Effects of Crop Insurance and Government Payments on Annual Financial Risk

Bruce A. Babcock
Center for Agricultural and Rural Development
www.card.iastate.edu

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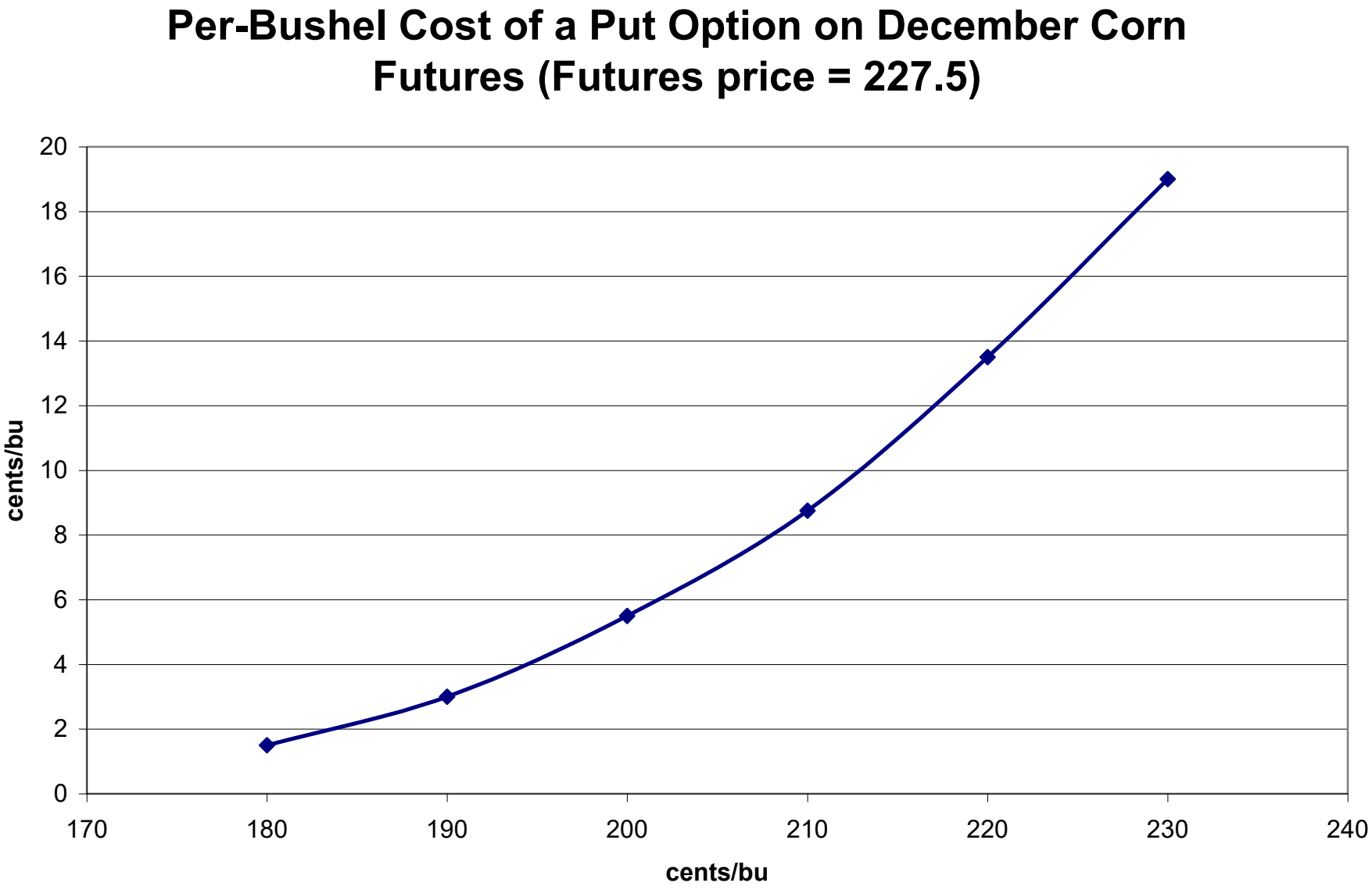
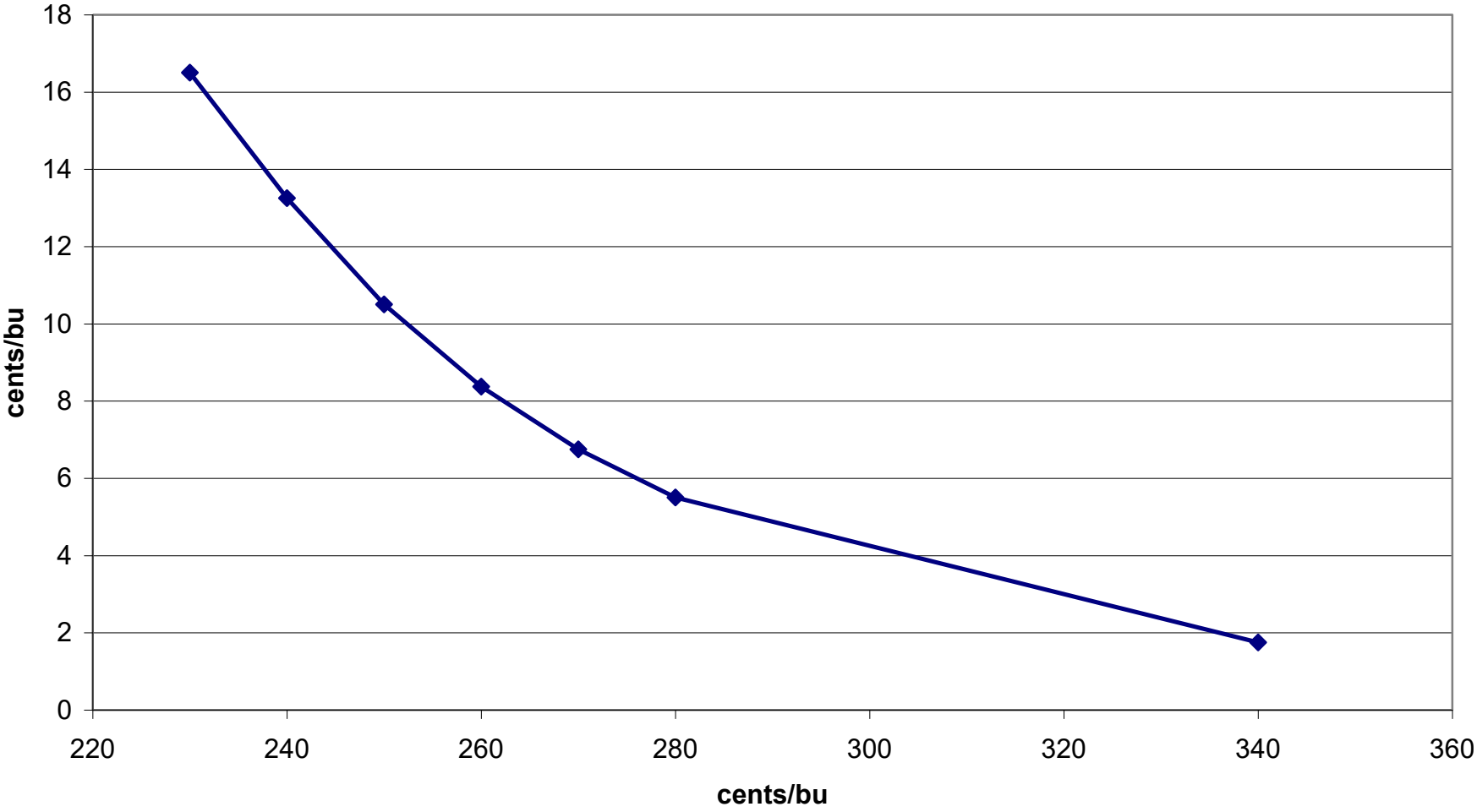
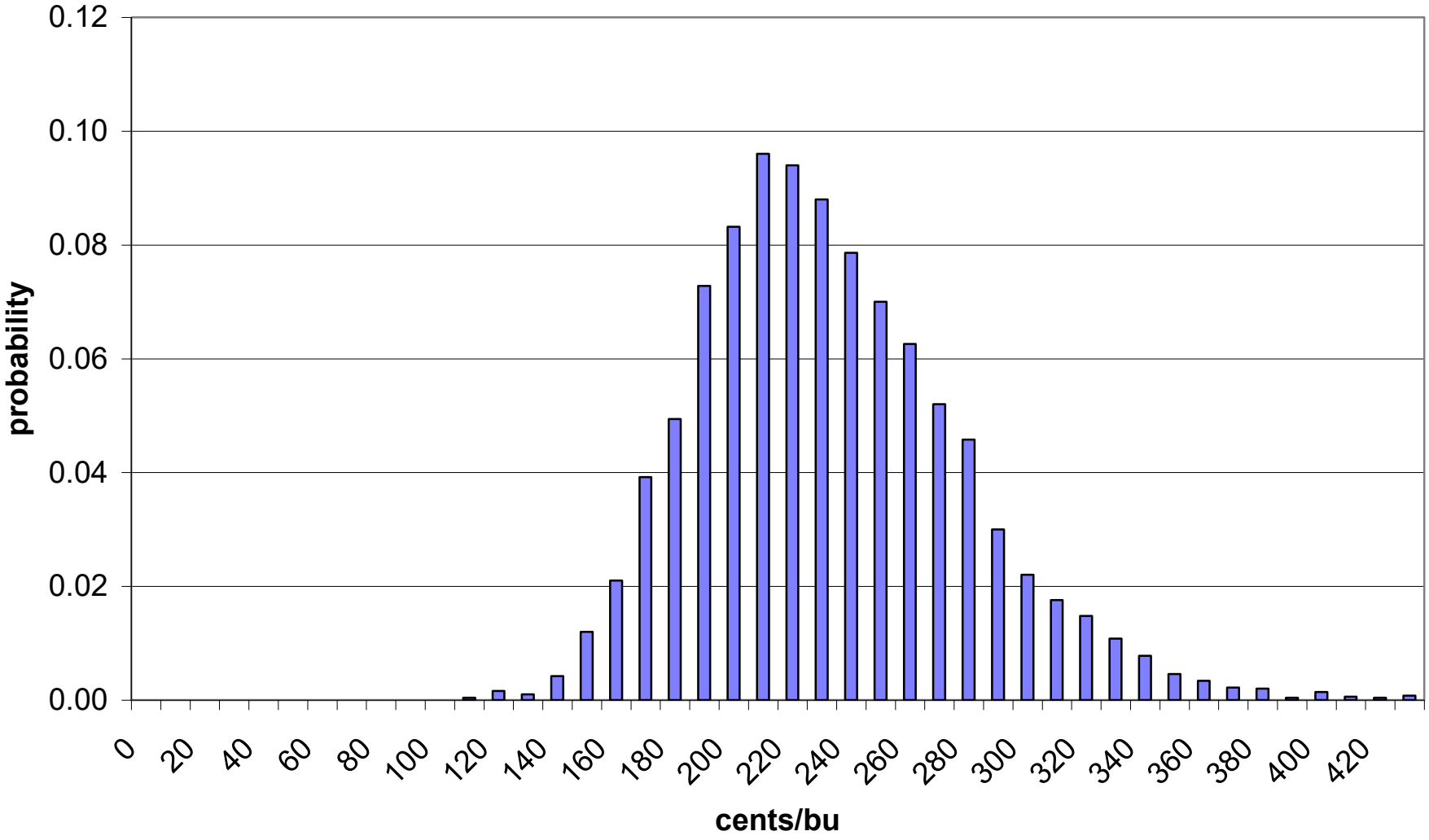
Talk Outline

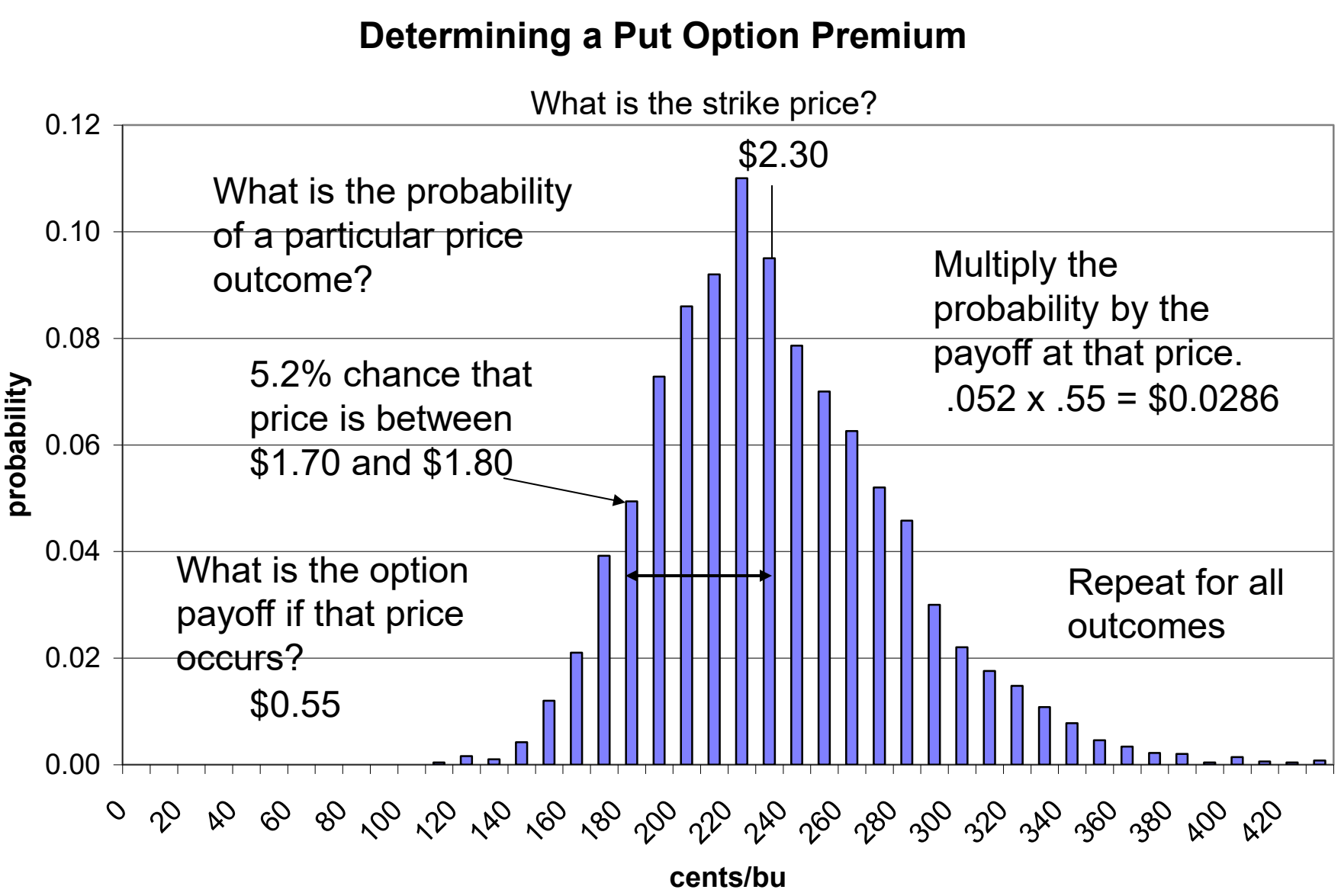
- How are option premiums determined?
- Effects of hedges, puts, and insurance on risk
- How do commodity programs affect risk?
- How much risk is left over to reward management?
- Discussion


Per-Bushel Cost of a Put Option on December Corn Futures (Futures price = 227.5)
20
18
16
14
12
10
8
6
4
2
0
cents/bu
170
180
190
200
210
220
230
240
cents/bu

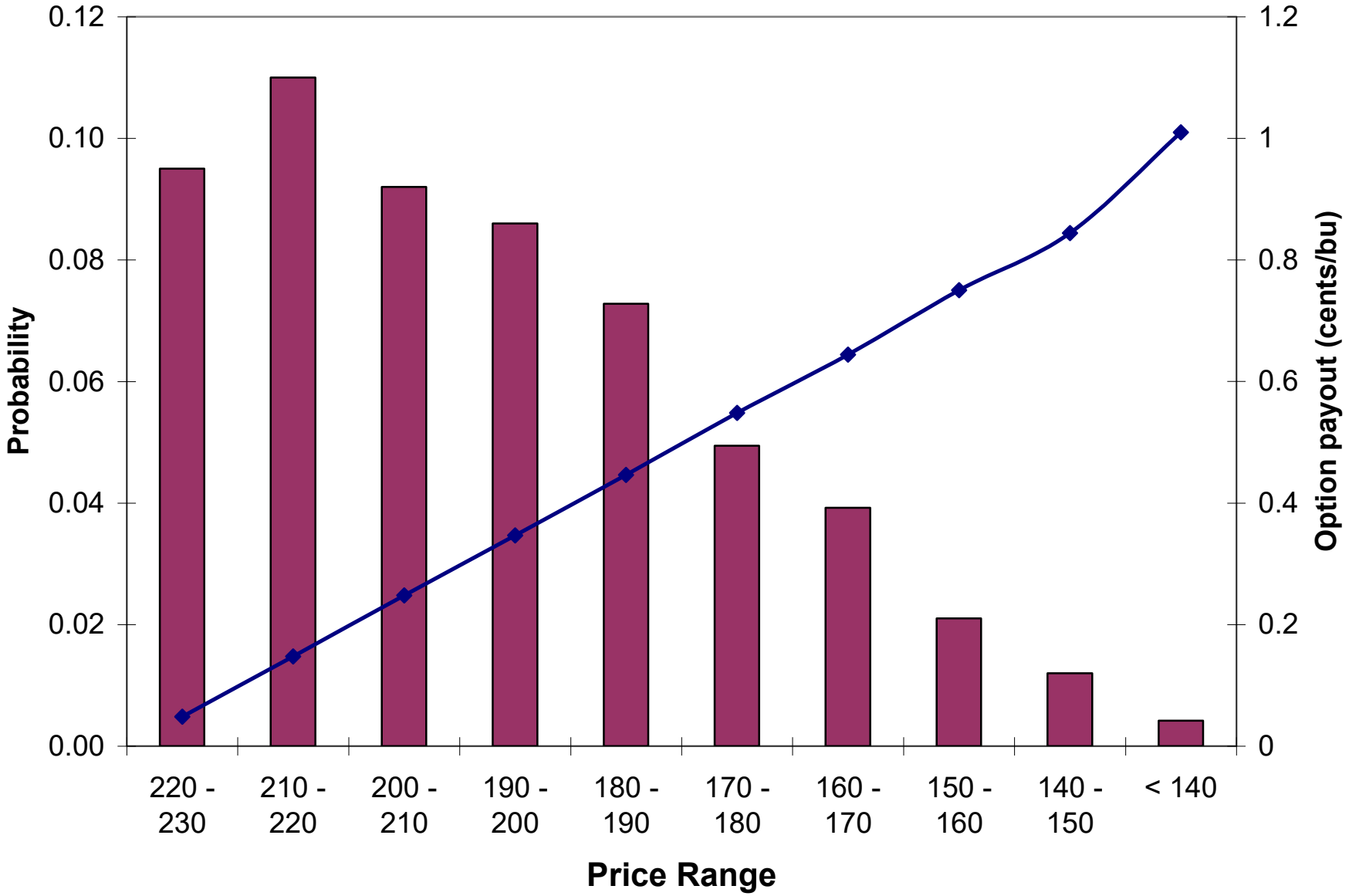
Per-Bushel Cost of a Call Option on December Corn Futures (Futures price = 227.5)

