The Potential Use of Weather Derivatives to Hedge Vineyard Harvest Rainfall Risk

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Extended Abstract

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Weather derivatives represent a new form of financial security with payoffs contingent on weather related variables, providing firms with the ability to hedge against unforeseen climatic changes that can result in significant variability in revenues and costs. They include various instruments such as swaps, options and option collars with payoffs dependent upon a wide variety of weather related variables. Contracts have been written not only on temperature related measures but also on variables such as precipitation, wind, and frost. Although standardized temperature-related contracts, traded on the Chicago Mercantile Exchange by energy firms, continue to comprise the majority of notional value, the availability of non-standardized over-the-counter contracts has increased dramatically. This increase has been facilitated largely by the entry into the market of a variety of financial intermediaries willing to write such contracts. Recent applications include almost all economic sectors as it has been estimated that as great as one-seventh of the industrialized economy is weather sensitive.

The viticulture industry, like much of the agricultural sector, is extremely sensitive to weather with a major weather-related risk faced by many wine producers being that of heavy rainfall during the harvest period. Optimal conditions over the summer growing season can be severely offset by excessive rainfall during the months of September through October, causing harvest delays and a lower quality crop. In particular, heavy rains during ripening and harvest can result in lower Brix levels and consequently a lower price per tonne achieved for the crop, or a lower quality of wine produced.

In the current paper, we explore the usefulness of weather contracts designed to hedge the risk of excessive harvest rainfall. As a practical example we consider the major wine producing region of Canada – the Niagara Peninsula. Employing rainfall data for the years 1965 through 2007, we attempt to identify the stochastic process underlying annual cumulative rainfall for the September through October months. Our results indicate that a mixed jump diffusion process best characterizes the time series of cumulative harvest rainfall (CHR) for the region.

Burn-rate analysis, commonly used in the insurance industry and also Monte Carlo simulation under varying stochastic process assumptions is then used to derive benchmark values for call options written on cumulative harvest rainfall. We provide comparative prices for such options under a variety of contract specifications, indicating the viability of their use by wine producers to hedge this critical risk.

Although the focus of this paper is specifically on the use of weather contracts for hedging harvest rainfall risk, the potential use of similar contracts to hedge a wide variety of weather-related risks inherent in the wine production process is great. Their potential value is even greater considering the recent predictions of greater variability of weather conditions, associated with global warming.