

The optimal drought index for designing weather index insurance

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Summary

Weather index insurance can mitigate financial climate risks. This removal of financial downside risks helps to overcome poverty traps, improves farmers' well-being and facilitates economic growth in agriculture.

We empirically test different drought indices regarding their risk-reducing potentials for weather index insurance. Results indicate that the drought index with greatest risk reduction is farm-individual.

1 Introduction



Climate change threatens agricultural production and particularly increases catastrophic drought risks.

Weather index insurance can reduce the financial consequences from catastrophic drought events. It has low administrative costs and a transparent payout mechanism that depends on an underlying drought index.

Basis risk is the difference between the actual loss and the payout. The greater basis risk the lower the downside risk removal. As the payout depends on a drought index, it is crucial to identify the most risk-reducing drought index.

2 Drought indices

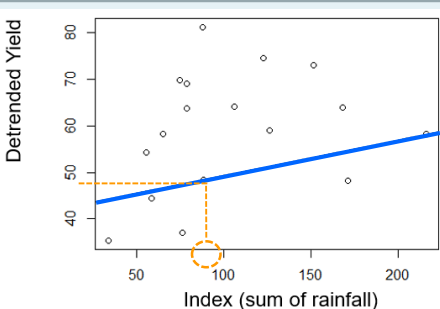
Sum of rainfall & SPI	SPEI	Soil moisture	Evaporative stress
(Standardized) sum of rainfall	Standardized difference betw. rainfall and potential evapotranspiration	Average plant available field capacity	Standardized ratio of actual to potential evapotranspiration

Flexible index measurement period in accordance to timing of critical growth phases of winter wheat

3 Methods and data

Quantile regression to reflect farm-specific drought risk in payout formula:

$$\text{Payout} = \text{Price} * \text{Tick size} * \max\{\text{Strike level} - \text{Index}, 0\}$$



Tick size: Yield reduction per unit of drought index. Equal to slope coefficient of quantile regression.

Strike level: Undercutting triggers payout. Derived from estimated quantile regression.

Empirical risk analysis with the expected utility model and lower partial moments.

Yield panel consisting of 85 winter wheat producers in Eastern Germany. Phenology and meteorological data from German Weather Service.

4 Results

Best drought index (most risk-reducing drought index) for designing weather index insurance is farm-individual

