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Do snowmaking investments improve the financial situation of the ski area operation companies in the perspective of climate change?

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Abstract

The ski area operation sector is often perceived as the backbone of winter tourism. Deteriorating snow conditions threaten this sector. In this paper, we investigate the impacts of snowmaking investments on the financial situation of the ski lift operators. First, we find that the partial effect on the EBITDA is positive but tends to decrease for higher investments. Secondly, we show to which extent additional snowmaking investments would have improved the financial situation of Swiss ski area operation companies taking all the costs related to these investments into account.

Keywords: Alpine winter tourism, ski industry, climate change impacts, adaptation, snowmaking

1 Introduction

In Swiss mountain areas, tourism as a core activity can contribute up to 35% of the GDP (Rütter and Partner in BCV 2006). In these tourism economies strongly depending on the winter season, the ski area operation sector plays a primary role in catalysing the economic activity. However, this sector must now cope with the impacts of climate change. In particular, climate change will affect many ski resorts due to deteriorating snow conditions. For that reason, some will not be able to continue operating profitably (cf. OECD 2007). It is also expected that companies in this sector will get opportunity to generate more summer revenues yet these new revenues will only partly make up for the winter losses[1]. For this reason, the measures taken to enable companies to maintain skiing activities will play a primary role. Snowmaking for example, as one of these measures, requires massive investments (CHF 1 Mio per km), usually financed through an important contribution of foreign capital. Artificial snow thus creates heavy depreciation and financial costs for the company. Annual operating costs can also be considerable (current values generally range from CHF 50,000 to 75,000 per km)[2]. Therefore, it is unclear whether artificial snow is an adaptation measure that increases or decreases the companies' profitability. This paper aims at answering this question by applying a statistical model of companies' operating results for the year 2004. After defining the notion of EBITDA, section 2 will focus on the elements that influence the operating results of a ski area operation company. Section 3 will then describe our sample of companies and give the data sources. A linear model is derived and estimated in section 4 followed by conclusions (Section 5).

1 For more about summer revenues and their comparing with winter losses, refer to Müller and Weber 2007
2 Costs associated to snowmaking investments are given in Furger 2002

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2 Understanding the operating results of the sector's companies

2.1 Definition of EBITDA

EBITDA are the company's earnings before taking into account interest, tax payments, depreciation and amortisation, i.e. the difference between operating revenues and costs. Since ski area operation companies have large amounts of fixed assets, this earnings measure is of particular interest as it essentially gives the income available to the company for interest payments and investments. Because the EBITDA is neither influenced by depreciation practices, banking rate policies and the organisation of the company's external financing nor by the cantonal and communal tax rates, it can be used to compare the companies' performance with greater ease.

2.2 Observed variables determining the operating results

2.2.1 Weighted transport passenger flow

In Switzerland, the number of ski lifts is decreasing. They are only partly replaced by chair lifts (FOSD 2001, SBS 2006). Accordingly, companies modernise their supply (comfort, speed) while presumably reducing their operating costs (less staff because of less facilities). At first sight, the financial implications of this trend are positive. At the company level, this phenomenon can be measured by the mean transport passenger flow. It also might be useful to assess the portion of the company's supply that was modernised. Taking the difference between the started and finished stations of a facility as an indicator of its importance for a ski resort's operations, we could then use these data to compute the weighted transport passenger flow (WTPF).

2.2.2 Total length of marked slopes in kilometers

Large companies have higher EBITDA values. Apart from this scale effect, economies of scale must also exist since important initial investments must be made to operate a ski area. Companies operating a vast ski area have most likely been able to take advantage of all or part of these economies of scale, ultimately resulting in lower average cost with notably a more favorable ratio of labor costs to developed services. We thus expect the company's profitability to increase with the size of the ski area, which is referred to in this study as the number of km of prepared slopes (Slopes).

2.2.3 Resort lodging

Of the 24 million skier-days generated by the Swiss population in 2001 about 75% were made by people lodging in the ski resorts. The remaining 25% were "excursionists" (cf. Bieger & Laesser 2005). Thus, mainly people residing in the ski resorts are on the ski slopes. Moreover, residents in a given resort are often the core business of this resort's ski lifts. In the resorts where Compagnie des Alpes (CDA) operates, on average 85% of ski lifts clients reside in the resort. The resort's capacity and type of lodging is thus crucial. Professional supply generally corresponds to "warm

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beds" (hotels, holidays villages, tourism residencies, furnished apartments, chalets) whereas the private lodging supply is mainly made up of "cold beds" (individual owners with secondary houses can indeed rent out their lodging on an occasional basis) (International Tourism Symposium 2005, 79–86). Based in these insights, our model distinguishes between different types of beds to analyse the effect of "identical" bed-types on companies' financial results. As our data does not enable us to establish this distinction between professional and private beds, we will operate the distinction between hotel beds (hbeds) and para-hotel beds (phbeds)[3].

