Evaluating the Interaction between Farm Programs with Crop Insurance and Producers' Risk Preferences

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Outline

- Problem statement
- Senate proposed farm programs
- Simulation model, methods and data
- Summary statistics from simulation model
- Certainty equivalent maximization results
- Suggestions for further research

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Introduction

- Farm programs are integrated with crop insurance and have insurance-type structure
  - Farm managers have challenge of understanding and quantifying stochastic interactions between policy tools and crop insurance
  - Managers need to understand correlation between farm-level yields, county-level yields, U.S. MYA prices and crop insurance prices
- Risk preferences may be important to this decision
  - Risk neutral prefer largest return over risk management cost
  - Risk averse may prefer a lower expected return in exchange for reduced down-side risk

Problem Statement…

- Preferred alternatives likely to be location specific and crop specific as some policies appear to have components with preferential treatment

- Some proposed policies require enrollment of all crops under operational control in the program. Managers need to understand how alternatives perform for each crop to make enrollment decisions.

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Researchable Problem

- Simulate the returns over risk management costs for a non-irrigated Illinois corn-soybean farm and an irrigated Mississippi cotton-rice farm.

- Effect of risk preferences on the risk efficient set of risk management alternatives determined for varying levels of risk-aversion

Senate Farm Bill Proposal Overview

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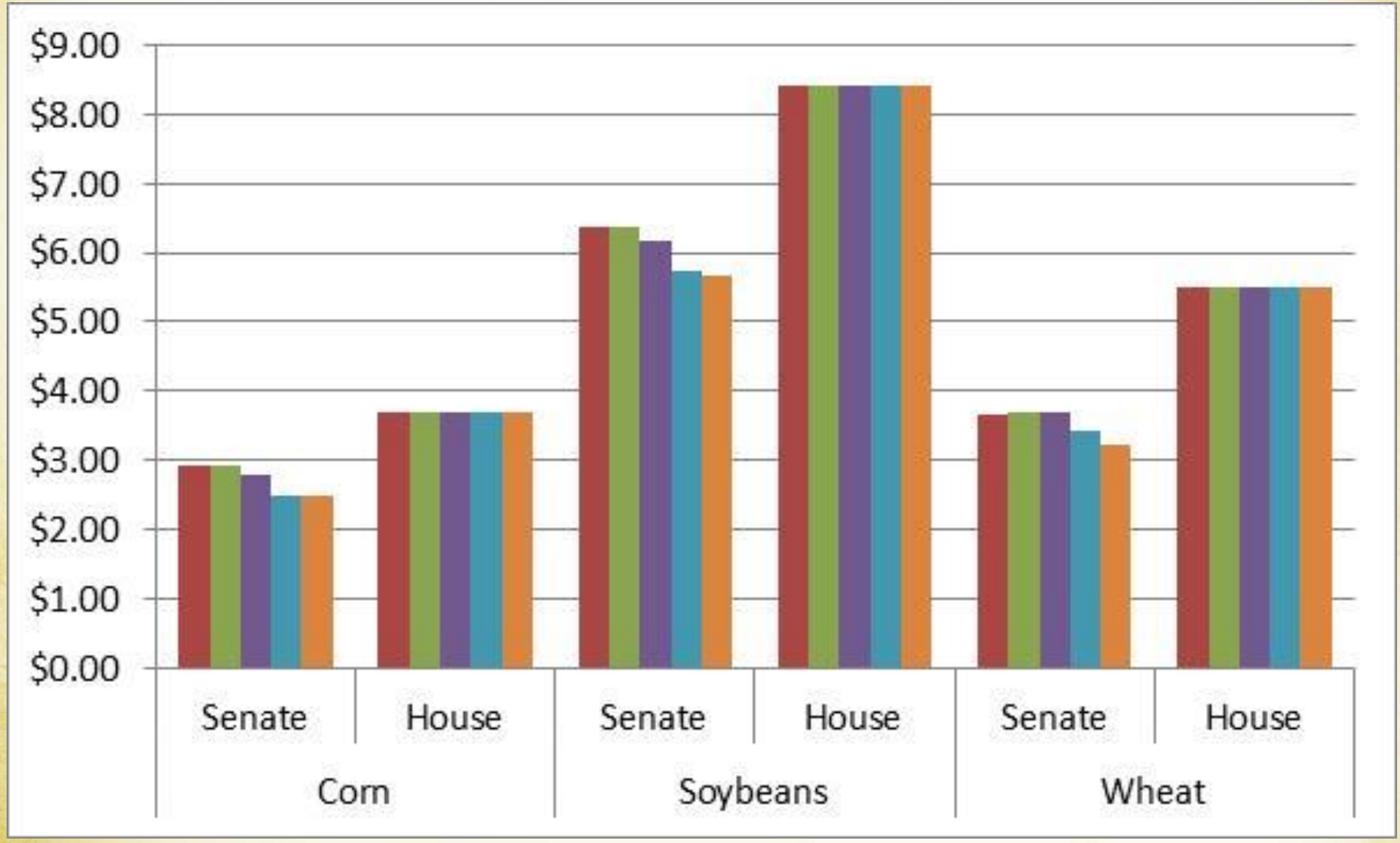
	Senate
Direct Payments	Repeals
Counter-Cyclical Payments	Repeals CCP. Creates Adverse Market Payments (AMP) Payment is difference between Reference Price and Marketing-Year Average price Reference is 55% of Olympic Average Marketing-Year Average Price so protection adjusts to market Rice is $13.30/cwt. and Peanuts $523.77/ton Paid: 85% Base x CCP yield

