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# Indifference Pricing of Weather Insurance: Abstract

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Weather derivatives are difficult to price because weather cannot be traded, i.e., the market for weather risk is incomplete. Hence, a straightforward application of standard pricing models for financial derivatives is impossible. Actually, the poor transparency of pricing algorithms employed by sellers is considered a major cause of the slow development of weather markets.

We seek to contribute to the ongoing discussion on pricing of weather derivatives by introducing a new approach—indifference pricing. Indifference pricing starts with the appealing notion that the amount of money at which a potential buyer (or seller) of weather insurance is indifferent, in terms of expected utility between buying (or selling) and not buying (selling), constitutes an upper (lower) limit for the contract price. Such an approach can take into account the particular economic situation of individual buyers (sellers). However, compared with other approaches, indifference pricing is less ambitious since it does not attempt to predict a unique market price or even an equilibrium price. Instead, it calculates price boundaries for sellers and buyers and simply states whether or not transactions are likely to occur. Nevertheless, the approach circumvents the determination of the market price of risk. Clearly, along with this comes the cost of specifying a utility function, but this is unavoidable whenever no-arbitrage arguments are insufficient to determine a unique price. Furthermore, a nice property of indifference prices is that

they recover familiar Black-Scholes prices in the case of complete markets. An additional advantage of indifference pricing is that it does not require the assumption of continuous trading which is at the heart of modern financial economics. It can also be applied in a discrete time setting where buying and selling positions are retained once they have been realized.

Taking up the general idea of indifference pricing, we develop a model that can be used to calculate the willingness to pay for weather insurance in an agricultural context. Then we apply this model to crop farms in Germany. First, we calculate indifference prices for wheat producers in northeast Germany and compare them with other pricing methods. Second, we ask for the willingness to pay for weather insurance in other regions and for other farm types.

Our findings show that under moderate risk aversion maximal bid prices of the grain producers exceed the minimal selling prices of insurers only for a few regions and crops. The basis risk that is inherent to a weather derivative, which has been optimized for a particular crop and a particular region, makes it less attractive for farmers in other regions. In other words, our calculations confirm results of previous studies, showing a considerable magnitude of basis risk inherent to index-based weather insurance in the agribusiness sector. Another finding is the considerable differences that may occur between indifference prices and the actuarial “fair price.”

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## Reference

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