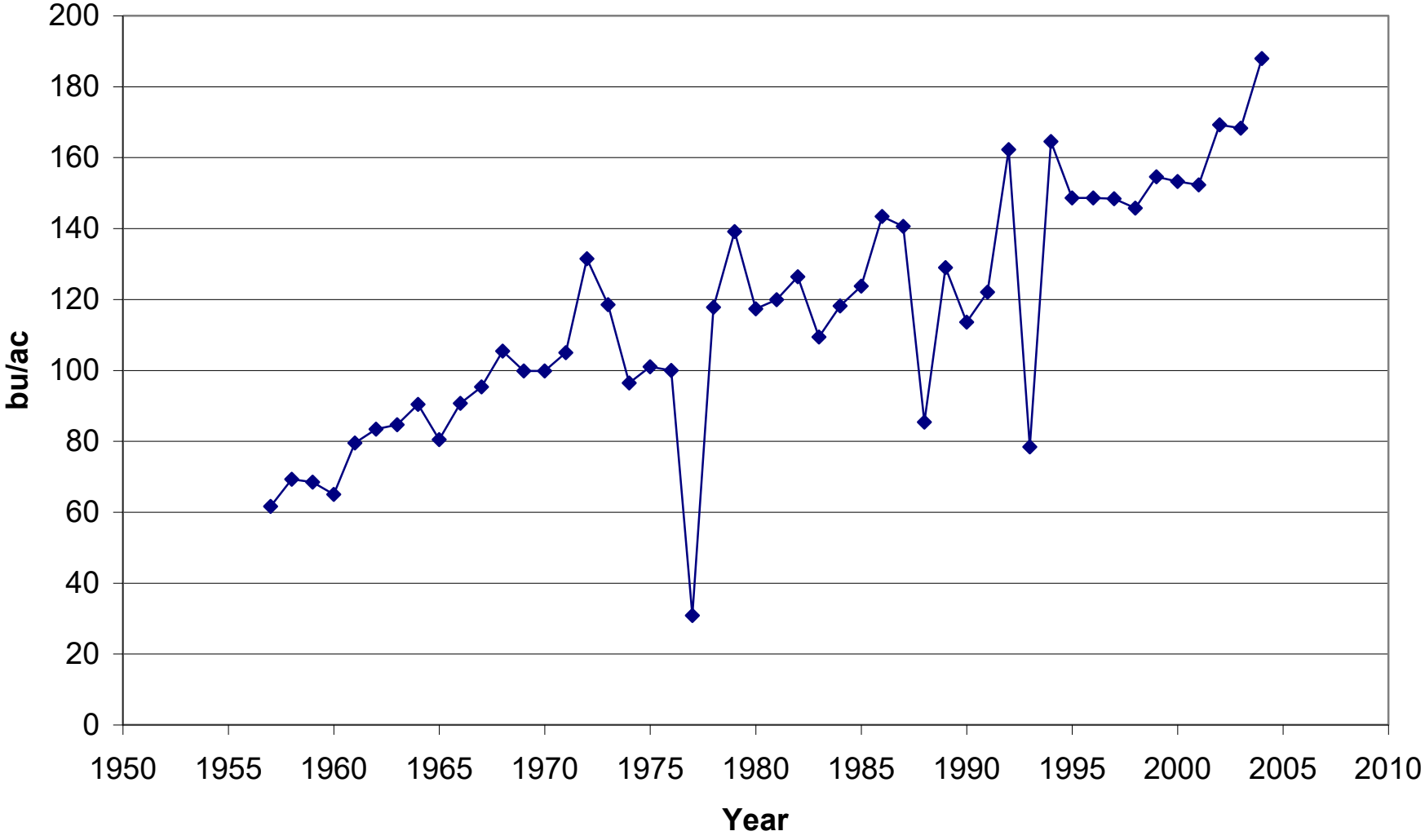


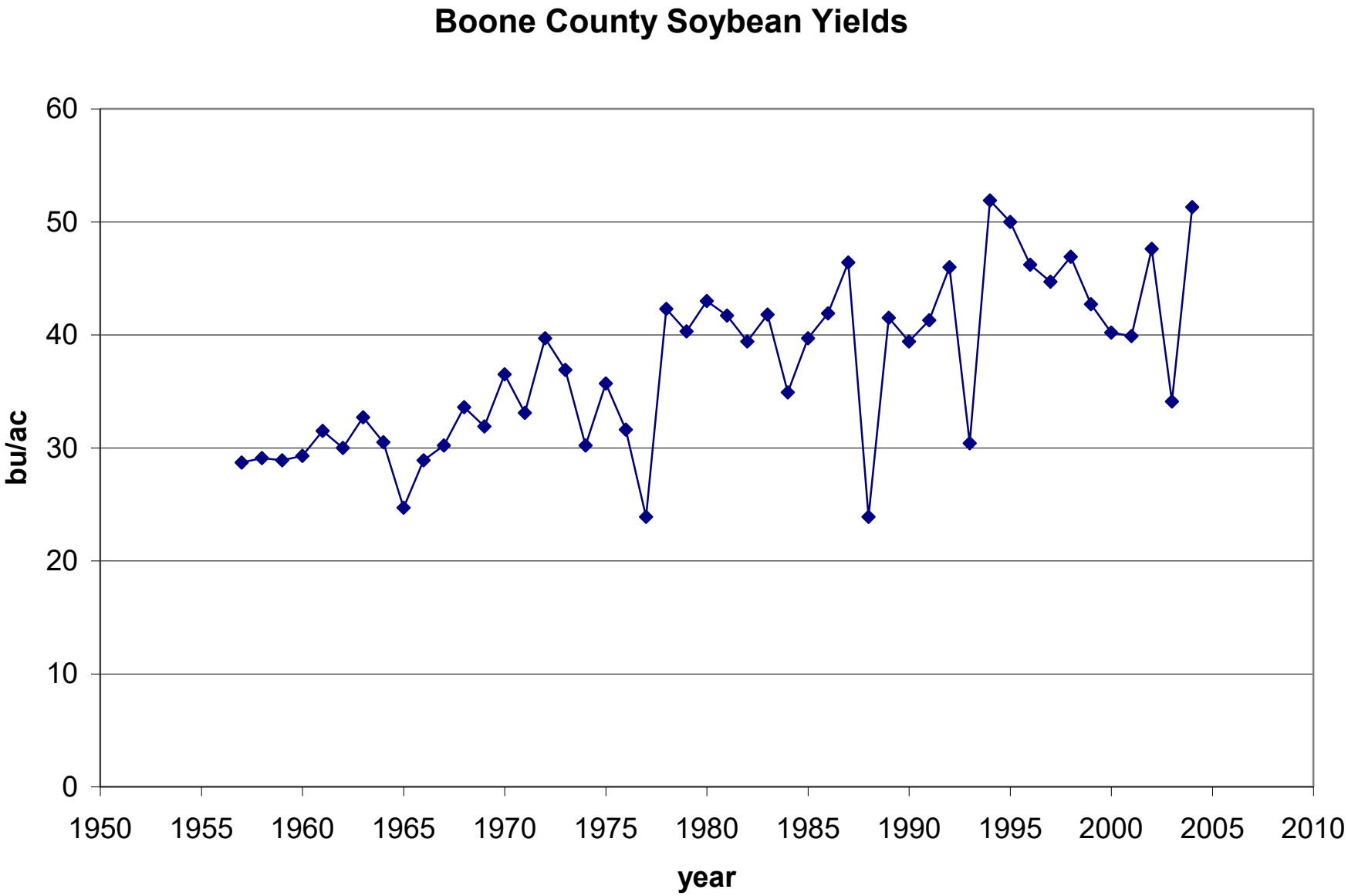

Distribution of December Futures Prices as of Feb 4, 2005
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
cents/bu

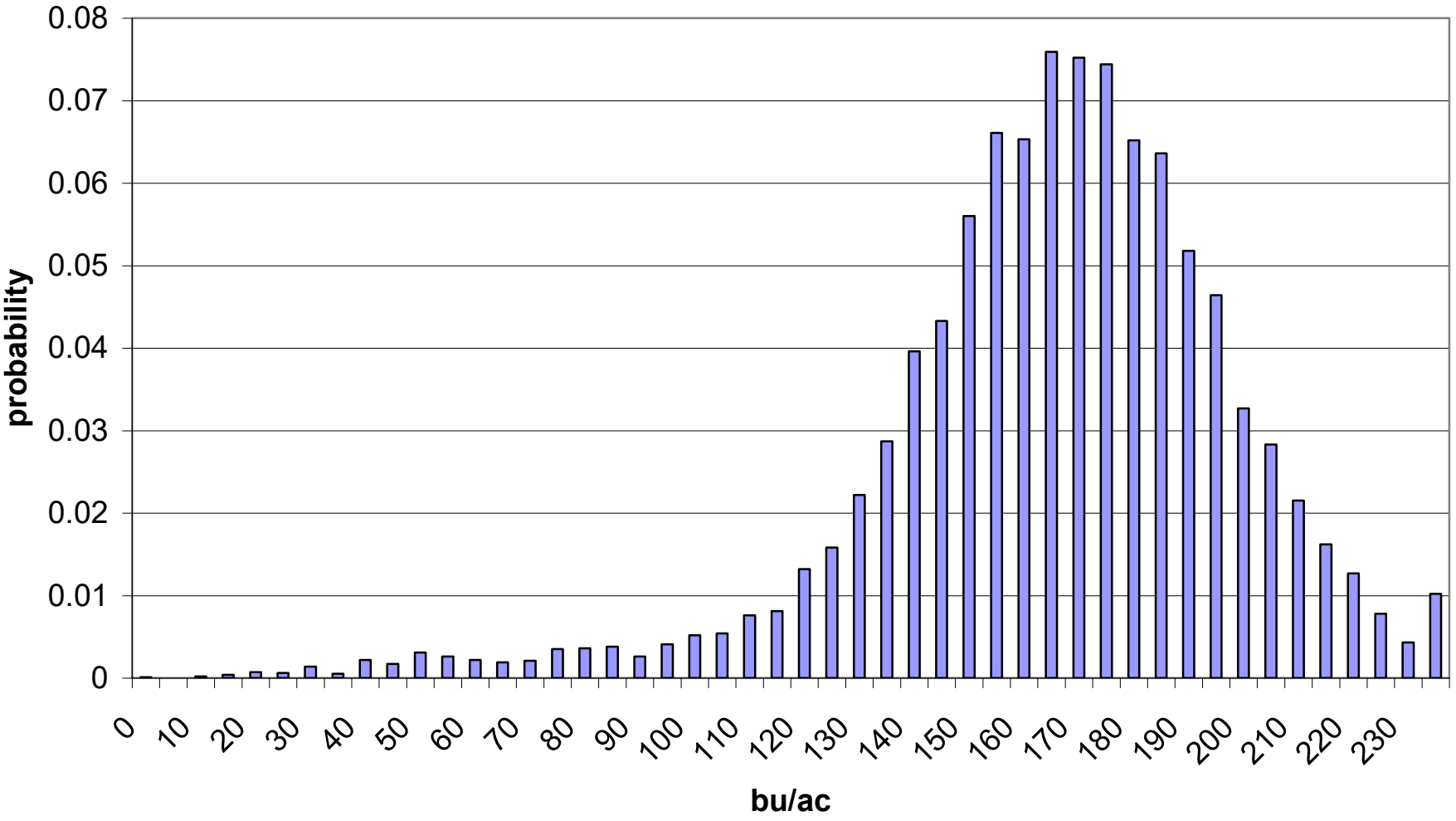

Determining a Put Option Premium
What is the strike price?
$2.30
What is the probability of a particular price outcome?
5.2% chance that price is between $1.70 and $1.80
What is the option payoff if that price occurs?
$0.55
Multiply the probability by the payoff at that price.
.052 x .55 = $0.0286
Repeat for all outcomes
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
cents/bu

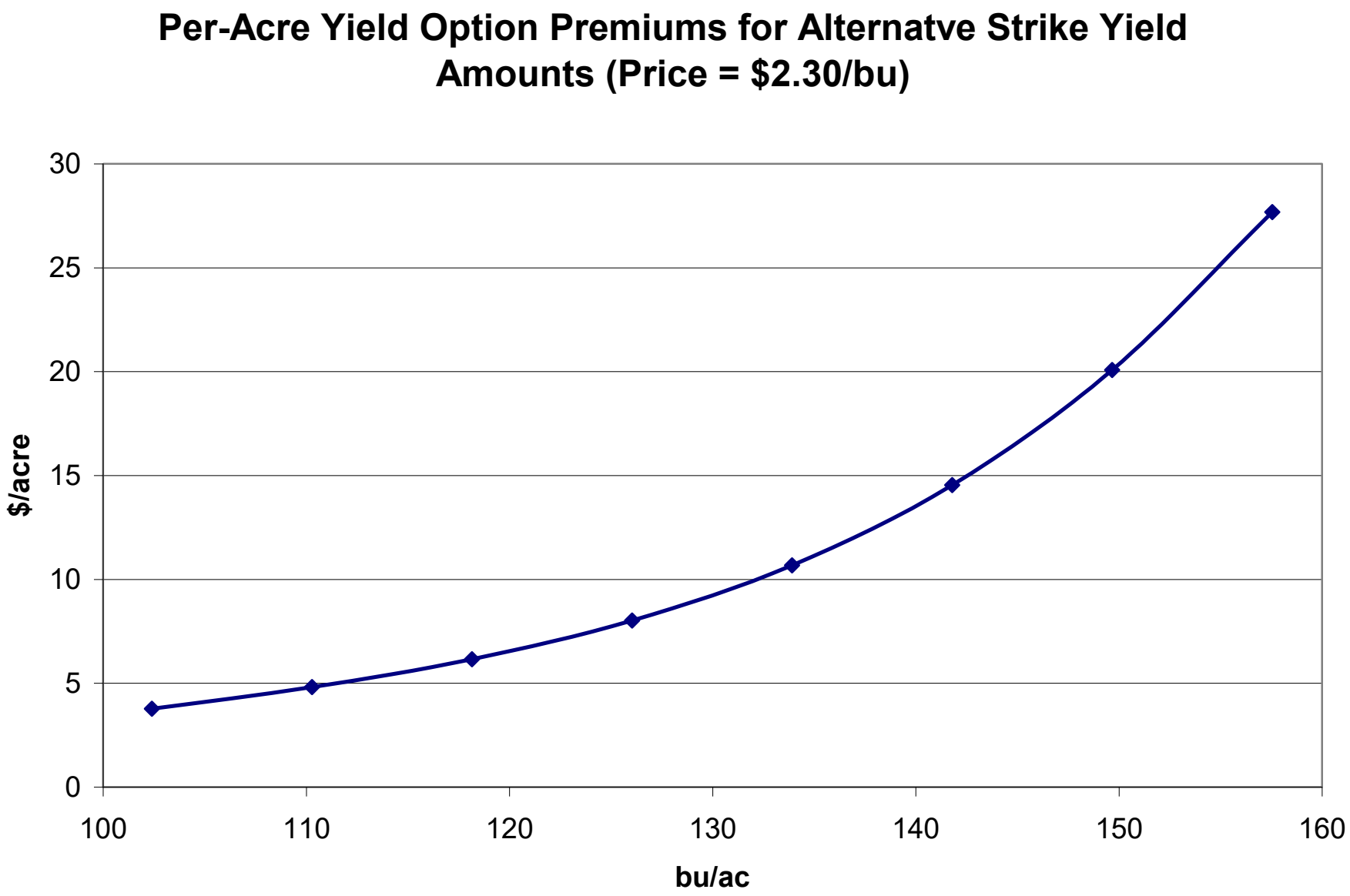
Summing up all outcomes: $0.19 for a $2.30 put option

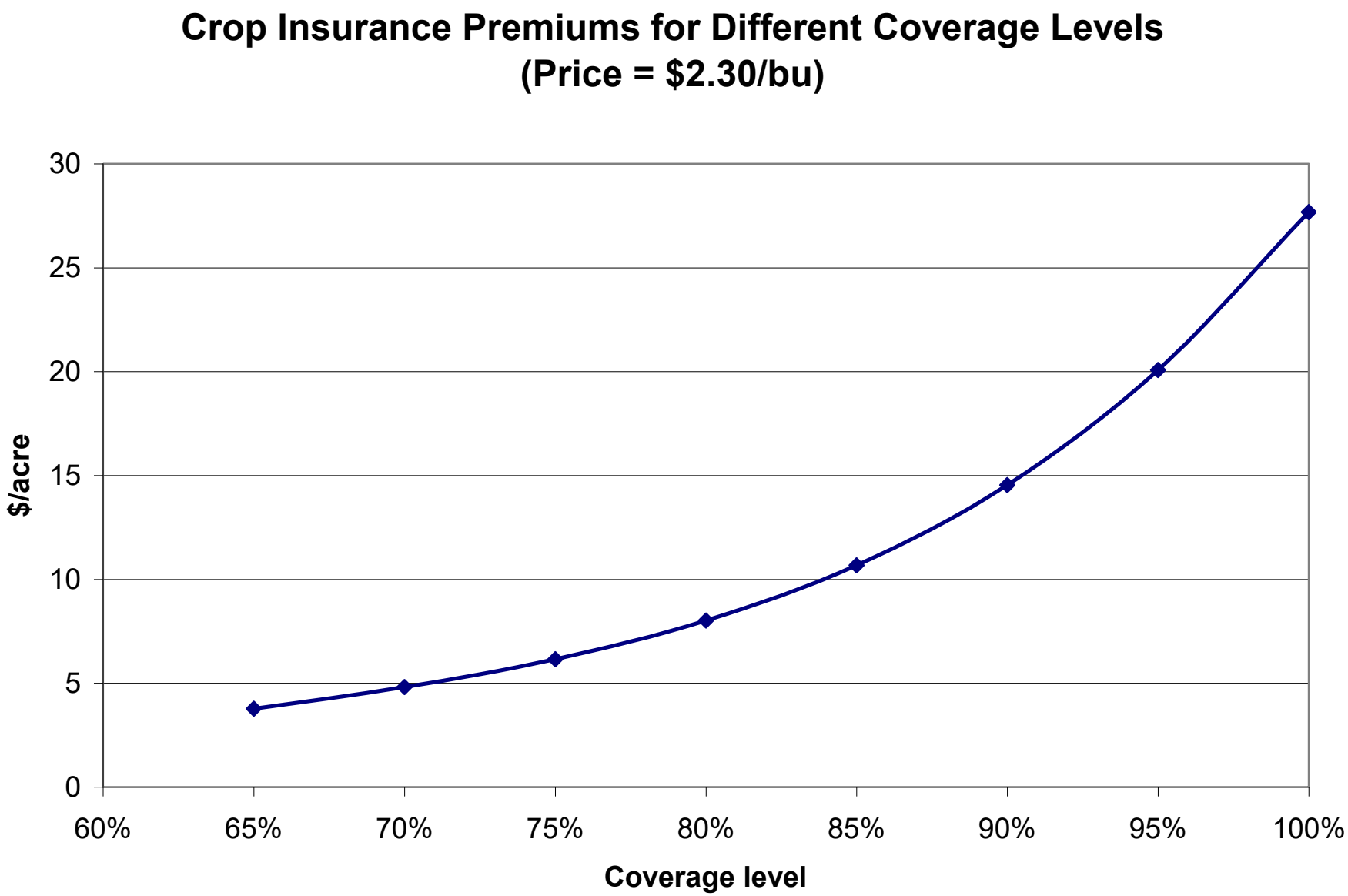



Boone County Corn Yields: 1957 to 2004
bu/ac
200
180
160
140
120
100
80
60
40
20
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
Year

