The Efficacy of Crop Insurance and Commodity Title Programs in Reducing Risk on Midwest Grain Farms

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Objectives and Approach

Objective

- Examine the importance of crop insurance and commodity title programs in reducing risk
  - Is ARC or PLC more beneficial in reducing risk?
  - How much does crop insurance reduce risk?
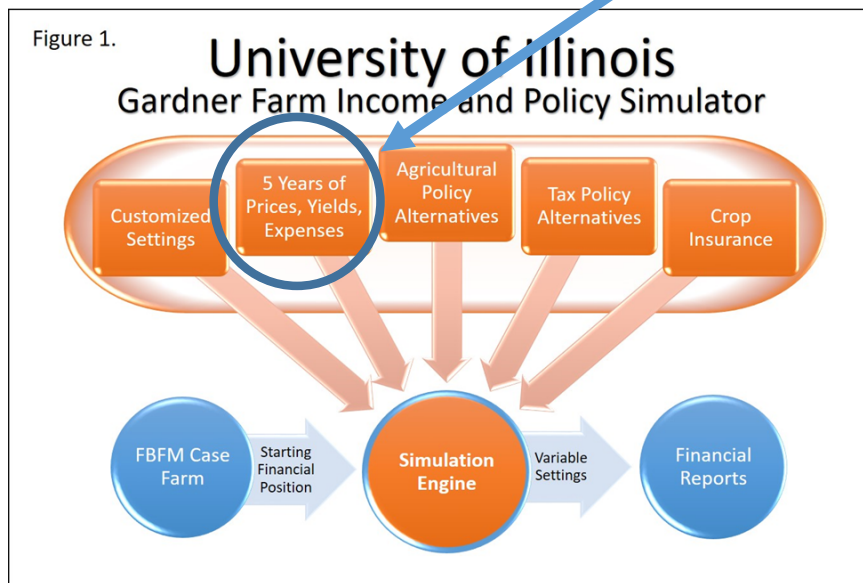 - Does the combination of commodity title and crop insurance reduce risk?

Approach

- Simulate financial performance of a Midwest grain farm over five years (2018 through 2022)

- Evaluate performance under:
  - No program
  - ARC and PLC
  - Revenue Protection (RP) at 75, 80 and 85% levels
  - Combinations of the above

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Methodology

Farm Simulation Model

Figure 1.

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Gardner Farm Income and Policy Simulator

Customized Settings | 5 Years of Prices, Yields, Expenses | Agricultural Policy Alternatives | Tax Policy Alternatives | Crop Insurance

FBFM Case Farm — Starting Financial Position → **Simulation Engine** — Variable Settings → Financial Reports

Price/Yield Model

- For each year, simulate
  - County yield (corn, soybeans)
  - Farm yield (corn, soybeans)
  - Harvest price (corn, soybeans)
  - Market year average price (corn, soybeans)

- Across years
  - Trend yield increases in yields
  - Projected price based on lagged prices

Within Year Price/Yield Model

- County yields (CY_i) distributed Weibull

- Harvest price (HP_i) is distributed lognormally with mean equal to project price (PP_i)

- Farm yields (FY_i) distributed Weibull, with mean the same as county yield (County-to-farm correlation = .74 for corn and .72 for soybeans)

- Market Year Average price (MYA_i) is a linear function of harvest price

- Projected prices in next year is a function of prices in previous year

Correlation Matrix

|	CY_c	CY_b	HP_c	HP_b
CY_c	1	0.75	-0.68	-0.42
CY_b	0.75	1	-0.52	-0.52
HP_c	-0.68	-0.52	1	0.60
HP_b	-0.42	-0.52	0.60	1

Farm Yield drift up by trend each year
   2.0 bushels per acre for corn, .5 for soybeans

Long-run prices: Corn = $3.70, Soybeans = $9.39

Base Farm

- Farm Characteristics and Starting Financials
  - Average of Actual Farms in Region and Farm Size
  - McLean County, Central Illinois High Productivity
- Farm Characteristics
  - 1,700 Acres on 50/50 rotation of corn and soybeans
  - 14% Owned, 45% share rented, 41% cash ($261) rent
  - One scenario with all cash rent
- Starting Financials
  - Net Worth: $3.67 million
  - Debt-To-Asset Ratio: 26.0%

