The Effect of Time Commitments on Crop Insurance Demand: An Experiment

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Overview

- Behavioral motivation: myopic loss aversion (MLA)
  - People tend to treat a series of lotteries one-at-a-time
  - Fail to see changing risk profile over a series vs. one-off
  - Forced time commitments can lead to better outcomes
- Policy motivation: potential for time commitments in FCIC?
  - ARC/PLC had 5-year commitments in 2015 Farm Bill
  - Can we increase participation and/or lower subsidies?
- This paper: an experimental test
  - Time commitment increases insurance demand
  - 5-periods commitment ~ 20% additional subsidy

MLA Background

* Modeled as linear loss aversion (prospect theory) combined with myopia (failure/inability to aggregate over gambles).
* Hypothesized to be responsible for overly safe (and low return) retirement allocations.
* Key prediction:

  subjects fail to recognize how aggregating positive expectation gambles removes risk, shifting the distribution into gains domain.
* Seminal experimental papers (QJE, 1997):
  * Thaler et al.: stocks vs. bonds fund choices
  * Gneezy & Potters: repeated +EV gambles
  * Both rely on between subjects identification. Treatment is aggregated gambles (choices binding for multiple periods).

MLA Example

* It's not clear exactly how subjects fail to aggregate over gambles, but one theory is "non-belief in law of large numbers" or *NBLLN* (Benjamin et al., 2016).
* People tend to assume risk of 7 heads out of 10 fair coin flips is same as 70 heads out of 100 fair coin flips.
* More generally, suppose a +EV gamble, $X \sim (\mu > 0, \sigma)$, with N independent draws:
  * Correct evaluation: $Y \sim (N\mu, \sqrt{N}\sigma)$, with higher Pr(gain).
  * *NBLLN* evaluation: $Y \sim (N\mu, N\sigma)$, with same Pr(gain).

Does MLA affect crop insurance demand?

- MLA predictions are clear for a series of +EV lotteries:
  - Subjects fail to see global choice in each step
  - Time commitments make aggregation explicit
    - More participation and better payoffs, ex-post.
- MLA predictions are less clear for crop insurance:
  - Compounding effects over time not analytically tractable
  - Subsidized insurance is +EV, but how is it *framed*?
- We simulated effects of time commitments with myopia:
  - Babcock (2015) prospect theory model/representative farmers
  - Narrow framing: same buy-up/participation with less subsidy
  - Broad framing: same, but buy-up increases

