



Farm-level choice of crop insurance coverage level: A preliminary assessment

Rob Johansson, Tom Worth, and Joe Cooper

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Motivation

1. What happens if you change subsidy rate?
 - Do producers increase/decrease coverage?
 - Do producers increase/decrease acres covered?
2. What happens if prices change?
 - Do producers insure more/less?
 - Do producers adopt different risk management strategies?
3. What happens if you revise premium rates?

Examples

- “...A 5 percentage point reduction in Federal premium subsidies for revenue policies would potentially save millions, and larger reductions would save more ...” GAO 2014
- “...Reducing the crop insurance subsidies as specified by this option (average 40 percent subsidy) would save \$27 billion over that period (next 10 years)...” CBO 2013
- “...In addition, the Administration is proposing to reduce producers’ premium subsidy by 2 basis points for all but catastrophic crop insurance, where the subsidy is greater than 50 percent. This will have little impact on producers...This proposal is expected to save \$3.3 billion over 10 years...” OMB 2013

Previous Work

1. Pre-ARPA vs. Post-ARPA

- Less familiarity with the program
- Large changes in the program
- Few sales of revenue insurance

2. After 2008

- Familiarity with programs
- Smaller changes to the programs
- Heavy reliance on revenue insurance

Data used in previous studies

1. Generally County-Level

- Aggregate measures of participation
 - Liability
 - Coverage
- Aggregate measure of yield and acres

2. Farm-level

- Participation is farm-level
 - Liability
 - Coverage
- Farm measures of yield and acres

And apparently, no datasets with choice of coverage rate at the farm level.