2.2.4 Location variable/potential commuting

As previously described, one-day excursions are not an insignificant source of income for the ski area operation sector. Further, as the distribution of these skier-days is very uneven between the different regions of Switzerland, the part of "excursionists" in the whole of skier-days of a company can be very important in certain cases. Actually, this depends a lot on the distance to the big population basins. To take into account the advantage from being located in the proximity of densely populated regions, two binary variables will be added to the model. The first one takes a unitary value when a company's ski area is accessible by car in 90 to 120 minutes from the nearest big population basin (dist1) while the second takes its highest value when more than 120 minutes are needed (dist2).

2.2.5 Availability of natural snow

Quantity and timing of snowfall strongly influences a company's profitability. The variability of the snow blanket during the winter season motivates us to calculate the number of days with the natural snow reaching 30 cm, which is taken as the minimum threshold for skiing (Bürki 2000). In regard to profitability we noticed that revenue and cost flows are not constant throughout the operating season (i.e. a lack of snow is more damaging during activity peaks). Accordingly, we determine the number of days with a sufficient snow cover for peak and non-peak periods (Cdays and NCdays). Christmas and February/March holidays and weekends of January/February are key-periods. For a number of regions, periods of high activity are defined based on school holiday periods of the majority of the clientele's cantons of origin. At the company level, its size and its clientele type were also taken into account to determine peak periods.

2.2.6 Use of artificial snow

Artificial snow guarantees a snow cover and thus running the ski area, which is a revenue guarantee for the company. On the other hand, it creates operating costs (water, electricity and labor). In our model, the intensity of investment in artificial snow is represented by the number of kilometers of slopes that can be covered in artificial snow (artkm). A quadratic term is added to the model, as it is plausible that the benefits of these investments will decrease with increasing investments. From an operational point of view, it seems logical that companies first ensure the snow

[3] In our analysis, the para-hotel sector comprises rented holiday houses and apartments, youth hostels and group accommodations (with the exception of the mountain huts)

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cover of their resort's main supply (main slopes, those leading back to the station, connecting slopes) before eventually extending it to the rest of the resort.

2.2.7 Public contributions

Since investment subsidies do not influence the EBITDA, we focus our discussion on the money received by the companies for their operations. With regards to the operation of transport facilities, we can distinguish between indemnities and subsidies. The notion of indemnity applies to money spent by cantons and the Confederation for transport services that have a public service character. Subsidies, for their part, are only paid for by communes. When deriving the EBITDA from the raw financial data, we will subtract values of the communal subsidies from values of the firms' operating revenues. Unlike indemnity payments, lump-sum and regular communal subsidies will therefore not influence the EBITDA in our model. Only a binary variable linked to the payments of indemnities will be added to our model (grant).

2.3 Non observed variables

In addition, a company's operating results may depend on factors such as professionalism, meteorological conditions (especially during weekends), privileged situation and landscapes, investments undertaken to develop the summer season, access to the ski resort, public policies and measures, existence of integrated structures, and snow conditions in competing and/or lower located resorts. We have not yet mentioned these as they are not systematically observed and/or are difficult to quantify. Therefore, they will be included in the error of the multiple linear regression model addressed in section 4.

3 Data summaries and sources

Only companies with a ratio transport revenues/total revenues > 2/3 are considered, i.e. companies that continue to concentrate on transport activities. By doing so, we favor companies of certain regions (Valais, Berne) at the expense of others (Grisons, Central Switzerland) to form a relatively large sample representing nearly 45% of the sector's total supply in terms of prepared slopes. The 87 sampled cases are mostly located in the cantons of Valais, Grisons, and Berne. Eventually, values of the EBITDA contained in our sample have the following features: the average EBITDA equals CHF 2.5 Mio. Values of the EBITDA are scattered since the interquartile range is equal to CHF 2.375 Mio. Four cases display a negative EBITDA. Note also that the upper tail of the EBITDA distribution is fat: the standardised sample skewness is equal to 3.22 meaning that the data are skewed to the right.

Seilbahnen Schweiz (SBS) provided the financial data and the Swiss Federal Statistical Office (FSO) the data on lodging supply. Data on the snow heights origins from MeteoSwiss and the Swiss Federal Institute for Snow and Avalanche Research (SLF). In addition to the data obtained from personal inquiries, both the ITT sta-

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tistics (FOSD 2001) and the SBS database were used to derive information on the facilities (transport and snowmaking) and the skiing areas.