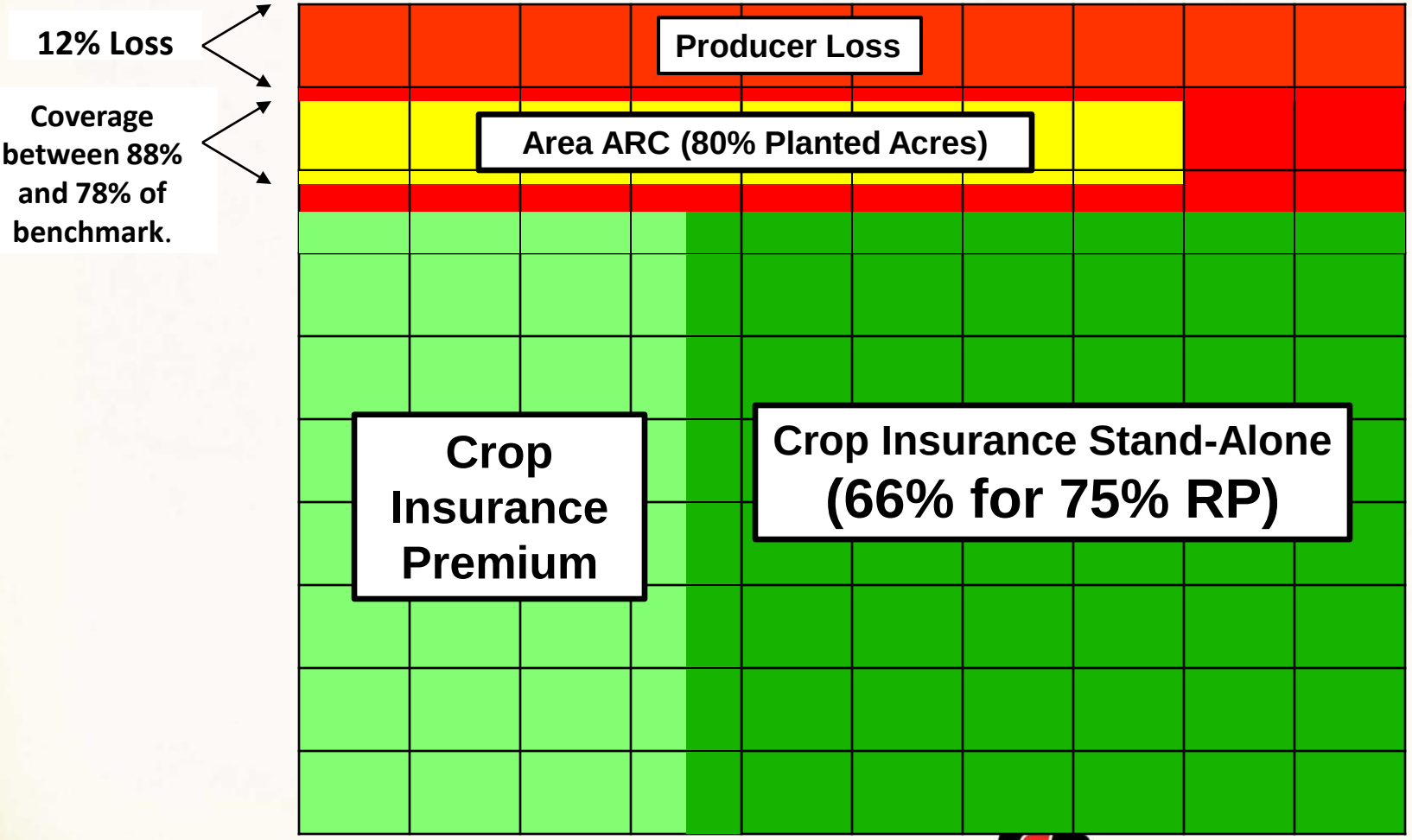
Implied Reference Prices – House v. Senate



