The Stagnation of Summer Glacier Skiing

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Abstract

After a short boom phase between the end of the 1970s and beginning of the 1980s the number of transported passengers in glacier ski areas in the summer season stagnated. Estimates using dynamic panel data models based on detailed lift data show that the number of glacier skiing demand in the summer season is significantly positively related to real private consumption and significantly negatively related to tourism prices. Furthermore, for the highest sections of the ski areas of about 3000 metres we find that natural snow depth is significantly positively related to the number of passengers transported uphill.

Keywords: summer ski areas, glacier skiing, number of visitors, snow conditions, income and price elasticities

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1. Introduction

There is declining interest in skiing on Austrian glaciers during the summer season. Up until the 1980s there was a strong increase in the number of persons transported uphill, however the number of lift transports declined up until the mid 1980s and then remained stable in subsequent years. For Switzerland, in a study from more than a decade ago, a similar trend is also reported (König and Abegg, 1997). Similarly for the French Alps, Tuppen (2000) also suggests that the interest for summer skiing on glaciers (Tignes and La Plagne) is limited (see also Mayer 2012 for the European Alps).

There are a number of possible factors responsible for the stagnation of the number of summer visitors to Austrian glacier ski areas. Possible reasons are changes in leisure preferences towards other outdoor activities and global warming with an increase in snow poor summer seasons. Another reason might be low income elasticities resulting in the number of visits not increasing by the same proportion as real income rises. A high price elasticity in absolute terms combined with strong increases in lift ticket prices may also have contributed to the stagnation of visitors.

This paper investigates the determinants of the number of transported passengers for 12 ski lifts in six Austrian glacier ski areas during the summer season for the period 1972-2007. The empirical model is based on a dynamic panel data model. The aim of the paper is to obtain first insights into the determinants of summer visitors to glacier ski areas. Knowledge of the sensitivity of the number of summer visitors with respect to natural snow depth is interesting given that climate change scenarios predict a reduction of snowfall and rapid glacier melting and retreat in the next 50 years.

There are numerous studies investigating the relationship between the demand for downhill skiing and snowboarding and weather factors in the winter season (for recent studies see Shih et al., 2009; Gonseth, 2013, Holmgren & McCracken, 2014; Falk, 2015). The majority of these studies show that skier visits or lift ticket sales depend significantly on variations in natural snow depth and other weather factors. However, to our knowledge no study has rigorously investigated the factors determining the number of visitors in glacier ski areas in the summer season. The modeling of the determinants of demand for summer glacier skiing is an interesting topic because glaciers are particularly vulnerable to global warming.

2. Empirical model

Favorable natural snow conditions are not only important for winter sport activities in the winter season but also for skiing on glaciers during the summer season. Good snow cover reduces the number of open crevasses. If there is less snowfall glaciers could shrink, threatening ski lift operations. Summer seasons with poor snow conditions in the glacier ski area itself may lead to a decline in interest for skiing activities in favour of other leisure activities such as hiking and mountain biking.

A tourism or recreation demand model is specified to investigate the determinants of passengers in ski lifts in the summer season. The theory predicts that the number of visitors depends positively on real income and negatively on tourism prices (Song & Li, 2008). Gilbert and Hudson (2000) find that economic factors such as high expenses and high costs are one of the major constraints for skiing participation. The standard tourism demand model is augmented by snow depth leading to following specification:

$$\ln X_{it} = \alpha_i + \alpha_1 \ln P_t + \alpha_2 \ln Y_t + \alpha_3 \ln SD_t + \alpha_4 t + \varepsilon_{it} ,$$

where i stands for ski lifts (with i=1,..,12) and t denotes the time periods (with t=1972,...,2007). X denotes the number of passengers transported uphill. α_i denotes the individual effects, P stands for prices of tourism services (mean of domestic consumer price index and that of foreigners in Austria), and Y is the real private consumption index (unweighted mean for Austria and Germany). SD is average snow depth for the months May to September in cm measured at the Sonnblick weather station at 2,950 metres and t is the time trend. Given that average snow depth shows positive values, its logarithm can be used. The static model can be transformed into a dynamic model using an autoregressive distributive lag specification. After some transformations the following dynamic tourism demand equation is obtained:

