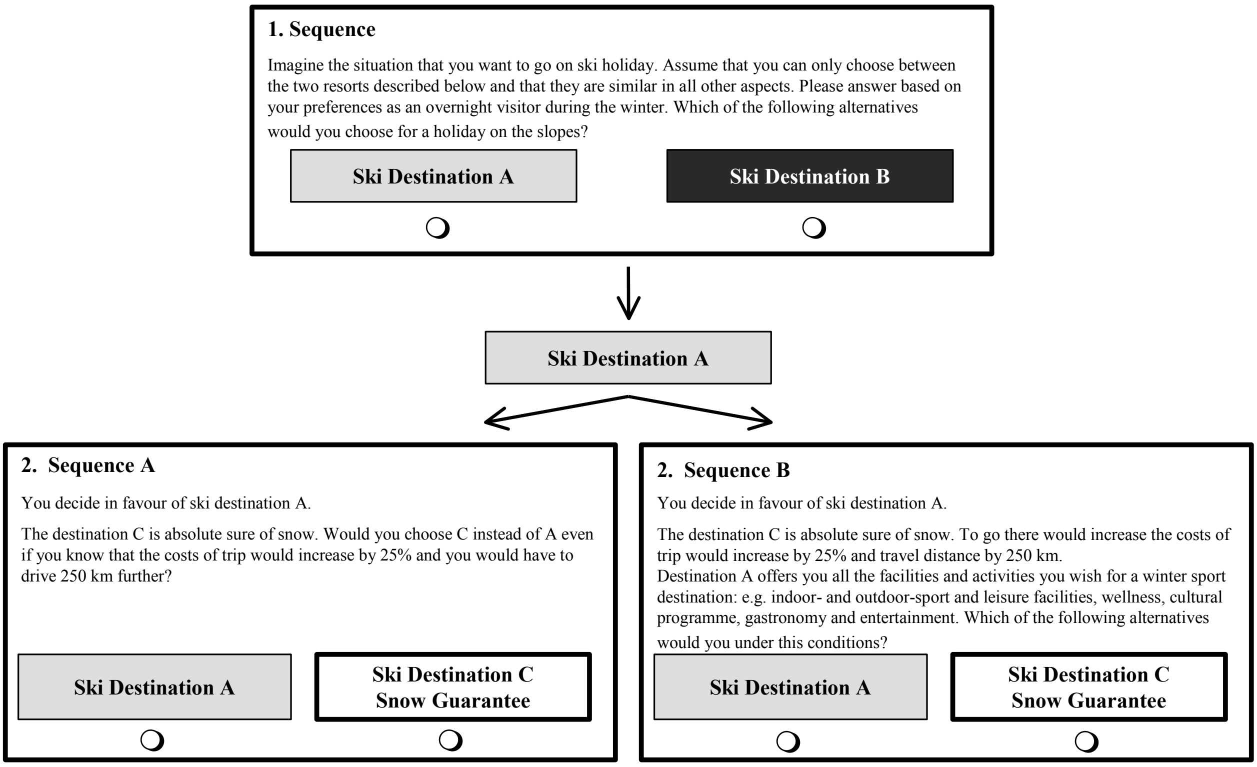

Figure 2: Design of the experiment (schematic graph)

3. Discrete Choice Modelling bases on the Random Utility Theory (RUT), which posits that the benefit an individual recieves from a given alternative is observable with some degree of uncertainity. The choice of an individual is taken as the choice of a representative individual. Each individual holds an own utility function, which is determined by the characteristics of the alternative, the charateristics of the available subsitutes and some interperson taste-differences, that explain the variety of preferences. The RUT assumes that the individual acts according to the principle of utility maximisation.

The statistical analysis bases on the general assumptions of random utility models (see Proenca 1995, I.; Halperin, W. C. et al. 1984). Random Utility Models model the factors that influence the destination choice of test persons.The selection of one alternative over another implies that the utility of the chosen alternative is higher than the other. Each alternative has an overall utility which is represented by an utility function containing a deterministic and a stochastic component $U_{ni} = V(Z_i * W_{ni} * Y) + \varepsilon_{ni}$ (McFadden 1974).

That means in a simple case that the overall utility gained by the i-th individual be expressed by the sum of determinante component V and the random number ε. V represent the utility expectation of an individual i influenced by the determining attributes. The factor ε represents the unknown factors of the individual decisions as well as the differences between the indivual behaviour and the behaviour of the representativ individual. V is a vector, which integrates the levels of all determining attributes of an alternative and the exogene variable z, the edogene attributes of the alternatives W and the unknown vector of parameters Y.

Because of the stochastic component the function describes the probability of choosing a single alternative. The regression estimates for each attribute level the part worth utility and therefore their relevance for the decision. The individual chooses that alternative, for which the expected utility is the highest of all other alternatives: $\Pr op\{i - chosen\} = prob\{V_i + \varepsilon_i > V_j + \varepsilon_j ; \forall j \in C\}$ (McFadden 1974).

4 OUTLOOK

The survey aims to establish scenarios of future development potentials of Austrian alpine regions to estimate their attractiveness for winter sport under conditions of climate change. A Decision Support System (DSS) for future investment and planning guidance is offered to support a sustainable development involving trade offs between several desirable interests. It considers possible climate developments, trends in tourism, spatial resistances, the performance of skiing regions and socio-economic developments in the society. It gives local decisions makers and investors an idea about the future development potentials in winter sport tourism under conditions of climate change. The decompositional nature of the Discrete Choice Experiment added by the part worth utilities allows the evaluation of any profile that can be generated out of the used attributes and attribute levels and offers the opportunity to model the joint effects of changes in destination choice. By modelling the destination choice of winter sport tourists, the future demand on the regions and on their performances can be estimated. The DSS helps to estimate the development potentials of various destinations and to qualify the necessary supply and therefore supports the consideration of social, ecological and economic impacts for a sustainable regional development.

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