	Senate
Average Crop Revenue Election (ACRE)	Repeals Creates Agriculture Risk Coverage (ARC) Can combine with AMP
	Payments made on planted and prevented planted acres Payments triggered when actual revenue falls below 88% of benchmark
	Area (county) and individual (farm) level program
	Benchmark is 5-year Olympic average yield x 5-year Olympic average MYA Price
	Paid on 80% (county) or 65% (individual) planted acres + 45% prevented-planted acres. Can’t exceed base.

Agriculture Risk Coverage Only (Area Election)

For ARC Benchmark Revenue Based On 5-Year Olympic Average County Yields/Marketing Year Average Prices



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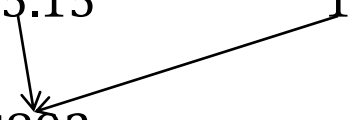
Agricultural Risk Coverage Example – County Based (from Senate Bill)

Year	MYA Price	Howard County Yield
2008	$4.06	188
2009	$3.55	186
2010	$5.18	169.4
2011	$6.22	163.9
2012	$7.20	154.2
Olympic Average	$5.15	173.1
Benchmark Revenue	$892	
ARC Guarantee (88% Benchmark)	$785	



ARC payment made when Actual County Revenue is between $785 and $706/acre (10% loss cap)

Supplemental Coverage Option (SCO)

Senate
Covers part of the deductible of the underlying policy An area GRIP-Like product that can be combined with an underlying farm-level or area-level policy. Must purchase underlying insurance SCO payments after a 10% loss from Expected county crop value Payments can not exceed the deductible of the underlying product Can be combined with ARC – deductible is 22% instead of 10% Premium subsidy of 65%