Experimental Design

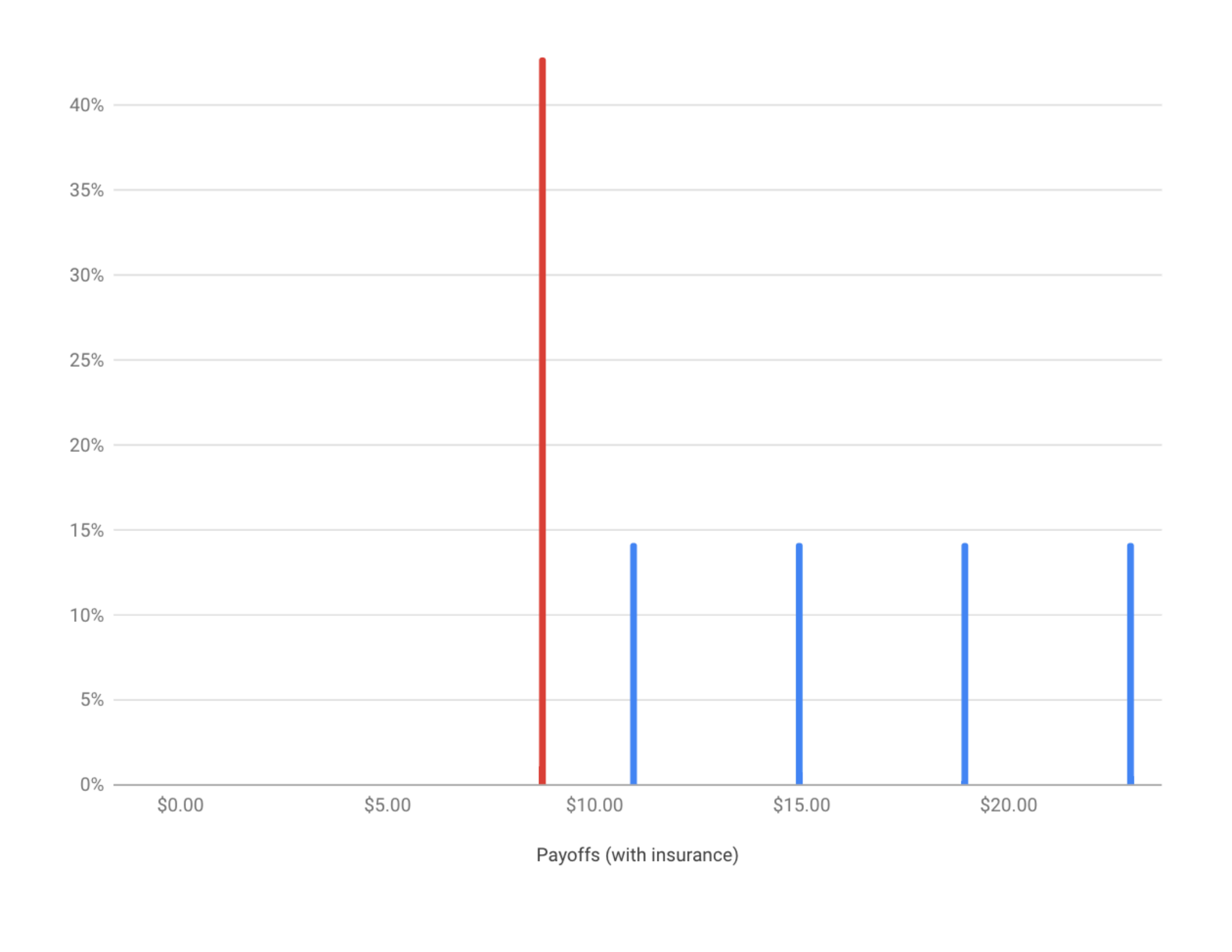
* Subjects face 30 periods where they can buy crop insurance
* Uniform 7-point distribution of revenues (4 random profiles)
* Random coverage amount (guarantees similar to FCIC)
* Random subsidy from 70% below fair to 100% above fair
* 15 choices high frequency
* 3 choices low frequency, binding for 5 periods (treatment)
* Within-subjects design, treatment order randomized
* Embedded in larger study, incentive compatible due to random stage chosen for payment at end.

Please review the charts and indicate whether you will buy insurance at the quoted price.

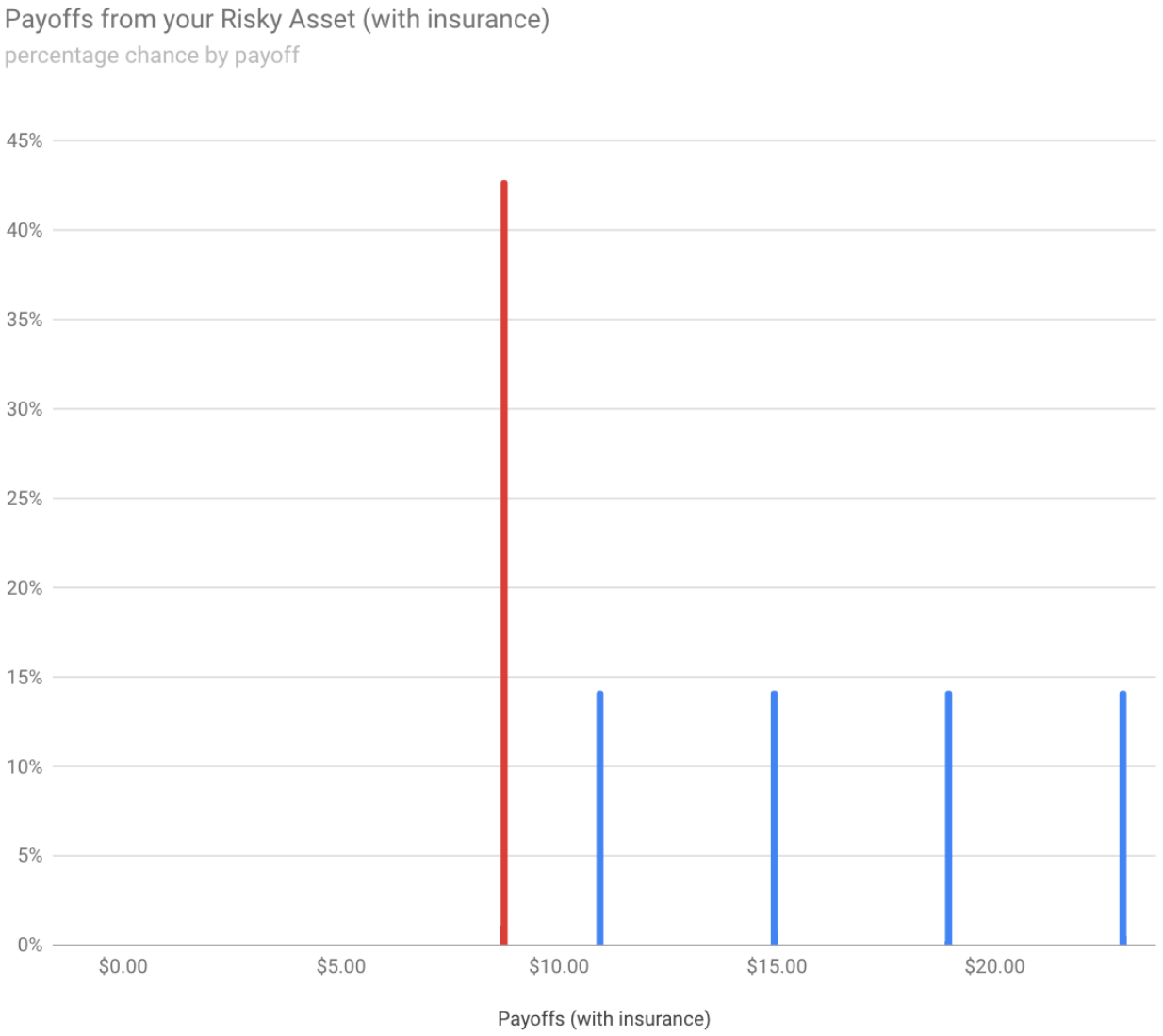
The charts below show your payoffs both with no insurance and with insurance. You can mouse over (or tap) each "bar" to see the payoff amount and its percentage chance of occurring.

