

FEASIBILITY OF THE PRODUCER ACCUMULATOR CONTRACT IN CORN AND SOYBEAN MARKETS

by Chad Te Slaa

South Dakota State University

Mentors: Dr. Lisa Elliott & Dr. Matt Elliott

AAEA Graduate Student Extension Competition

7/30/2017

INTRODUCTION

South Dakota Production

- Corn
 - 799.77 million bushels
- Soybeans
 - 235.52 million bushels

Risk Management Approaches

- Cash Sales at Harvest
- Grain Marketing Strategies
 - Futures
 - Options
 - Elevator Contracts
- New Generation Grain Marketing Strategies – Producer Accumulator Contract

PROBLEM

General Problem – Risk Management for Grain Marketing

- Lack of Adoption
 - Hedging – 20% of producers
 - Forward Contracts – 38% of producers
 - Production Contracts – 18% of producers

Specific Problem – Producer Accumulator Contract

- Complexity – Mechanics & Rules
- Performance – Risk Reduction & Profitability
- Perception – Prior Research: Accumulator or “i-kill-you-later”

INFORMATION TO SHARE

Background

- Pricing Rules
- Examples
- Interactive Hand-outs

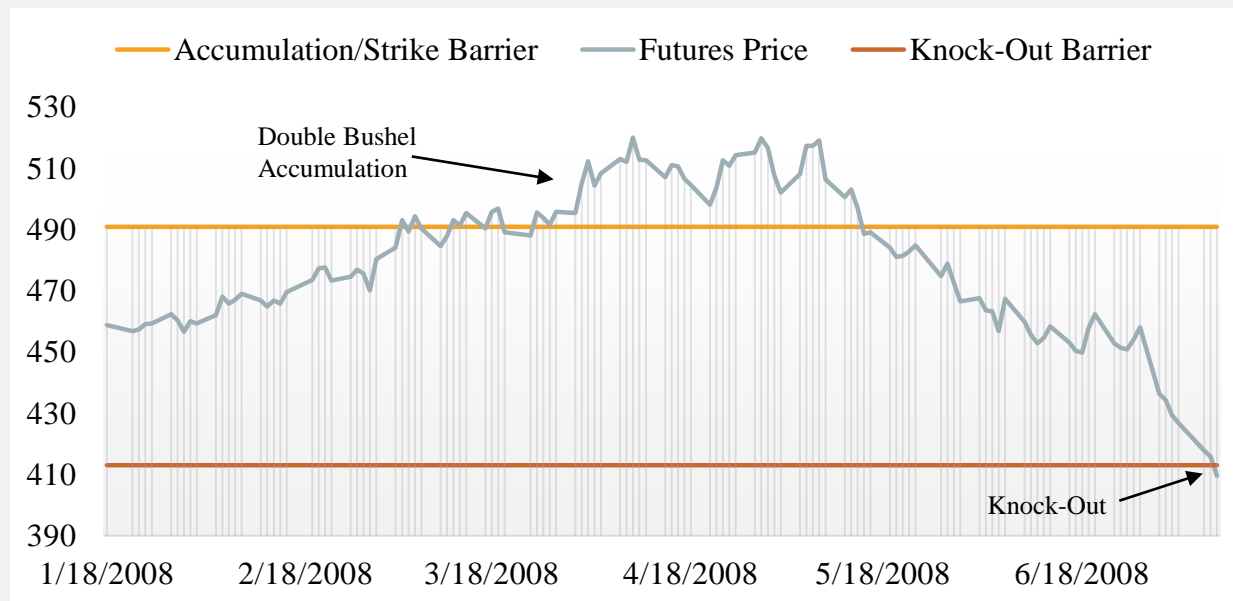
Results

- Explain & Review Back-testing Performance

Implications

BACKGROUND

- INTL FCStone: beginning 2005
- Averaging Contract: weekly bushel pricing
- Accumulation Strike Barrier
- Knock-Out Barrier
- Advantage: bushel premium
- Disadvantage: double-up, early knock-out