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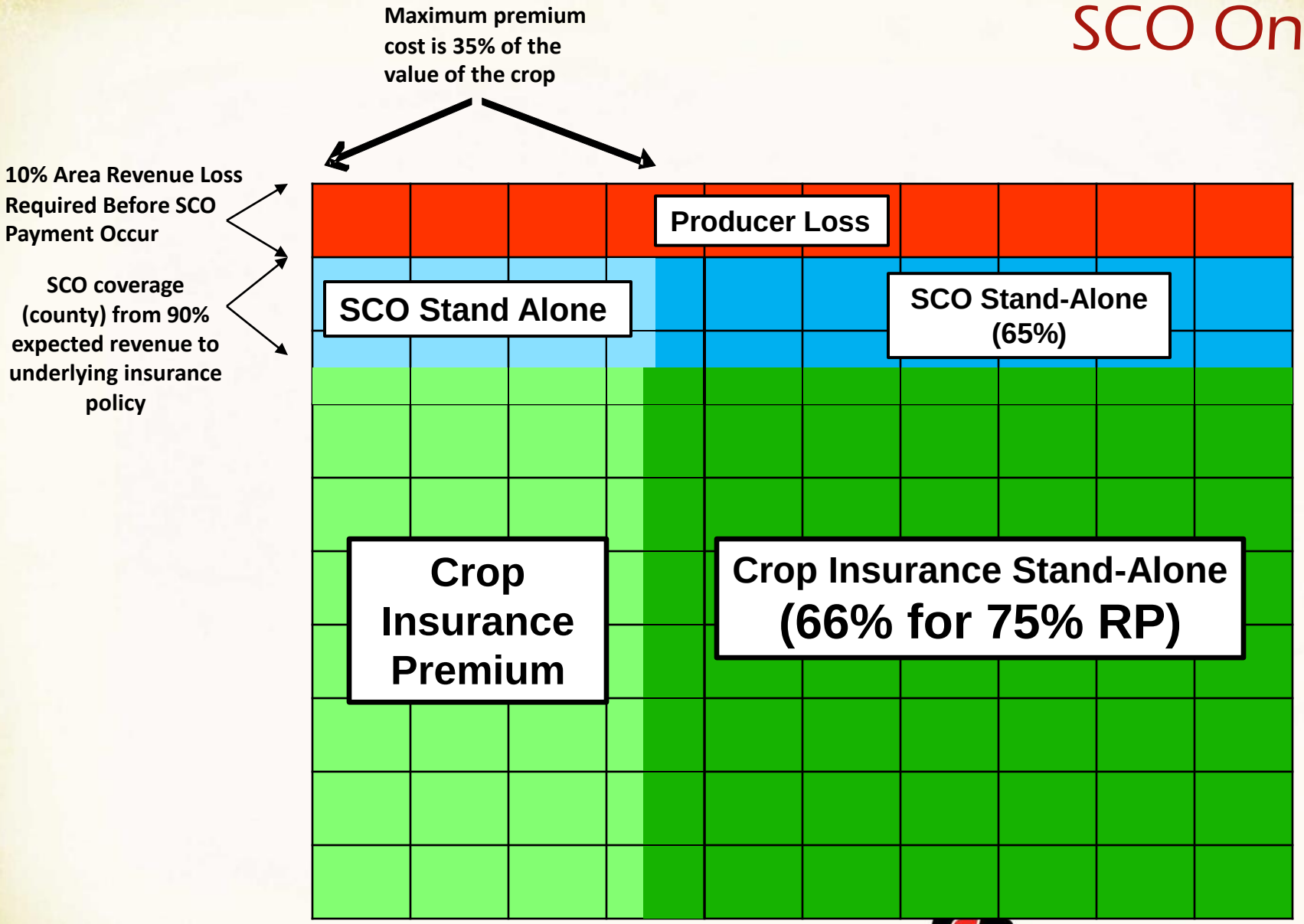
SCO Only



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SCO Example with RP (75% Coverage)

- County GRP Yield = 175 bu/acre
- RP Price = $5.65
- SCO Guaranteed Revenue = $989/acre
- SCO Loss Trigger = $890/acre (10% loss)
- If actual county revenue is less than $890, a SCO payment will be made
- Indemnity similar to GRIP insurance where the indemnity is based on % loss and the guaranteed revenue with % capped by underlying coverage level

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Stacked Income Protection Plan (STAX)

Senate
Only for cotton
Revenue based area-wide policy: GRIP-like
120% productivity factor
Do not have to buy underlying insurance
Payments triggered after 10% loss of expected county revenue
Payments capped by underlying product's coverage level or 30%
80% premium subsidy

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Stochastic Simulation Model, Data and Methods

- Stochastic simulation model of net revenue from crop production developed for McLean County Illinois corn-soybean farm and Bolivar County Mississippi cotton-rice farm
  - Simulate stochastic farm yield, county yield, RP projected and harvest price, and marketing-year average price for each crop for a five-year farm bill
  - Yield and price distributions used to generate distributions of crop revenue, RP indemnities, AMP program payments, ARC payments, and SCO payments with and without ARC
    - STAX for cotton

