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Estimating the potential of index-based insurances for irrigated agriculture in climate change adaptation

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Although crop drought insurances are quite developed and applied in rainfed crops, their extension to irrigated crops is still under development. Among the different options existing, index-based insurances appear as a promising alternative. However, their application in complex water resource systems is hindered by the fact that well-known indicators and indices do not guarantee a comprehensive evaluation of the state of the system. In this regard, Spanish river basins represent an exception, since all of them use systems of indicators and indices that summarize their status on a single metric that condenses meteorological, hydrological and hydrogeological variables. These indices, as well as their formulations, are published in the Water Resource Management Plans of all Spanish river basins, facilitating their reproduction. Despite some recent research has defined index insurance schemes based on them, their evaluation in a climate change context is still missing.

This study estimates the performance of several index-based insurance schemes for irrigated agriculture under a climate change context. To this end, hydroeconomic modelling is combined with a reproduction of the official Scarcity State Index (in Spanish Indice de Estado de Escasez, IES) in climate change scenarios. The Jucar river system in Spain is used as case study. In particular, insurances were built for the lower basin crops (citrus trees). Climate projections come from CMIP6 are employed to force a fully distributed eco-hydrological model to provide hydrological projections (TETIS) and crop modelling to infer future crop water needs (AQUACROP for herbaceous crops and FAO56 combined with a soil water balance model for citrus tree crops). Results from both models are then used to input the hydroeconomic model, which takes into account the current operating rules of the system. Afterwards, the results obtained by this model, together with the ones from the eco-hydrological model and the climate change projections, are combined to reproduce the IES. Finally, index insurance schemes are applied to estimate fair risk premiums, maximum compensations and deductible franchises that would be paid by and to farmers if insurances were purchased. Two insurance schemes were analysed: 1-year insurance characterized by a premium, a deductible franchise and an index trigger; and a 2-year multi-annual contract. The evaluation is done comparing the farmers' economic balance without and with insurances, analysing the cumulative distribution of net benefits. This analysis, performed for all climate change scenarios, assess which insurance configuration and under which scenarios

contribute to the economic adaptation of farmers to climate change.

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