



# Determinants of corporate adaptation to climate change in winter tourism: An econometric analysis

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## ABSTRACT

While corporate adaptation strategies in response to climate change have been characterized, the determinants of adaptation have not been comprehensively analyzed. Knowledge of these determinants is particularly useful for policy makers to provide favorable conditions in support of corporate adaptation measures. Based on unique data from a survey of Swiss ski lift operators, this paper empirically examines such determinants at the business level. Our econometric analysis with linear regression and count data models finds a positive influence of the awareness of possible climate change effects on the scope of corporate adaptation. Surprisingly, no significant influence of the vulnerability to climate change effects on the scope of adaptation could be found. Finally, the dependency on the affected business and the ability to adapt influence the specific strategic directions of corporate adaptation.

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## 1. Introduction

Despite ongoing activities to mitigate climate change, a further increase in the earth's surface temperature is inevitable and will lead to effects such as changes in frequencies of extreme weather events and levels of precipitation (IPCC, 2007). These direct climate change effects are expected to have significant impacts on the natural environment and society at different spatial and time levels. Within society, companies are important entities by which adaptation to climate change effects occurs. The ways in which affected companies adapt will, to a large extent, determine the nature and scale of impacts and possibly the companies' survival in the long-run. Research on adaptation as a corporate response to climate change effects is still at an early stage (Arnell and Delaney, 2006). Previous studies predominantly focused on describing adaptation by means of case study research in different sectors such as agriculture (e.g. Schneider et al., 2000; Seo and Mendelsohn, 2008), residential construction (e.g. Hertin et al., 2003) and winter tourism (e.g. König and Abegg, 1997; Abegg et al., 2007; Scott and McBoyle, 2007). While some authors categorized adaptation measures by their type, such as commercial, techno-

logical or financial measures (Smit and Skinner, 2002; Hertin et al., 2003), others holistically described entire adaptation strategies they observe as "risk assessment and options appraisal" or "bearing and managing risks" (Berkhout et al., 2006). However, only few scholars (e.g. Arnell and Delaney, 2006) referred to the strategic objectives that different adaptation measures serve.

In addition, while some determinants of corporate adaptation to climate change such as characteristics of the respective company or managerial perceptions about climate change have been proposed (Fankhauser et al., 1999; Bleda and Shackley, 2008), they have not been investigated comprehensively. Yet, knowledge about these determinants is particularly important to enable policy makers to support favorable conditions for corporate adaptation. Based on a new framework of adaptation strategies and on unique data from a survey of Swiss ski lift operators, this paper therefore empirically examines such determinants. In this respect, the scope of corporate adaptation (measured by the total number of adaptation measures) as well as measures that companies take to follow specific strategic directions of corporate adaptation (such as to protect the affected business) are analyzed. We consider the case of ski lift operators because they are highly affected by climate change due to their dependency on natural snow availability, making adaptation strategies seem especially relevant (Scott et al., 2003, 2008; Wolfsegger et al., 2008).

Building upon previous case study research, Section 2 develops a general framework of corporate adaptation strategies and derives hypotheses for an econometric analysis. In Section 3 we discuss to

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what extent winter tourism and particularly ski lift operators are specifically affected by climate change. Section 4 describes our data set and the variables in our econometric analysis, while Section 5 presents the empirical results. The final section discusses these results and concludes by developing recommendations for policy makers.

## 2. Corporate adaptation strategies

### 2.1. Scope and strategic direction of adaptation

Corporate adaptation can be understood as the result of measures that a company chooses to implement in order to adapt to climate change (Adger et al., 2005). The scope of corporate adaptation describes the degree of adjustment required (Smit and Wandel, 2006) or the extent to which the company adapts by, for example, pursuing a number of adaptation measures simultaneously. However, adaptation measures can pursue different strategic directions to reflect several objectives a company might have with respect to adapting to climate change. A company can follow multiple of these strategic directions at the same time, possibly with different intensities. As a consequence, an adaptation strategy can be conceptualized as the combination of adaptation measures with possibly distinct strategic directions that a company pursues. A first fundamental distinction between adaptation measures that seek to buffer a company against climate change and measures that attempt to change the company to meet the conditions of climate change was made by Smithers and Smit (1997). While their first set of adaptation measures do not transform the company, measures of their second set deliberately change the company. Another framework was proposed by Arnell and Delaney (2006) and consists of four categories: providing the same standard of service or product (using different methods if necessary), providing different products and services with broadly the same function, ceasing to provide the product or service, or ignoring climate change.

