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Does Crop Insurance Affect How Much Acreage Gets Harvested?

Anh Nam Tran
FAPRI - University of Missouri

Mesbah Motamed
Tani Lee
Economic Research Service – USDA

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A little bit.

Anh Nam Tran
University of Missouri

Mesbah Motamed
Tani Lee
Economic Research Service - USDA

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Crop insurance can influence producers' decisions in different ways.

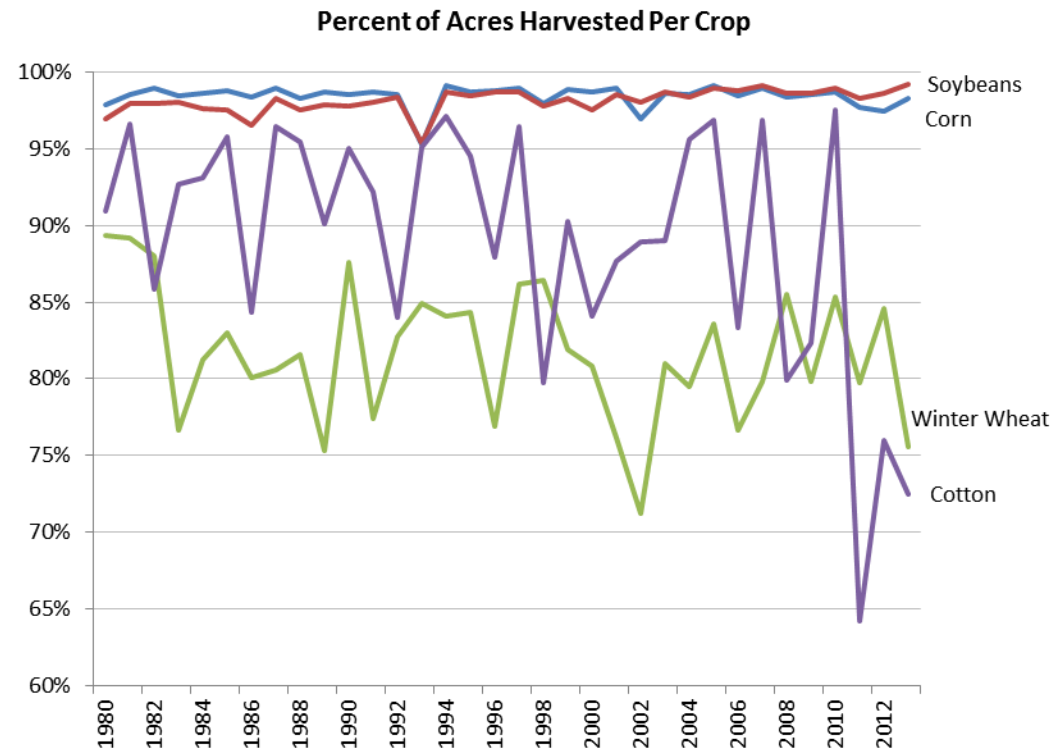
- It can incentivize production on marginal acres due to the risk-reduction benefits (Goodwin et al. (2004), Lubowski et al. (2006), Wu (1999)).
- It can alter input usage, though the direction remains debated.
- It can also drive crop selection.

Objective

We investigate whether insurance affects how much acreage farmers choose to harvest after planting, focusing on corn, soybeans, cotton, and winter wheat.

Why study harvesting decisions?

- Unharvested acres represent a sizeable loss of value.
 - From 1980 to 2013, total unharvested acres for corn, soybeans, cotton, and wheat are 43 million, 43 million, 47 million, and 302 million, respectively.
 - This unharvested area adds up to about \$181 billion of unsold crops abandoned in fields, based on 2013 production cost estimates.*
- Test for efficiency of farmer's harvesting choices:
 - With insurance, farm expands onto marginal areas thus bringing down average farm land quality. It is expected that, keeping everything else constant, an effective and profit maximizing farmer will harvest less of his land.