4 Statistical results

For companies of similar size, EBITDA values are typically relative. Moreover, large values of EBITDA are likely to vary more than small ones. Along with the statistics derived previously for the EBITDA distribution, these elements motivate the transformation of the dependent variable with the natural logarithm. We also use the same transformation for the explanatory variables with a skew distribution. The scatterplot of the transformed variables is given in figure 1.

The marginal response plots are all nearly linear (except when the predictor is artkm which is not transformed). Looking at the three marginal response plots log EBITDA versus log hbeds, log Slopes and log WTPF, we can see that the variance is decreasing, which is a strong hint that the variance will also be decreasing for the full regression model. This motivates us to define some weights: $w_i = \log(\text{Slopes}_i)$ and to use weighted least squares (WLS). Due to the choices that we have made until now, five cases are removed from the sample (one case with Slopes = 1 km and four

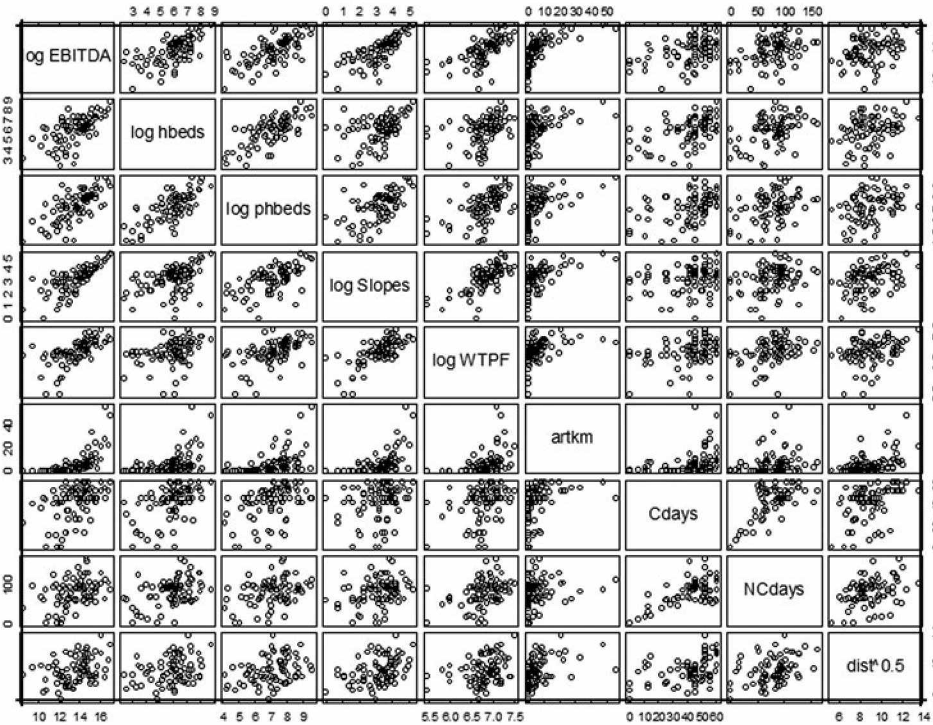

Figure 1: Scatterplot matrix for the transformed dependent and independent variables.

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cases with EBITDA < 0). We can now write down an initial (estimable) linear model in the following way:

$$\log EBITDA_j = \beta_0 + \beta_1 \log WTPF_j + \beta_2 \log Slopes_j + \beta_3 \log hbeds_j + \beta_4 \log phbeds_j + \beta_5 dist1_j + \beta_6 dist2_j + \beta_7 Cdays_j + \beta_8 NCdays_j + \beta_9 artkm_j + \beta_{10} artkm^2_j + \beta_{11} grant_j + \varepsilon_j$$

The error term ε includes omitted factors as listed in subsection 2.3 and measurement errors. Estimation results using WLS are presented in the following table.

*Table 1: Parameter estimates and standard errors for the full linear model and the model fitted by backward elimination. Individual coefficients are statistically significant at the * 10% level, ** 5% level or *** 1% significance level.*

Variables	**Initial model Est (SE)**		**Final model Est (SE)**	
Dependent variable: log(EBITDA)				
Explanatory variables:				
Intercept	4.1965*	(2.4768)	3.2859	(1.9841)
log(WTPF)	0.6320	(0.4219)	0.9123***	(0.3277)
log(Slopes)	0.4519**	(0.2103)	0.5266***	(0.1581)
log(hbeds)	0.2620**	(0.1143)	0.3669***	(0.0742)
log(phbeds)	0.2191*	(0.1294)		
dist1	−0.3287	(0.2578)	−0.3708*	(0.2018)
dist2	−0.4762	(0.2871)	−0.5114**	(0.2197)
Cdays	−0.0035	(0.0103)		
NCdays	0.0040	(0.0043)		
artkm	0.1197***	(0.0299)	0.1107***	(0.0230)
$artkm^2$	−0.0017***	(0.0005)	−0.0016***	(0.0004)
grant	0.5328	(0.4372)		
Nbr of obs	79		81	
R^2	0.7817		0.8233	

