The Impact of Crop Insurance on Farm Credit and Investment Decisions

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Introduction

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Research Questions

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What sort of investment does increased risk management promote on-farm?

Three

To what extent is capital-labor substitution another channel by which risk management augments firm value?

Mechanisms

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- Theoretical models of risk balancing (Gabriel and Baker, 1980)
- Overcoming credit constraints (Liang, 2014)
- FCI as collateral: lenders driving relationship
- Lower variability of income increase demand for investment
- Estimation strategy can identify only direct relationships with crop insurance; use theory to form connections between them

Summary

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Data

91,000 farm-year observations from ARMS cross section; 30,000 farm-year observations from the ARMS unbalanced panel

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Unbalanced panel and FCI program coverage limits as an instrumental variable for insurance coverage (premiums paid per acre)

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Results

Increased FCI:
1) Increases in the quantity and intensity of short term debt use;
2) Increased equipment value and more labor-saving equipment used;
3) Increases farm household specialization: increased operator on-farm hours with decreased spouse on-farm hours

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  - ARMS observations can be linked over time (Weber et al., 2016)
  - Use data from 2000-2014
  - Farms must have had at least $10,000 in sales from the primary insurable crops
  - Must have participated in FCI in at least one year

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- Operations with and without crop insurance differ markedly `panel`
- Measure crop insurance participation using premiums paid per acre

Instrumental variable

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- Use the IV developed by Weber et al. (2016):
  - Maximum coverage levels means that some farmers can increase coverage more than others
  - Program limits are plausibly exogenous to current decision making
  - The ratio of the initial premium and the maximum premium therefore serves as an instrument for the difference in premiums between any two years:
  -

$$ln(PA_{i,t=2}) - ln(PA_{i,t=1}) = \theta ln(\frac{PA_{i,t=1}}{MaxPA_{i,t=1}}) \qquad (1)$$

Estimating equation: Farm panel

$$y_{it} = \beta_0 + \tau_t + \gamma_c + \beta_1 \underbrace{P_{it}}_{=\theta ln(\frac{PA_{i,t=1}}{MaxPA_{i,t=1}})} + \beta_2 \boldsymbol{F_{it}} + \epsilon_{ict} \tag{2}$$

where:

y_{it} is the outcome of interest for farm i in year t

P_{it} is FCI coverage

$\theta ln(\dfrac{PA_{i,t=1}}{MaxPA_{i,t=1}})$ is IV described previously

F_{it} are controls for time-variant operator characteristics

τ_t are year fixed effects

γ_c are county fixed effects

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- Increase in premiums paid increases farm operation's short term debt
- Results driven by increase in outstanding (rather than repaid) debt
- Effect concentrated among operations that are:
  - Less leveraged than average
  - Have higher DRCU than average
  - Have operators that are older

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No impact on long term debt (real estate) but investment in capital does increase:

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- Increase in annual spending on:
  - Non-tractor farm machinery ($2,700*)
  - Attachments for farm machinery ($1,700*)

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- Increase in annual spending on:
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  - Attachments for farm machinery ($1,700*)
- Increase in market value of farm machinery ($40,000***)

Is this equipment labor-saving? Labor allocations

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Farm households' response to risk management:

- Operators increase on-farm hours
- Spouses and other (business) partners decrease on-farm hours
- Net effect: fewer on-farm hours

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- Simultaneous increase in investment in equipment, which is less labor-intensive
    - Robustness check using machinery characteristics from Phase2
- Managerial vs. "employee" labor: Advantages to freeing up employee labor

Conclusion

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- Previous research (i.e. Weber et al. (2016)) finds minimal impact of crop insurance on the intensive margin of production, for example chemical expenditure.
  - Our research suggests alleviation of financial frictions leads to dynamic adjustments in capital/labor use by farm households
  - Farm household behavior and decision making is relevant for analysis of commercial agriculture

Thank you!

Any questions?

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Cross section summary statistics

| | Restricted cross section (select variables) | | |
	Obs	Mean	Std. Dev.
Insurance acres dummy	91,171	0.6797337	0.4665814
FCI premium paid per acre ($)	88,867	$ 7.24	$ 15.58
Outcomes			
totalshort	123,122	$ 266,389.20	$ 968,516.80
financed	122,860	0.556	15.68
dshort	123,122	$ 95,246.66	500031.9
repaid	123,122	$ 171,142.50	707988.9
dreale	123,122	$ 206,759.30	$ 895,115.90
dnreale	123,122	$ 84,739.47	$ 462,139.70
Operator characteristics			
Operator age	123,122	55.05	12.08
Total off-farm income	117,149	$ 53,171.37	$ 142,985.80
Operation characteristics			
Acres operated	123,122	1681.34	4262.38
Share of acres owned	123,122	0.551	1.738
Sales class			
$500,000+	123,122	42.18%	49.39%
$250,000-$499,000	123,122	18.56%	38.88%
$100,000-$249,000	123,122	18.47%	38.81%
$40,000-$99,999	123,122	11.08%	31.39%
$20,000-$39,000	123,122	4.54%	20.81%
$10,000-$19,000	123,122	2.40%	15.32%
$9,999 or less	123,122	2.76%	16.39%