Weekly Price > Accumulation Strike Barrier

Price: accumulation strike

Bushels Accumulated: 2x weekly quantity

Weekly Price < Accumulation Strike Barrier & Daily Price > Knock-Out Barrier

Price: accumulation strike

Bushels Accumulated: weekly quantity

Daily Price <= Knock-Out Barrier

Price: n/a

Bushels Accumulated: n/a

Rule 1: 0

if $\max_{0 \leq t \leq t_i} F_{ti} \leq H_d$

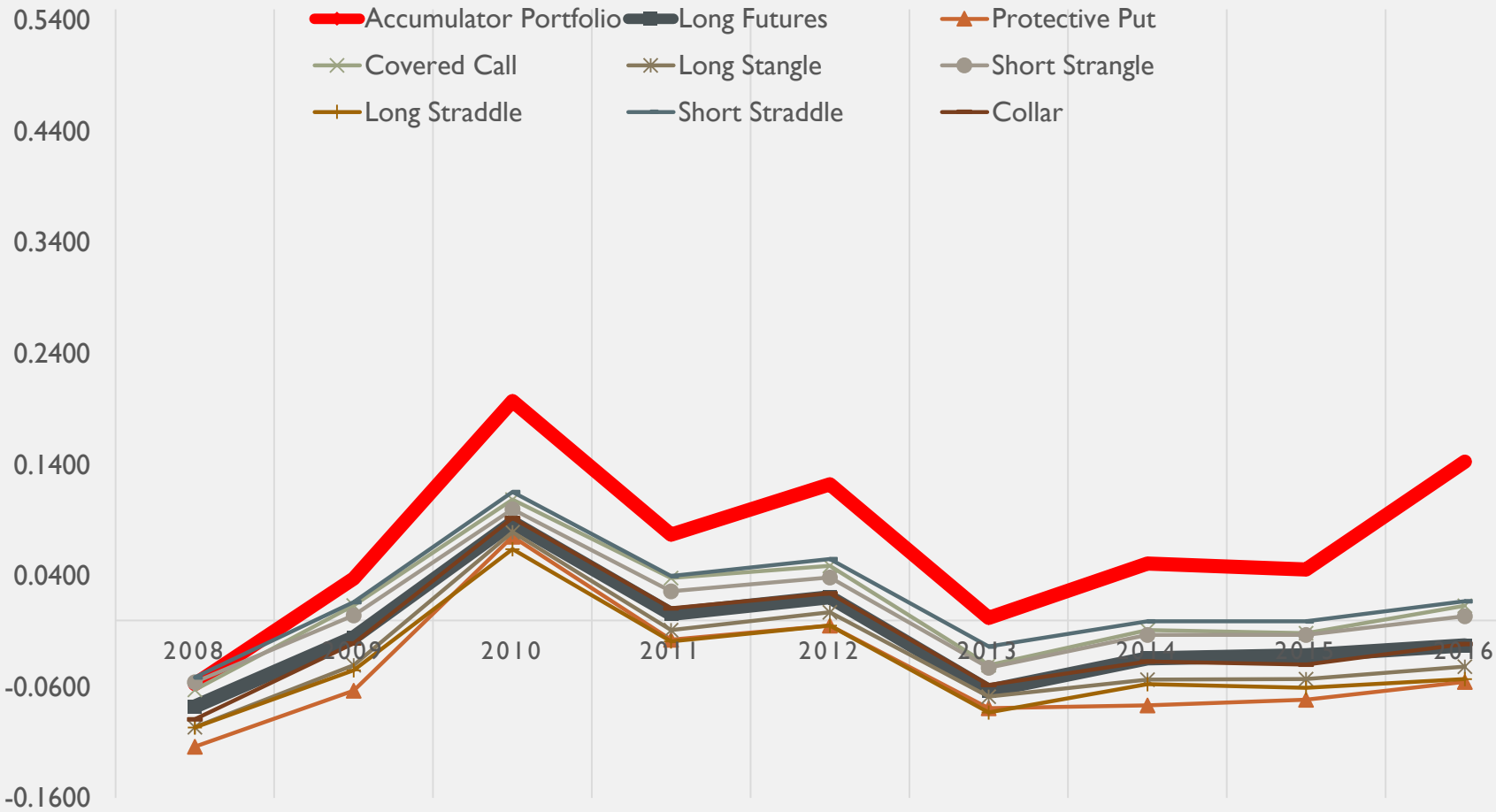
Rule 2: $X - F_{Ti}$

if $\max_{0 \leq t \leq t_i} F_{ti} > H_d, F_{ti} \leq X$

Rule 3: $2(X - F_{Ti})$

if $\max_{0 \leq t \leq t_i} F_{ti} > H_d, F_{ti} > X$

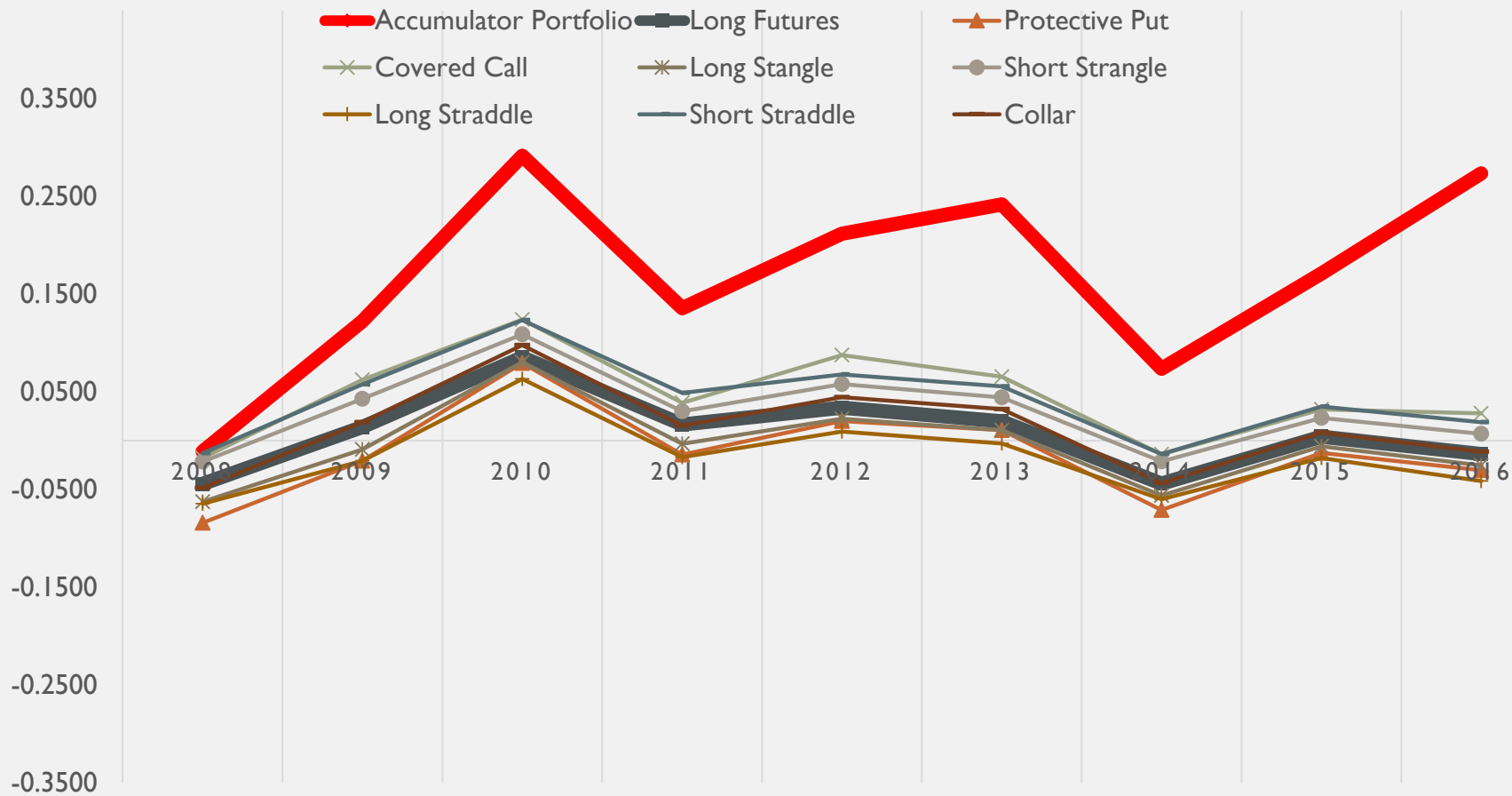
RESULTS – SHARPE RATIO IN CORN



Month	Corn – Producer Accumulator	Corn – Long Futures
January	0.126	-0.014
February	0.112	-0.019
March	0.05	-0.01
April	0.044	-0.014
May	0.047	-0.016
June	0.038	-0.019
July	0.058	-0.014
August	0.067	-0.012
September	0.106	-0.008
October	0.105	-0.009
November	0.106	-0.01
December	0.126	-0.009
Growing Season (April-September)	0.06	-0.014