Unharvested acres and costs from 1980 to 2013

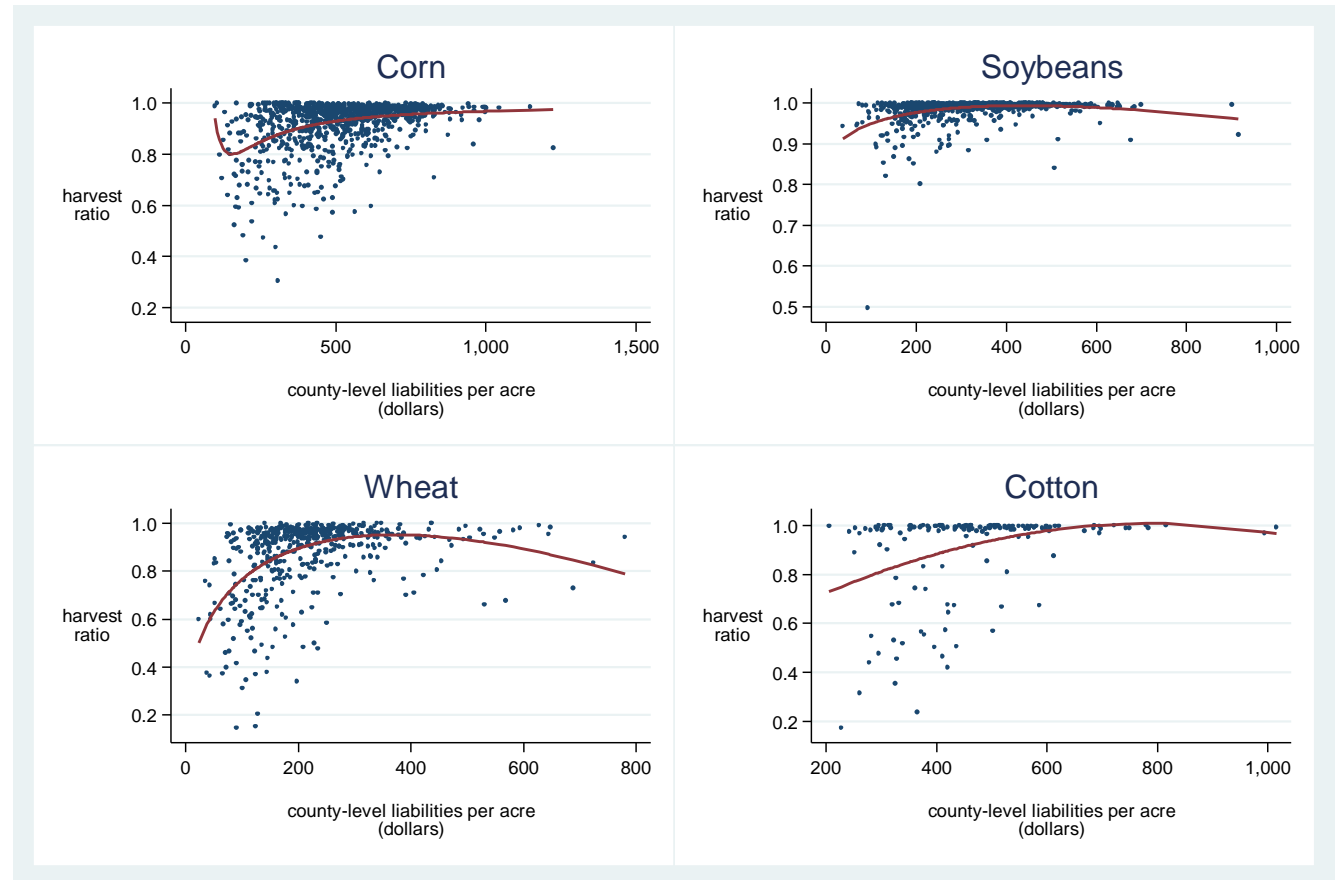
Crop	Unharvested acres	Unsold Crop Value*
Corn	43 million	\$29 billion
Soybeans	43 million	\$20 billion
Cotton	47 million	\$38 billion
Winter Wheat	302 million	\$94 billion

How could insurance affect harvesting decisions?

- The Federal Crop Insurance Reform Act of 1994 expanded crop insurance dramatically and has become the most important risk management tool and income support program for US field crop producers.
- Crop insurance works by paying producers when their revenues and production fall below some guaranteed amount, typically determined by past annual revenues and production.
- Having a higher past performance entitles a producer to higher liability and thus potentially higher indemnities in the future.
- Higher performance also qualifies producers for lower premium rates since insurance programs try to reward higher productivity.
- Facing these incentives, producers may harvest more acres in order to increase their future potential indemnities and reduce their premium.

Does any relationship appear between insurance and harvested acreage?

- County-level data from National Agricultural Statistical Service (NASS) and the Risk Management Agency (RMA) covering corn, soybeans, cotton, and wheat from 1980-2013.
- Keep counties with continuous production
- From this data, we can observe the harvest ratio (acreage harvested/acreage planted), and liabilities per planted acre.
- Over the densest portion of the observations, the relationship between harvest ratios and liabilities appears positive.



Fractional polynomial fits relating per acre liabilities to harvest ratios in 2012.

Testing the relationship between insurance and harvest ratios

- Using USDA NASS and RMA data, we construct a panel of county-level observations for 34 years, broken into two periods
 - 1980 – 1993, pre-Crop Insurance Reform Act
 - 1994 – 2013, post-Crop Insurance Reform Act
- We test the effect of insurance on harvest ratios with a fixed effects estimator using the fractional response method described in Papke and Wooldridge (2008).
- We include controls for weather, prices, county-level unobservables, and time.
- The reduced form of the model looks like:

$$\frac{\text{harvested acres}}{\text{planted acres}} = f(\text{insurance, weather, price, county, time trend})$$

Testing the relationship between insurance and harvest ratios

- Since the insurance decisions is potentially endogenous to the harvest outcome, we present alternative results that rely on the previous year's temperature to instrument for the present year's insurance coverage.
- Endogeneity test, however, fails to reject the null hypothesis that insurance is exogenous

Impact on Harvest Ratios		Corn	Soybeans	Wheat	Cotton
Liability per planted acre	Exogenous	0.0037**	0.0006	-0.0059*	-0.0004
	Endogenous	0.0058	-0.0018	0.0088	-0.0302
Insured acre per planted acre	Exogenous	0.0350**	-0.0006	-0.0050	-0.0360*
	Endogenous	0.0155	-0.0125	0.0579	-0.3199*

Significance levels are ***, **, and * for 1%, 5%, and 10% respectively.

Summarizing the results

- The results show significant, albeit modest, effects on acreage.
- Raising the per acre liability coverage by 10% changes the harvest ratio of corn, cotton, and wheat by 0.037, -0.36, and -0.059 percentage points respectively
- Soybeans harvest response, however, registers insignificantly.

Concluding thoughts

- Unharvested acreage represents a serious loss of value in U.S. agricultural production.
- The Federal Crop Insurance Act of 1994 potentially incentivizes producers to harvest more corn acres than they would otherwise.
- With land expansion onto marginal areas, this also suggests that farmers are making inefficient harvesting decisions.
- Results from our estimation show a mixed and modest effect on harvest ratios. Obtaining the total benefits and costs of these harvested and unharvested acres should be counted towards the overall value generated by the crop insurance program.