We use backward elimination to select most relevant explanatory variables from our initial model. This procedure results in a model in which the EBITDA increases with the modernity of the transport facilities (as summarised by the variable WTPF), the size of the ski area, the number of beds in the hotel industry, the proximity to a big population basin, and snowmaking investments. More precisely, the partial effect on the EBITDA of the latter variable is positive but tends to decrease as the level of investments becomes higher and can even be negative at some point. When there is no snowmaking, the fact to equip one kilometer with snowmaking facilities induces an 11.1% change in the EBITDA. When the initial recourse to snowmaking is equal to 10, 20, 30, 40 km, the partial effect shrinks to 7.9%, 4.7%, 1.5%, and −1.7%. Figure 2 shows 95% confidence intervals for the true value of these partial effects.

Several elements can be put forward to explain why the variables Cdays and NCdays were not significant. First, it is questionable whether the snow conditions vary sufficiently within our cross-section sample to affect values of the dependent

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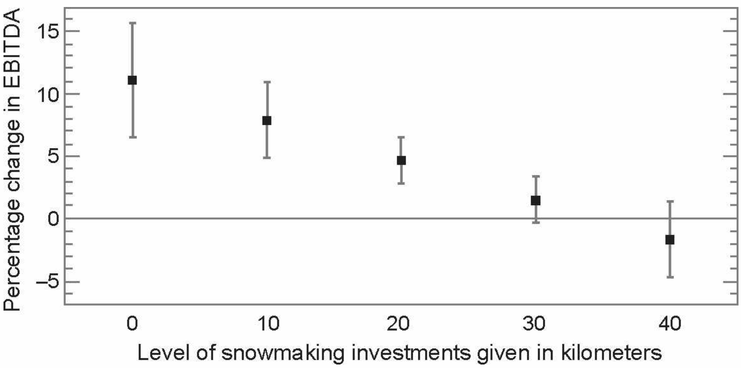

Figure 2: 95% confidence intervals of the partial effect of snowmaking investments computed at different initial levels of these investments.

variable. Second, our measures of the snow conditions are not accurate. These variables might also be negatively correlated with air temperature and length of the sunny period thereby increasing the probability of Type II error.

Interest payments and depreciation costs render things more complex when assessing the impact of additional snowmaking investments on the financial situation of a given company. In this case, the impact will not only depend on the initial level of investments but also on the preexisting level of EBITDA. Table 2 presents our predictions for Switzerland concerning the potential for EBITDA, cash flow, and net income improvements through snowmaking investments during the financial year 2003/04.

Table 2: Percentage of our sample's companies for whom additional snowmaking investments would have increased 1/the EBITDA, 2/the cash flow and 3/the net income.

EBITDA enhancing	Cash flow enhancing	Net income enhancing
97.5%	86.4%	61.7%

5 Conclusion

Based on a sample of 87 Swiss companies, the effect of snowmaking investments on the EBITDA of ski area operation companies was investigated. We found that the partial effect is positive but tends to decrease with increasing investment level. The results also give insights on the economic advisability of forthcoming investments in snowmaking. We found that additional investments during the financial year 2003/04 would have enhanced the cash flow of 86.4% of the companies while it would have increased the net income of only 61.7% of them. The latter result seems to draw some economical limitations to the widespread and intensive use of snowmaking facilities as a way to cope with the impacts of climate change. At this point, it is however difficult to draw final conclusions. Further research should be carried out. As regards the statistical analysis, the estimable model should be expanded by adding omitted and/or proxy variables. The estimation technique should be

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possibly changed to cope with potential endogeneity problems. Finally, the sample should be redefined so as to consider a more homogenous set of companies. On the other hand, two preliminary studies still have to be carried out in connection with the yearly variability in snow conditions. The first should analyse, for a sample of companies, whether annual snow production changes to a relevant degree and should identify the main driving forces. The second preliminary study should define types of winter with different snow conditions for which data on the elements influencing the EBITDA are available. These two studies would then allow formulating hypotheses on both the possibility/intensity of use and the gains from securing snow cover for different winter seasons. These hypotheses could then be tested with an improved estimable model. In regard to climate change, they will modify both the benefits and the costs associated to snowmaking facilities. The above approach could help to assess the impacts of snowmaking investments under climate change. However, additional research on alternative ways to introduce these changes in the statistical approach should also be carried out.

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