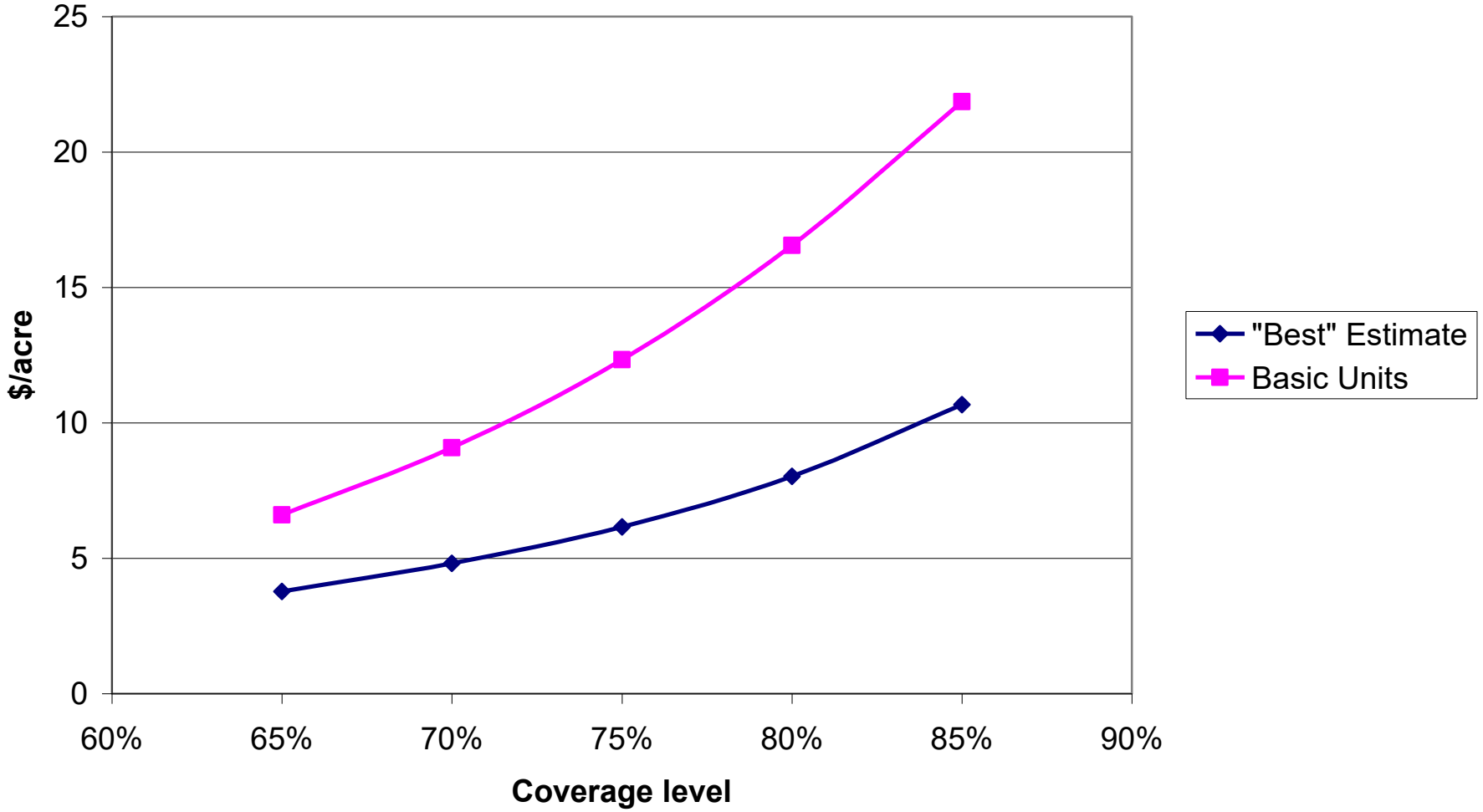

Boone County Soybean Yields
60
50
40
30
20
10
0
bu/ac
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
year

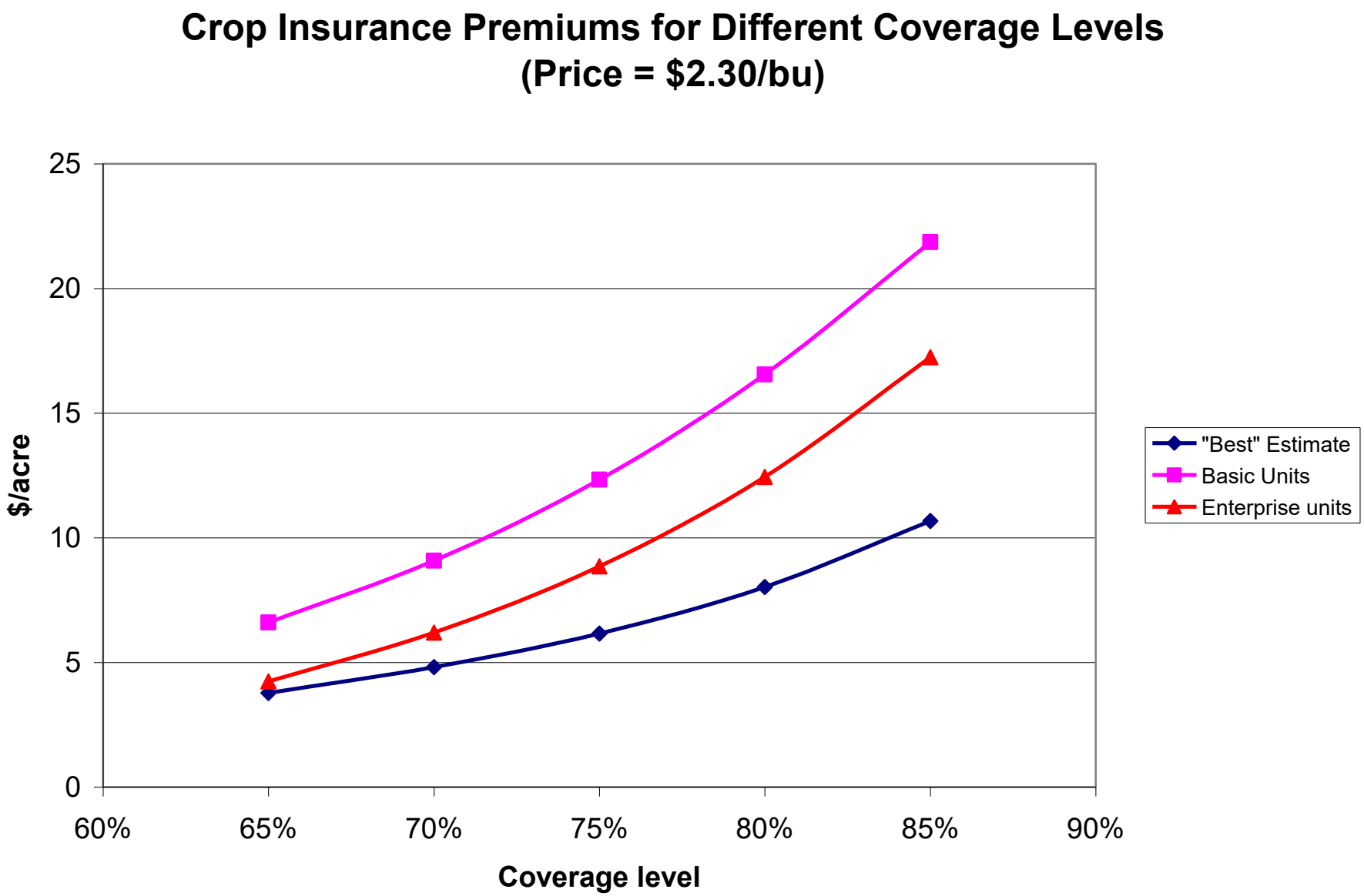

Distribution of Farm (not field) Yields for an Average Boone County Farmer
probability
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
bu/ac


Per-Acre Yield Option Premiums for Alternatve Strike Yield Amounts (Price = $2.30/bu)
30
25
20
15
10
5
0
$/acre
100
110
120
130
140
150
160
bu/ac

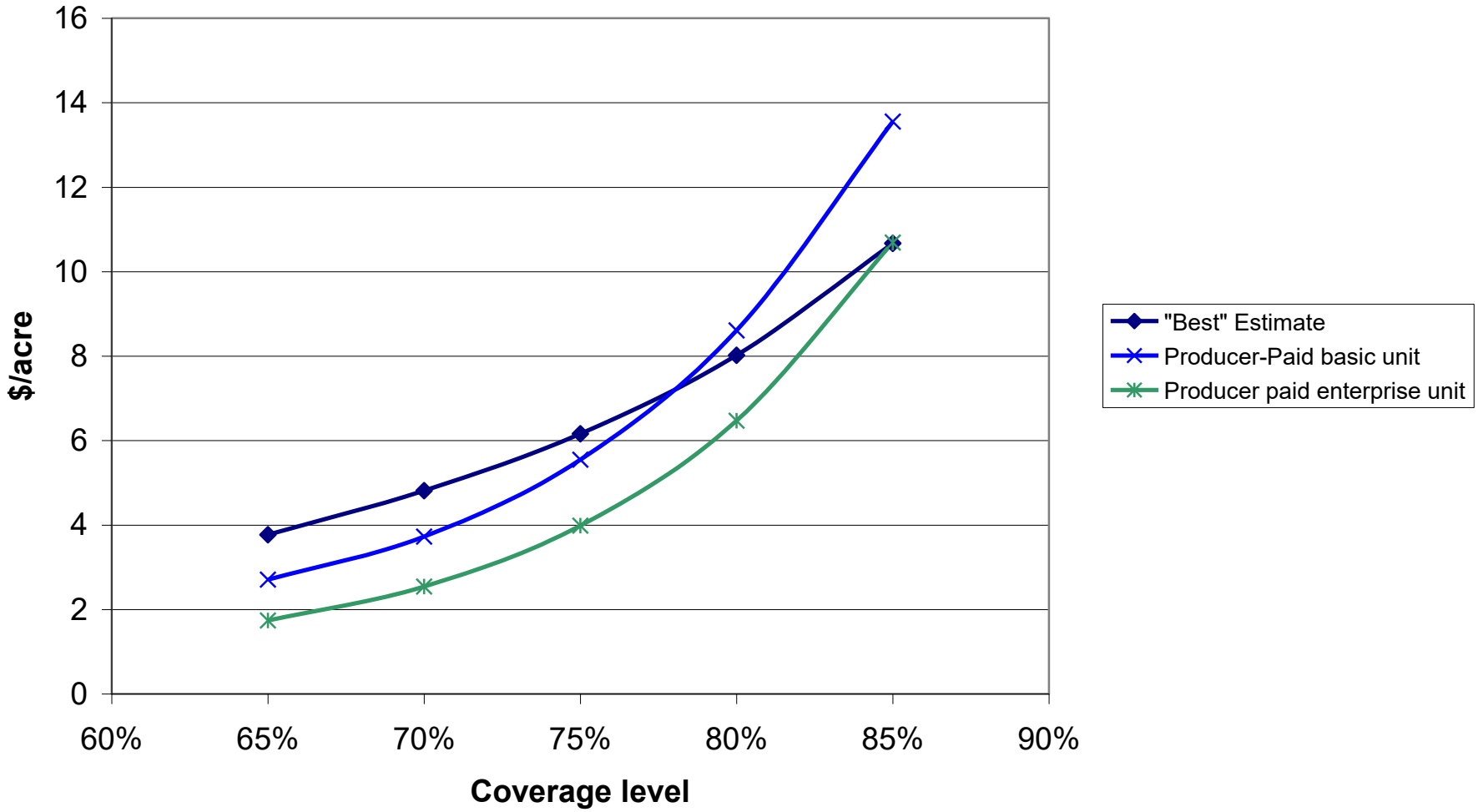

Crop Insurance Premiums for Different Coverage Levels
(Price = $2.30/bu)
$/acre
30
25
20
15
10
5
0
60%
65%
70%
75%
80%
85%
90%
95%
100%
Coverage level

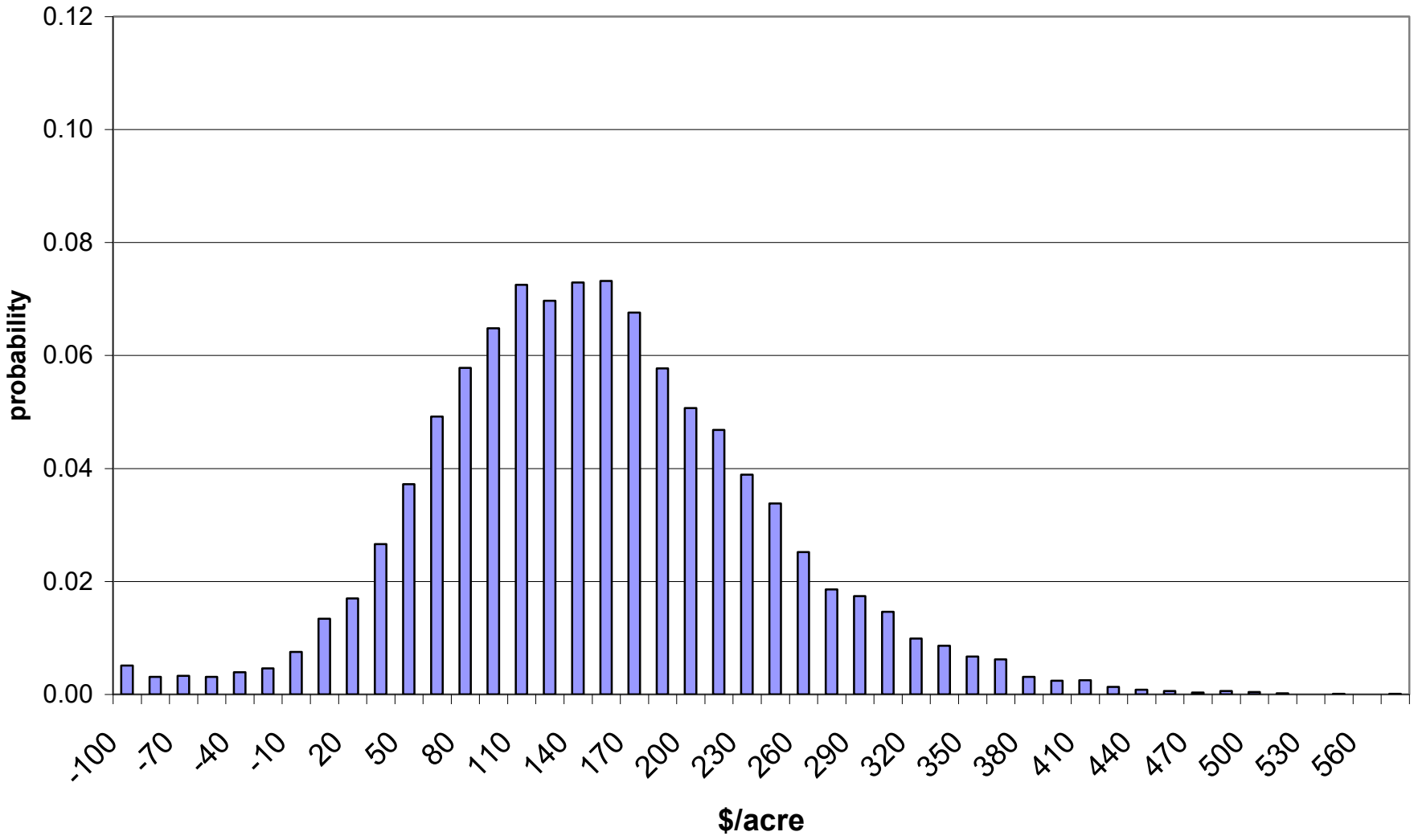
Unsubsidized Crop Insurance Premiums for Different Coverage Levels (Price = $2.30/bu)