Non-Growing Season (October-March)	0.104	-0.012

Range	Producer Accumulator	Long Futures	Protective Put	Covered Call	Long Stangle	Short Strangle	Long Straddle	Short Straddle	Collar	Accumulator Rank
2008-2017	0.0813	-0.0134	-0.0438	0.0128	-0.0296	0.0066	-0.0396	0.0210	-0.0139	1

RESULTS – SHARPE RATIO IN SOYBEANS



Month	Soybeans – Producer Accumulator	Soybeans – Long Futures
January	0.225	0.003
February	0.226	-0.007
March	0.171	0.008
April	0.156	-0.002
May	0.145	-0.001
June	0.096	-0.007
July	0.113	0
August	0.142	0.005
September	0.186	0.009
October	0.22	0.018
November	0.217	0.018
December	0.226	0.013
Growing Season (April-September)	0.14	0.001
Non-Growing Season (October-March)	0.214	0.009

Range	Producer Accumulator	Long Futures	Protective Put	Covered Call	Long Stangle	Short Strangle	Long Straddle	Short Straddle	Collar	Accumulator Rank
2008-2017	0.1776	0.0045	-0.0167	0.0410	-0.0088	0.0263	-0.0216	0.0396	0.0090	1

IMPLICATIONS

Producer Accumulator = Efficient Risk Management Strategy

- Average Price – Producer Accumulator ~ Long Futures, \$-.05/bu in corn \$+.01/bu in soybeans
- Sigma – Producer Accumulator < Long Futures, \$154.79 in corn and \$382.12 in soybeans
- Sharpe Ratio – Producer Accumulator > Long Futures
 - According to Modern Portfolio Theory, producer accumulator is a more efficient portfolio.

Non-Growing Season (October-March) Execution is Optimal

- Average Price – Growing Season ~ Non-Growing Season
- Sigma – Growing Season > Non-Growing Season
- Sharpe Ratio – Growing Season < Non-Growing Season
- Bushel Accumulation – Growing Season < Non-Growing Season

Hedging Account for Producer Accumulator Defense

- Corn – 3,165 average bushels accumulated 2008-2017, skewed toward lower bushel bins in histogram
- Soybeans – 4,752 average bushels accumulated 2008-2017, skewed toward higher and lower bushel bins in histogram

Combine with a Basis Contract

TARGET AUDIENCE

Primary Target Audience

- Corn and soybean producers with medium to large scale operations in South Dakota.
- > \$350,000 in Gross Cash Farm Income

Why?