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Simulation Model

- County yields from 1996-2012 used to simulate county and farm yields (USDA-NASS).
  - Error terms from de-trended county yields used with an expansion factor to simulate farm yields
  - County and farm yields drawn from a Beta distribution with a county/farm correlation of 0.45 exogenously imposed

- Prices simulated by 5-year random walk assuming a lognormal distribution correlated to the yields (USDA: NASS and USDA: RMA)
  - 500 five-year set of yields and prices simulated for each crop and each location

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Methodology

- Farmer's cost of risk management incorporated in net revenue
  - AMP and ARC administered by FSA with no direct cost
  - SCO, STAX and RP administered by RMA with a subsidized premium paid by farmer
- Actuarially fair RP, SCO and STAX premiums calculated from simulated price and yield data
  - A&O is average of RMA's per acre insured administrative expenses, other program fund costs, and other administrative and operative fund costs from 2003-2012 ($6.04 per acre)
  - Farmer subsidies for RP, SCO (65%) and STAX (80%) included
  - Farmer's share is Actuarially fair premium + A&O less subsidy
    - Farmers pay a share of A&O to keep premiums positive

Methodology

- Annualized net revenues calculated for each crop and farm
  - Net present value revenue less risk management cost determined for each 5-year stochastic price/yield series
  - Discounted at 5% discount rate
  - Each NPV annualized for a distribution of 500 five-year annuities

- The Certainty Equivalent of each distribution determined using a power expected utility function with coefficients of relative risk aversion from 0 to 5

Scenarios Simulated

Alternative	Description
Do Nothing	Do not participate in crop insurance, AMP, ARC or SCO
RP Only	Only purchase RP insurance at the 55% to 85% level
AMP Only	Only participate in AMP
ARC Only	Only participate in ARC at individual or area level
RP + AMP	RP insurance at the 55% to 85% levels plus participation in AMP
RP + ARC	RP insurance at the 55% to 85% levels plus participation in ARC at either the individual or area level
RP + SCO	RP insurance at the 55% to 85% level plus participation in SCO
RP + SCO + AMP	RP insurance at the 55% to 85% levels plus SCO plus the AMP program
RP + SCO + ARC	RP insurance at the 55% to 75% level s plus SCO plus ARC at either the individual or area level

Selected Results of the Simulation of the Senate Proposal

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The Importance of the Regulations…

"It depends on what the meaning of the word 'is' is."

William Clinton
42nd President of the United States
1946 -

Simulated Illinois Corn Farm Annualized Net Revenues ($/acre)

Alternatives [1/]	Total Distribution [2/] Mean	Std. Dev.	Max	Min	Positive Net Annualized Values: Probability of Payment [3/]	Expected Value of Payment [4/]
Revenue	$934	$184	$1,761	$504		
RP55	-$2.29	$0.31	$4.60	-$2.31	0.2%	$4.60
RP60	-$2.43	$1.11	$14.08	-$2.56	1.4%	$6.31
RP65	-$2.21	$2.47	$23.68	-$2.68	4.6%	$6.92
RP70	-$1.85	$4.98	$38.01	-$3.56	13.4%	$8.44
RP75	-$0.53	$9.14	$55.71	-$5.27	25.7%	$11.95
RP80	$1.38	$14.68	$71.34	-$9.06	37.7%	$16.30
RP85	$3.31	$21.57	$97.81	-$16.78	45.9%	$21.52
SCO-55	$15.36	$23.57	$107.94	-$12.08	67.5%	$26.60
SCO-60	$15.36	$23.57	$107.94	-$12.08	67.5%	$26.60
SCO-65	$15.35	$23.52	$107.95	-$12.07	67.5%	$26.57
SCO-70	$15.12	$22.88	$104.48	-$11.94	67.5%	$26.17
SCO-75	$14.21	$20.98	$91.70	-$11.45	68.7%	$24.15
SCO-80	$11.85	$17.03	$69.77	-$10.17	70.9%	$19.53
SCO-85	$6.89	$10.23	$45.09	-$7.48	73.1%	$11.17
ARC-SCO55	-$0.12	$7.25	$36.34	-$3.70	24.6%	$10.23
ARC-SCO60	-$0.12	$7.25	$36.34	-$3.70	24.6%	$10.23
ARC-SCO65	-$0.14	$7.15	$36.35	-$3.69	24.6%	$10.12
ARC-SCO70	-$0.36	$6.08	$27.07	-$3.57	24.6%	$8.82
ARC-SCO75	-$1.28	$3.00	$11.49	-$3.07	25.7%	$3.42
ARC-Individual	$14.87	$11.74	$47.34	$0.00	80.2%	$18.53
ARC-Area	$17.06	$15.14	$63.32	$0.00	76.8%	$22.20
AMP	$0.22	$1.43	$19.02	$0.00	5.2%	$4.18