$$\Delta \ln X_{it} = \alpha_{oi} - \phi_i \ln X_{i,t-1} + \alpha_{1,i} \ln Y_t - \alpha_{2,i} \ln P_t + \alpha_{3,i} \ln SD_t + \alpha_{4,i} t_t + \theta_{5,i} + \beta_{1i} \Delta \ln Y_t + \beta_{2i} \Delta \ln P_t + \beta_{3i} \Delta \ln SD_t + v_{it},$$

where Δ denotes the first difference operator. Given that T is much larger than N we employ the pooled mean group estimator developed by Pesaran et al. (1999) specified as follows:

$$\Delta \ln X_{it} = -\phi_i \left(\ln X_{i,t-1} - \theta_1 \ln Y_t + \theta_2 \ln P_t - \theta_3 \ln SD_t - \theta_4 t_t + \theta_{5,i} \right) + \beta_{1i} \Delta \ln Y_t + \beta_{2i} \Delta \ln P_t + \beta_{3i} \Delta \ln SD_t + v_{it},$$

where ϕ denotes the error-correction coefficient. The long-run elasticities, θ_1, θ_2, θ_3 and θ_4 are assumed to be similar across ski lifts. In order to account for the unification of Germany a dummy variable indicating one for 1991 and zero for the remaining years is introduced in the equation. The error correction model can be estimated by maximum likelihood under the non-linear restrictions: $\alpha_{k,i} / \phi_i = \theta_k$.

3. Data and descriptive statistics

Summer skiing activities on Austrian glaciers started with the building of the t-bar lift on the Schmiedinger glacier located on the Kitzsteinhorn mountain (Province Salzburg) in the mid 1960s (Haimayer, 1989). In the following years between the end of the 1960s and 1975 five other ski lift operators started operations in summer or early autumn on glaciers.

Beginning of the 80s additional two glacier ski areas opened and in 1987 the last one entered. Information on number of passenger transports and elevation is drawn from the railway statistics provided by the Austrian Ministry of transport, infrastructure and technology and is available from the 1950s to 2007.[1] We use data for 12 ski lifts (gondolas, cable cars and chair lifts) in six glacier ski resorts. Information for T-bar lifts is only partly available and therefore could be not included. Data refers to the summer season (May to October).

The number of transported passengers uphill in the summer season increased rapidly from 100,000 in 1966 to about 2.5 million until the first half of the 1980s but then stagnated in the following years (see Figure 1 in the appendix). The summer ski market is generally small with about 1 million persons transported uphill calculated as the sum of the main valley lifts in the six glacier ski areas in the summer season.

Private consumption in constant prices for Austria and Germany is drawn from the OECD Key Economic Indicators Database. Prices refer to tourism prices (accommodation prices included) and are drawn from the WIFO database. Snow depth data in cm refers to the mean over the months May to September and are provided by ZAMG. The weather station is located on the Goldbergkees glacier at 2950 metres a.s.l. in the Sonnblick mountain area.

4. Empirical results

Before we present the estimation results, we investigate the order of integration of the time series. Given that the dependent variable and at least one of the explanatory variables is integrated of order one, and snow depth is stationary, the error correction model can be applied. Table 2 shows the results of the pooled mean group estimator based on a panel of 12 ski lifts in six glacier ski areas. The maximum likelihood pseudo R squared shows that the model accounts for 40 percent of the variations in number of persons transported uphill in the

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[1] More recent data cannot be used since the lift statistics is no longer mandatory from 2007 onwards. There is no data available for summer 2005 and 2006.

summer season which is reasonably high when the dependent variable is measured in growth rates. Since the Hausman test rejects the null hypothesis of homogeneity of long-run coefficients we provide separate estimation results for two subsamples: one for the group of six ski lifts at an elevation of the uphill station of 3,000 metres or above (see specification ii), and one for the sample of ski lifts with a maximum elevation of 3,000 metres or below (see specification iii). The long-run coefficients can be directly interpreted as elasticities.

