Supplement of Nat. Hazards Earth Syst. Sci., 23, 1335–1354, 2023
https://doi.org/10.5194/nhess-23-1335-2023-supplement

Natural Hazards and Earth System Sciences
Open Access

Supplement of

Review article: Design and evaluation of weather index insurance for multi-hazard resilience and food insecurity

Marcos Roberto Benso et al.

Correspondence to: Marcos Roberto Benso (marcosbenso@gmail.com)

Table S1 – Description of risk pricing methods

	Model	Authors
Expected Value	Burning rate	(GUERRERO-BAENA; GÓMEZ-LIMÓN, 2019; HOHL et al., 2020; MORTENSEN; BLOCK, 2018; SHIRSATH et al., 2019)
	Probabilistic fit	(BOKUSHEVA, 2018; BUCHELI; DALHAUS; FINGER, 2021; EZE et al., 2020; KATH et al., 2018, 2019; MARTÍNEZ SALGUEIRO, 2019; RICOME et al., 2017; SACCHELLI; CIPOLLARO; FABBRIZZI, 2018; VROEGE; FINGER, 2020; WARD; MAKHIJA, 2018)
Stochastic	Index modeling	(ALEXANDRIDIS et al., 2021; BERHANE et al., 2021; GÓMEZ-LIMÓN, 2020; GÜLPINAR; ÇANAKOḠLU, 2017; GUO et al., 2019; KAPSAMBELIS; MONCOULON; CORDIER, 2019; MARTÍNEZ SALGUEIRO, 2019; MOHOR; MENDIONDO, 2017; RODRÍGUEZ; PÉREZ-URIBE; CONTRERAS, 2021)
Market price	Wang Transform	(BOYLE; HAAS; KERN, 2021; DENARO et al., 2018)

Table S2 – Description of insurance policy evaluation methods

Method	Authors
Utility function	(BUCHELI; DALHAUS; FINGER, 2021; EZE et al., 2020; FURUYA et al., 2021; RICOME et al., 2017; VROEGE et al., 2021; WARD; MAKHIJA, 2018)
Loss ratio	(MOHOR; MENDIONDO, 2017)
Conidtional VaR	(BOKUSHEVA, 2018)
Lower partial moment	(BOKUSHEVA, 2018)
Coefficient of variation for downside risk	(BOKUSHEVA, 2018b; MARTÍNEZ SALGUEIRO, 2019)
Minimum Support Price (MSP)	(WARD; MAKHIJA, 2018)
Mean Root Square Loss (MRSL)	(KATH et al., 2019)
Certainty Equivalence of Revenue (CER)	(KATH et al., 2019)
Conditional tail expectation (CTE)	(KATH et al., 2018)
Expected Shortfall	(BOKUSHEVA, 2018; MARTÍNEZ SALGUEIRO, 2019)
Risk Mitigation Level (RML)	(DENARO et al., 2018)
Maximum cost savings	(BOYLE; HAAS; KERN, 2021)

References

ALEXANDRIDIS, A. K. et al. Extracting pricing densities for weather derivatives using the maximum entropy method. **Journal of the Operational Research Society**, v. 72, n. 11, p. 2412–2428, 2021.

AWONDO, S. N. Efficiency of region-wide catastrophic weather risk pools: Implications for African Risk Capacity insurance program. **Journal of Development Economics**, v. 136, p. 111–118, jan. 2019.

BERHANE, T. et al. Pricing of weather derivatives based on temperature by obtaining market risk factor from historical data. **Modeling Earth Systems and Environment**, v. 7, n. 2, p. 871–884, 2021.

BERTRAM-HUEMMER, V.; KRAEHNERT, K. Does index insurance help households recover from disaster? Evidence from IBLI Mongolia. **American Journal of Agricultural Economics**, v. 100, n. 1, p. 145–171, 2018.

BOKUSHEVA, R. Using copulas for rating weather index insurance contracts. **Journal of Applied Statistics**, v. 45, n. 13, p. 2328–2356, 2018a.

BOYLE, C. F. H.; HAAS, J.; KERN, J. D. Development of an irradiance-based weather derivative to hedge cloud risk for solar energy systems. **Renewable Energy**, v. 164, p. 1230–1243, 2021a.

BUCHELI, J.; DALHAUS, T.; FINGER, R. The optimal drought index for designing weather index insurance. **European Review of Agricultural Economics**, v. 48, n. 3, p. 573–597, 2021.

DENARO, S. et al. Fostering cooperation in power asymmetrical water systems by the use of direct release rules and index-based insurance schemes. **Advances in Water Resources**, v. 115, p. 301–314, 2018.

EZE, E. et al. Feasible crop insurance indexes for drought risk management in Northern Ethiopia. **International Journal of Disaster Risk Reduction**, v. 47, 2020.

FU, H. et al. Risk transfer mechanism for agricultural products supply chain based on weather index insurance. **Complexity**, v. 2018, 2018.

