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A comparative study on the impact of yield correlation on the effectiveness of risk pooling of farm-level yield crop insurance and area-yield crop insurance

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Risk theory tells us that risk can be effectively pooled when there is little dependence among individual losses. As farm-level crop yields generally exhibit high spatial correlation, the conventional indemnity-base crop insurance has been criticized for low risk-pooling effectiveness. While the index-based insurance has been advocated in recent years, it indemnifies policyholders based on the observed value of a specified "index" that is highly correlated with losses and therefore, individual indemnities could be highly correlated as well. Whether spatial correlation of farm-level yield lead to severe impacts on conventional or index-based crop insurance remains controversial in the literature.

In this article, we compared the impact of yield correlation on the effectiveness of risk pooling of two commonly used crop insurance contracts, a conventional farm-yield crop insurance (FYCI), and an area-yield crop insurance (AYCI). We followed Wang and Zhang (2003)'s approach and used catastrophic loading on premium to measure the impact of yield correlation, given different pool sizes and insurance coverage levels. The catastrophic loading on premium was approximated with the normal power approach by estimating the first-three moments of the regional aggregate indemnity (RAI) as suggested by Cummins (1991).

Results indicate that for the first three moments of RAI, FYCI has a larger expected value and a smaller variance for all valid scenarios of yield correlation, pool size, and coverage levels. But the relative size of skewness depends on scenario parameters. Putting the first-three components together, we found that the catastrophic loading in absolute values of AYCI is larger than FYCI as long as yield correlation is not severe. However, the catastrophic loading factor (loading measured in terms of standardized distribution) of AYCI is always larger than FYCI. Our model results were further verified using surveyed actual farm-level yield and corresponding county-level yield. Our results imply that, in general, spatial correlation and catastrophic risk should not be regarded as one of the advantages of index-based crop insurance over conventional crop insurance. For regions with medium-to-low yield correlation, FYCI could still serve as a better choice for running crop insurance programs.

Keywords: Farm-level yield crop insurance, Area-yield crop insurance, Catastrophic risk, Yield correlation.

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