Center of the world
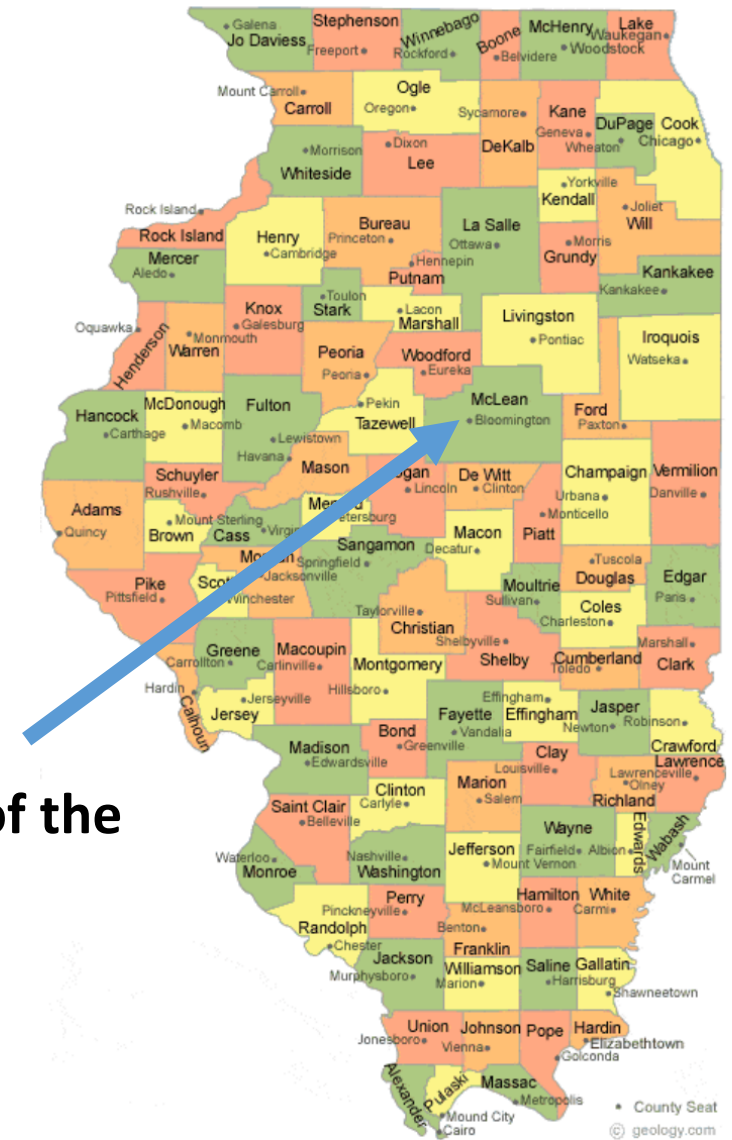
Commodity Title

ARC

- County revenue program whose guarantee is 86% of Five-year Olympic average of prices and yields

- 2018 Farm Bill modifications
  - RMA yields instead of NASS
  - Trend-adjusted benchmark
  - Benchmark price escalator provision

PLC

- Makes payments based when market average price is below effective reference price

- Effective reference price is minimum of
  - Reference price ($3.70 for corn, $8.40 for soybeans)
  - Escalator provision: 85% of five-year moving average of prices

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Expected Yields, Prices, PLC, and ARC Payments

Year	Yield		MYA Prices		PLC Payments		ARC Payment	
	Corn	Soybeans	Corn	Soybeans	Corn	Soybeans	Corn	Soybeans
	Bu/acre	Bu/acre	$/bu	$/bu	$/b acre	$/b acre	$/b acre	$/b acre
2018	198	60	3.76	9.35	$30	$11	11	6
2019	199	61	3.77	9.38	$43	$11	15	9
2020	201	61	3.77	9.36	$49	$12	11	7
2021	202	62	3.77	9.36	$49	$12	12	7
2022	205	62	3.78	9.39	$49	$12	10	6

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Distribution of PLC and ARC Payments, Corn, 2020, $ per base Acre