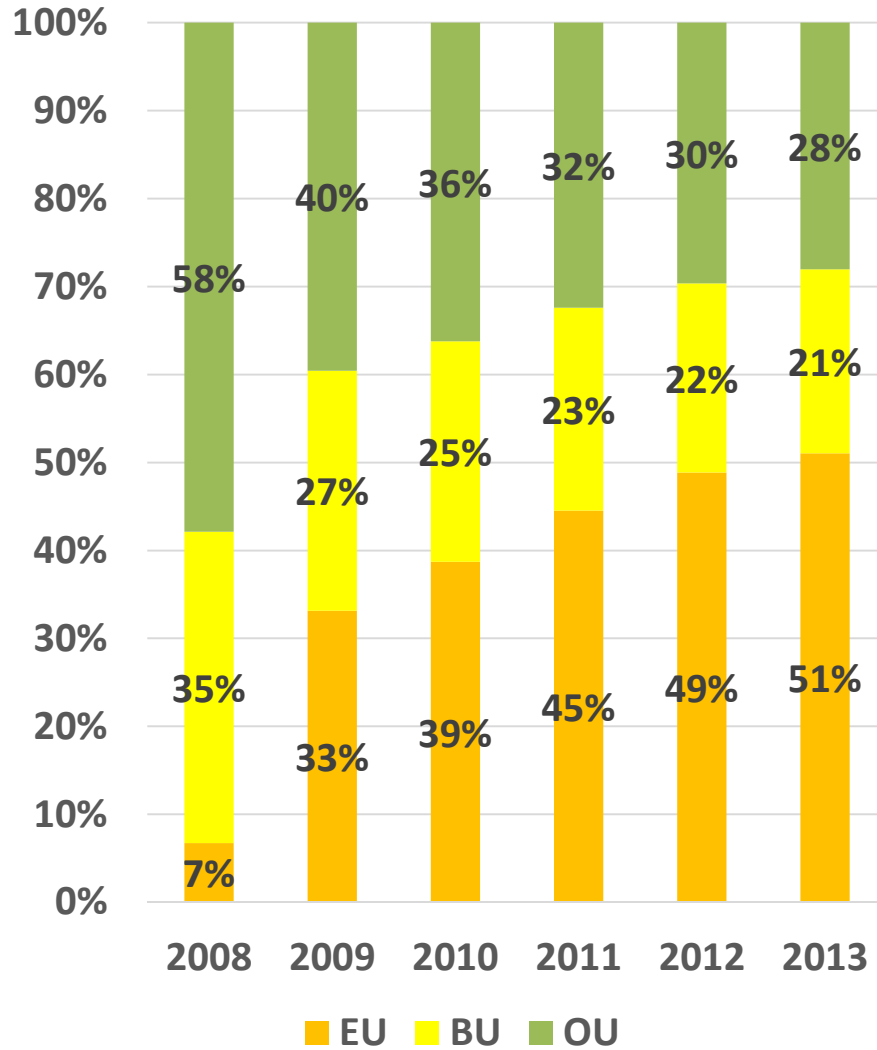
Data

- Farm-level data of revenue insurance
- Around some policy change

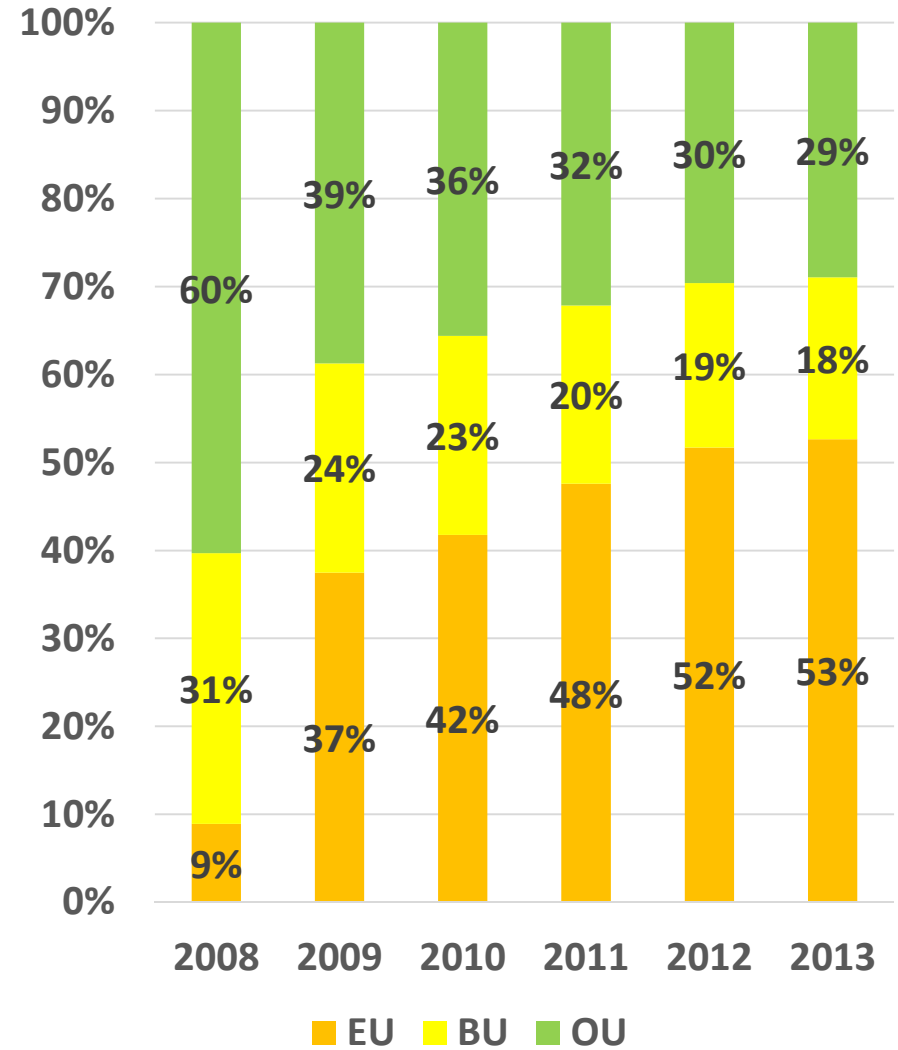


- 2008 Farm Bill increased subsidy rate for enterprise units.
 - ✓ Larger areas with lower risk, lower premium, lower premium subsidies, lower complexity.