The results show that the number of transported passengers depends significantly positively on real private consumption and significantly negatively on tourism prices. Furthermore, the long-run coefficient of natural snow depth measured is 0.13 and significant at the 10 percent level. When dividing that sample by elevation, one can see that snow depth is only significant for the sample with an uphill lift station of 3,000 metres or above. Here the snow depth coefficient is 0.19 and significant at the 5 percent level indicating that the effect of snow depth is larger in the highest sections of the glacier ski areas. The magnitude of the impact of snow depth on the number of transported persons can be expressed as the impact of a one standard deviation increase in snow depth. An increase in the snow depth of one standard deviation - which is equal to a rise in snow depth of 70 cm or 30 percent - leads to an increase in lift transports by 7 percent. Comparing the findings with the literature investigating the winter season reveals that the sensitivity of lift transports with respect to variations in snow depth is more pronounced in the summer season than in the winter season. For instance, for French ski resorts belonging the Compagnie des Alpes group, Falk (2015) finds that the magnitude of the relationship between snow depth and skier visits in the winter season is rather small. Furthermore, there is a significantly negative long-run impact of tourism prices on passenger transports. The price elasticity is quite large in absolute terms of -1.38.

Table 1: Determinants of the change in the number of passengers transported uphill in the summer season based on the pooled mean group estimator

	(i) total sample			(ii) lifts >=3,000 metres			(iii) lifts <3,000 metres		
	coeff.		t	coeff.		t	coeff.		t
error-correction coefficient (t-1)	-0.55	***	-7.83	-0.49	***	-6.86	-0.61	***	-7.61
long-run elasticities:									
log snow depth mean May-Sep (t)	0.13	*	1.93	0.19	**	1.99	-0.01		-0.13
log prices tourism sector (t)	-1.38	**	-2.46	-0.88		-0.90	-1.67	***	-2.71
log real private consumption (t)	1.22	*	1.82	1.08		1.05	0.94		1.09
time trend (t)	0.00		-0.25	-0.02		-0.68	0.02		0.90
dummy variable for 1991	0.49	**	2.11	0.65	*	1.82	0.25		0.90
short term parameters:	yes			yes			yes		
constant	9.70		7.76	7.57	***	7.27	11.67	***	7.16
number of observations	325			144			181		
number of groups (lifts)	12			6			6		

Note: ***, ** and * denote significance at the 1, 5 and 10 per cent significance levels. Long-run coefficients can be directly interpreted as long-run elasticities.

Thus one main reason for the stagnation of summer visitors in glacier ski areas is the relative high price sensitivity combined with the price increase which exceeds the inflation rate.

The elasticity of number of transported passengers with respect to private consumption in constant prices is 1.22 and significant at the 10 percent level. The finding of an income elasticity of about one shows that skiing in summer ski areas cannot be regarded as a luxury product. Based on meta-analysis Peng et al. (2015) find for European destinations an average income elasticity of 3.5. The time trend is not significantly different from zero. This indicates that given the impacts of real private consumption, tourism prices and snow conditions, the demand for glacier skiing in the summer season is stagnating. The stagnation of mountain tourism is not only limited to summer skiing but can be observed for snow based winter tourism activities in general (Hudson, 2000). Possible reasons for the stagnation are shift in preferences towards other leisure activities. For instance, new attractions like theme parks and mountain bike parks are increasingly popular among mountain tourists.

To shed further light on implications of the estimates one can calculate the contribution of changes in prices, private consumption and snow depth to the change in the number of lift transports. The decomposition analysis shows that economic factors are much more important than snow depth in determining the change in lift transports in glacier ski resorts over a longer period. Given the price increase of 2.8 percent per year on average from the period 1984 to 2007 and the price elasticity of -1.38 one can see that price increases account for a decrease in passenger transports of 4 percentage points per year on average (Table 2).

Table 2: Contribution of the determinants to the log change in number of passengers transported uphill in glacier ski areas in the summer season

	Average annual growth rate´84-'07	Contribution in percentage points
average annual change in log number of transports in percent	-1.4	
average annual change in log prices in percent	2.8	-3.9
average annual change in snow depth in percent	-1.3	-0.2
average annual change in log real private consumption in percent	2.1	2.5

Note: own calculations based on the estimates provided in Table 1.

At the same time growth of real private consumption leads to increases in the number of passengers transports by 2.5 percentage points per year on average. However the long-term decline in snow depth of 1.3 percent per year accounts for only -0.2 percentage points of the decline in number of transported passengers.

