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Commodity Support Payments and Climatic Variability

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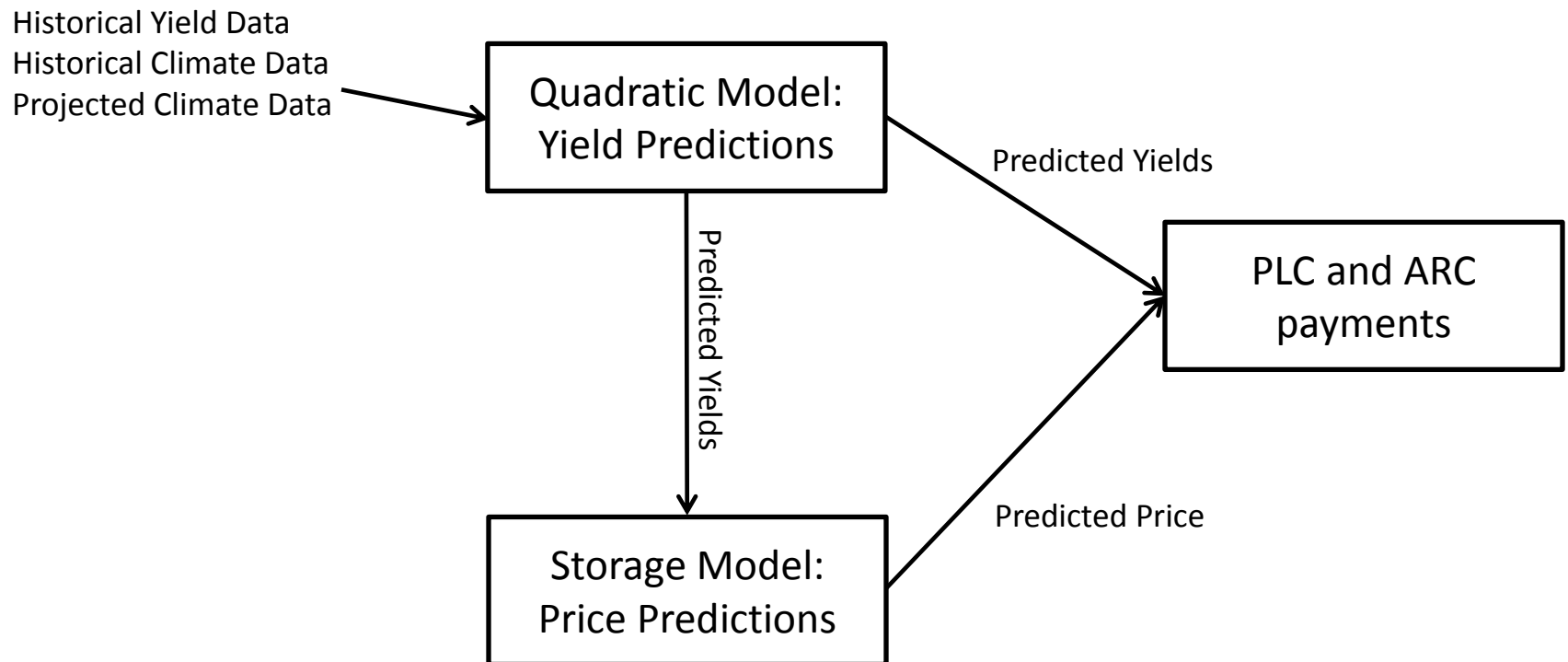
Background

- The 2014 Farm Bill introduced Price Loss Coverage (PLC), Agriculture Risk Coverage (ARC) programs
- Farm producers are required to make a one time, irrevocable decision to elect either PLC or one of ARC options for the entire period from 2014-2018
- PLC: Farmers will receive payments if a covered commodity's national average marketing year price is below its “reference price”
- ARC
 - County option—Farmers will receive payments if the ARC-County actual crop revenue is less than the ARC-County revenue guarantee
 - Individual option—Farmers will receive payments if the actual revenue from all covered commodities is less than the ARC-Individual guarantee
- The establishments of these new initiatives raise questions about the level of support farmers receive under each of them

Objectives

Investigate the expected payments of ARC-CO and PLC from 2015 to 2018 for corn and soybeans using anticipated climate variability

Model: Overview



Model: Yield Predictions

- Regress historical county level yields on a quadratic model of historical weather variables and time trend
- Holding time trend *constant*, predict county yields for 2015-2020 using only climatic variability
- Weighing by planted acres, aggregate county yields to national yield
- Run 1000 bootstraps with 9 climate projections results in 9000 yield predictions for each county in each year and 9000 national yield predictions in each year