- As the number of acres farmed increases, importance of grain marketing increases (Barry & Micheels, 2005).
- Farms using production or marketing contracts include: 11% of all farms, 3.6% of rural residence farms, 16% of intermediate farms, and 41.7% of commercial farms (MacDonald et al., 2004).

COMMUNICATION METHODS



Presentation

- “Managing the Margin Workshop” in Spring 2018 at SDSU in the E-trading Lab

Pamphlet

- “Managing the Margin Workshop” in Spring 2018 at SDSU in the E-trading Lab

Article Series

- SDSU Extension iGrow Website

Links

- SDSU Extension iGrow Website
- Access the electronic pamphlet, thesis entitled “Performance of the Producer Accumulator in Corn and Soybean Commodity Markets,” and NCCC-134 conference paper.

WHERE?



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FIRST DAKOTA
NATIONAL BANK

e-trading
Education Lab



SHORT-TERM GOAL

Goal

- Spread Information
 - Spread information to corn and soybean producers.

Evaluation

- Clicker Survey
 - Following workshop presentation.
- Viewings
 - Record the number of viewings of the article series on the SDSU extension iGrow website.

MEDIUM-TERM GOAL

Goal

- Feasibility
 - Corn and soybean producers analyze our research to determine the feasibility of incorporating the producer accumulator as a risk management tool.

Evaluation

- Feasibility Survey
 - Email feasibility Survey
 - Stakeholders
 - Producers
 - Grain Merchandisers
 - University Extension Specialists
 - Agri-business Lenders

LONG-TERM GOAL

Goal

- Adoption
 - Increase corn and soybean producer understanding of risk reduction and profitability leading to higher adoption of producer accumulator contracts in producer risk management plans.

Evaluation

- Adoption Survey
 - Email Adoption Survey
 - Stakeholders
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EXTENSION OPPORTUNITIES