RP Policies, Corn, 2020
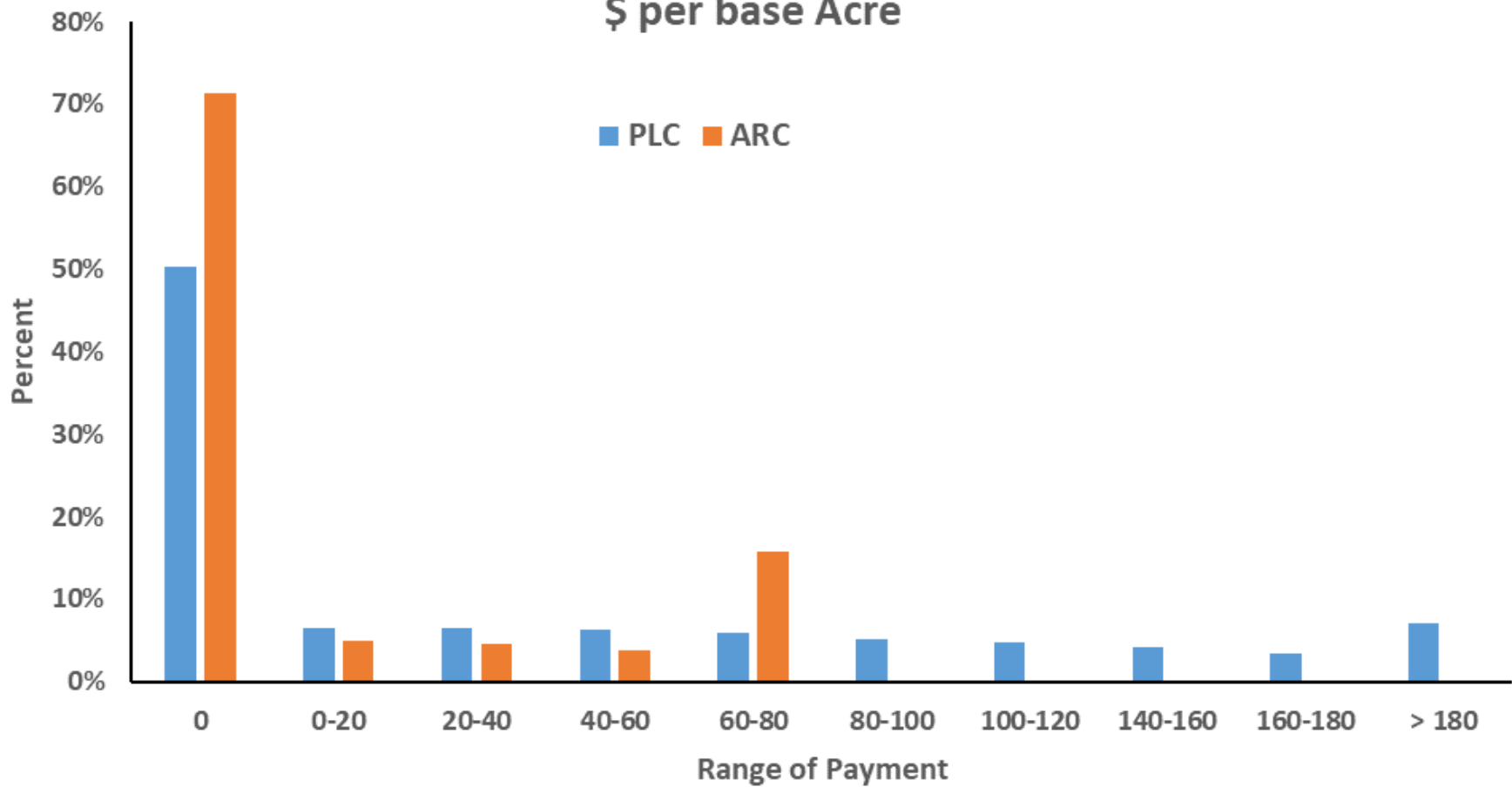
	75%	80%	85%
Expected Payment	$8.60	$20.25	$36.08
Farmer-Paid Premium	$2.49	$5.38	$12.55
Difference	$6.11	$14.87	$23.53