Illinois Corn Farm Certainty Equivalent Analysis

CRRA [1/]	Revenue [2/]	Revenue + RP85	Revenue + RP75 + SCO	Revenue + RP80 + SCO	Revenue + RP85 ARC-Individual	Revenue + RP85 ARC-Area	Revenue + RP75 + ARC-Area + SCO
0	$934.07	$937.36	$947.73	$947.27	$952.19	$954.39	$947.09
1	$916.86	$920.71	$930.82	$930.56	$937.34	$940.08	$931.95
2	$900.31	$904.76	$914.62	$914.55	$923.24	$926.56	$917.54
3	$884.39	$889.48	$899.11	$899.22	$909.86	$913.77	$903.84
4	$869.03	$874.84	$884.26	$884.55	$897.14	$901.67	$890.78
5	$854.21	$860.80	$870.05	$870.51	$885.04	$890.19	$878.31

- Robust CE results for all CRRA levels
- While not CE maximizing, lower RP coverage levels + SCO Have larger CE than RP85
- ARC > SCO because ARC is free

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Simulated Illinois Soybean Farm Annualized Net Revenues ($/acre)

Alternatives [1/]	Total Distribution [2/] Mean	Std. Dev.	Max	Min	Positive Net Annualized Values: Probability of Payment [3/]	Expected Value of Payment [4/]
Revenue	$736	$106	$1,276	$498		
RP55	-$2.30	$0.00	-$2.30	-$2.30	0.0%	$0.00
RP60	-$2.51	$0.00	-$2.51	-$2.51	0.0%	$0.00
RP65	-$2.51	$0.18	$1.42	-$2.51	0.2%	$1.42
RP70	-$2.83	$0.62	$7.36	-$2.88	0.6%	$4.90
RP75	-$3.02	$1.31	$13.30	-$3.23	1.8%	$5.01
RP80	-$3.16	$2.96	$18.71	-$4.13	9.4%	$4.76
RP85	-$3.07	$5.84	$35.09	-$6.37	21.2%	$6.56
SCO-55	$4.44	$10.75	$42.53	-$6.17	57.9%	$11.23
SCO-60	$4.44	$10.75	$42.53	-$6.17	57.9%	$11.23
SCO-65	$4.44	$10.75	$42.53	-$6.17	57.9%	$11.23
SCO-70	$4.40	$10.64	$42.55	-$6.15	57.9%	$11.14
SCO-75	$4.23	$10.15	$39.80	-$6.05	57.9%	$10.77
SCO-80	$3.62	$8.80	$38.81	-$5.72	58.3%	$9.41
SCO-85	$1.77	$5.67	$22.11	-$4.72	61.3%	$5.30
ARC-SCO55	-$1.47	$2.60	$17.94	-$2.21	9.2%	$5.46
ARC-SCO60	-$1.94	$2.62	$17.44	-$2.71	9.4%	$5.01
ARC-SCO65	-$1.94	$2.61	$17.44	-$2.71	9.4%	$5.00
ARC-SCO70	-$1.98	$2.29	$11.05	-$2.69	9.4%	$4.36
ARC-SCO75	-$2.16	$1.27	$6.28	-$2.60	9.4%	$1.57
ARC-Individual	$7.17	$7.85	$33.61	$0.00	63.7%	$11.26
ARC-Area	$8.04	$9.71	$43.32	$0.00	59.7%	$13.47
AMP	$0.37	$1.82	$18.58	$0.00	7.4%	$4.99

