

Insurance of Weather Risk in Agriculture

Martin Odening, (HU Berlin); Oliver Musshof, Ron Weber

Background and Motivation

Agriculture and the agribusiness sector are highly affected by climate change. First, climate change changes the natural production conditions for agriculture in different regions. Average temperatures as well as the amount and the distribution of rainfall are expected to alter. Farmers might respond to these shifts by adjusting their production program or using new varieties. Second, apart from these rather slow shifts it is widely acknowledged that climate change also increases the likelihood of extreme weather events like draughts, flooding or storms. That means weather risk is of growing importance in agriculture. Third, new instruments to handle weather risks have been developed. In particular, we could observe the emergence of weather markets in the mid of nineties, where weather derivatives, CAT bonds and other ART products are traded over the counter or on exchanges (MUBHOFF, ODENING and XU 2005). While these markets boosted at the beginning of this century a consolidation seems to happen now. Successful applications of weather derivatives and index based insurance are also documented for the agricultural sector. However, it is difficult at present to assess the relevance that weather markets will have for the agribusiness in the future. The objective of this paper is

- to provide an overview about existing concepts for coping with weather risk in agriculture and to discuss their strength and weaknesses
- to assess the potential demand and supply for weather derivatives and index based insurance under different conditions by means of a theoretical model
- to quantify the actual interest of German farmers in weather insurance and their willingness to pay. This is accomplished by a farm survey.

Methods and Data

The empirical part of the study is based on a survey of 200 farms in North East Germany. In view of a series of extreme crop failures in the drought years 2000, 2003 and 2006, where only governmental disaster relief prevented farmers from becoming insolvent, there is a pronounced interest in introducing some kind of weather insurance. Information is gathered on natural production conditions, the exposition to weather risk (drought in particular), the preferred type of insurance, and the attitude towards risk. This information is used to explain the willingness to pay for drought insurance. In addition, interviews with experts from insurance companies were conducted in order to get information about the supply side of weather insurance.

The theoretical part of the paper applies a rather new pricing approach for weather derivatives, namely indifference pricing (WEI, ODENING and MUBHOFF, 2007). Indifference pricing starts with the appealing idea 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). In this paper we take up the general idea of indifference pricing and develop a model that can be used for pricing weather insurance in an agricultural context. Afterwards we apply this model to crop farms in Germany. The model outcome is valuable for potential sellers who contemplate entering this market segment.

Preliminary results

Our calculations confirm results of previous studies, showing a considerable magnitude of basis risk inherent to index-based weather insurance in agribusiness (ODENING, MUBHOFF and XU 2007, MUBHOFF, ODENING and XU 2007). Geographical basis risk, in conjunction with production related basis risk, erodes the potential advantages of weather derivatives over traditional crop insurance. To overcome this problem, insurers should offer tailored products that match the specific demand of individual producers. However, this is only a realistic scenario if the design of individual insurance contracts does not entail high transaction costs. The proposed indifference pricing approach may facilitate reducing such costs.

References

- Odening, M., Mußhoff, O., Xu, W. (2007): Analysis of Rainfall Derivatives Using Daily Precipitation Models: Opportunities and Pitfalls. *Agricultural Finance Review* 67 (1): 135-156.
- Xu, W.; Odening, M.; Mußhoff, O. (2007): Indifference Pricing of Weather Insurance. Paper presented at the 101st seminar of the European Association of Agricultural Economists (EAAE) "Management of Climate Risks in Agriculture", July 5-6, 2007 in Berlin.
- Mußhoff, O., Odening, M., Xu, W. (2007): Zur Quantifizierung des Basisrisikos von Wetterderivaten. In: Kuhlmann, F.; Schmitz, M. (Hrsg.): *Good Governance in der Agrar- und Ernährungswirtschaft*. 46. Jahrestagung. Schriften der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues (GeWiSoLa), Landwirtschaftsverlag, Münster-Hiltrup (im Druck).
- Mußhoff, O., Odening, M., Xu, W. (2005): Zur Bewertung von Wetterderivaten als innovative Risikomanagementinstrumente in der Landwirtschaft. *Agrarwirtschaft* 54 (4): 197-209.