Model: Price Predictions

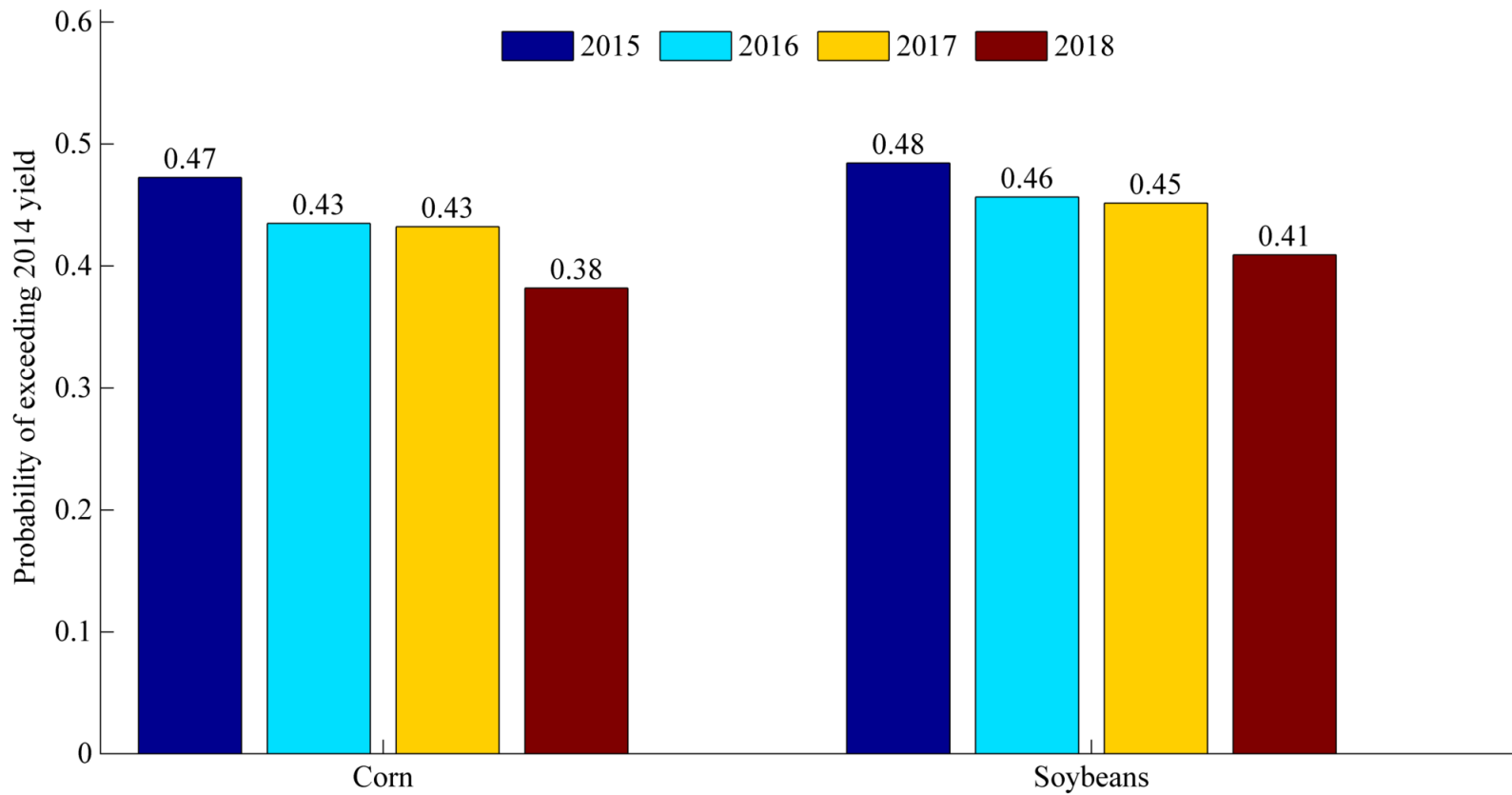
- With predicted yield data in 2020, solve for solution of the storage model in 2020, assuming that the models parameters, yield distribution, and equilibrium remains constant after 2020.
- Use backward induction to find multiple storage equilibria from year 2019 back to 2014, assuming the respective predicted yield distribution for each year that we found earlier.
- Feed the national yield distribution from 2014 to 2018 through the sequence of storage equilibria of the same years to find the national price distributions
- The use of backward induction results in path dependent price series (i.e., how price gradually adjust over time instead of several disconnected static point)
- Model parameters are calibrated using a grid search to minimize score generated from simulated GMM objective function. Simulated price and yield distributions in 2014 was calibrated to match the following moments:
 - national corn and soybeans price reported in crop year 2014
 - historical corn price and yield correlation
 - historical soybeans price and yield correlation
 - historical corn and soybeans price correlation

Data

- Historical county yield data from National Agricultural Statistics Service - USDA. Keep only counties with continuous production between 1975-2013
- Historical weather data from PRISM climate group – Oregon State University
- Projected weather data from Forest Service – USDA (A1B: CGCM, CSIRO, MIROC; A2: CGCM, CSIRO, MIROC; B2: CGCM, CSIRO, HADN)