193 bushels per acre APH

Distribution of RP Payments by Coverage Level, Corn,2020, $ per base Acre

RP Policies, Soybeans, 2020
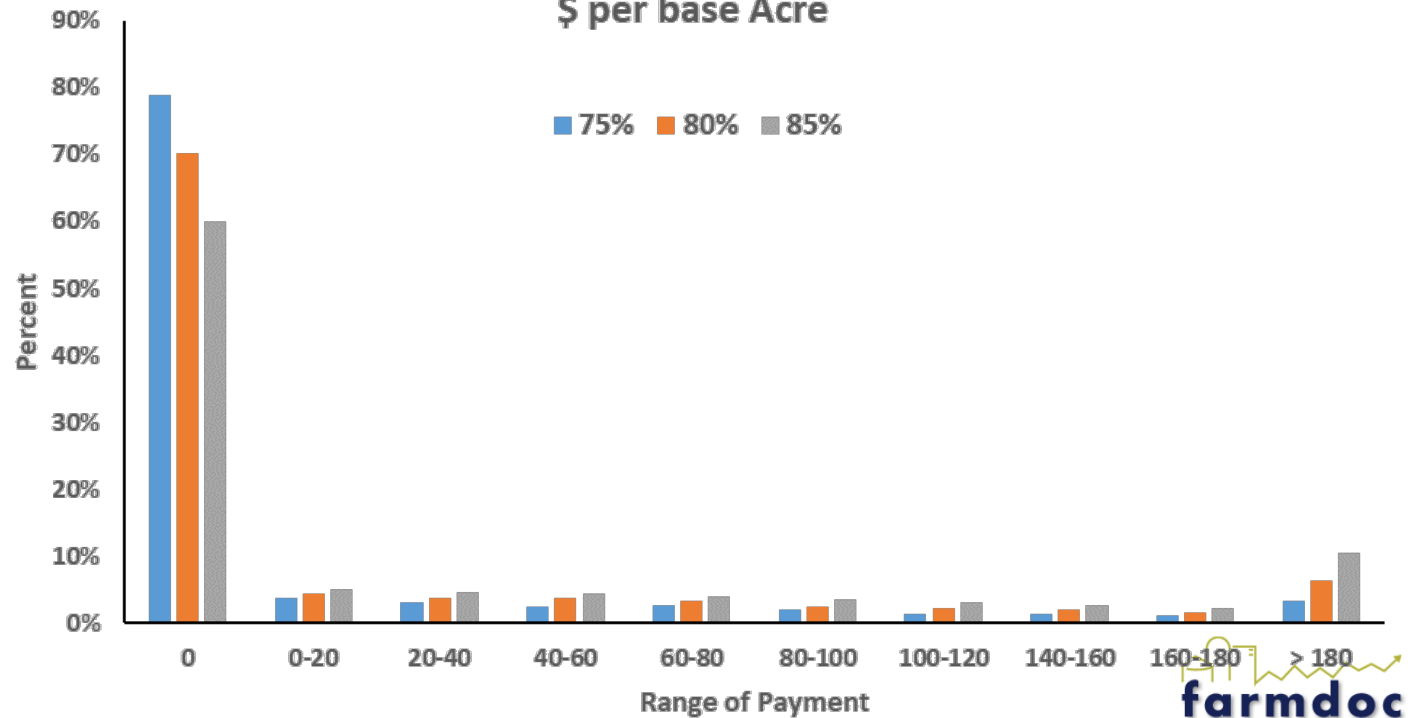
	75%	80%	85%
Expected Payment	$3.24	$6.06	10.05
Farmer-Paid Premium	$1.79	$3.61	$7.52
Difference	$1.45	$2.45	$3.53

