**Climate change adaptation strategies as a source of competitive advantage in the California wine industry**

Kerrigan Marie Machado Unter

University of St. Gallen

Jorge Rivera

George Washington University

**Summary**

Increasingly, firms are facing irreversible and unavoidable changes to their natural environment that effect both the ability to operate, as well as the ability to gain and maintain a competitive advantage. Yet, there has been limited attention to how the biophysical environment, including climate change[[1]](#footnote-1), impacts firm decisions and performance. In this paper we aim to address this gap by answering the following research questions: 1) How does the external biophysical environment affect firm climate change adaptation strategies and performance?, and 2) Are climate change adaptation strategies a source of competitive advantage for firms?

We focus on how biophysical conditions affect firm climate change adaptation strategies and performance. The *biophysical environment* encompasses both the physical environment (e.g., water, soil, etc.) as well as the biological activity within it. This is a complex set of biotic, climatic, and abiotic factors that act upon an organism and determine its form, survival, and how it adapts over a time. The biophysical environment can vary in scale from microscopic to global and include marine, terrestrial, and atmospheric environments (Dunlap & Catton, 1979). Changes in change is one aspect of the biophysical environment that is of increasing attention to management scholars (Nyberg & Wright, 2022). Importantly, the biophysical environment, including climate change, is also part of the external environment that can drive organizational changes such as adaptation (Rivera et al., 2022; Smit et al., 2000). In response to shifts in climate, firms adopt climate change adaptation strategies. *Climate change adaptation* consists of “the process of adjustment to actual or expected climate and its effects, in order to moderate or avoid harm or exploit beneficial opportunities” (IPCC, 2022: 43).

To bridge the gap between research on what affects both organizational responses and performance (Davis & DeWitt, 2021), we examine how climate change adaptations in response to biophysical conditions may be a source of sustained competitive advantage for firms. We draw on resource-based view (RBV) to show that firm climate change adaptations to natural conditions can be a source of competitive advantage to firms. Firms adapt to the biophysical environment to secure access to natural resources in the face of environmental uncertainties, and, subsequently, firms gain value from those adaptations.

We conducted our study in the California wine industry with a sample of 50,156 wine-winery-year observations for 535 wineries covering the years 1981-2019. We created our sample by first creating a complete list of every winery in California. We then geocoded the location of each winery[[2]](#footnote-2). Third, we used GIS to match each winery every wildfire occurrence withing 25 km. Finally, we collected wine level data from Wine Spectator which included release price, vintage, region, variety, and grape source (i.e., to the most specific location whether that be as broad as the State of California or as specific as a single vineyard).

Our findings indicate that the adoption of climate change adaptation strategies are a source of competitive advantage for firms. We find that the adoption of adaptation strategies by wineries that increase the number of vineyard sources for winegrapes were positively related to wine price. Wineries adopt these adaptation strategies in response to more frequent wildfires to ensure continued access to critical natural resources. Further, we also find that firm climate change adaptation strategies mediate the relationship between biophysical conditions and product price. There is support that wildfire frequency is indirectly and positively related to wine price through the number of vineyards.

 This study contributes to research on RBV by integrating the role of the natural environment. First, we extend the boundary conditions of RBV to show that firm responses to the natural environment can be a source of financial value for firms. RBV was designed for stable conditions and does not consider how unstable natural conditions may impact the ability of a firm to gain a competitive advantage.

Second, our study also expands beyond the role of nature that is discussed in the Natural Resource-based View (NRBV) view of the firm. NRBV primarily focuses on how practices to mitigate harm to the natural environment (i.e., pollution prevention, product stewardship, and sustainable development) can be a source of sustained competitive advantage to a firm (Hart, 1995). Firms adapt to adverse natural conditions to secure access to natural resources in the face of environmental uncertainties. Because the firm can secure resources at a necessary quantity and quality to continue operating, these adaptations are a source of value to the firm. Our research builds on prior work by Tashman and Rivera (2016) to show that not only to firms respond to the natural environment through climate change adaptation strategies to manage resource uncertainties, but those adaptation strategies are also a source of value to the firm because they secure key natural resources for the firm to produce a high value product. We go beyond NRBV and show that adaptation to the natural environment can also be a source of competitive advantage to firms. More than just reducing harm to nature, firms can also gain value from responding to the effects of nature.

Finally, this research also contributes to the growing stream of research on corporate climate change adaptation. To date, most of this research and focused on the types of adaptations that firms can implement as well as what drives those adaptations (Gasbarro & Pinkse, 2016; Hoffman & Jennings, 2018; Orsato et al., 2019; Sharma & Vredenburg, 1998). Our study extends this area by examining the effects of climate change adaptation on firm product performance. Importantly, we find not only do firms adapt to climate, but climate change adaptation strategies also positively impact firm performance. Climate change adaptation strategies can not only limit the harmful effects of climate change on firm operations, but it also can improve the financial performance of firms.

1. *Climate change* is a change in the average and/or variability of the state of climate properties that occurs for an extended period of time (IPCC, 2022). [↑](#footnote-ref-1)
2. A combination of California wine regulations, practices common in the California wine industry, and satellite imagery made it possible for us to geocode the location of each winery and confirm that the winery grows grapes. [↑](#footnote-ref-2)