Panel summary statistics

	Obs	Restricted panel Mean	Std. Dev.
Insurance acres dummy	22,371	0.702	0.457
FCI premium paid per acre ($)	27,921	$ 7.35	$ 14.28
Outcomes			
totalshort	30,957	$ 458,179.20	$ 1,519,330.00
financed	30,930	0.514	0.866
dshort	30,957	$ 157,107.20	$ 770,473.90
repaid	30,957	$ 301,072.00	$ 1,137,942.00
dreale	30,957	$ 329,667.50	$ 1,333,795.00
dnreale	30,957	$ 139,431.60	$ 627,065.80
Operator characteristics			
Operator age	30,957	54.60	11.09
Acres operated	30,957	2512.49	6212.23
Soybeans share	30,957	20.66%	23.60%
Corn share	30,957	17.89%	21.60%
Wheat share	30,957	9.58%	16.85%

Cross section: FCI participants vs. non-participants

	Obs	Any Insurance Mean	Std. Dev.	Obs	No Insurance Mean	Std. Dev.	Difference significant at:
Insurance acres dummy	64,991	0.954	0.210	26,180	0	0	***
FCI premium paid per acre ($)	64,145	10.03	17.56	24,722	0	0	***
Outcomes							
totalshort	86,989	$ 301,813.20	$ 936,834.50	36,133	$ 181,107.20	$ 1,035,899.00	***
financed	86,976	0.562	0.837	35,884	0.541	28.98	
dshort	86,989	$ 103,916.10	$ 480,045.50	36,133	$ 74,375.34	$ 544,592.50	***
repaid	86,989	$ 197,897.10	$ 673,003.30	36,133	$ 106,731.80	$ 782,117.70	***
dreale	86,989	$ 211,898.70	$ 841,170.00	36,133	$ 194,386.40	$ 1,013,182.00	***
dnreale	86,989	$ 87,799.53	$ 376,065.30	36,133	$ 77,372.48	$ 622,253.00	***
Operator characteristics							
Operator age	86,989	54.34	11.85	36,133	56.75	12.46	***
Total off-farm income	83,094	$ 51,218.25	$ 144,638.60	34,055	$ 57,936.95	$ 138,757.00	***
Operation characteristics							
Acres operated	86,989	1906.01	3642.47	36,133	1140.45	5436.16	***
Share of acres owned	86,989	0.444	0.719	36,133	0.808	2.992	***
Sales class							
$500,000+	86,989	45.21%	49.77%	3.61E+04	34.90%	47.67%	***
$250,000-$499,000	86,989	20.62%	40.45%	36,133	13.60%	34.28%	***
$100,000-$249,000	86,989	19.05%	39.27%	36,133	17.07%	37.63%	***
$40,000-$99,999	86,989	10.01%	30.01%	36,133	13.68%	34.36%	***
$20,000-$39,999	86,989	3.18%	17.54%	36,133	7.81%	26.84%	***
$10,000-$19,999	86,989	1.27%	11.21%	36,133	5.13%	22.05%	***
$9,999 or less	86,989	0.67%	8.15%	36,133	7.80%	26.82%	***

*** $p<0.01$, ** $p<0.05$, * $p<0.1$; subset of control variables from cross section analysis

Panel: FCI participants vs. non-participants

	Obs	FCI Panel: Insurance Mean	Std. Dev.	Obs	FCI Panel: No Insurance Mean	Std. Dev.	Difference significant at:
Insurance acres dummy	16,780	0.9359356	0.2448749	5,591	0	0	***
FCI premium paid per acre ($)	21,177	$ 9.69	$ 15.69	6,744	0	0	***
Outcomes							
totalshort	23,137	$ 483,616.30	$ 1,462,872.00	7,820	$ 382,918.70	$ 1,673,101.00	***
financed	23,135	0.570	0.791	7,795	0.346	1.040	***
dshort	23,137	$ 157,104.40	$ 763,784.40	7,820	$ 157,115.70	$ 789,984.00	
repaid	23,137	$ 326,511.90	$ 1,063,437.00	7,820	$ 225,803.00	$ 1,331,468.00	***
dreale	23,137	$ 313,314.50	$ 1,152,952.00	7,820	$ 378,051.10	$ 1,762,606.00	***
dnreale	23,137	$ 133,104.60	$ 506,455.10	7,820	$ 158,151.10	$ 892,930.30	***
Operator characteristics							
Operator age	23,137	54.27	10.92	7,820	55.60	11.53	***
Acres operated	23,137	2772.20	5311.63	7,820	1744.10	8277.43	***
Soybeans share	23,137	23.61%	23.92%	7,820	11.95%	20.28%	***
Corn share	23,137	20.31%	22.11%	7,820	10.75%	18.22%	***
Wheat share	23,137	11.11%	17.81%	7,820	5.06%	12.60%	***

*** $p<0.01$, ** $p<0.05$, * $p<0.1$