61 bushel TA-APH

Distribution of RP Payments by Coverage Level, Soybeans, 2020, $ per base Acre
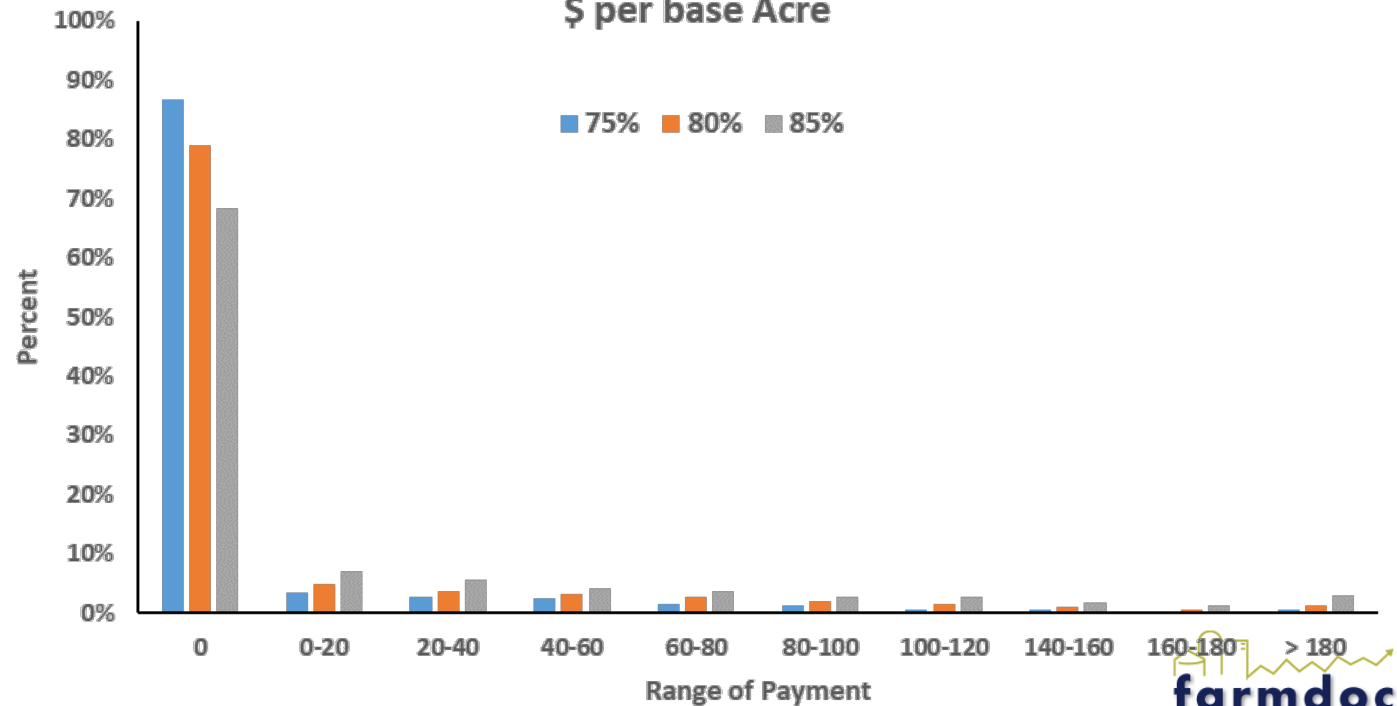
Simulation results

	No Program	ARC	PLC		RP 75%	RP 80%	RP 85%	With RP 85%		
								ARC	PLC	PLC-SCO
Mean farm Incomes										
2018	76,201	85,149	94,107		80,494	85,037	90,484	99,432	108,390	112,611
2019	25,959	38,981	55,441		30,195	34,685	40,143	53,145	69,615	73,667
2020	34,946	45,955	68,864		49,719	58,604	68,237	79,115	101,845	108,912
2021	37,413	49,299	73,258		53,360	62,931	73,487	85,197	108,881	116,619
2022	46,591	57,587	83,821		62,940	72,596	83,248	94,020	119,845	127,174
Net Worth in 2022 (2018 net worth = $3,670,000)										
Mean	3,445,814	3,501,245	3,592,545		3,499,549	3,527,954	3,559,894	3,610,455	3,691,209	3,712,934
5% VAR	2,525,973	2,710,438	2,958,510		2,610,801	2,658,989	2,709,991	2,885,004	3,114,975	3,137,393
Debt-to-Asset Ratio in 2018 (2018 debt-to-asset ratio = .26)										
Mean	29%	28%	26%		28%	29%	26%	26%	24%	24%
5% VAR	54%	49%	42%		52%	50%	49%	44%	38%	38%