FURUYA, J. et al. Optimum insurance contract of flood damage index insurance for rice farmers in Myanmar. **Paddy and Water Environment**, v. 19, n. 2, p. 319–330, 21 abr. 2021.

GÓMEZ-LIMÓN, J. A. Hydrological drought insurance for irrigated agriculture in southern Spain. **Agricultural Water Management**, v. 240, p. 106271, out. 2020a.

GUERRERO-BAENA, M.; GÓMEZ-LIMÓN, J. Insuring Water Supply in Irrigated Agriculture: A Proposal for Hydrological Drought Index-Based Insurance in Spain. **Water**, v. 11, n. 4, p. 686, 3 abr. 2019.

GUO, J. et al. Design of temperature insurance index and risk zonation for single-season rice in response to high-temperature and low-temperature damage: A case study of Jiangsu province, China. **International Journal of Environmental Research and Public Health**, v. 16, n. 7, 2019a.

HOHL, R. et al. Using a regional climate model to develop index-based drought insurance for sovereign disaster risk transfer. **Agricultural Finance Review**, v. 81, n. 1, p. 151–168, 2020.

KAPSAMBELIS, D.; MONCOULON, D.; CORDIER, J. An innovative damage model for crop insurance, combining two hazards into a single climatic index. **Climate**, v. 7, n. 11, 2019a.

KATH, J. et al. Index insurance benefits agricultural producers exposed to excessive rainfall risk. **Weather and Climate Extremes**, v. 22, p. 1–9, 2018.

KATH, J. et al. Spatial variability in regional scale drought index insurance viability across Australia's wheat growing regions. **Climate Risk Management**, v. 24, p. 13–29, 2019a.

MARTÍNEZ SALGUEIRO, A. Weather index-based insurance as a meteorological risk management alternative in viticulture. **Wine Economics and Policy**, v. 8, n. 2, p. 114–126, 2019.

MARTINEZ SALGUEIRO, A.; TARRAZON-RODON, M.-A. Approaching rainfall-based weather derivatives pricing and operational challenges. **REVIEW OF DERIVATIVES RESEARCH**, v. 23, n. 2, p. 163–190, jul. 2020.

MOHOR, G. S.; MENDIONDO, E. M. Economic indicators of hydrologic drought insurance under water demand and climate change scenarios in a Brazilian context. **Ecological Economics**, v. 140, p. 66–78, out. 2017.

MORTENSEN, E.; BLOCK, P. ENSO Index-Based Insurance for Agricultural Protection in Southern Peru. **Geosciences**, v. 8, n. 2, p. 64, 9 fev. 2018.

RICOME, A. et al. Are subsidies to weather-index insurance the best use of public funds? A bio-economic farm model applied to the Senegalese groundnut basin. **Agricultural Systems**, v. 156, p. 149–176, 2017.

RODRÍGUEZ, Y. E.; PÉREZ-URIBE, M. A.; CONTRERAS, J. Wind put barrier options pricing based on the nordix index. **Energies**, v. 14, n. 4, 2021.

ROZNIK, M. et al. Improving agricultural microinsurance by applying universal kriging and generalised additive models for interpolation of mean daily temperature. **Geneva Papers on Risk and Insurance: Issues and Practice**, v. 44, n. 3, p. 446–480, 2019.

SACCHELLI, S.; CIPOLLARO, M.; FABBRIZZI, S. A GIS-based model for multiscale forest insurance analysis: The Italian case study. **Forest Policy and Economics**, v. 92, p. 106–118, jul. 2018.

SHIRSATH, P. et al. Designing weather index insurance of crops for the increased satisfaction of farmers, industry and the government. **Climate Risk Management**, v. 25, p. 100189, 2019a.

TURVEY, C. G.; SHEE, A.; MARR, A. Addressing fractional dimensionality in the application of weather index insurance and climate risk financing in agricultural development: A dynamic triggering approach. **Weather, Climate, and Society**, v. 11, n. 4, p. 901–915, 2019.

VROEGE, W. et al. Insuring crops from space: the potential of satellite-retrieved soil moisture to reduce farmers' drought risk exposure. **European Review of Agricultural Economics**, v. 48, n. 2, p. 266–314, 6 mar. 2021.

VROEGE, W.; FINGER, R. Insuring Weather Risks in European Agriculture | Assurer les risques météorologiques dans l'agriculture européenne | Die Versicherung von Wetterrisiken in der europäischen Landwirtschaft. **EuroChoices**, v. 19, n. 2, p. 54–62, 2020.

WARD, P. S.; MAKHIJA, S. New modalities for managing drought risk in rainfed agriculture: Evidence from a discrete choice experiment in Odisha, India. **World Development**, v. 107, p. 163–175, 2018.

YAMADA, Y.; MATSUMOTO, T. Going for derivatives or forwards? Minimizing cashflow fluctuations of electricity transactions on power markets. **Energies**, v. 14, n. 21, 2021.