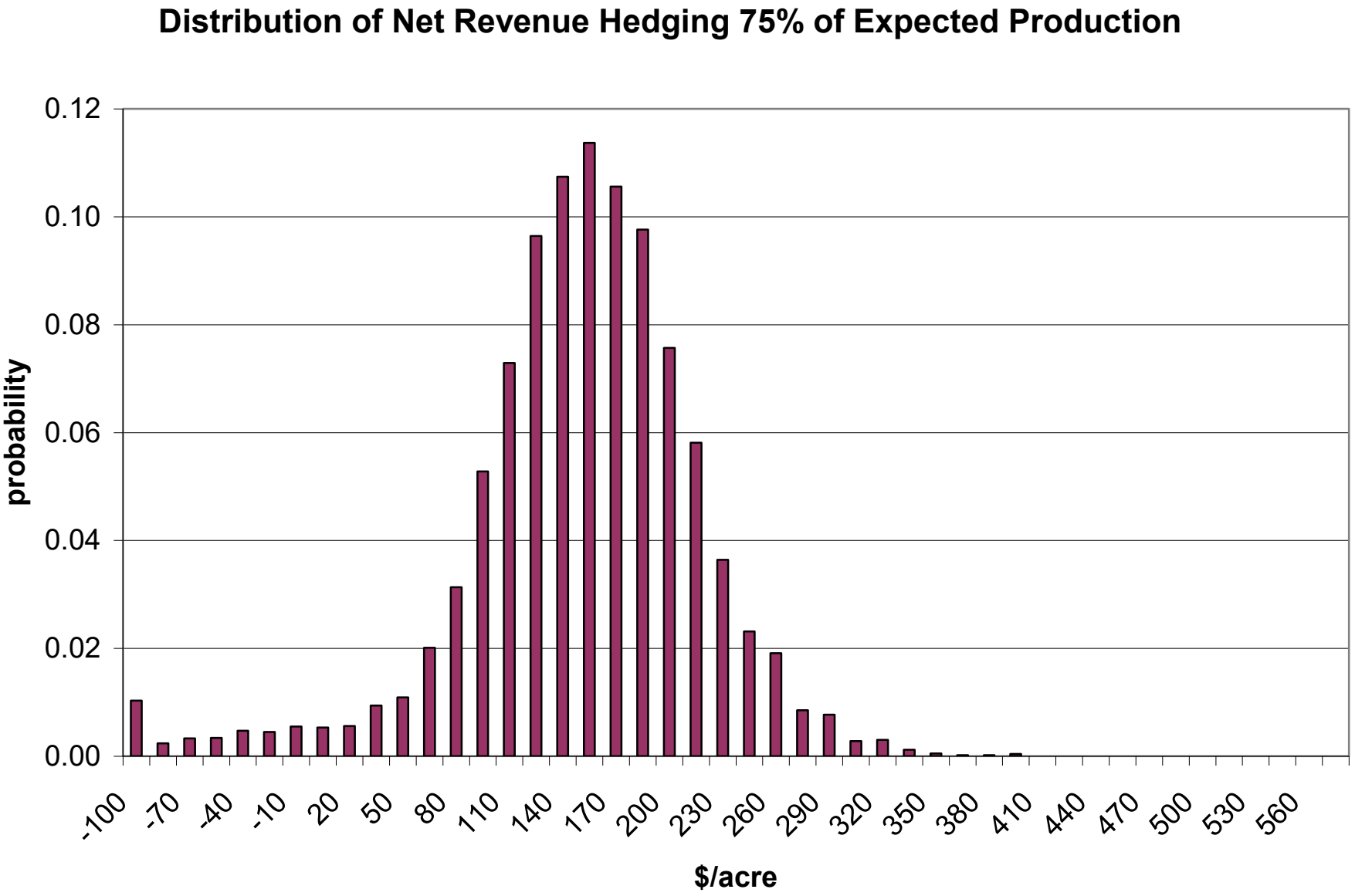


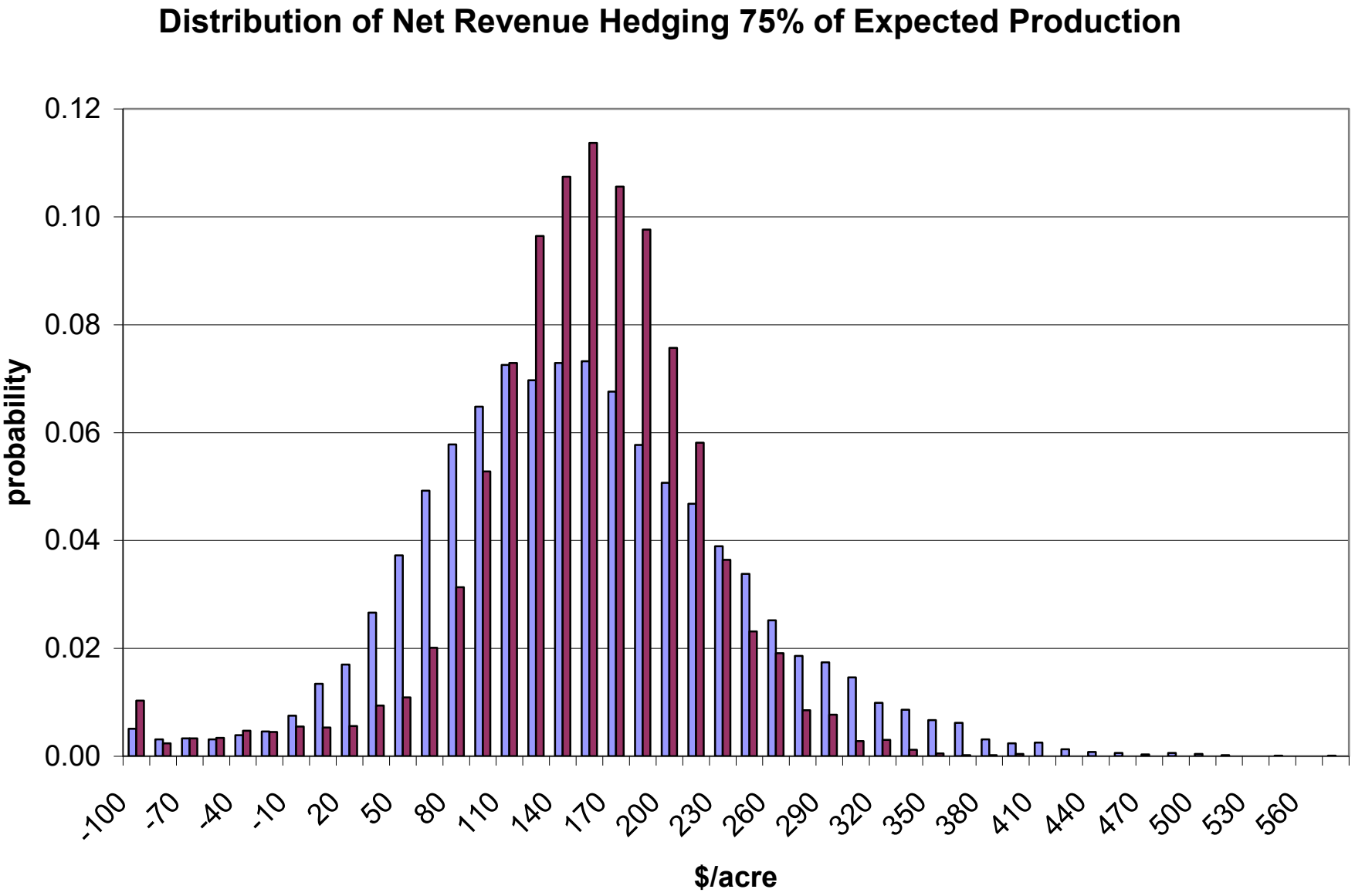

Crop Insurance Premiums for Different Coverage Levels
(Price = $2.30/bu)
25
20
15
10
5
0
$/acre
60%
65%
70%
75%
80%
85%
90%
Coverage level
"Best" Estimate
Basic Units
Enterprise units

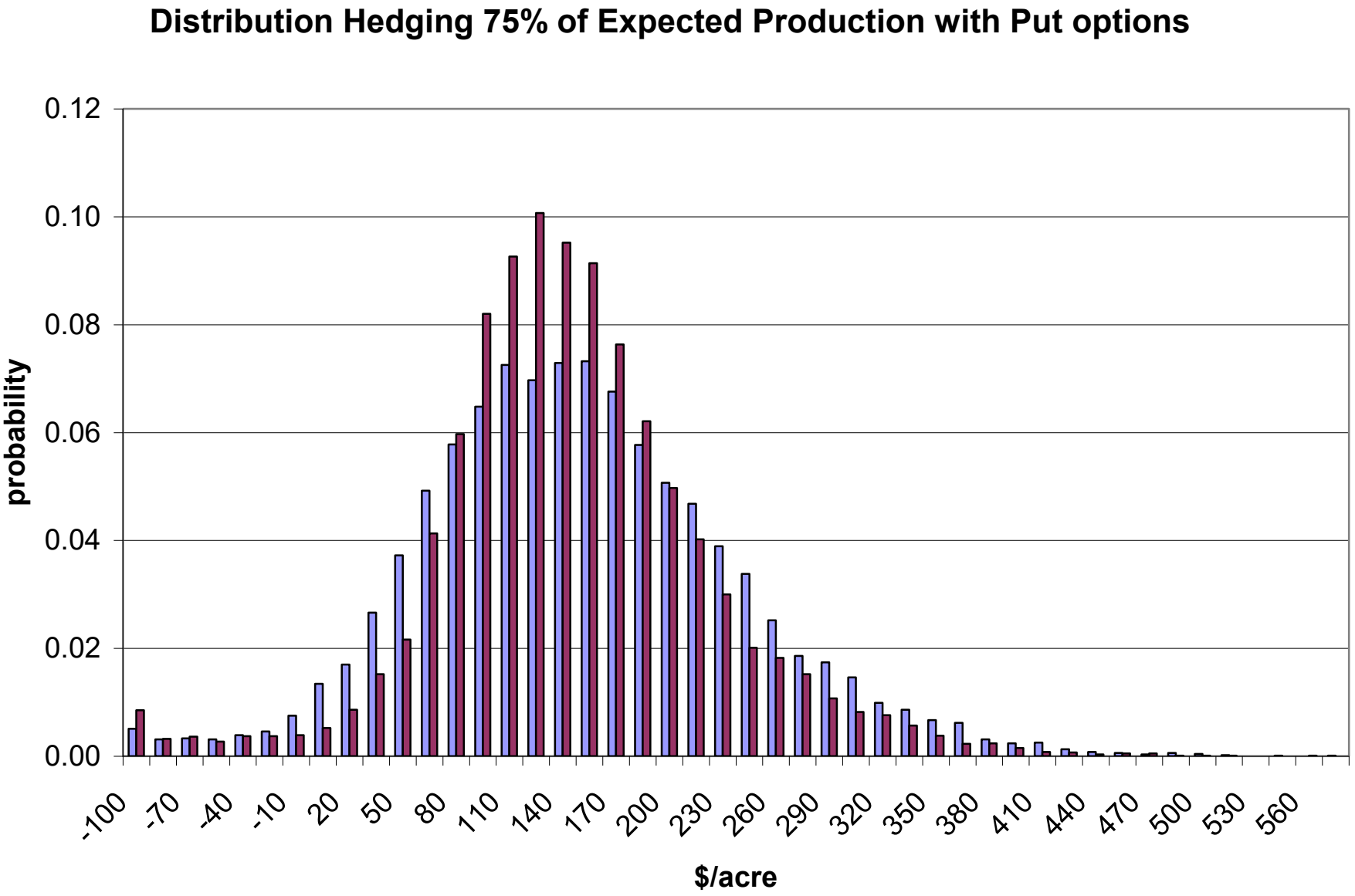
Crop Insurance Premiums for Different Coverage Levels (Price = $2.30/bu)

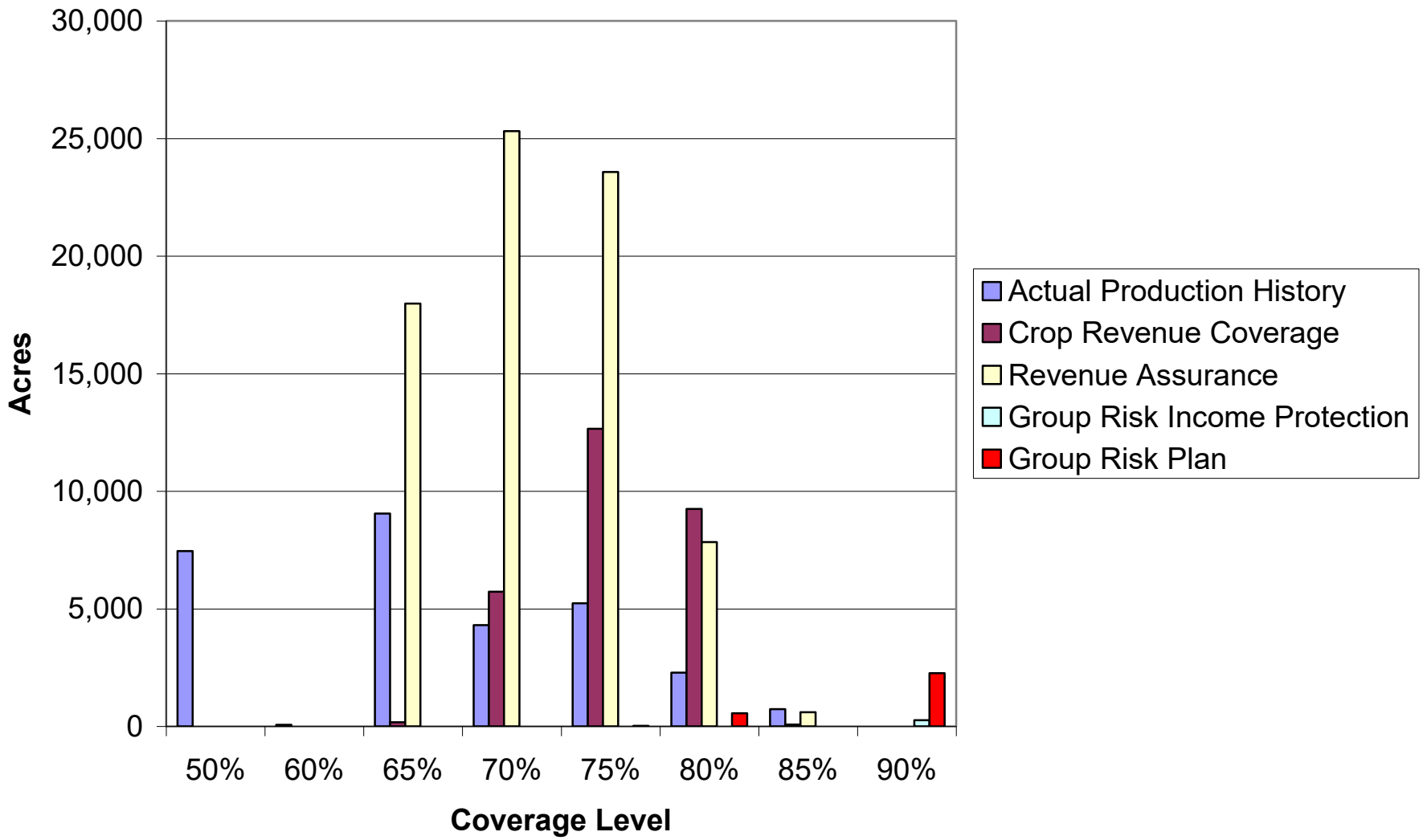


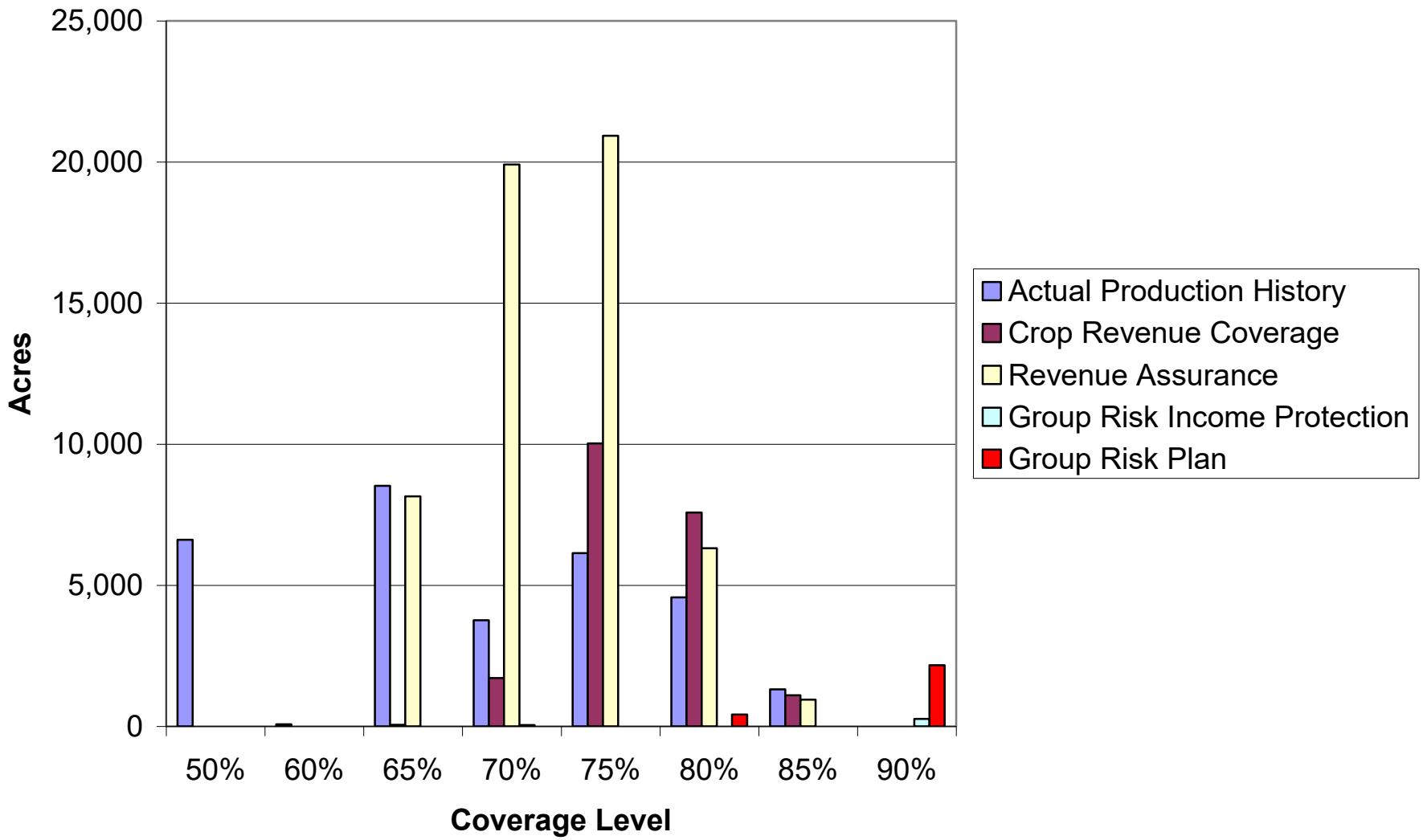

Distribution of Corn Harvest Revenue Less $180 Variable Cost
0.12
0.10
0.08
0.06
0.04
0.02
0.00
probability
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre

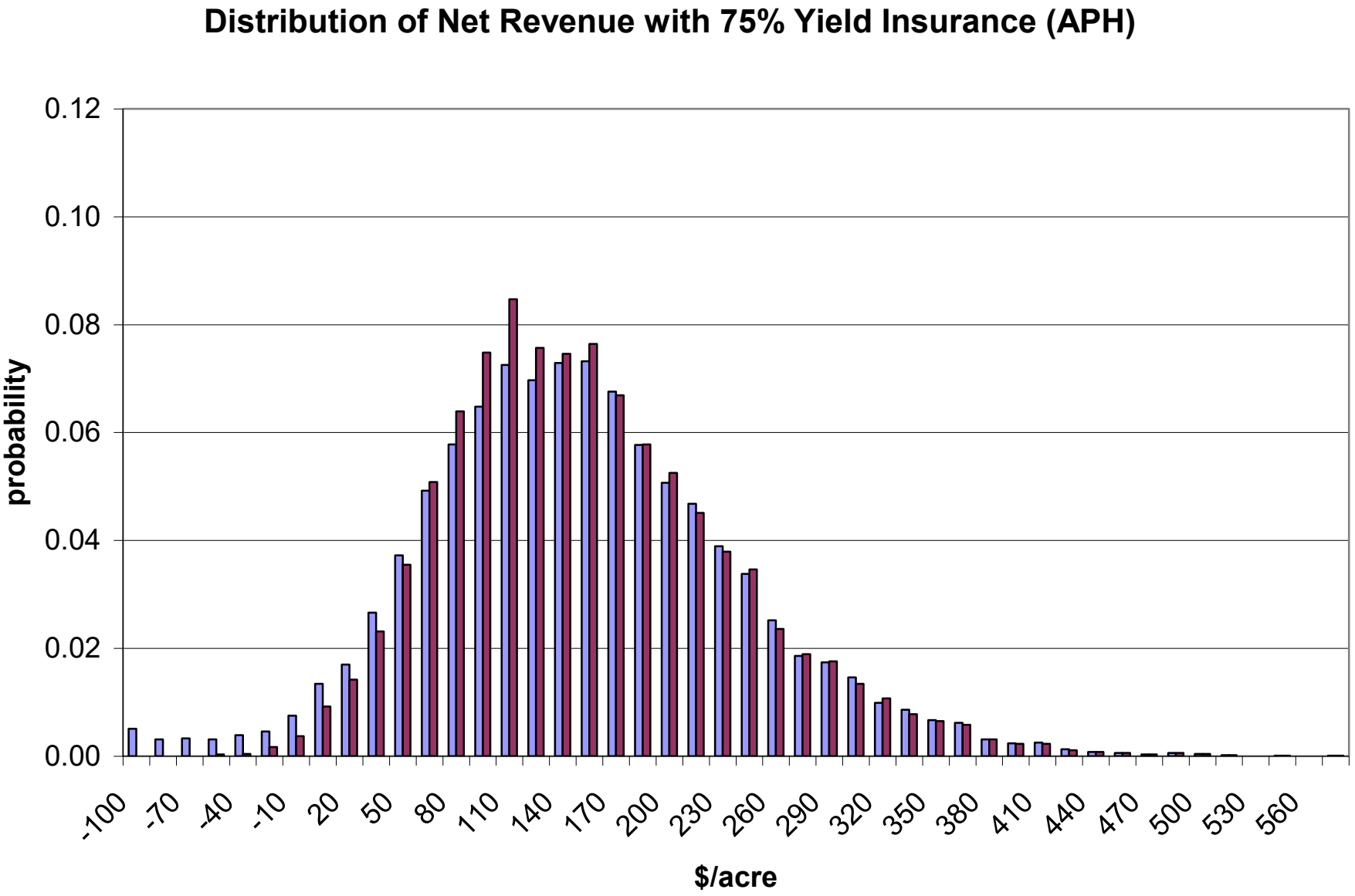

Distribution of Net Revenue Hedging 75% of Expected Production
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre

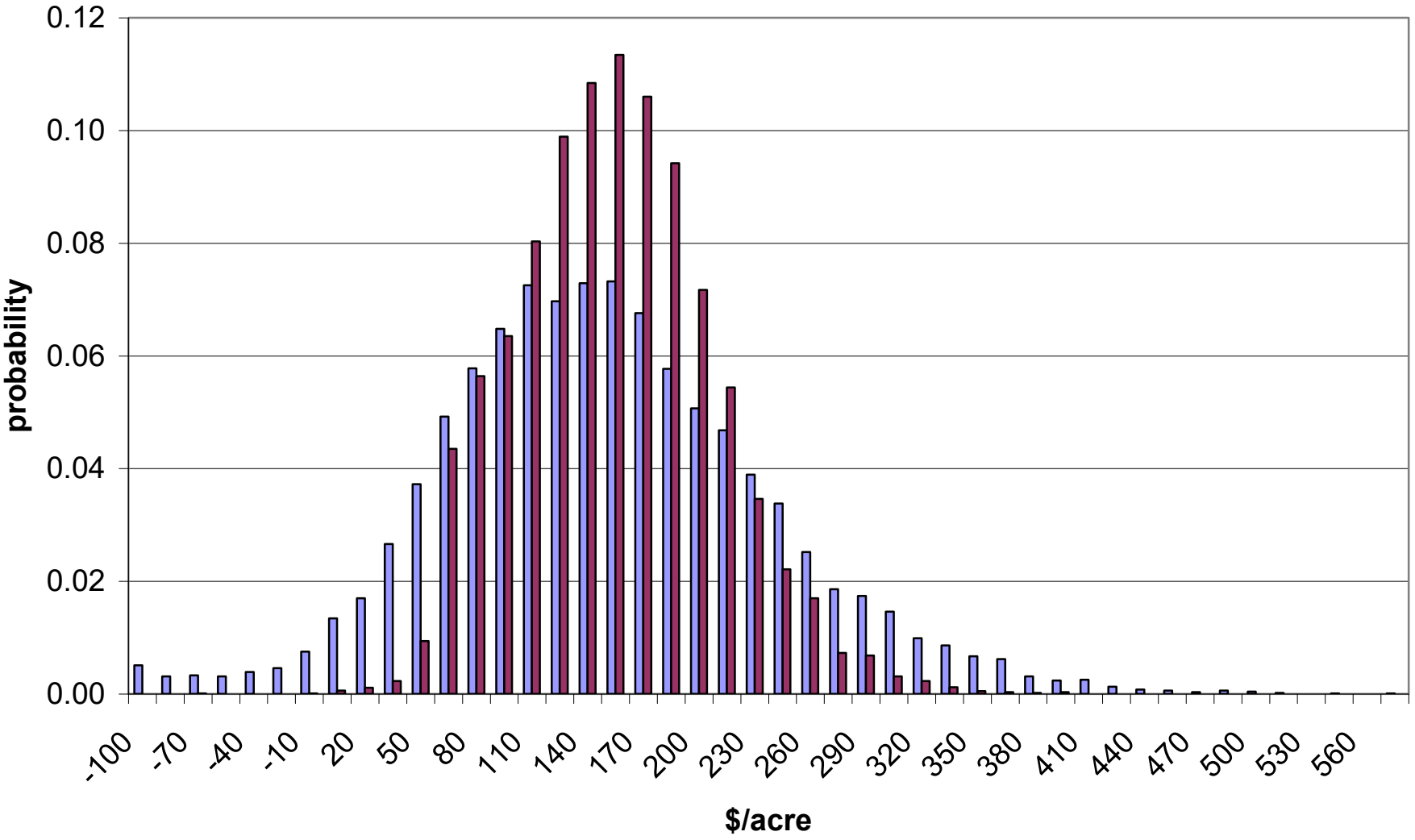

Distribution of Net Revenue Hedging 75% of Expected Production
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre

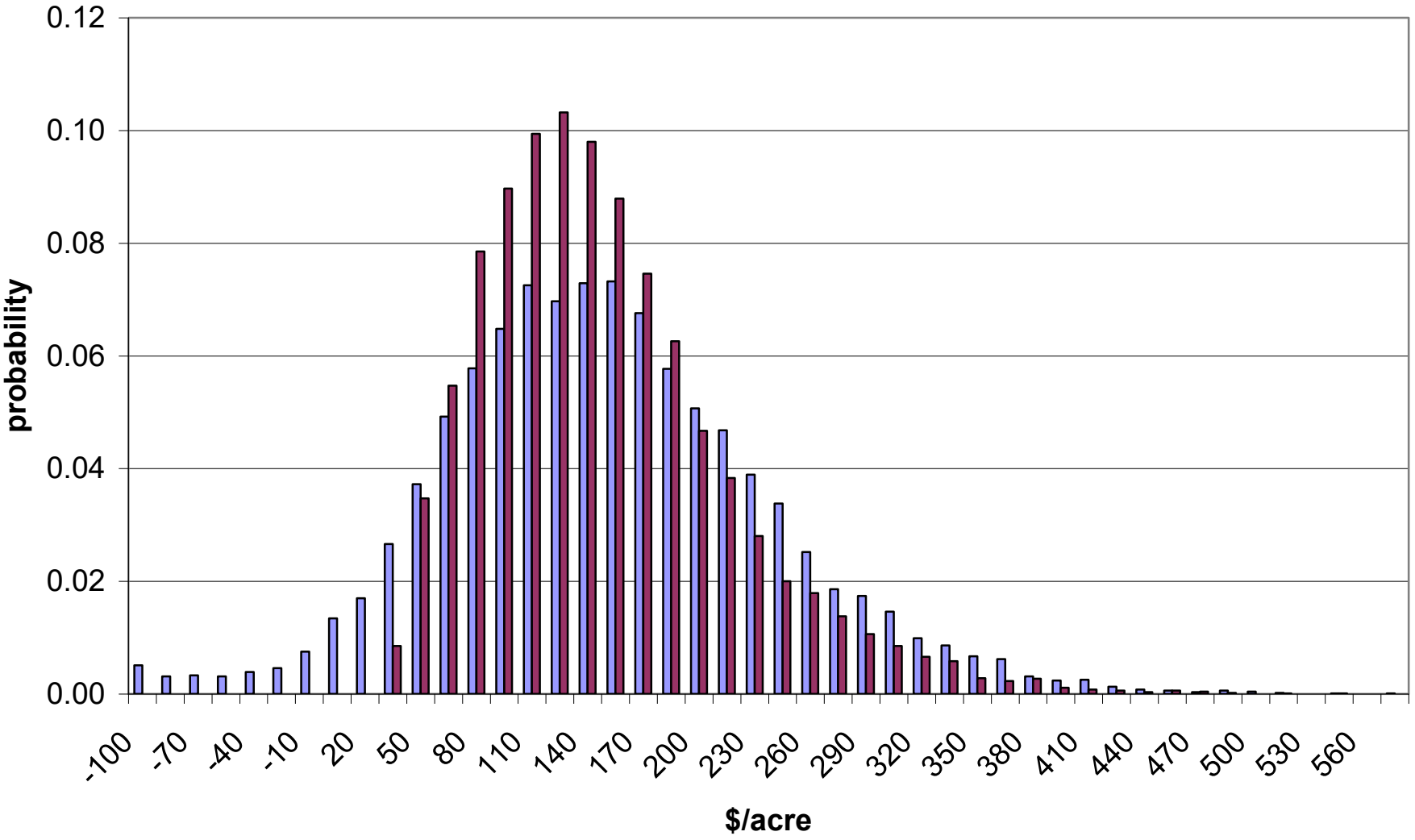

Distribution Hedging 75% of Expected Production with Put options
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre

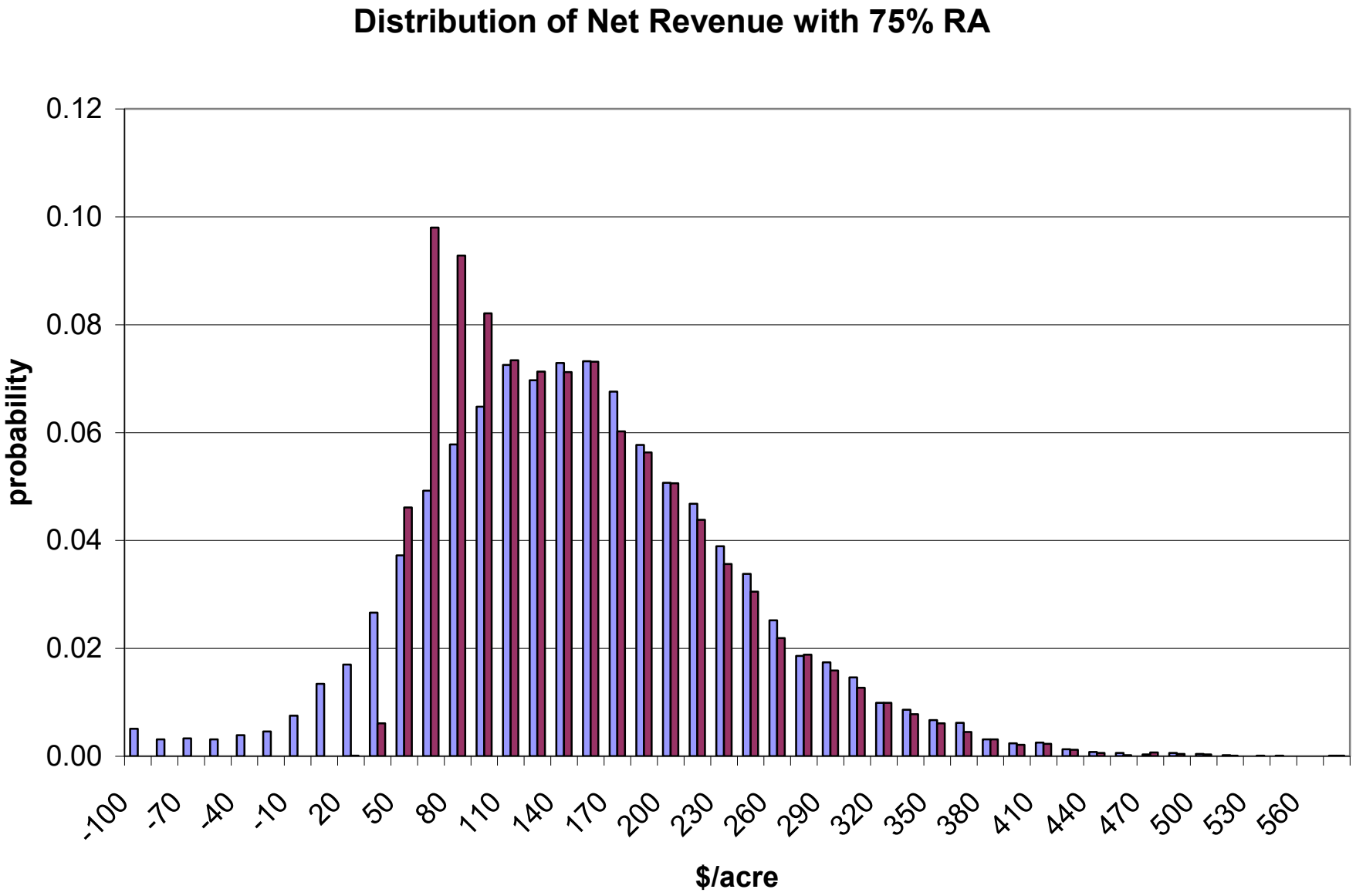

Corn Acres Insured in Boone County in 2004
30,000
25,000
20,000
15,000
10,000
5,000
0
Acres
50%
60%
65%
70%
75%
80%
85%
90%
Coverage Level
Actual Production History
Crop Revenue Coverage
Revenue Assurance
Group Risk Income Protection
Group Risk Plan

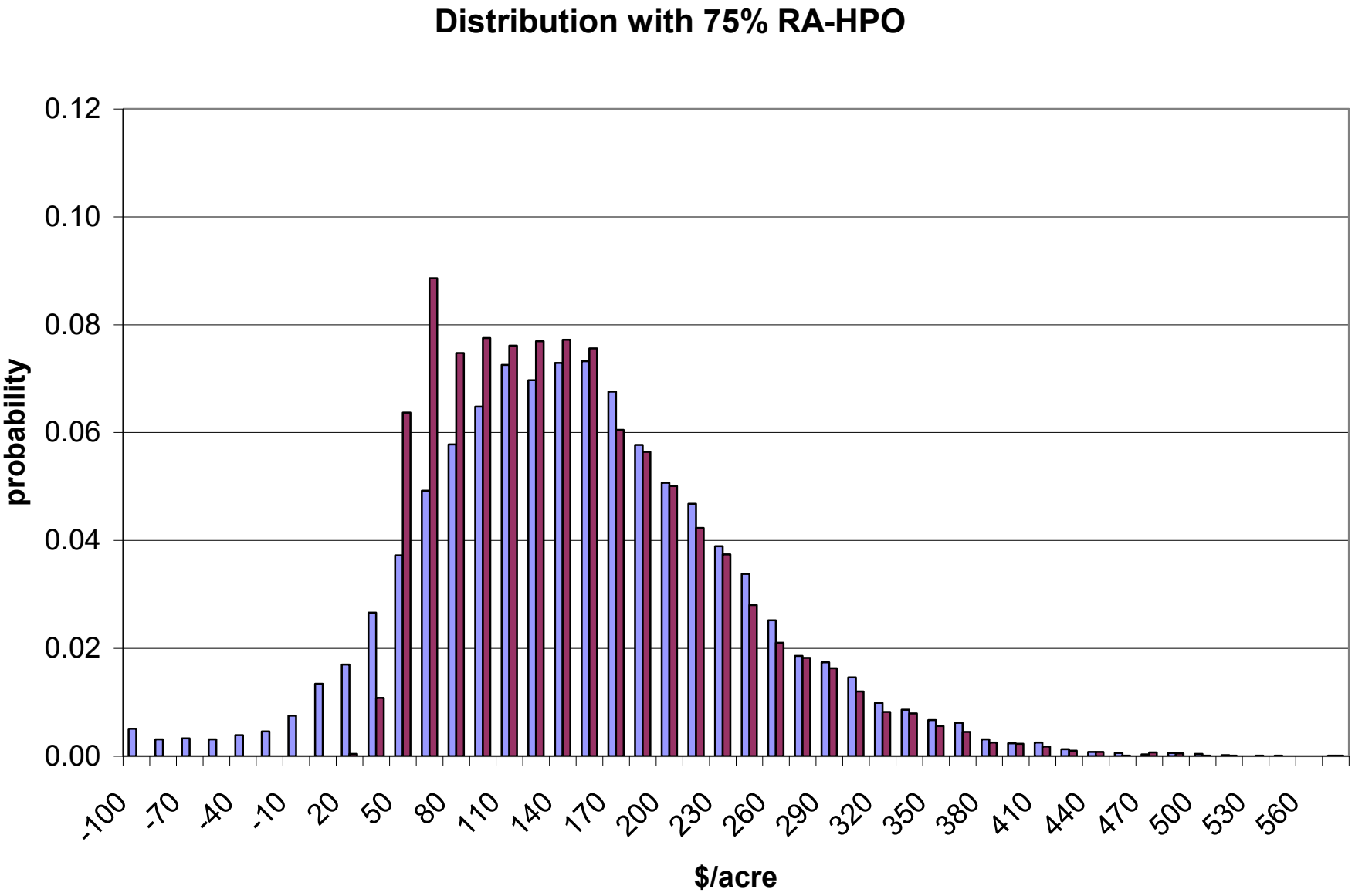

Soybean Acres Insured in Boone County in 2004
25,000
20,000
15,000
10,000
5,000
0
Acres
50%
60%
65%
70%
75%
80%
85%
90%
Coverage Level
Actual Production History
Crop Revenue Coverage
Revenue Assurance
Group Risk Income Protection
Group Risk Plan