Illinois Soybean Farm Certainty Equivalent Analysis

CRRA [1/]	Revenue [2/]	Revenue + RP55	Revenue + RP55 + SCO	Revenue + ARC-Individual	Revenue + ARC-Area	Revenue + RP55 ARC-Area	Revenue + RP55 + ARC-Area + SCO
0	$736.03	$733.73	$738.19	$743.21	$744.08	$741.78	$740.31
1	$728.69	$726.36	$730.78	$736.68	$737.67	$735.35	$733.86
2	$721.55	$719.20	$723.55	$730.39	$731.50	$729.16	$727.67
3	$714.60	$712.23	$716.47	$724.33	$725.57	$723.21	$721.70
4	$707.82	$705.43	$709.55	$718.47	$719.84	$717.47	$715.95
5	$701.22	$698.81	$702.77	$712.82	$714.32	$711.93	$710.39

- Need insurance to purchase SCO so RP55 is cheapest prerequisite
- Doing nothing > RP55 (“Insurance doesn’t work!”)

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Simulated Mississippi Rice Farm Annualized Net Revenues ($/acre)

	---------- Total Distribution [2/] ----------				Positive Net Annualized Values	
Alternatives [1/]	Mean	Std. Dev.	Max	Min	Probability of Payment [3/]	Expected Value of Payment [4/]
Revenue	$1,205	$170	$1,815	$801		
RP55	-$2.30	$0.00	-$2.30	-$2.30	0.0%	$0.00
RP60	-$2.51	$0.00	-$2.51	-$2.51	0.0%	$0.00
RP65	-$2.51	$0.17	$1.36	-$2.51	0.2%	$1.36
RP70	-$2.83	$0.71	$10.50	-$2.88	0.6%	$5.65
RP75	-$3.07	$1.49	$19.69	-$3.20	0.8%	$12.14
RP80	-$3.31	$3.00	$28.43	-$3.97	6.0%	$6.45
RP85	-$3.33	$6.71	$42.61	-$5.94	14.6%	$9.84
SCO-55	$17.12	$25.03	$130.36	-$12.93	71.7%	$27.26
SCO-60	$17.12	$25.03	$130.36	-$12.93	71.7%	$27.26
SCO-65	$17.09	$24.90	$130.38	-$12.91	71.7%	$27.21
SCO-70	$17.00	$24.56	$130.43	-$12.86	71.7%	$27.06
SCO-75	$16.44	$23.26	$119.83	-$12.58	72.1%	$26.03
SCO-80	$14.39	$19.40	$87.14	-$11.50	73.3%	$22.40
SCO-85	$8.87	$12.14	$54.56	-$8.54	77.2%	$13.18
ARC-SCO55	-$0.81	$6.35	$44.50	-$3.29	18.2%	$9.90
ARC-SCO60	-$0.81	$6.34	$44.50	-$3.29	18.2%	$9.89
ARC-SCO65	-$0.84	$6.11	$44.52	-$3.27	18.2%	$9.66
ARC-SCO70	-$0.94	$5.52	$36.88	-$3.22	18.4%	$8.79
ARC-SCO75	-$1.49	$3.16	$16.55	-$2.94	19.2%	$4.34
ARC-Individual	$1.93	$4.21	$24.99	$0.00	28.5%	$6.78
ARC-Area	$2.31	$5.20	$38.15	$0.00	27.5%	$8.37
AMP	$9.51	$19.16	$114.63	$0.00	42.5%	$22.37

Mississippi Rice Farm Certainty Equivalent Analysis

CRRA [1/]	Revenue [2/]	Revenue + RP55	Revenue + RP55 + SCO	Revenue + AMP	Revenue + RP55 AMP	Revenue + RP55 + AMP + SCO	Revenue + RP55 ARC-Area + SCO
0	$1,205.16	$1,202.86	$1,220.03	$1,214.69	$1,212.39	$1,229.56	$1,204.33
1	$1,193.36	$1,191.03	$1,208.16	$1,204.71	$1,202.39	$1,219.49	$1,192.49
2	$1,181.71	$1,179.36	$1,196.44	$1,195.10	$1,192.77	$1,209.78	$1,180.77
3	$1,170.23	$1,167.86	$1,184.91	$1,185.88	$1,183.52	$1,200.46	$1,169.20
4	$1,158.93	$1,156.53	$1,173.56	$1,177.04	$1,174.67	$1,191.53	$1,157.77
5	$1,147.82	$1,145.40	$1,162.42	$1,168.58	$1,166.20	$1,182.98	$1,146.51