Insured Acres by Unit Structure - Soybeans

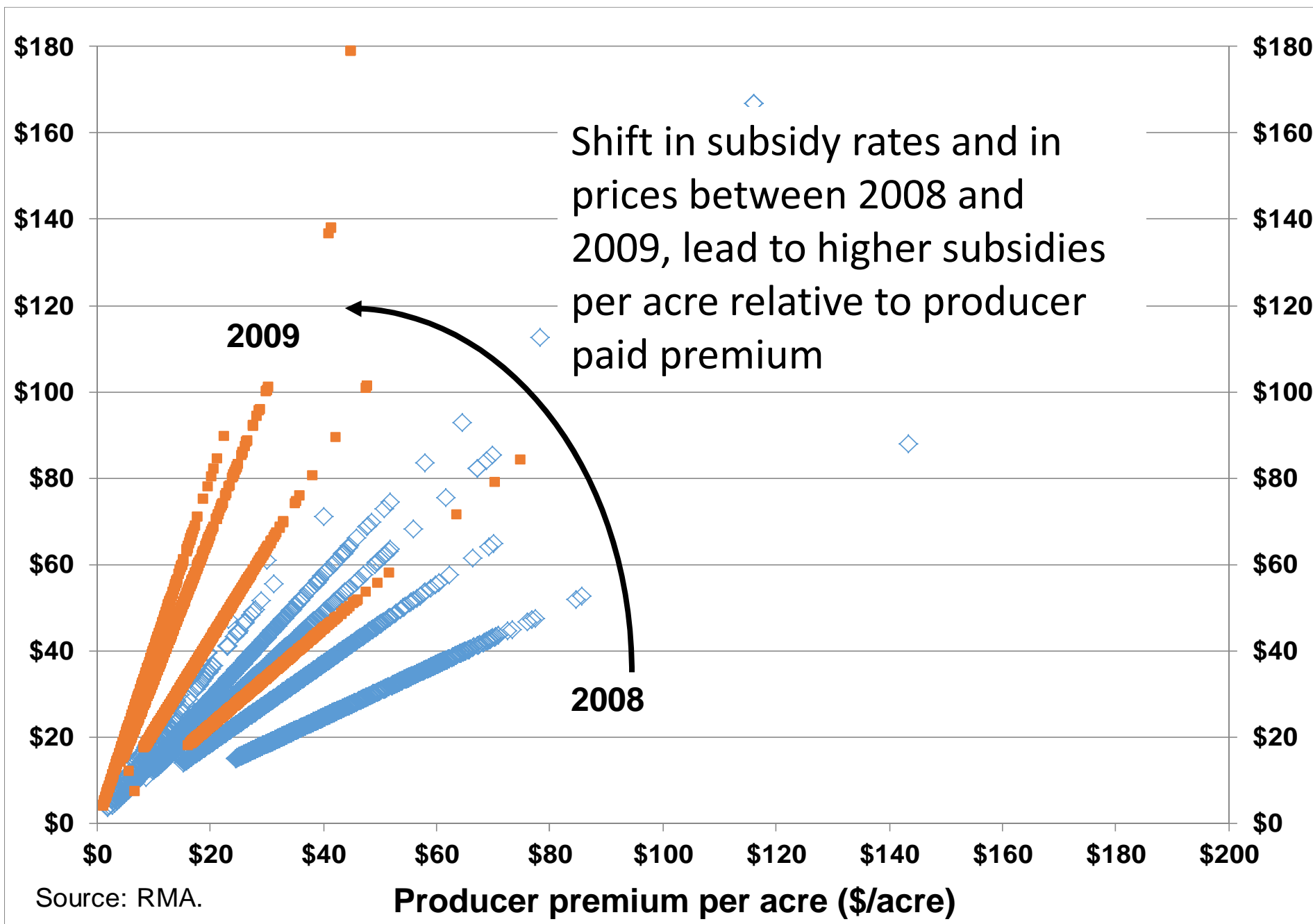


Insured Acres by Unit Structure - Corn



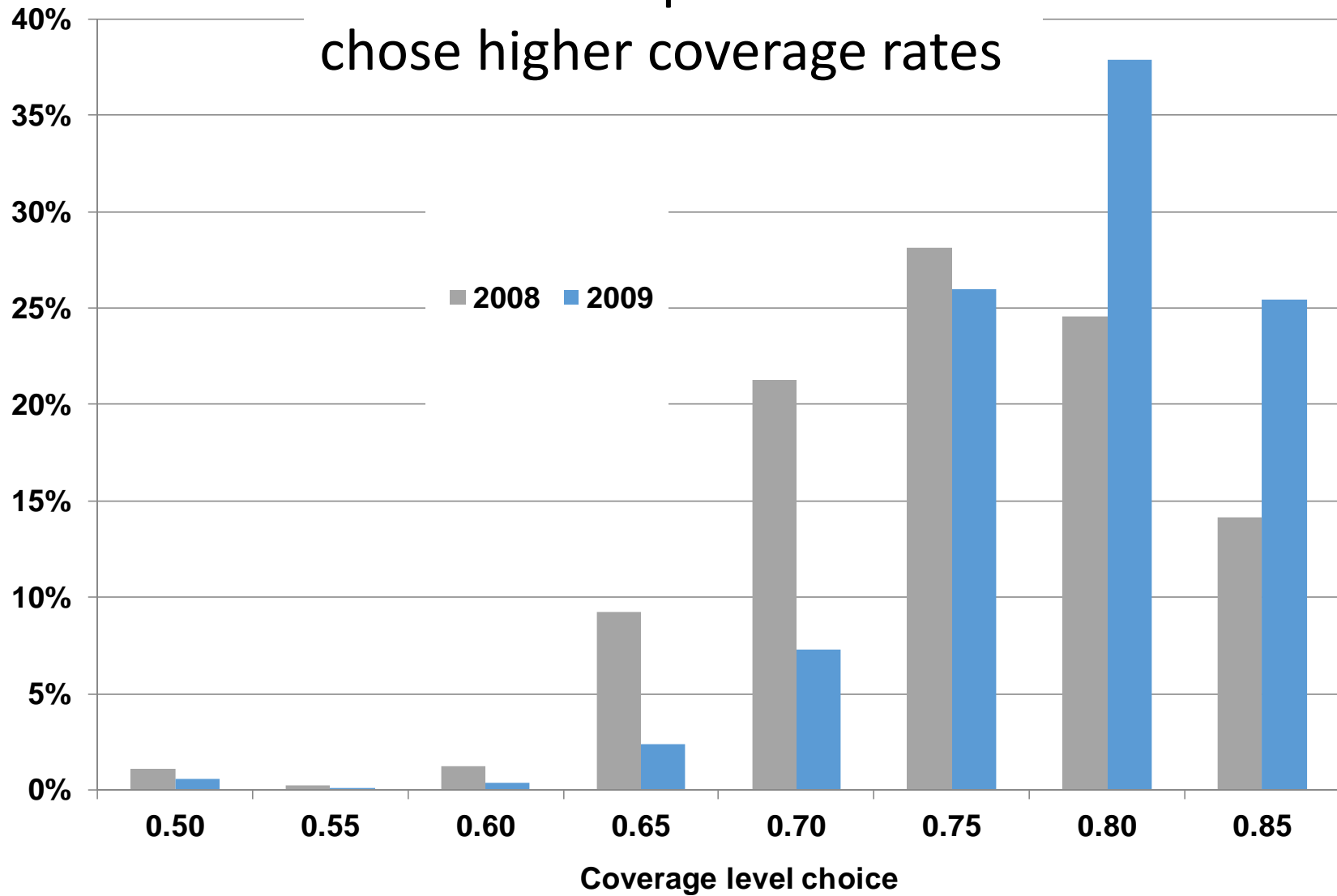
Subsidy per acre (\$/acre)

Subsidy per acre (\$/acre)



Percent of acres

In 2009 more producers
chose higher coverage rates



Summary stats for the data

	Variable	Total (\$mil.)	Per acre
2008 (n = 13,502)	Liability	\$ 3,480.00	\$ 648
	Acres	\$ 5.28	\$ 391
	Prod. Prem	\$ 128.00	\$ 24
	Subsidy	\$ 128.00	\$ 25
2009 (n = 14,540)	Liability	\$ 2,960.00	\$ 507
	Acres	\$ 5.76	\$ 396
	Prod. Prem	\$ 86.80	\$ 15
	Subsidy	\$ 167.00	\$ 30

Liability is down, even though acres and coverage levels are up (lower prices)

		<u>Average per acre</u>				
Coverage	Year	subsidy	prod. premium	total premium	revenue	Obs.
50	0	\$15.59	\$7.68	\$23.26	\$765.90	73
	1	\$12.00	\$3.00	\$15.00	\$625.19	45
55	0	\$17.78	\$10.00	\$27.78	\$814.00	21