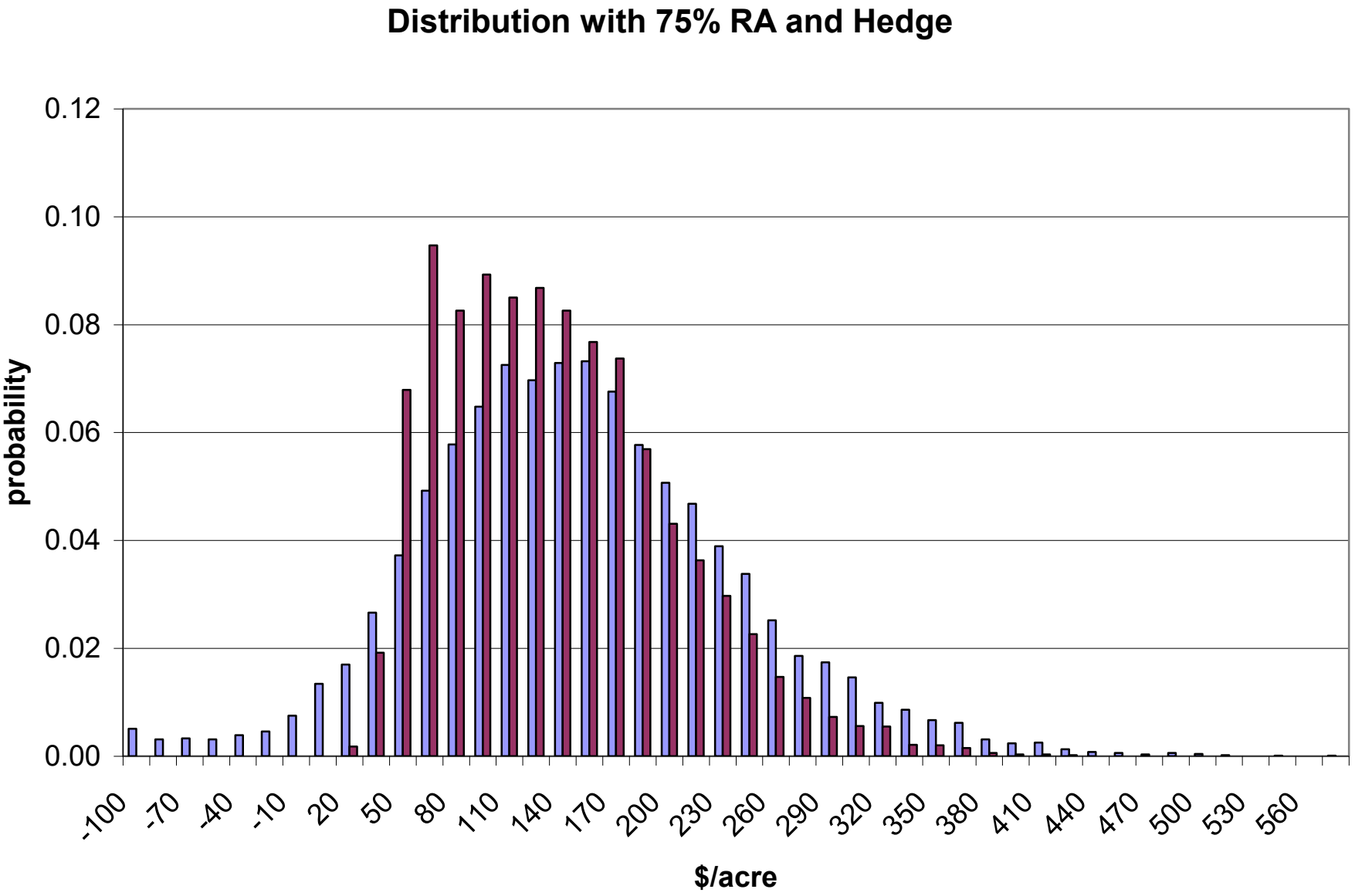

Distribution of Net Revenue with 75% Yield Insurance (APH)
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre

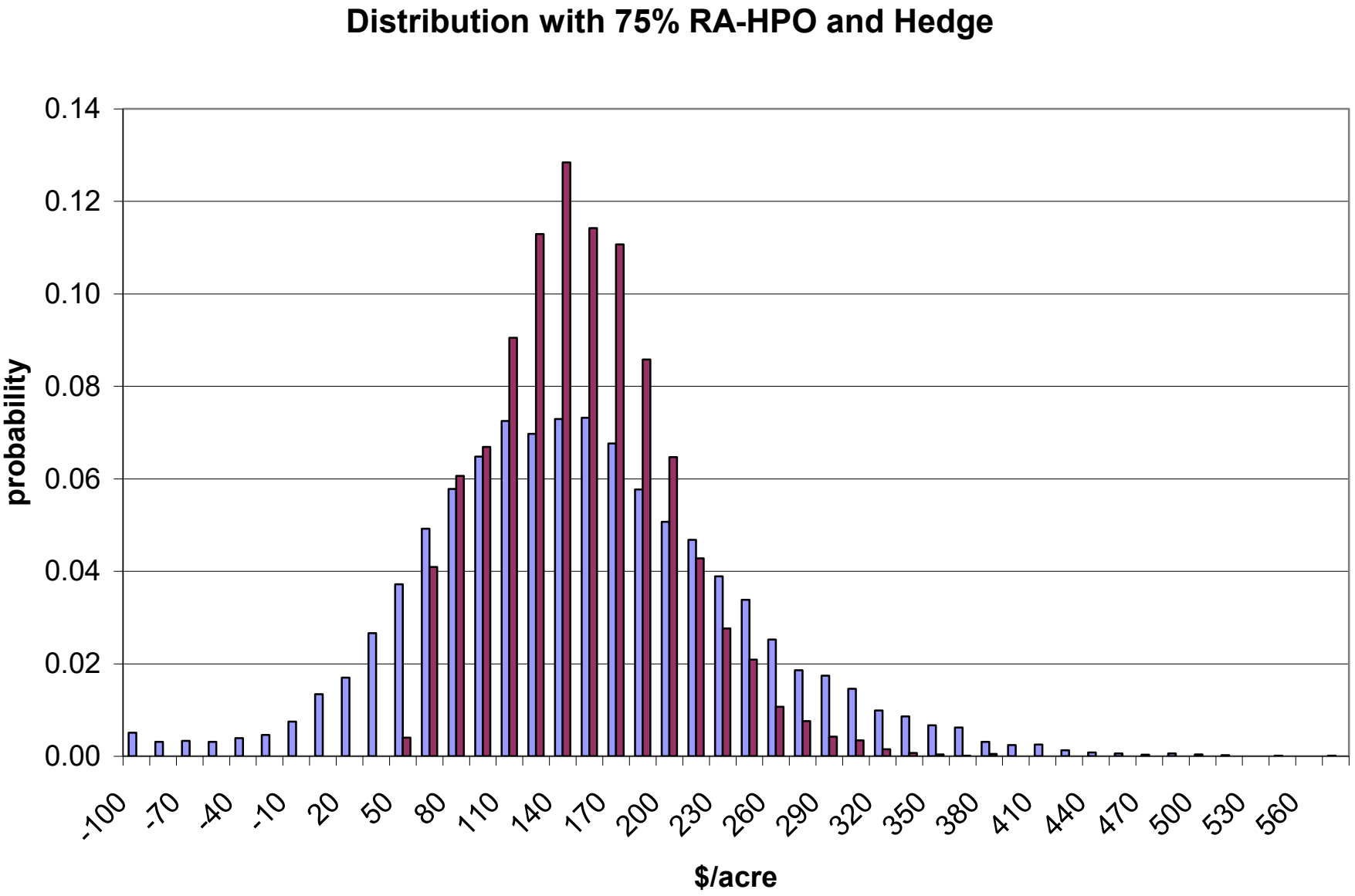

Distribution with Yield Insurance and 75% Hedge
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre


Distribution Using Yield Insurance and Put Options
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre

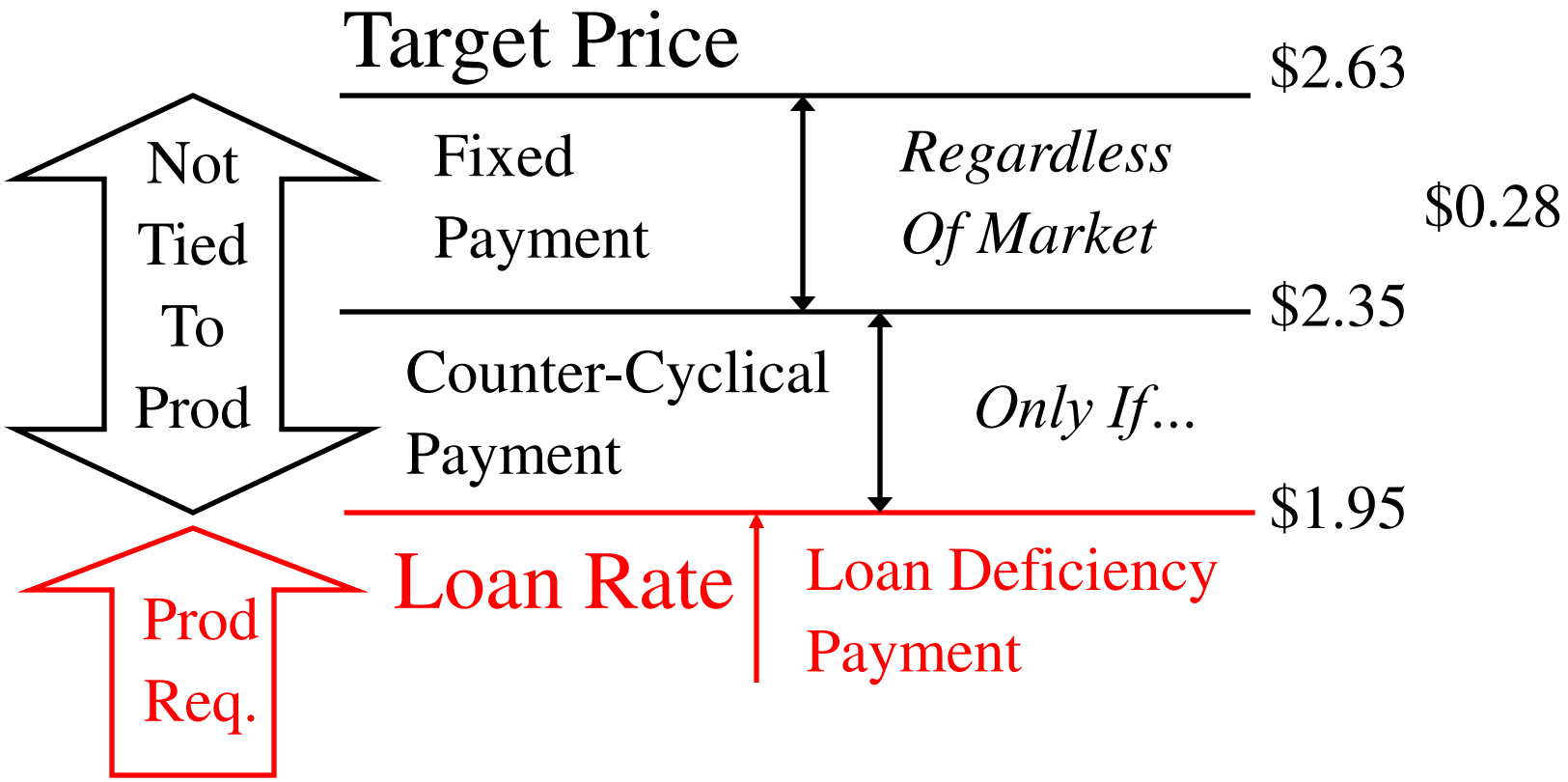

Distribution of Net Revenue with 75% RA
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre

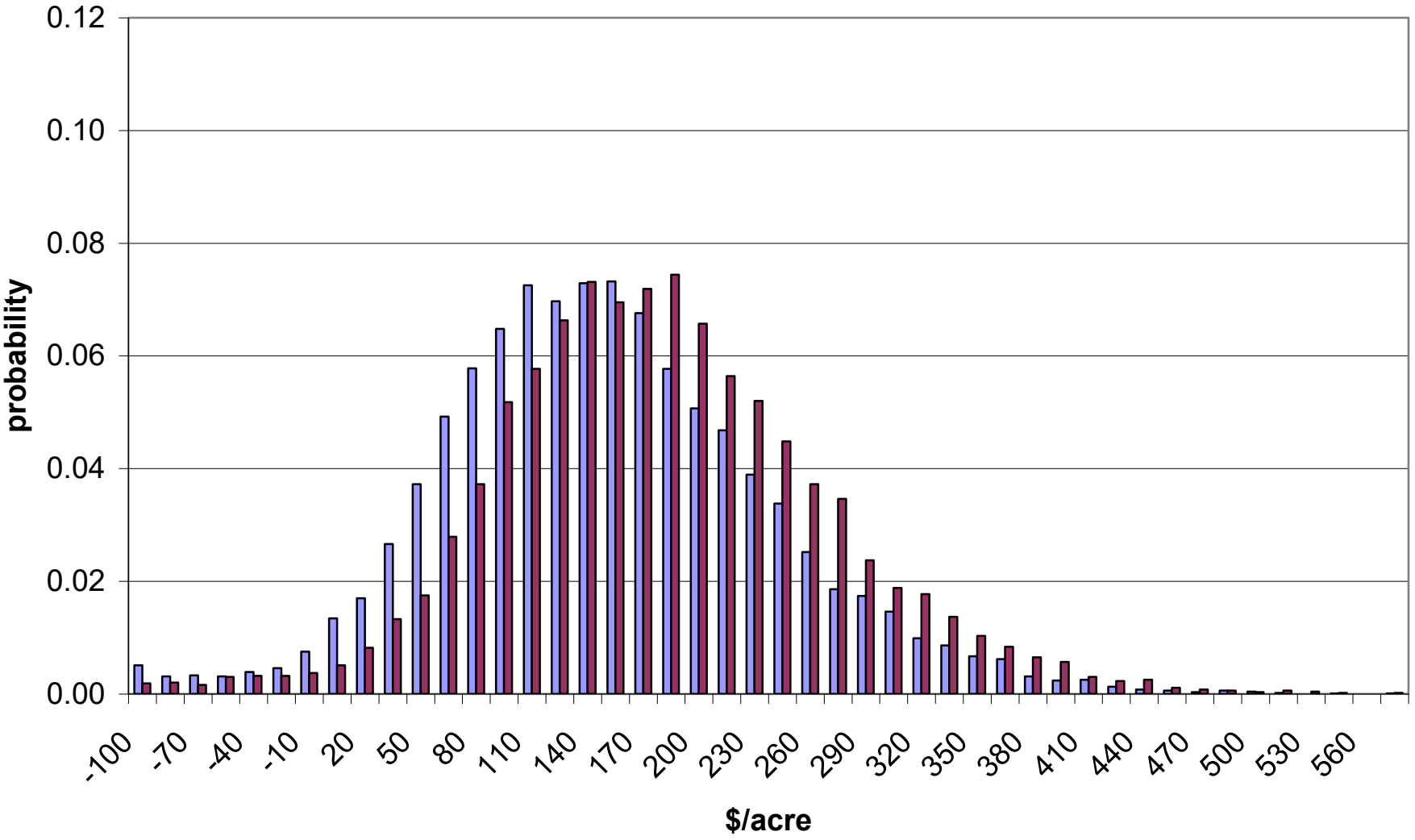

Distribution with 75% RA-HPO
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre

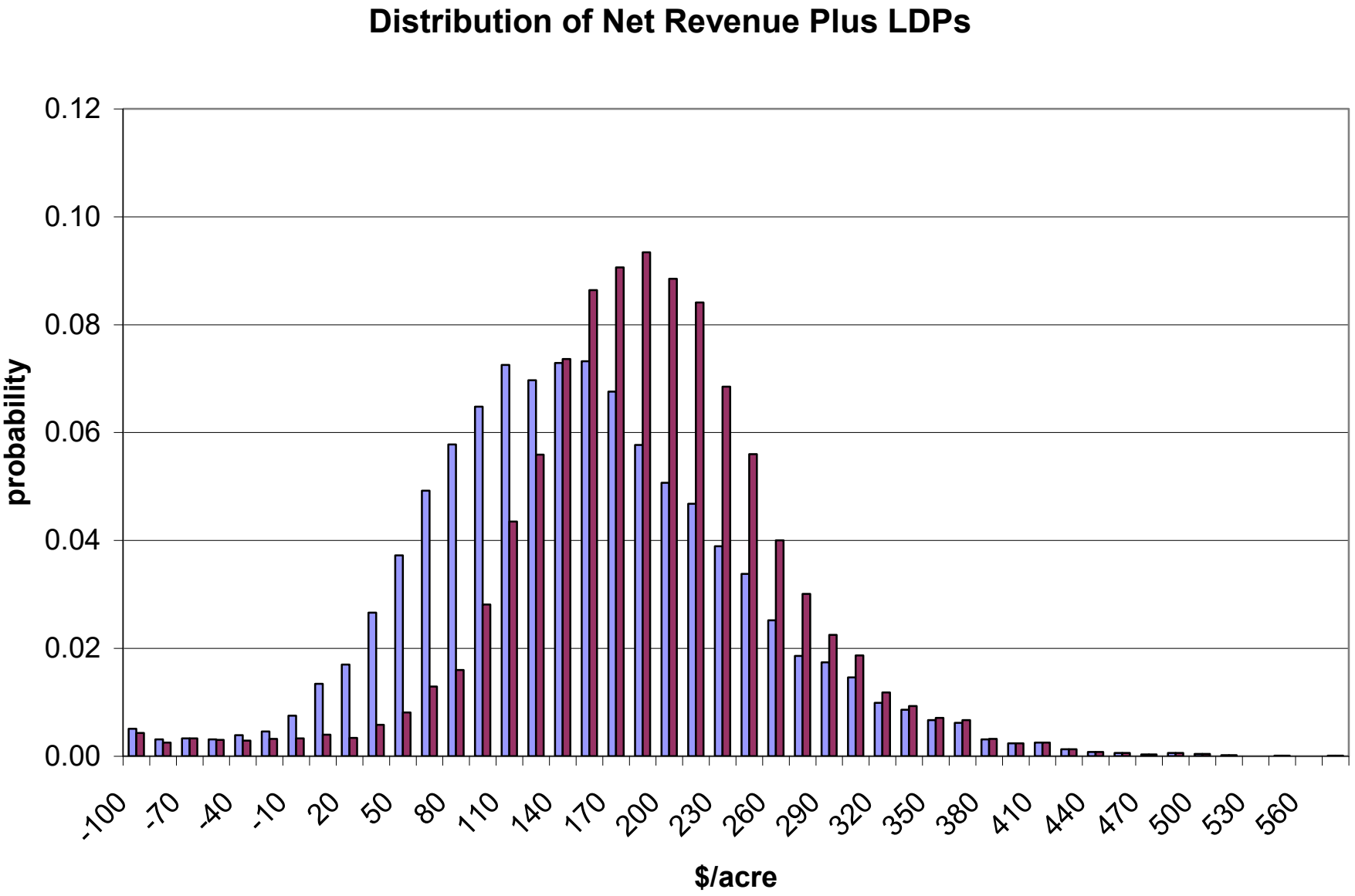

Distribution with 75% RA and Hedge
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre

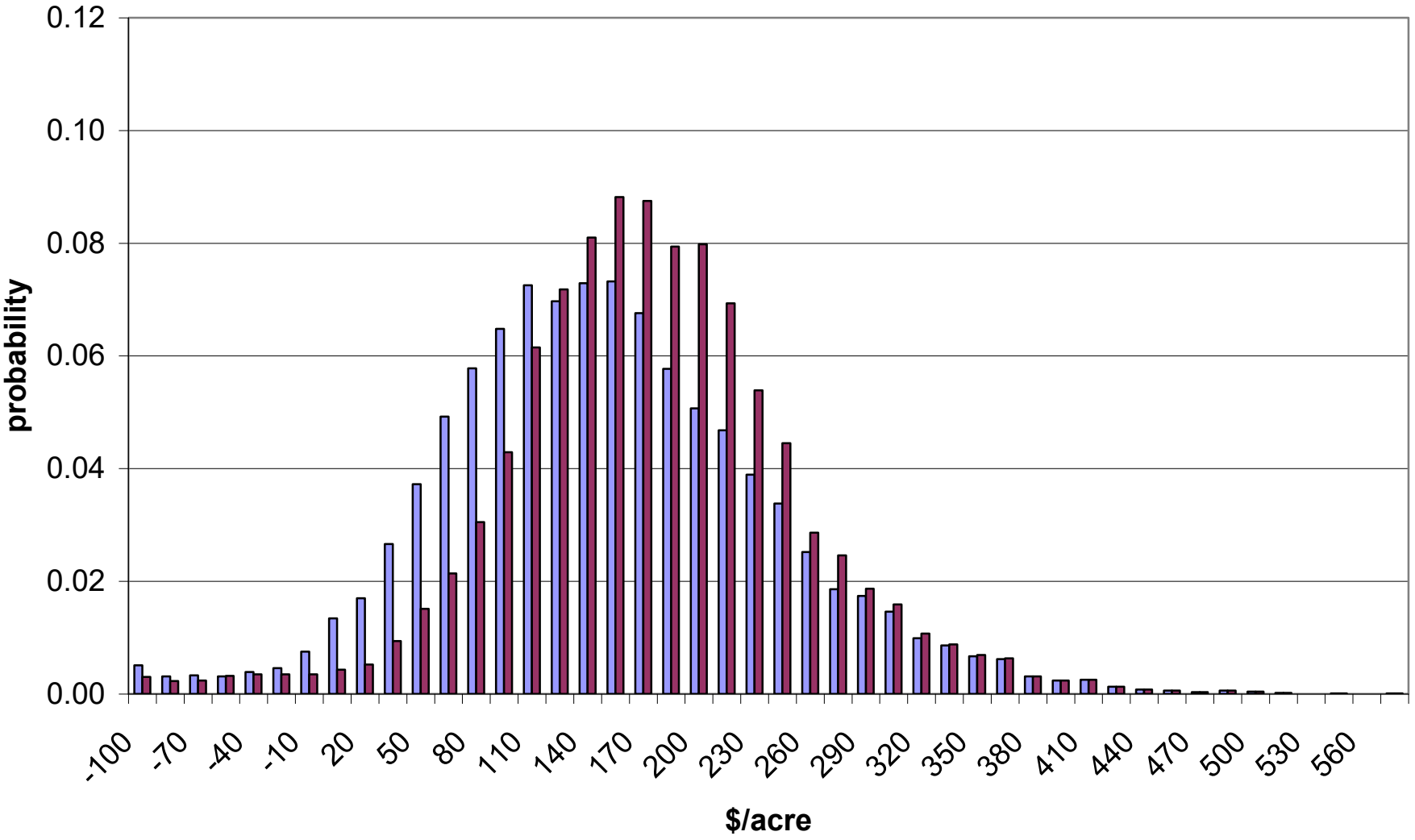

Distribution with 75% RA-HPO and Hedge
probability
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre

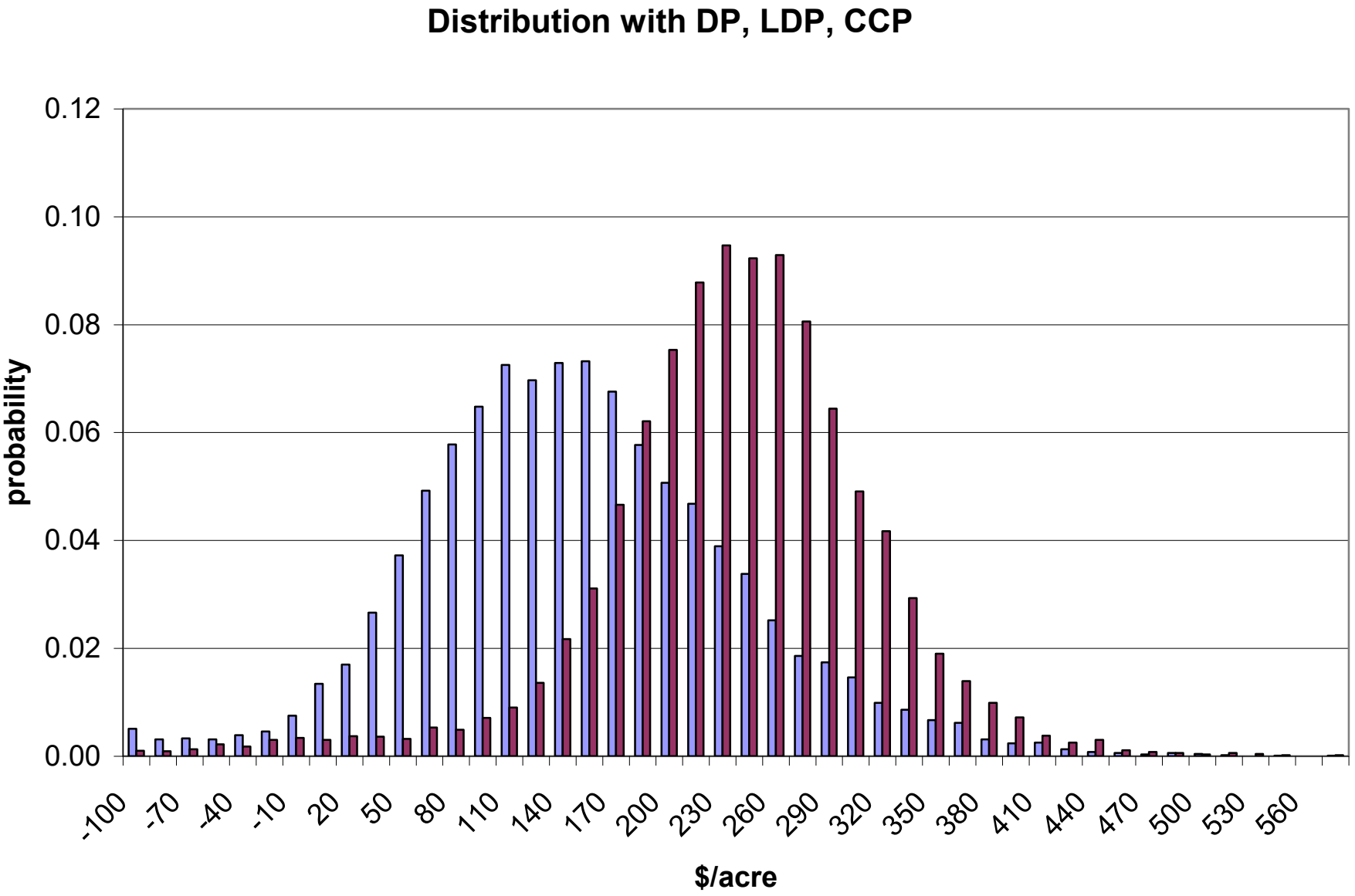
Structure of Program Payments for Corn

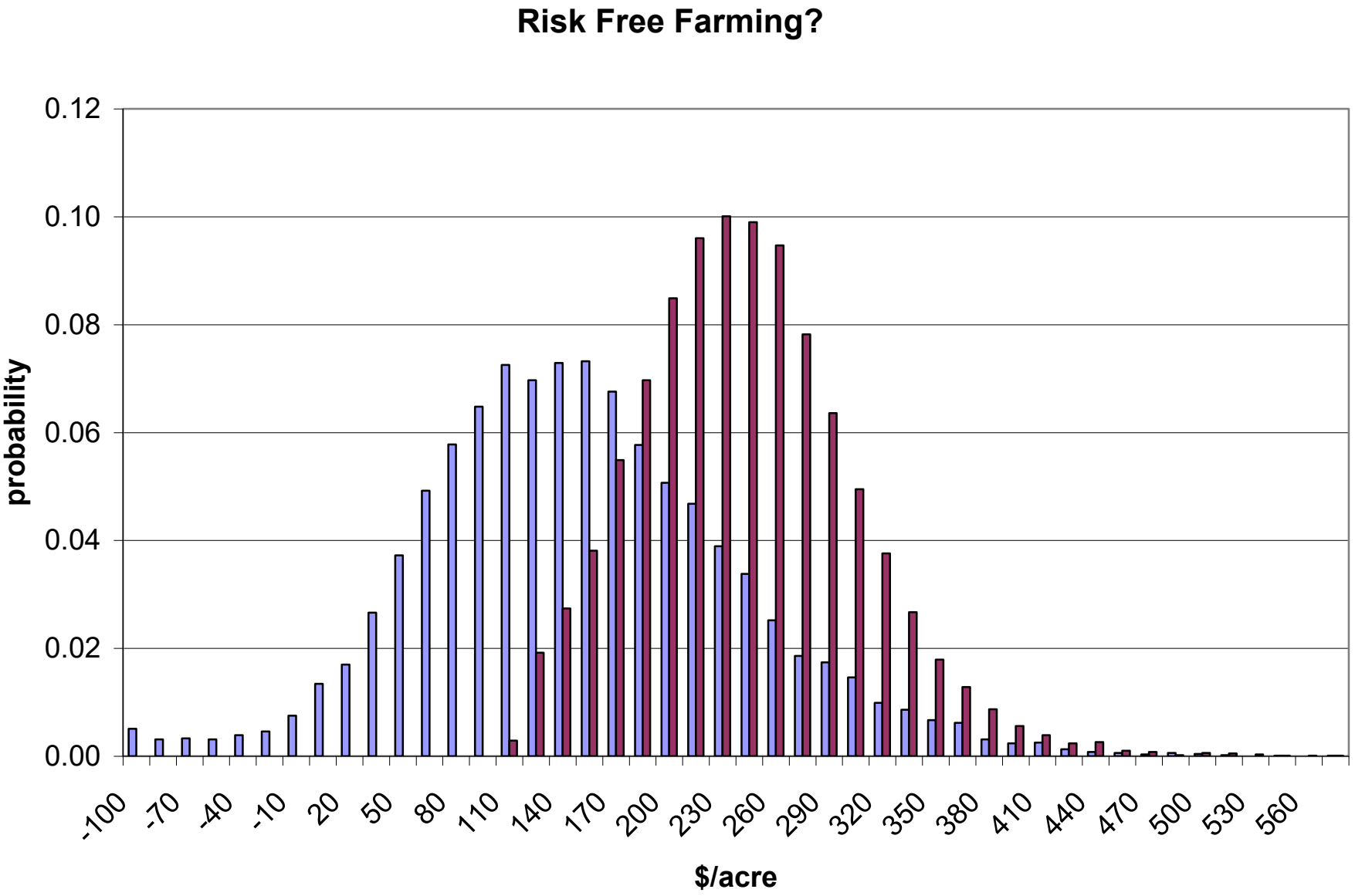



Distribution of Net Revenue Plus Direct Payments
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre


Distribution of Net Revenue Plus LDPs
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre


Distribution of Net Revenue Plus CCPs
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre


Distribution with DP, LDP, CCP
0.12
0.10
0.08
0.06
0.04
0.02
0.00
probability
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre


Risk Free Farming?
0.12
0.10
0.08
0.06
0.04
0.02
0.00
probability
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre

Reduced Risk

- With no insurance or government programs:
  - Average return over variable cost = $143/ac
  - 3.8% probability of not covering $180 variable cost
- With all government programs and insurance:
  - Average returns over variable cost = $235/ac
  - 5.6% probability that returns are less than $143/ac

Costs of Benefits of Crop Insurance Decisions

- What product to buy?
  - APH, RA, RA-HPO, CRC, GRP, GRIP, GRIP-HRO
- What coverage level to buy?
  - CAT, 65%, 70%, 75%, 80%, 85%
- What unit structure to use?
  - (optional, basic, enterprise, whole-farm)

Effects of Coverage and Unit Structure on Premium

	Coverage Level		
	65%	75%	85%
Total Premium			
Optional	6,749	16,594	32,478
Enterprise	4,545	12,425	24,610
Whole-Farm	2,440	10,270	21,870
Producer Premium			
Optional	2,767	7,452	20,136
Enterprise	1,863	5,591	15,258
Whole-Farm	1,000	4,621	13,559

Change in Expected Indemnity	65% to 75%	75% to 85%
Optional	9,845	15,884
Enterprise	7,880	12,185
Whole-Farm	7,830	11,600
Change in Producer Premium		
Optional	4,685	12,684
Enterprise	3,728	9,667
Whole-Farm	3,621	8,938

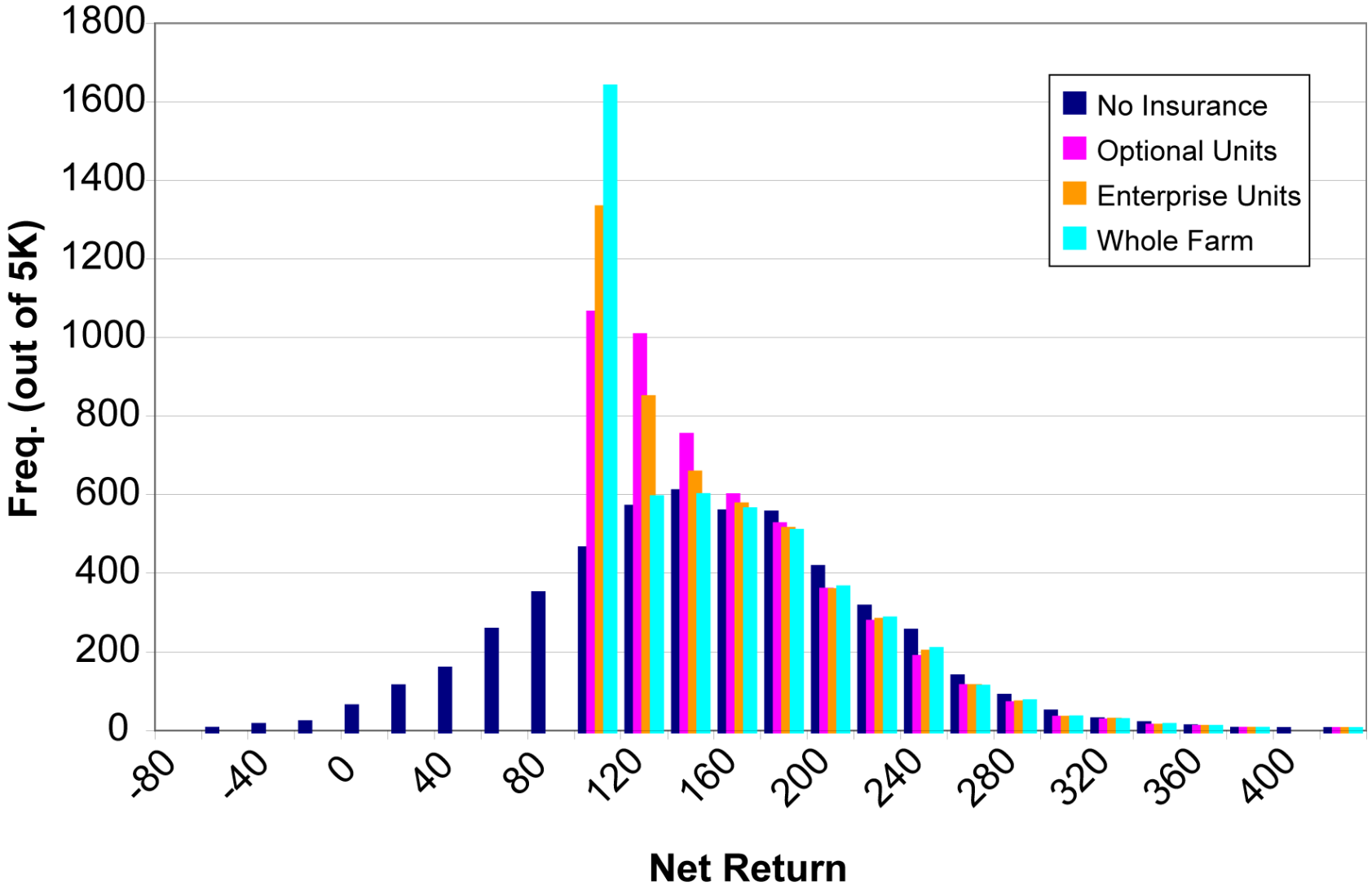
Expected rate of return from increasing coverage

	65% to 75%	75% to 85%
Optional	110%	25%
Enterprise	111%	26%
Whole-Farm	116%	30%

Expected rate of return to changing unit structure

_____	Whole-Farm to Enterprise	Enterprise to Optional
65%	144%	144%
75%	122%	124%
85%	61%	61%

Distribution of Returns by Unit Structure



GRIP and GRIP-HRO

- GRIP guarantee =

  Factor*CBOT Springtime Price*Expected County Yield

- GRIP-HRO guarantee =

  Factor*CBOT Fall or Spring Price*Expected County Yield

  Factor lies between 0.6 and 1.5.