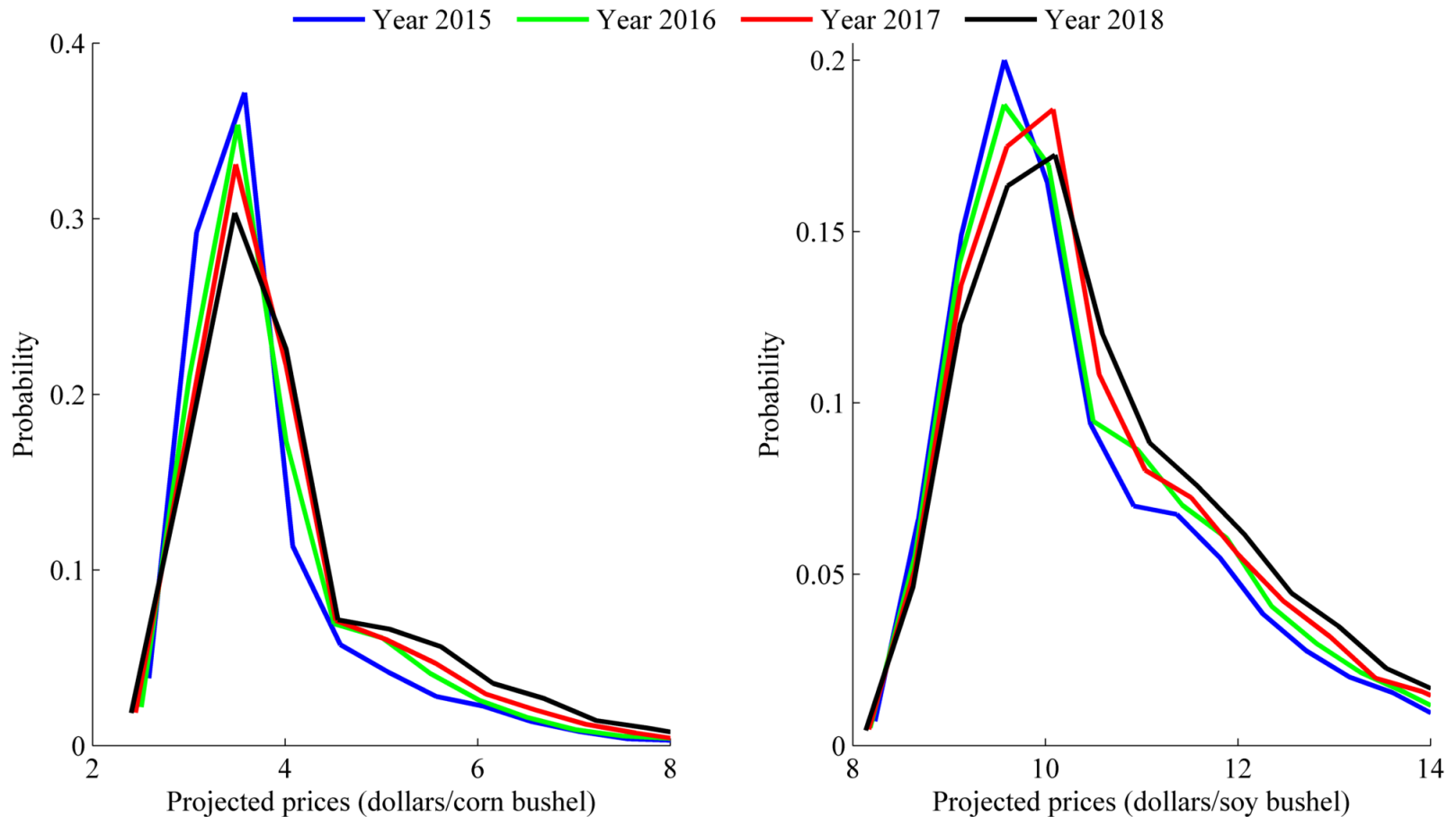
Results

Probability of Exceeding 2014 National Yield



Results

Crop Prices Distribution Over Time



Results

National average payments (\$/acre) (2015 – 2018)

	Corn				Soybeans			
	2015	2016	2017	2018	2015	2016	2017	2018
PLC	25.4	22.5	20.8	19.9	0.01	0.02	0.02	0.02
	(28.0)	(28.2)	(28.7)	(29.4)	(0.3)	(0.3)	(0.3)	(0.3)
	[0 - 89.9]	[0 - 90.4]	[0 - 92.7]	[0 - 95.5]	[0 - 0]	[0 - 0]	[0 - 0]	[0 - 0]
ARC	42.2	30.3	9.9	7.1	15.2	13.6	8.6	2.2
	(12.6)	(12.2)	(9.3)	(12.0)	(3.5)	(3.2)	(2.9)	(2.0)
	[14.7 - 62.9]	[10.6 - 58.8]	[0.8 - 40]	[0.1 - 52]	[8.5 - 21.4]	[7.8 - 20]	[3.6 - 14.5]	[0 - 7.3]

Mean

(Standard deviation)

[95% confidence interval]

Conclusion

Assuming 2014 prices as starting point:

- ARC results in higher payments for soybeans between 2015 – 2018
- ARC for corn is higher in 2015 and 2016 while PLC is higher in the latter years
- ARC for corn varies less than PLC, presumably because of the negative correlation between yield and price