	1	\$19.74	\$4.94	\$24.68	\$621.98	10
60	0	\$19.39	\$10.91	\$30.30	\$750.00	88
	1	\$24.26	\$6.07	\$30.33	\$578.15	16
65	0	\$17.69	\$12.29	\$29.99	\$826.09	1,170
	1	\$21.30	\$5.33	\$26.63	\$625.96	326
70	0	\$24.50	\$17.02	\$41.52	\$809.04	2,668
	1	\$28.71	\$7.18	\$35.89	\$600.29	1,091
75	0	\$26.64	\$21.79	\$48.43	\$846.04	3,925
	1	\$31.71	\$9.47	\$41.18	\$610.25	3,559
80	0	\$26.43	\$28.64	\$55.07	\$876.26	3,501
	1	\$31.19	\$14.68	\$45.87	\$642.96	5,779
85	0	\$23.68	\$38.64	\$62.32	\$908.74	2,056
	1	\$26.78	\$23.74	\$50.52	\$683.71	3,714

Model Selection

- Each producer faces a menu of choices: acres covered, type of policy, unit structure, and coverage level
- We focus on the last choice, assuming that acres covered and policy choice is relative constant (and we have not looked at unit data)
- Question of interest:
 - “How does the subsidy rate affect a producer’s coverage level choice?”