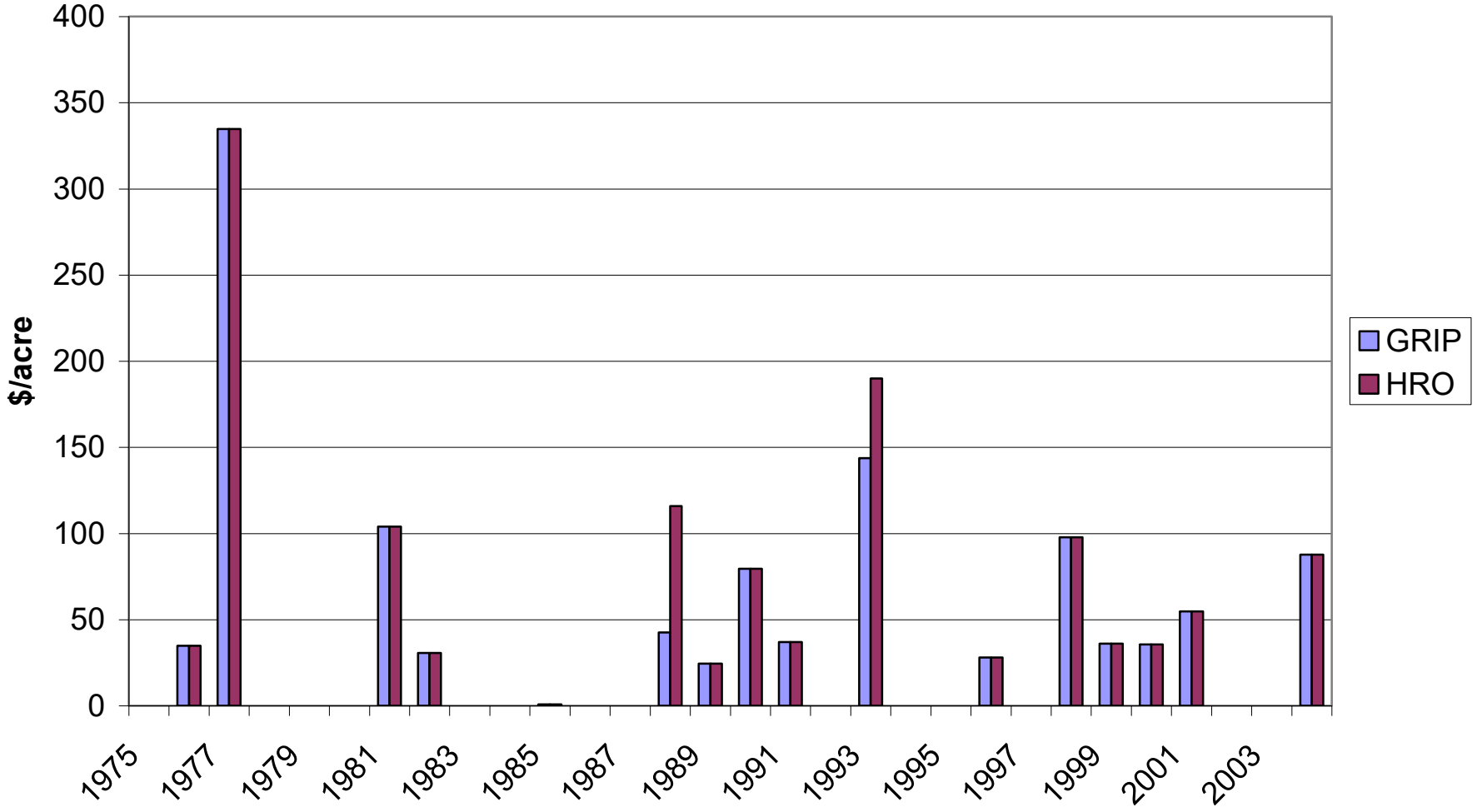
Who Should Buy GRIP?

- Farmers who do not have a representative APH yield
- Farmers who are lower risk than that assumed in APH program
- Farmers with yields that are highly correlated with county yields

GRIP and GRIP-HRO in Boone County (Expected Yield = 167.5 bu/ac)

	Maximum Coverage Per-Acre $/acre	Total Premium $/acre	Producer Premium $/acre
GRIP	**570.34**	**33.59**	**15.12**
GRIP-HRO	**570.34**	**42.20**	**18.99**

Historical Indemnities that Would Have Been Paid Out Under GRIP and GRIP-HRO in Boone County

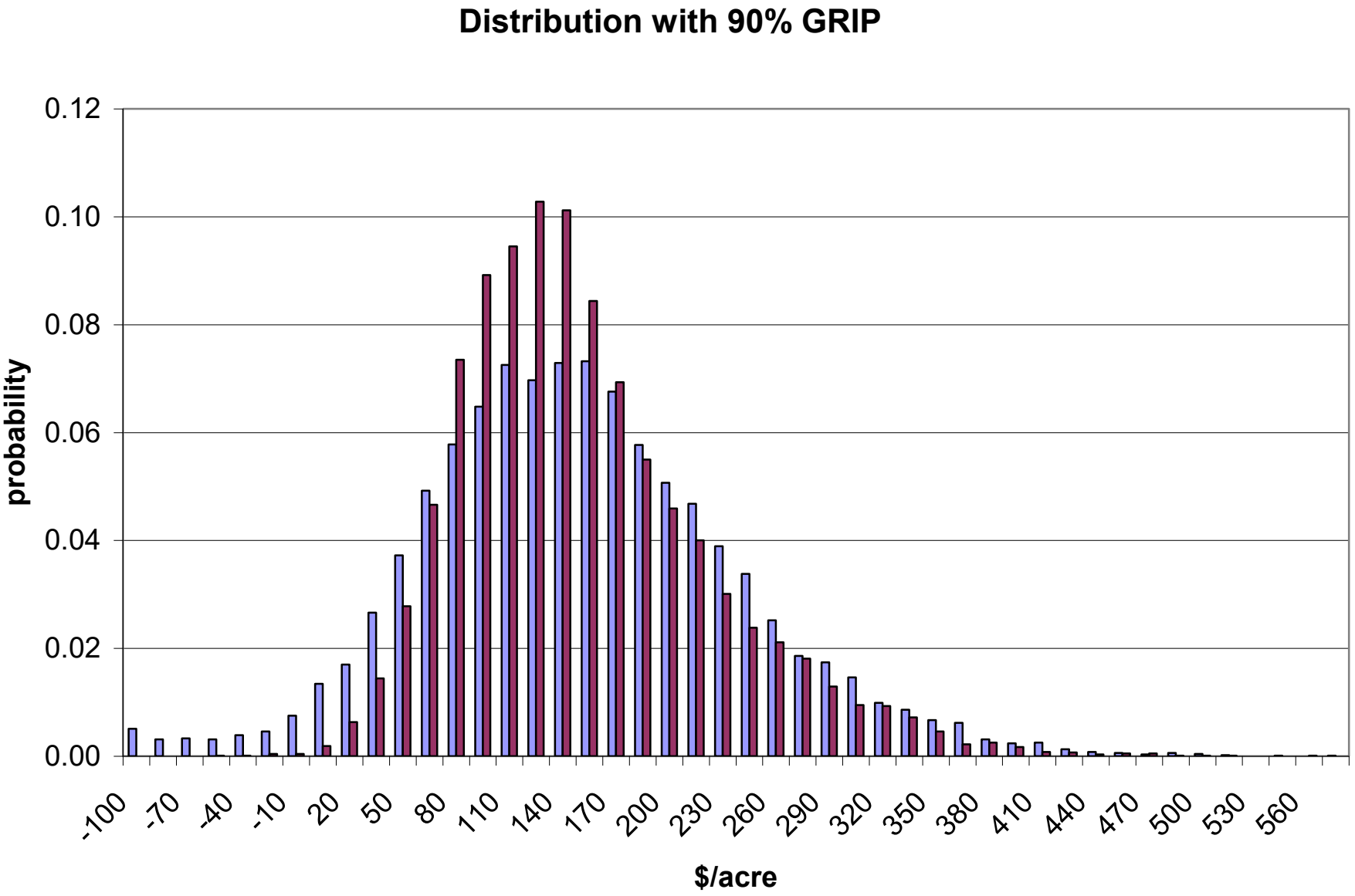


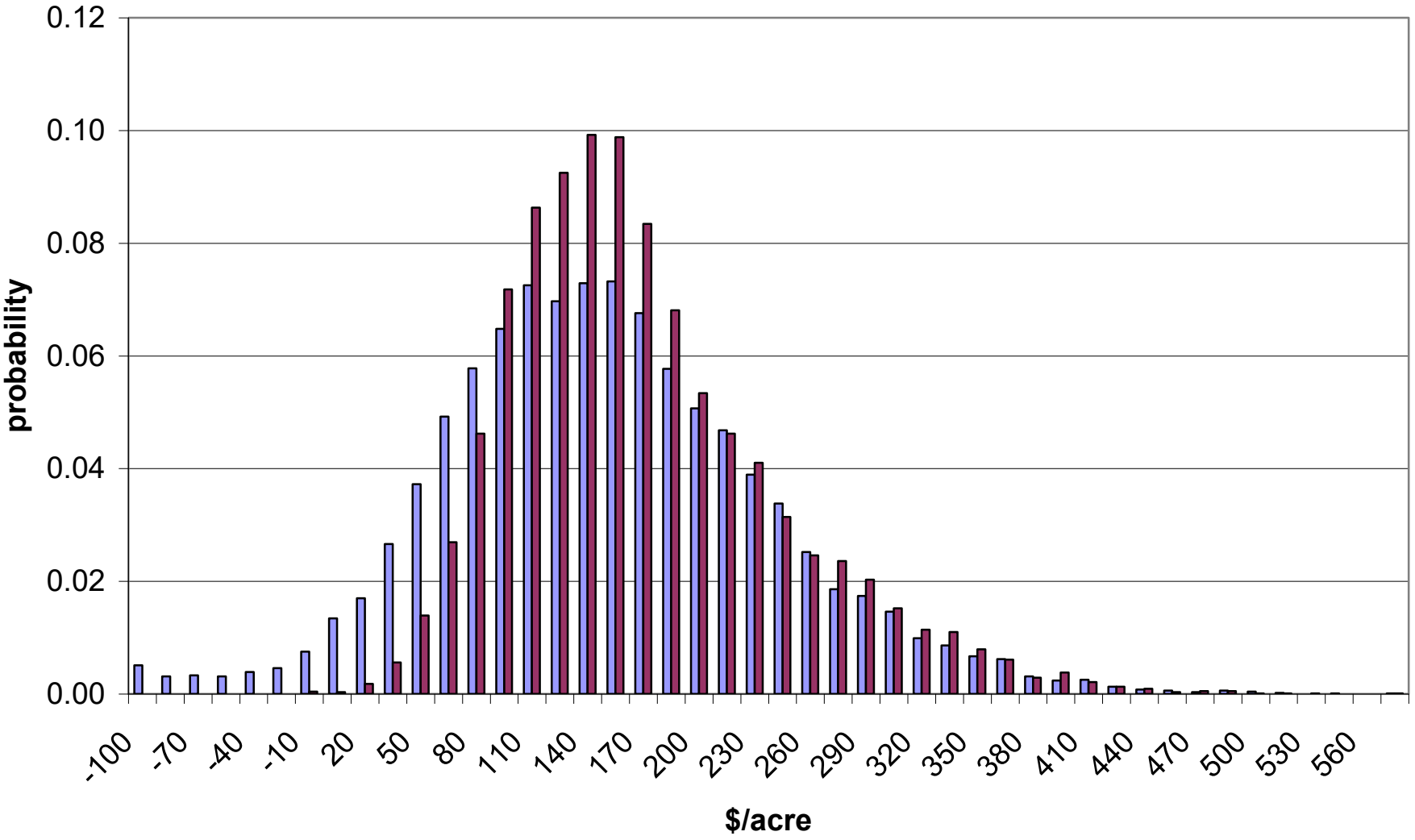
Payoff from GRIP and GRIP-HRO

- Total payout = 7.5% of liability for GRIP and 8.2% of liability for HRO from 1975 to 2004.
- Premium rate = 5.89% of liability from GRIP and 7.4% of liability from GRIP-HRO.
- Since 1975, rate of return = 26.5% for GRIP and 11.1% for HRO.

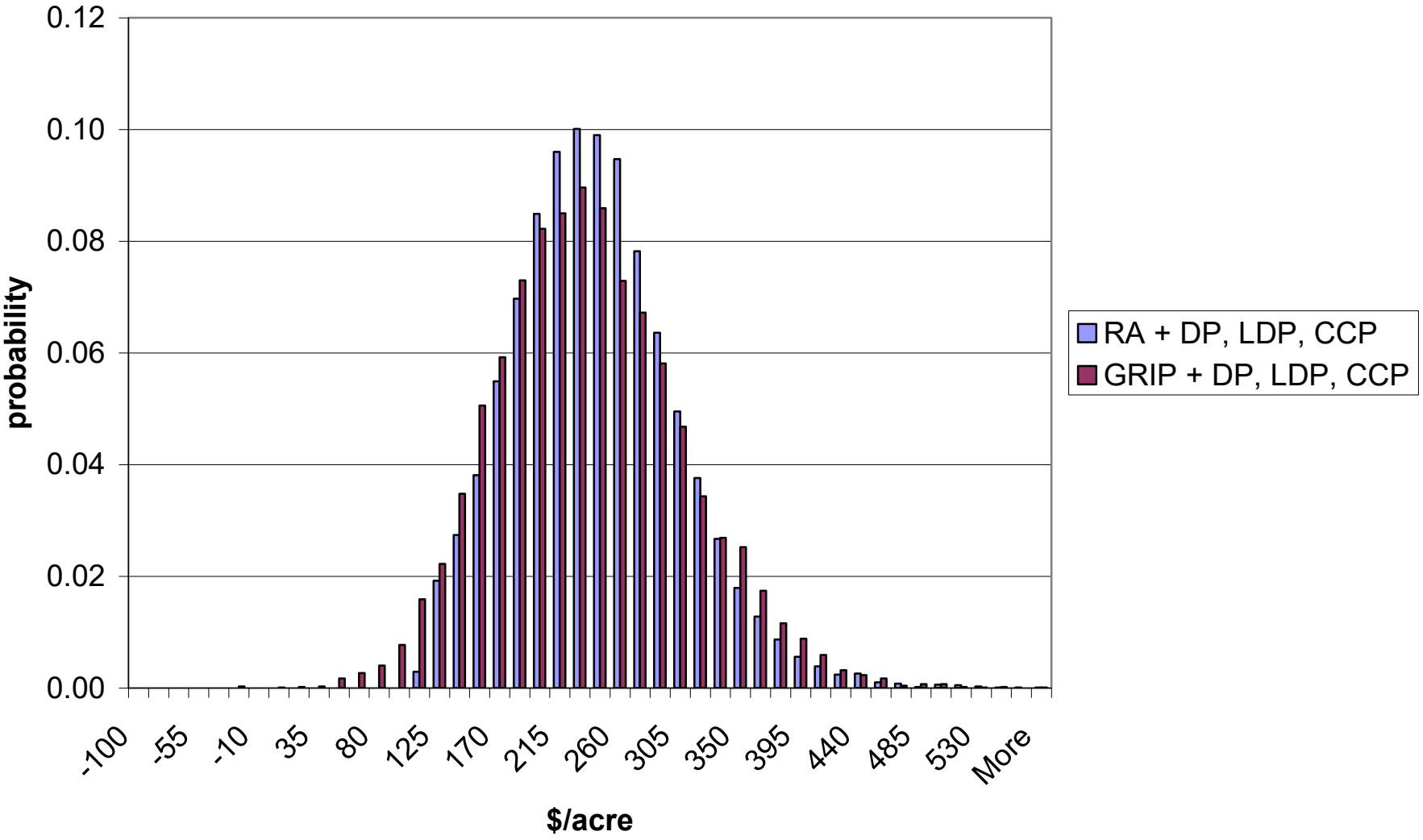
Subsidized rate of return for GRIP and GRIP-HRO

- 2005 Premium = $15/acre for GRIP and $18 for GRIP-HRO
- Expected Payout from 1975 to 2004: $42 for GRIP and $47 for HRO
- Expected Payout from 1957 to 2004: $34 and $42.
- Expected return = $25 or $19 per acre for GRIP, $29 or $24 per acre for HRO.

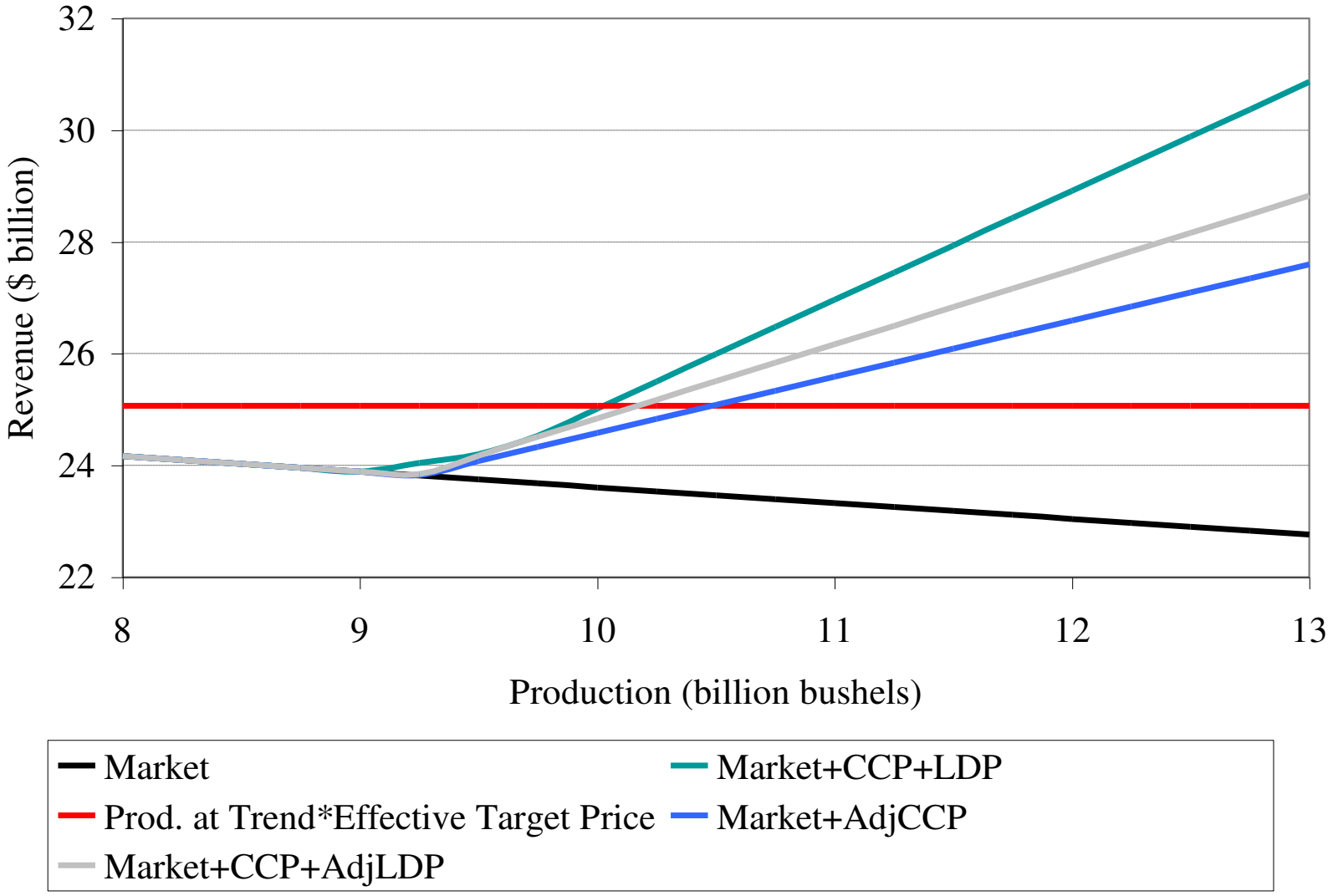

Distribution with 90% GRIP
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre


Distribution with 90% GRIP-HRO
probability
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-100
-70
-40
-10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
$/acre

How Does GRIP-HRO Perform Relative to the Gold Standard?



Impact of Proposed Changes to Marketing Loan Program



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- Discussion