



Weather risk management in ski resorts: Financial hedging and geographical diversification

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Abstract

As weather volatility increases, weather risk has become a critical management issue in weather sensitive industries. This study uses ski resorts as an example to examine two promising weather risk management strategies: geographical diversification and financial hedging. The empirical analysis results suggest that financial hedging might be a more effective strategy for ski conglomerates. Guidelines for ski conglomerates to achieve better weather risk management outcomes are provided based on simulating the interactions between geographical diversification and financial hedging. Although based on ski resorts and snowfall risk, the methodology is also applicable to other weather sensitive hospitality businesses.

Research highlights

- ▶ Ski conglomerates benefit more from financial hedging.
- ▶ A contract that covers only a quarter or even a month instead of the entire season is more effective.
- ▶ The correlations between snowfalls and between bases are more important than the cross-correlations between snowfalls and bases.
- ▶ The choice on the direction of correlations adjustment depends on the relative position of the actual correlation to the minimum HE point.
- ▶ Business diversification could improve the outcomes of financial hedging.

Introduction

As a result of climate change, the volatility and intensity of shorter-period weather patterns have increased (Intergovernmental Panel on Climate Change, 2007). Beyond ecological and social challenges, volatile weather increasingly poses economic ramifications as well (Chichilnisky and Heal, 1998). The Chicago Mercantile Exchange (2005) estimates that nearly 20% of the U.S. economy is directly affected by weather. The impact of weather volatility is especially significant on nature-based tourism businesses

because the natural setting determines not only demand and supply but also the quality of tourism offerings (Scott, 2003). As weather volatility grows, managing weather risk, especially in weather sensitive industries, has become a key component of creating shareholder value.

The ski industry has long been identified as vulnerable to weather risk. First, the number of visits is closely tied to snow depth (Fukushima et al., 2002) and daily ski lift ticket sales are highly influenced by weather variations (Shih et al., 2009). Second, capacity and quality of the tourism offerings are determined by the amount of snowfall because snow has to be at least 30 cm deep to be skiable (Scott et al., 2003). While the uncertainty in demand and supply poses direct challenges for ski resort management in terms of planning facilities, operations, and marketing programs, based on financial theories (Smith and Stulz, 1985), higher cash flow volatility could also cause additional financial burdens such as bankruptcy and financial distress costs, taxes, external financing costs, and higher underinvestment costs. Reducing cash flow volatility could decrease these financial costs, therefore increasing firm value. Empirically, Allayannis and Weston (2001) demonstrated that firm value can increase 4.87% just by reducing cash flow volatility caused by foreign exchange fluctuation.

A number of studies have examined the impact of long-term climate changes on tourism demand (e.g. Gomez Martin, 2005, Hamilton et al., 2005) and the ski industry (e.g. Hamilton et al., 2007, Scott and McBoyle, 2007). Yet, few studies have explored strategies that could address shorter-term weather volatility and the interaction between long-term and short-term strategies. In this study, we aim to fill this gap by examining the interaction between two promising weather risk management strategies in the context of ski resorts: geographical diversification and financial hedging. Theoretically, this study extends the literature of weather risk management by incorporating multiple risks in weather risk hedging. In the finance domain, many researchers have studied the effect of basis risk on hedging effectiveness, but most studies (Castelino et al., 1991, Figlewski, 1984, Netz, 1996) consider only one basis risk and are based on price risks, such as stock index futures and commodity futures. Golden et al. (2007) extended the literature by studying the interaction between credit risk and basis risk for weather derivatives, but they still considered only a single basis risk. This study fills this gap in the weather risk management literature. Practically, the study provides decision making guidelines for coordinating geographical diversification and financial hedging strategies. Although the present study is based on ski resorts and snowfall risk, the methods and results are applicable to all nature-based businesses sensitive to weather risks. With this study, we hope to provide a stepping stone towards the integration of these two weather risk management strategies.

Specifically, there are two objectives in this study: (1) exploring the effects of geographical diversification on the exposure of company-level cash flow to snowfall risk and (2) examining the effects of geographical diversification on snowfall risk hedging. Ski resorts provide an ideal platform for our analysis because weather risk is a major business risk for ski resorts and can be managed by either geographic diversification or financial hedging. Furthermore, the outcomes of these two strategies are interrelated due to their correlations with snowfalls, providing an opportunity to examine the interaction between the two strategies.

Section snippets

Weather risk and weather derivatives

Brockett et al. (2005) define weather risk as “the uncertainty in cash flows and earnings caused by non-catastrophic weather events.” Subsequently, exposure to weather risk is measured as the sensitivity of cash flows to weather indices. Weather risk is different from commodity price risk and other financial risks in several aspects (Cogen, 1998). First, weather risk is a ‘volume’ risk in that it affects quantity not price. Second, weather risk is a highly localized risk because micro-climates...

Data and analysis

To test the aforementioned relationships, we carry out two stages of empirical analysis: (1) testing the effects of geographical diversification on risk exposure and (2) simulating the hedging effectiveness under multiple snowfall risks. The first stage is further divided into two scenarios: (1) single-property versus multiple-property and (2) multiple-property plus one. Although different analyses and data are required for each stage, company level cash flows and property level snowfalls form...

Effects of geographical diversification on risk exposure

The results of the analysis of Scenario 1, Stage 1 are reported in Table 3. Because the exposure to the Vail snowfall index is negative, the absolute value is used for the *T*-test in order to compare the magnitude of exposure without the influence of the direction of exposure. The definitions of fiscal quarter are different between Winter Sports and Vail Resorts by one month. However, their second quarters overlap across the months of December and January, the traditionally busiest months. With...

Conclusion

This study set out to analyze the effects of geographical diversification on risk exposure and the hedging effectiveness of multi-property ski resorts. The results provide theoretical and empirical evidence that geographical diversification can effectively reduce the risk exposure of a single-property ski resort, while ski conglomerates may benefit more from reducing snowfall risk through financial hedging. For a single-property ski resort the choice between financial hedging and geographical...

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...The importance of non-linear models and methods in tourism demand is also highlighted in Baggio and Sainaghi (2016). Beyazit and Koc (2010) adopt snow options as well for hedging in their study, although the issue of basis risk is

not dealt with; Đorđević (2018) and Tang and Jang (2011, 2012), on the other hand, consider the case of snowfall forwards in the context of the minimum variance principle. The paper is organized as follows....

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...Data from the US National Oceanic and Atmosphere Administration (NOAA) show that weather extremes account for significant losses - 2015, there were 10 such events with losses exceeding \$1 billion each across the United States alone.¹ As environmental volatility grows, risk transfer solutions have become key tools for measuring vulnerability, including geographical diversification (Tang and Jang, 2011), as well as financial hedging techniques, such as insurance solutions (Collier and Skees, 2012), weather derivatives (Bank and Wiesner, 2011; Bertrand et al., 2015; Isakson, 2015; Pollard et al., 2008) and catastrophe bonds (Johnson, 2014, 2015). In the stock market, investors are able to hedge volatility risk by using derivative products based on the Volatility Index (VIX) index....

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