Discrete choice analysis of farm level crop insurance decisions date at least as far back 1996, but these focus on decisions at the extensive margin.

That is, they tend focus on upper-level decisions, such as to insurance or not, or choice of insurance product.

- Coble, knight, Pope and Williams (1996) use a binomial probit to examine the decision to participate in FCI or not.
- Sherrick et al (2004) utilize a multinomial model examine choices between hail, yield, and revenue products, and consequently, without the need for alternative-specific variables.
- Hojjati and Bockstael (1988) use a multinomial model to examine choices between insured and non-insured acreage.
- Mishra and Goodwin (2003) use a multinomial model to examine choices between yield and revenue insurance.
- Velandia et al (2009) use a multivariate probit to analyze risk management choices that include private risk management alternatives such as savings.

Choice of Coverage

	<u>Coverage Level</u>							
	50%	55%	60%	65%	70%	75%	80%	85%
EU'08	67%	64%	64%	59%	59%	55%	48%	38%
EU'09	80%	80%	80%	80%	80%	77%	68%	53%

Subsidy rates were increased in the 2008 Farm Bill for enterprise units to be equal to the subsidy rates offered on optional and basic units

Prices for major commodities also fell in 2009 relative to 2008.

Producer decision framework

$$\begin{aligned} \max_{A, \theta} & \left\{ \psi \left[\frac{w_i}{q} + \right. \right. \\ & \left. \sum_{j=1}^n \frac{1}{q} \left(P_j Y_{ij} + I_{ij} [Y_{ij}^b, P_j, Y_j, \theta_{ij}] - \rho_{ij}^* \right) \right. \\ & \left. \left. \left[P_j^b, Y_{ij}^b, P_j, \theta_{ij}, s_{\theta_{ij}}, G_{ij} \right] - C_{ij} \right) A_{ij}, \varphi_i \right\} \\ \text{s.t. } & f(\mathbf{A}, \boldsymbol{\theta}) = 0, \end{aligned}$$

- Over \mathbf{A} acres and coverage rate ($\boldsymbol{\theta}$)
- \mathbf{S} is subsidy rate

Using a multinomial logit

$$p_{ig} = \frac{\exp(x'_{ig}\beta + z'_i\gamma_g)}{\sum_{l=1}^m \exp(x'_{il}\beta + z'_i\gamma_l)}, \quad g = 1, \dots, m \text{ choices of coverage rate.}$$

$$\frac{\partial p_g}{\partial x_k} = \begin{cases} p_g(1 - p_g)\beta & g = k \\ -p_g p_k \beta & g \neq k \end{cases}$$

Positive coefficient (β) implies that the marginal effect of that variable increases the probability of that choice relative to the other choices.