- AMP designed for rice and triggers payment more frequently than for corn and soybeans
- Need insurance to purchase SCO so RP55 is cheapest prerequisite

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Simulated Mississippi Cotton Farm Annualized Net Revenues ($/acre)

	Total Distribution [2/]				Positive Net Annualized Values	
Alternatives [1/]	Mean	Std. Dev.	Max	Min	Probability of Payment [3/]	Expected Value of Payment [4/]
Revenue	$767	$107	$1,127	$528		
RP55	-$2.30	$0.00	-$2.30	-$2.30	0.0%	$0.00
RP60	-$2.30	$0.06	-$0.85	-$2.30	0.0%	$0.00
RP65	-$2.24	$0.80	$6.97	-$2.33	1.4%	$4.01
RP70	-$1.92	$2.27	$16.36	-$2.49	6.8%	$5.25
RP75	-$0.60	$5.36	$31.67	-$3.14	22.4%	$7.75
RP80	$2.32	$9.97	$51.53	-$4.58	41.3%	$11.54
RP85	$7.44	$15.95	$70.73	-$7.10	56.7%	$17.48
STAX	$173.18	$62.06	$370.40	$12.18	100.0%	$173.18
STAX55	$173.18	$62.06	$370.40	$12.18	100.0%	$173.18
STAX60	$173.18	$62.06	$370.40	$12.18	100.0%	$173.18
STAX65	$162.69	$54.91	$346.96	$14.80	100.0%	$162.69
STAX70	$144.44	$45.15	$299.10	$18.64	100.0%	$144.44
STAX75	$117.74	$33.69	$237.33	$17.26	100.0%	$117.74
STAX80	$83.45	$21.64	$156.40	$17.78	100.0%	$83.45
STAX85	$43.05	$10.42	$77.00	$10.89	100.0%	$43.05

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Mississippi Cotton Farm Certainty Equivalent Analysis

CRRA [1/]	Revenue [2/]	Revenue + RP55	Revenue + STAX	Revenue + RP55 + STAX	Revenue + RP65 + STAX	Revenue + RP75 + STAX	Revenue + RP85 + STAX
0	$767.02	$764.72	$940.15	$937.85	$927.42	$884.12	$817.54
1	$759.74	$757.42	$930.49	$928.16	$918.05	$875.54	$810.04
2	$752.64	$750.29	$921.12	$918.77	$908.96	$867.20	$802.75
3	$745.72	$743.36	$912.03	$909.66	$900.14	$859.11	$795.69
4	$738.99	$736.60	$903.23	$900.84	$891.58	$851.27	$788.84
5	$732.43	$730.03	$894.70	$892.29	$883.28	$843.68	$782.21

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Conclusions & Suggestions

- Farm managers need to understand the interaction between ARC and SCO as there could be an opportunity to shift some risk management costs from insurance to ARC/SCO
  - Perhaps farmers can buy down RP coverage (annual premium savings) and use ARC/SCO (or STAX for coverage)
  - Important that managers understand farm-level, county-level risk and interaction with prices and crop insurance
- Costs of the various insurance products important in understanding risk-efficient set
- Robust results for each crop
- Further analysis on cropping systems and determining risk-efficient set that maximizes crop-mix and risk management alternatives
- Further analysis on effect of payment limits and reduced subsidies on risk-efficient set

Conclusion

- When a farm bill is passed, careful analysis of the programs will be important
  - Not a simple calculation – need to consider probabilities associated with obtaining specific yields/prices
  - Smart folks at Land Grant Universities can provide decision spreadsheets to help with this decision
- Crop insurance will be a target now and in future.
- Crop insurance is the safety net now. Anything else is gravy.

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Thank You!

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