5. Conclusions

This paper provided first insights into the demand for summer skiing on Austrian glacier ski areas. The data consists of new and unique panel data on the number of persons transported uphill for 12 ski lifts in six Austrian glacier ski areas for the summer seasons 1972-2007. The results using dynamic panel data models show that the number of transported passengers depends negatively on tourism prices and positively on real private consumption of the main visitor countries. Furthermore, for the highest sections of the ski areas we find that natural snow depth is significantly positively related to the number of skiers. The main reason for the stagnation of lift transports in glacier ski areas in the summer season is the high price sensitivity of skiing demand and to a lesser extent the relatively low income elasticity. Another key result of the study is that the number of persons transported uphill in glacier ski areas in the summer season is stagnating given the impact of private consumption, tourism prices and snow depth. Google trends data for the period 2006-2014 suggests a continuous decline in interest for summer skiing whereas other mountain activities bike parks show are becoming increasingly popular.[2] The future prospects for ski lift operators providing summer ski activities in glacier resorts are poor given low income elasticities, high price sensitivity, increased glacier melting and rising operating costs of snowmaking. Snow making at higher elevations in the summer season is not a suitable adaptation option given it is particularly resource intensive and costly due to higher energy costs as compared to the winter season in middle elevation resorts. In additon, acceptance of the use of snow making in the summer seasons among skiers is low. Other adaptation strategy such the development of new ski terrain at higher elevations (Nicholls, 2006) are not possible given that the uphill lift stations in the Austrian Alps already have reached the highest elevations. Concentration on ski lift operations in the pre winter and high winter season is a favourable strategy. All of the glacier ski resorts offer ski lift operations in the winter season and have excellent growth prospects due to its high elevation.

[2] Data is available upon request.

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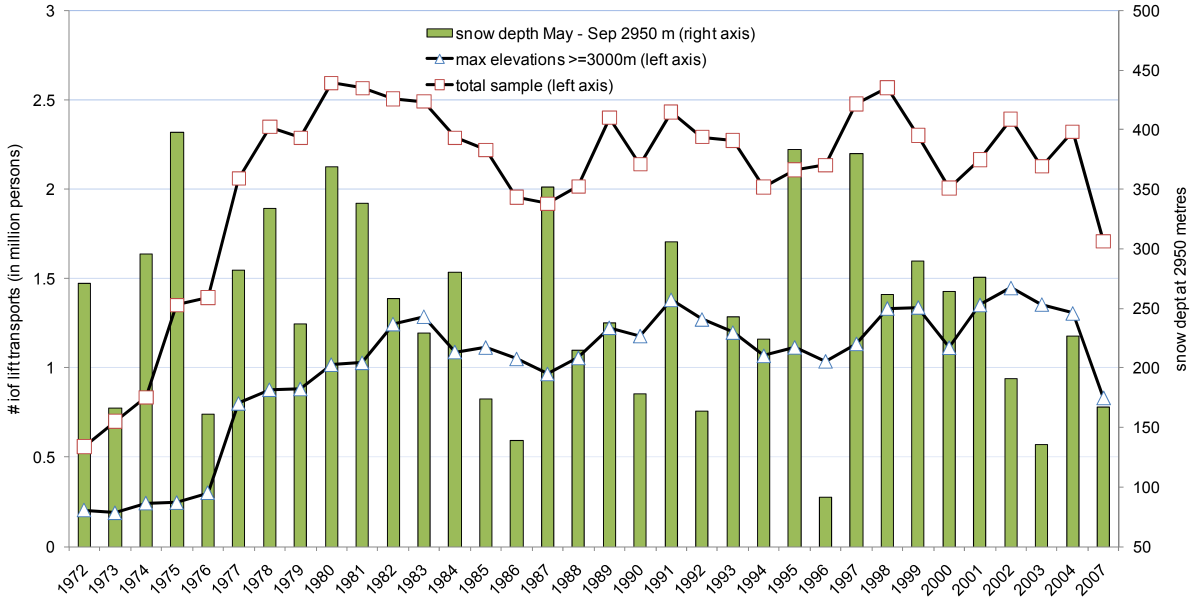
Appendix

Figure 1: Evolution of number of transported passengers in lifts in the summer season and average snow depth



Source: Austrian railway statistics and ZAMG. The weather station is located at the Sonnblick mountain (area Goldbergkees) at 2950 metres.