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A survival analysis of ski lift companies

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HIGHLIGHTS

- Early adoption of snowmaking leads to a significantly lower exit probability.
- Failure risk is lower for ski areas with an average elevation of 1700 m and above.
- Exit probability rises significantly during economic downturns.
- No significant relationship between snow depth and the exit probability.
- Only 2 percent of the total length (7780 slope kilometres) are shut down permanently.

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ABSTRACT

This article investigates the factors influencing the survival of 244 ski lift operators in Austria over the period 1995–2011. Both Cox proportional hazard and competing risk models with time-varying covariates are utilized to distinguish between ski lift operators that temporarily suspended operations (e.g. due to insolvency) and those that permanently stopped their service. The results show that early adoption of snowmaking facilities led to a significantly lower risk of failure. Introducing snowmaking at later periods (i.e. from 2000 onwards) did not have a significant impact. Size, elevation of the ski areas, local competition, and regional effects also play a significant role in the survival of ski areas, but these factors cannot explain temporary failures. Surprisingly, the probability of permanent exits and temporary failures is independent of variations in snow depth at the nearest weather station. A lack of accommodation capacity and economic recessions lead to a higher risk of both types of failures.

1. Introduction

Due to pressure introduced by climate change, changing demographics, increasing competition, intensified concentration, and saturated markets, the number of ski resorts has significantly decreased over the last decade (Hudson, 2004; Taylor, Yang, & Strom, 2007). According to the National Ski Areas Association (NSAA), the number of ski resorts operating in the US dropped from 735 in the 1982–1983 winter season to 471 in 2009–2010.[1] For New Hampshire, Hamilton, Rohall, Brown, Hayward, and Keim (2003) suggest that not only the number of small ski areas, but also the number of larger and chairlift-served ski areas decreased over time. With data up until 2007, Kureha (2008) showed that 147 ski areas closed in Japan. However, the decline in the number of ski areas seems to be uneven across world regions. In Austria and other European Alpine countries, the number of ski area shutdowns has been much lower. For instance, in Austria in the period 1995–2011, roughly 20 percent of 244 ski lift companies with three or more ski lifts went formally bankrupt or voluntarily closed their operations permanently for various reasons. With 23 ski areas having permanently disappeared from the market, the closure rate is still low in Austria: Just two percent of a total slope length (7780 km) was shut down between 1995 and 2011. Currently, little is known about the factors influencing the survival of ski lift companies. Possible determinants include firm characteristics, as well as location-specific and macroeconomic factors.

The aim of this paper is to provide an initial investigation into the survival determinants of ski lift companies. Investigated in particular are the impact of firm-specific effects (e.g. year of entry, extent and timing of adoption of snowmaking equipment and new, fast ski lifts), location-specific and regional effects (e.g. average elevation of ski areas, variations in snow depth, distance to nearest city and local competition), and macroeconomic factors (e.g. the business cycle). Special emphasis is also placed on how introducing snowmaking machines influences the survival probability of ski lift companies. Another key variable is ski area elevation: In particular, we investigate whether low- and high-elevation ski areas have different chances of survival, as a recent study by the OECD suggests that low-

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[1] See www.nsaa.org, retrieved September 2011.

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elevation ski stations are the most vulnerable to global warming and future climate change (Agrawala, 2007). The database consists of a new and unique data set covering 244 ski lift companies.

The empirical model is based on a Cox proportional hazard survival model, which describes both the occurrence and timing of exits. In the first step, we analyse the determinants of survival irrespective of whether the ski areas stopped their operations permanently or temporarily. In the second step, the determinants of permanent exits are investigated. Moreover, we use the competing risk survival model developed by Fine and Gray (1999), in which temporary and permanent exits are treated as competing hazards.

In tourism research, few empirical studies are available on the factors influencing the survival of firms. Examples include the accommodation, hotel, and restaurant sector (e.g. Gu, 2002; Gu & Gao, 2000; Kim & Gu, 2010, all for restaurants; Park & Hancer, 2012, for the hospitality industry; Kaniovski, Peneder, & Smeral, 2008, for the accommodation sector; and Santarelli, 1998, for new tourism service firms). The studies show that firm survival is significantly and positively related to firm size.

To the best knowledge of the authors, this is the first study investigating the determinants of exits and survival among ski lift companies. Knowledge of the determinants of business failures is relevant for policy makers, managers, and stakeholders for a number of reasons. On the one hand, failures involve large costs to private agents, such as investors and creditors. On the other hand, insights into the determinants of failures are important for local government authorities because some ski lift companies are partially under public ownership or supported by public funds. The study will make a number of significant contributions to the related literature: First, it provides an indication of the relative importance of technology adoption, location factors, business cycles, and weather factors to the failure risk of ski lift companies. Second, this paper contributes to the literature regarding the effects of innovation on the performance of tourism firms. Hjalager (2010) and Hall and Williams (2008) suggest that there is still limited empirical evidence of how innovation activities and technology adoption affects tourism enterprises. Third, our findings could be helpful in formulating a guideline on how to reduce the rate of failure in the future. The present paper is structured as follows. Section 2 presents the theoretical background and introduces the empirical model, while Section 3 presents the data and descriptive statistics. Section 4 presents the empirical results, and Section 5 concludes.