Based on this preliminary framing we develop a framework by which all adaptation measures can be clearly assigned to one strategic direction. For such a framework three different aspects have to be considered in terms of how climate change can affect a company. First, climate change may impact the ability to successfully carry out business activities in a certain part of the company (the “affected business”). Second, at the same time other parts of the company might not be affected (the “non-affected business”). Hence, when analyzing the impacts of climate change on the company overall, the degree to which the company depends on the affected business is important. Third, all possible impacts from climate change in real terms eventually translate into impacts affecting the company’s financial success. Congruent with these levels, there are three distinct strategic directions of adaptation measures.<sup>2</sup> We term the measures along these three strategic directions as measures to *protect the affected business*, to *expand beyond the affected business* and to *share risks of financial impacts*; we structure the universe of adaptation measures according to these three strategic directions.

#### 2.1.1. Protect affected business

Climate change may directly affect a company’s business activities (Berkhout et al., 2006). This affected business shows a certain vulnerability to climate change (Smit et al., 2000). The vulnerability of the affected business refers to the possible negative impacts of climate change in real terms (e.g. a power plant has to be shut down because of a temperature increase of

cooling water from a river). Companies that aim to continue their affected business at the same or even an extended level will pursue measures to decrease the vulnerability of the affected business. We thus define all measures that lower this specific vulnerability as measures to protect the affected business. Typically, these measures are of a technical or procedural nature. In their study on house construction companies in the U.K., for example, Hertin et al. (2003) listed modularization and prefabrication as potential adaptation measures to limit the vulnerability of the house construction activities to climate change. They found that there is broad agreement among house builders that “the portfolio of technological options available could, in principle, prevent or mitigate almost any impact of climate change on buildings and the construction process and thus enhance their robustness” (Hertin et al., 2003, p. 285).

#### 2.1.2. Expand beyond affected business

Looking at a company as a whole, additional business activities that are not affected by climate change may exist. Thus, the vulnerability of the company overall is also determined by the degree to which it depends on the affected business. Consequently, a company may decide to explore additional business activities that are not negatively affected by climate change. By doing so, the company lowers its overall vulnerability to climate change. Hence, we define all measures that lower the vulnerability of the company overall (without implementing any changes to the affected business itself) as measures to expand beyond the affected business. For example, Scott and McBoyle (2007) identified “revenue diversification” as a strategic direction of adaptation in the North American ski industry and found that many ski resorts have undertaken substantial investments in order to provide offerings for non-skiing visitors such as indoor pools and health and wellness spas.

#### 2.1.3. Share risks of financial impacts

When climate change leads to real term effects on the affected business, this causes a financial impact that can harm the company’s financial success. Therefore, a company may also choose to employ measures that change neither the vulnerability of its affected business nor the vulnerability of the company overall but that limit the potential financial impacts that might result from climate change. We term these measures to share risks of financial impacts. They include collaborations, mergers insurance, and other financial instruments. For the example of construction companies, Hertin et al. (2003) found that a number of house builders think that increasing financial reserves in the budgeting process to cover future maintenance costs or insuring building sites against weather damage from storms and flooding could become viable options.

### 2.2. Hypotheses on determinants of corporate adaptation measures

Several studies discussed possible determinants of corporate adaptation to climate change (Fankhauser et al., 1999; Arnell and Delaney, 2006; Berkhout et al., 2006; Bleda and Shackley, 2008). Fankhauser et al. (1999) proposed that adaptation depends on three elements: the recognition of the need to adapt, an incentive to adapt, and the ability to adapt. Arnell and Delaney (2006) similarly suggested that the company “must be first aware of the potential threat of climate change, and second concerned about potential impacts on its business. Without awareness there will be no concern, and without concern there will be no adaptation” (Arnell and Delaney, 2006, p. 229). Thus, it can be argued that the *awareness of possible climate change effects* and *need to adapt* is a determinant of corporate adaptation. In their case study analysis of the residential construction sector Hertin et al. (2003) observed

<sup>2</sup> This assumes that a firm cannot alter its exposure to climate change effects for example by preventing climate change or escaping the environment in which climate change occurs.

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