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Tradeoff between Short-Term and Long-Term Risk Management Tools: New Study Shows that Crop Insurance May Hinder Agricultural Innovations in Drought-Tolerant Technologies

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June 24, 2020

***farmdoc daily* (10): 115**

Recommended citation format: Miao, R. "Tradeoff between Short-Term and Long-Term Risk Management Tools: New Study Shows that Crop Insurance May Hinder Agricultural Innovations in Drought-Tolerant Technologies. " *farmdoc daily* (10): 115, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, June 24, 2020.

Permalink: https://farmdocdaily.illinois.edu/2020/06/tradeoff-between-short-term-and-long-term-risk-management-tools.html

A few studies show that the United States in the first two decades of the 21st century was much drier than normal (e.g., Hoerling et al. 2014; Williams et al. 2015), and part of the country perhaps is entering a 'megadrought' period that has not been seen since late 1500s (Williams et al. 2020). US farmers have various tools to manage production risks caused by droughts, such as crop insurance and drought-tolerant crop varieties. However, a recent study published in *European Review of Agricultural Economics* provides evidence that farmers' long-run capacity to battle with droughts via drought-tolerant crop varieties may be hindered by the prevalence of crop insurance.

By examining the relationship between insured acreage of ten major field crops and the number of patents in drought-tolerant traits associated with these crops over 1980-2013 in the United States, the study finds that the patent count for drought-tolerant traits of a crop in a year is positively associated with the occurrence of droughts in preceding two to five years but negatively associated with the insured acreage of these crops. Here droughts are measured by Palmer Drought Severity Index (PDSI), an index ranging from -6 to 6 with -6 indicating the driest. Also note that drought-tolerant traits are quite different from commercialized drought-tolerant varieties. The former can be viewed as possible building blocks of the latter. The latter might take more than ten years to develop but the former can be developed much quicker, e.g., one year or two.

Specifically, the study shows that if there were no crop insurance, then one-unit increase in drought severity measured by PDSI in previous three years would increase the patent number of drought-tolerant traits in a year by about 60%. However, in the presence of crop insurance, the same one-unit increase in drought severity would only increase the patent number by about 46%, about 23% smaller than the 60% increase without crop insurance.

In addition, not only does crop insurance mitigate the responsiveness of patent number to drought severity as discussed above, but it also directly reduces the patent number. The study estimates that on

average, under a normal wetness condition (PDSI being zero), a one-million-acre increase in insured acreage of a crop would reduce drought-tolerant patent count associated with this crop by about 2%. To put this in context, in 2019 the insured acreage for corn, soybeans, wheat, and cotton in the United States was about 87, 71, 39, and 13 million acres, respectively (Risk Management Agency 2020).

The study points out that the negative impact of crop insurance on drought-tolerant patent count results from the potential substitution relationship between crop insurance and drought-tolerant traits as risk management tools. Agricultural economists (e.g., Woodard et al. 2012) have shown evidences that the presence of crop insurance may discourage the adoption of some risk-reducing technologies. Some studies also show that the presence of crop insurance may reduce farmers' incentive to mitigate the adverse impact of severe weather (e.g., Annan and Schlenker 2015).

The study reveals a real dilemma over how to manage agricultural production risk in the short-term and in the long-term. If we view patents in drought-tolerant traits as essential elements upon which future commercial drought-tolerant varieties are built, then the negative link between crop insurance and patent counts discovered in this study indicates that the pool of new crop varieties available to farmers in the future might be shrunk, although unintentionally, by crop insurance. It provides evidence that the crop insurance not only affects farmers' risk management at the individual level but also influences the society's long-run capacity to manage agricultural production risk via technology innovation. An immediate implication of the study is that further policy interventions to incentivize agricultural innovation are needed to mitigate this impact from crop insurance.

In terms of risk management, crop insurance can be viewed as a reactive tool that focuses on short-term risk mitigation because farmers are covered after losses occur. It has little to do with preventing the losses from occurring at the first place. On the other hand, new technologies such as drought-tolerant varieties can be viewed as proactive tools that would benefit farmers in the long-run because the uses of such new technologies would prevent losses in the first place. As crop insurance is getting popular in both developed and developing countries, this study suggests that further economic research is needed to explore how to balance the tradeoff between the short-term and long-term risk management tools, with the consideration of farmers' current need for a safety net to smooth the income in every harvest season and the future need for toolboxes to combat the changing climate.

Complete citation for the study discussed here is:

Miao, Ruiqing. 2020. "Climate, Insurance, and Innovation: The Case of Drought and Innovations in Drought-Tolerant Traits in U.S. Agriculture." *European Review of Agricultural Economics*. doi: https://doi.org/10.1093/erae/jbaa010

Acknowledgments

This research was partially supported by the Alabama Agricultural Experiment Station and the Hatch program of the National Institute of Food and Agriculture, U.S. Department of Agriculture. The funders had no role in study design, data collection and analysis, decision to publish, and preparation of any manuscript.

References

Annan, F. and W. Schlenker. 2015. Federal Crop Insurance and the Disincentive to Adapt to Extreme Heat. *American Economic Review - Papers and Proceedings*, 105(5):262-266.

Hoerling, M., J. Eischeid, A. Kumar, R. Leung, A. Mariotti, K. Mo, S. Schubert, R. Seager. 2014. Causes and predictability of the 2012 Great Plains drought. *Bulletin of the American Meteorological Society* 95:269–282.

Risk Management Agency, U.S. Department of Agriculture. 2020. Summary of Business. Available at https://prodwebnlb.rma.usda.gov/apps/SummaryOfBusiness (accessed June 17, 2020).

Williams, A.P., E.R. Cook, J.E. Smerdon, B.I. Cook, J.T. Abatzoglou, K. Bolles, S.H. Baek, A.M. Badger, B. Livneh. 2020. Large contribution from anthropogenic warming to an emerging North American megadrought. *Science* 368(6488):314-318.

Williams, A.P., R. Seager, J.T. Abatzoglou, B.I. Cook, J.E. Smerdon, E.R. Cook. 2015. Contribution of anthropogenic warming to California drought during 2012–2014. Geophysical Research Letters 42, 6819–6828.

Woodard, J.D., A.D. Pavlista, G.D. Schnitkey, P.A. Burgener, and K.A. Ward. 2012. “Government Insurance Program Design, Incentive Effects, and Technology Adoption: The Case of Skip-Row Crop Insurance.” *American Journal of Agricultural Economics* 94(4):823-837.