2. Theoretical background and empirical model

2.1. Theoretical background and previous empirical literature

Firm survival depends on a number of factors (see Manjón-Antolín & Arauzo-Carod, 2008, for a recent survey of the literature). Firm age and size are central variables in the theoretical industrial organization literature on firm exits. Theoretical models show that firm exits are expected to decline with firm age due to firm-level learning. According to Klepper (1996, 2002), earlier entrants are more likely to be long-term survivors because they make higher profits in the early stages of the industry's lift cycle and also show higher performance. The failure probability is also expected to be higher for small firms (see e.g. Jovanovic, 1982). There are a number of reasons why large ski lift companies are less likely to fail. One reason is that large companies are closer to the minimum efficient scale. Small firms (and also young firms) often have limited access to external funds. However, Agarwal and Audretsch (2001) suggest that firm size is less relevant as a determinant of firm survival in the mature stage of the industry life cycle.

The literature widely agrees that innovative firms are more likely to be survivors. Cefis and Marsili (2006) suggest that innovation is an insurance against failure. Innovations can be measured in various ways. One can distinguish between market novelties and introduction of new products, services or production processes that are already introduced onto the market, but new to the firm. Other types of innovations includes organizational and management innovations (see Camisón & Monfort-Mir, 2012; Hjalager, 2010). In the skiing business, the major new technologies are the introduction of snow-making machines and detachable chairlifts and gondolas, which can be regarded as both a process innovation and a new and improved service.

Previous empirical literature has shown that the implementation of new products and production processes leads to a lower exit risk of firms (Agarwal, 1996; Cefis & Marsili, 2006; Doms, Dunne, & Roberts, 1995; Fontana & Nesta, 2009; Helmers & Rogers, 2010). For instance, using firm level data for manufacturing and service sectors in the Netherlands, Cefis and Marsili (2005) found that innovating firms (measured as introduction of product and/or process innovations) have an 11 percent higher chance of survival than non-innovating firms. The Capital Vintage Theory also has some implications for the relationship between technology use and survival. The theory predicts that plants with older equipment have higher exit rates than those with a more recent vintage of equipment (Salvanes & Tveterås, 2004).

In tourism research, few studies are available. Notable exceptions include Hall and Williams (2008), who revealed that tourism innovation plays an important role in determining the survival probability using data for tourism firms in New Zealand. For Switzerland, based on data for 147 Valaisan hotels, Scaglione, Schegg, and Murphy (2009) found that website adoption is positively related to revenue growth.

In this connection, it is useful to consider the theory of diffusion introduced by Rogers (1995), which classifies organizations and firms on the basis of timing of technology adoption: (1) innovators, (2) early adopters, (3) early majority, (4) late majority and (5) laggards. Recently, Sinha and Noble (2008) have emphasized the importance of the timing of adoption in determining firm survival. The authors propose three testable hypotheses concerning the relationship between timing of technology adoption and firm survival: early technology adoption will increase the likelihood of firm survival (H1); adoption prior to the maximum penetration will increase the likelihood of survival (H2); adoption of a greater number of technologies will increase the likelihood of survival (H3). Using firm level data for the UK manufacturing sector, the authors found that early adoption increases the likelihood of survival.

Another factor that is likely to affect company survival is the intensity of local competition. It is well established in business and economic literature that the intensity of local competition is important for productivity growth. Porter (1990, 1998, 2000) argues that strong competition in the same market provides significant incentives for innovation, which in turn accelerates the rate of productivity growth and the chance of survival. Similarly, Schmidt (1997) suggests that increased competition pressure may reduce bankruptcy risk because of a higher managerial effort to avoid bankruptcy risk. In addition, co-location of firms can have positive effects for neighbouring firms because of geographically localized spillovers or agglomeration advantages. However, competitive pressure may drive the less efficient firms out of the market. Agarwal and Gort (1996) suggest that the exit rate can increase in the late (mature) stage of the industry life cycle when the level of competition intensifies and the concentration rises. This is particularly relevant for the market of ski lift operators. In Austria, the ski business has already entered the mature stage of the industry life cycle with no entry after the mid 1990s and rising exits (see Fig. 6 in the Appendix A). Chung and Kalnins (2001) suggest that co-location of firms may lead to more intensive competition and, thereby, may increase the exit rate of weaker firms. Whether