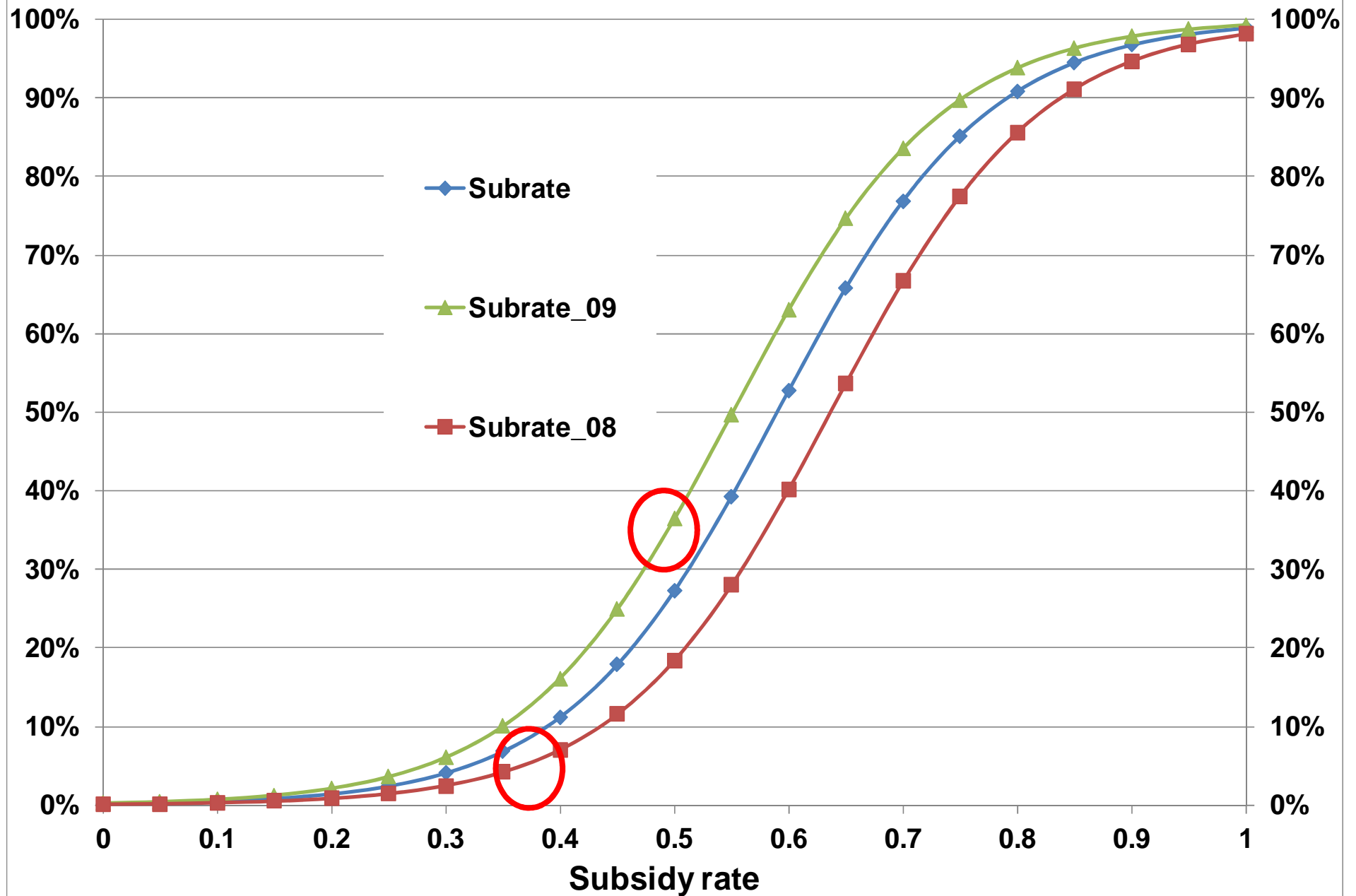
		<u>Model 3</u>	
Coverage Choice	Variable	Coefficient	P> z
ALL	subrate	10.9124	0.0000
	suba		
	pprema	-0.0839	0.0000
	tprema		
50 percent	----- base alternative -----		
55 percent	acre	-0.0001	0.8610
	aph	-0.0051	0.0140
	year	-0.8352	0.0360
60 percent	acre	-0.0005	0.2250
	aph	0.0068	0.0000
	year	-1.5244	0.0000
65 percent	acre	0.0001	0.6010
	aph	0.0306	0.0000
	year	-1.7304	0.0000
70 percent	acre	0.0004	0.1330
	aph	0.0371	0.0000
	year	-1.4245	0.0000
75 percent	acre	0.0004	0.1490
	aph	0.0457	0.0000
	year	-0.9590	0.0000
80 percent	acre	0.0006	0.0250
	aph	0.0542	0.0000
	year	-0.3484	0.0550
85 percent	acre	0.0007	0.0070
	aph	0.0642	0.0000
	year	0.1272	0.4900

A higher subsidy rate makes it more probable that the producer will select that coverage level, all else constant.

A higher producer premium makes it less probable that the producer will select that coverage level, all else constant.

Looking at 85% coverage choice; larger acres and yields and lower prices (year) made it more likely that produces would choose the highest level of coverage.

Probability of selecting 85% coverage rate



Next Steps --- lots of them

- First, comments on the paper/methods/etc. are most welcome.
- Relax IIA: We want to try some new models; e.g., random effects logit or multinomial probit
- Bootstrapping to correct for correlation in std. errors.
- Other crops
- Other unit structure
- Dynamic models, lagged variables