Payoffs from your Risky Asset (no insurance)

percentage chance by payoff


40%
35%
30%
25%
20%
15%
10%
5%
0%
$0.00
$5.00
$10.00
$15.00
$20.00
Payoffs (with insurance)

Note: the payoffs *with* insurance are adjusted for the price you pay when buying it.



Insurance Price: $0.96

Guarantee: $9.60

○ Buy Insurance in this Stage ○ Decline Insurance in this Stage

Empirics

* First 274 subjects of 500 (URI, MSU and Purdue)
* Regression test of treatment effect (5-period commitment) on insurance purchase choice (yes/no)
* Controls are subsidy, standardized coverage measure, plus subject-level fixed effects.
* Linear probability model with subject-level clustered standard errors:

$$Y_{it} = \alpha + D_{it} + \beta \cdot \text{subsidy} + \gamma \cdot \text{coverage} + \delta_i + \epsilon_{it}$$

Table: Fixed Effects Regression Results (Linear Probability Model)			
Dependent Variable: Insured			
	Model 1:	**Model 2:**	**Model 3:**
Covariates	**No Trend**	**With Trend**	**Pre/Post Only**
Treatment	0.0508**	0.0607***	0.0723*
	(0.0173)	(0.0170)	(0.0348)
Subsidy Rate	0.0027***	0.0027***	0.0028***
	(0.0001)	(0.0001)	(0.0005)
Coverage Level	0.0029***	0.0029***	0.0012
	(0.0006)	(0.0006)	(0.0017)
Trend	--	-0.0089***	--
		(0.0013)	
Constant	0.4236***	0.5036***	0.5096***
	(0.0389)	(0.0411)	(0.1115)
Subject Fixed Effects?	Y	Y	Y
Clustered Std. Errors?	Y	Y	Y
Corr(u_i, Xb)	-0.021	-0.020	-0.044
F-Statistic	134.89	114.09	14.93
Prob > F	0.000	0.000	0.000
N	4932	4932	548
Notes:			
Standard errors in parentheses.			
*,**,*** denote $p < 0.05$, $p < 0.01$, $p < 0.001$, respectively.			

Conclusions

- Robust treatment effect
  - About 5 percentage points extra participation (10% increase)
  - Equivalent to 15-20% marginal subsidy

- Potential savings for crop insurance program?
  - Depends whether results extrapolate to farmers
  - Technical details of what time commitments look like