If all cash rented land instead of share rent ($261 cash rent)
Mean: 28%
5% VAR: 46%
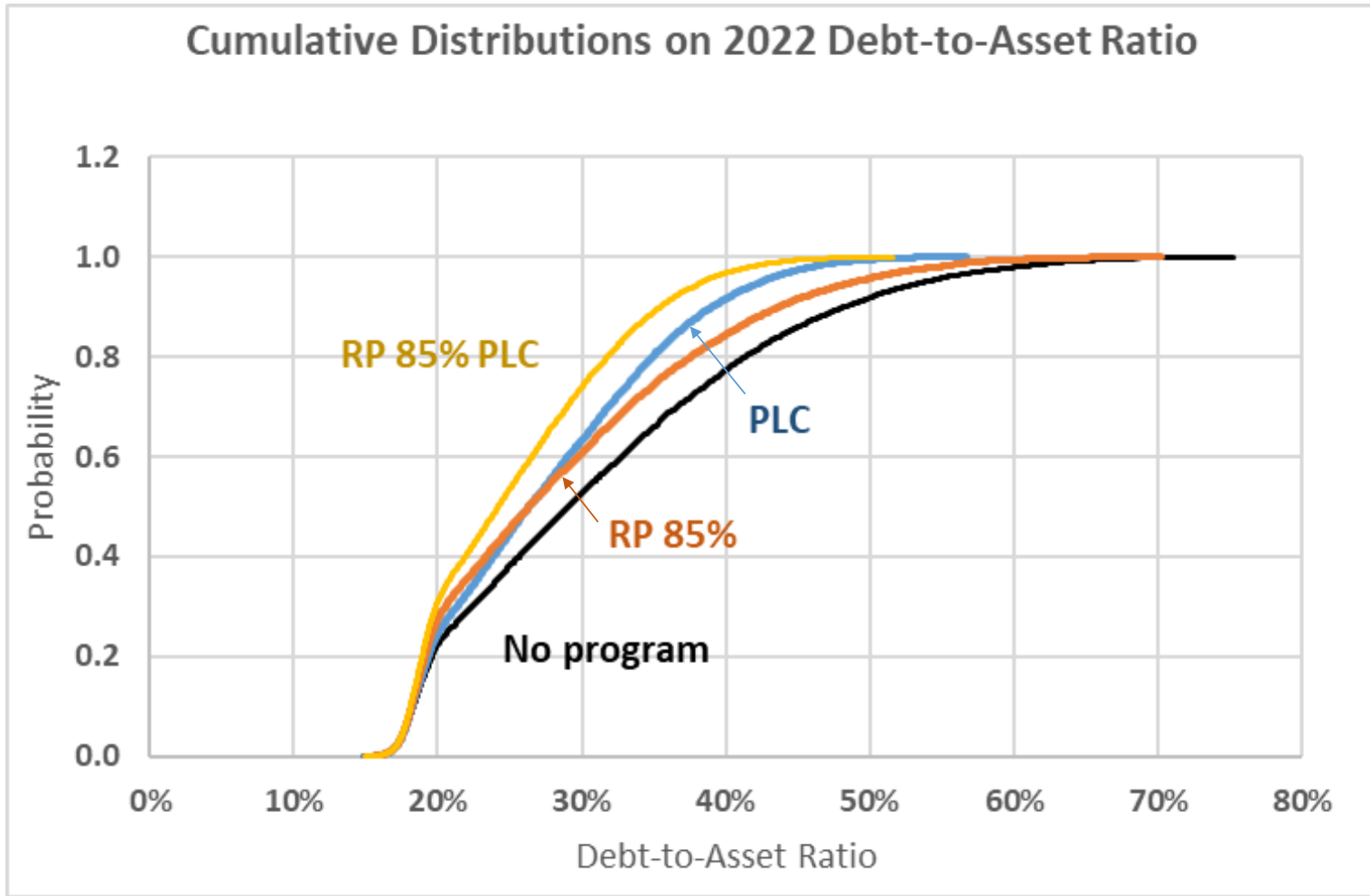
Summary

- PLC is more effective at reducing risk than ARC
  - Price scenario matters

- PLC reduces low end distributions more than RP
  - Price scenario matters

- The combination of PLC and RP reduces risks more