March, 2017 – Managing the Margin Workshop

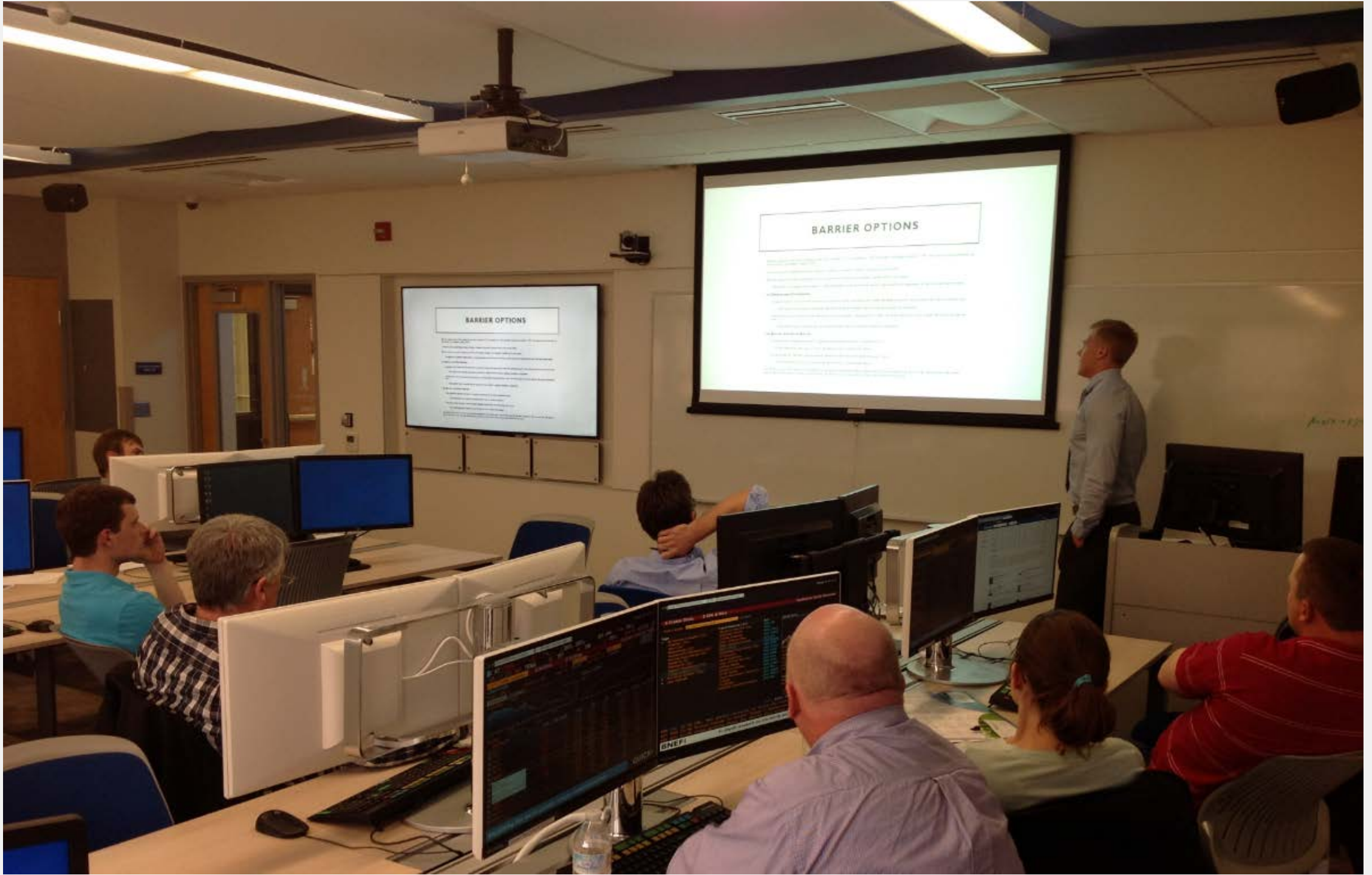
- South Dakota State University iGrow Extension
- Presented background and preliminary findings

June, 2017 – Agrivision's Beginning Farmer Program

- First Dakota National Bank
- Presented background, results, and implications

March, 2018 – Managing the Margin Workshop

- South Dakota State University iGrow Extension
- Present background, results, and implications



BARRIER OPTIONS

BARRIER OPTIONS

Growing American Farmers and Ranchers®

AGRIVISIONS®

BEGINNING FARMER PROGRAM

The key objective of the AgriVisions® Beginning Farmer Program is to educate and provide leadership to expand the opportunities available in agriculture.



INPUTS	OUTPUTS - Activities	OUTPUTS - Audience	OUTCOMES – Short Term	OUTCOMES – Medium Term	OUTCOMES – Long Term
What we invest	What we do	Who we reach	Learning	Action	Conditions
Perform research on the profitability and risk reduction of the producer accumulator contract in corn and soybean commodity markets	Write a series of articles discussing the research results for the SDSU extension iGrow website	Corn and soybean producers across South Dakota and the Midwest	Producer accumulator contract performance in corn and soybean commodity markets –	Producer accumulator contract performance in corn and soybean commodity markets –	Producer accumulator contract performance in corn and soybean commodity markets –
	Perform a presentation showing the research results of producer accumulator risk reduction and profitability performance in corn and soybeans at the “Managing the Margin Workshop” in Spring 2018 at SDSU in the E-trading Lab	Extension programs at universities in the Midwest	Spread information to corn and soybean producers regarding producer accumulator profitability and risk reduction to increase understanding and awareness	Corn and soybean producers analyze our research to determine the feasibility of incorporating the producer accumulator as a risk management tool	Increase corn and soybean producer understanding of risk reduction and profitability leading to higher adoption of producer accumulator contracts in producer risk management plans
	Design a pamphlet displaying the research results	Grain merchandisers at commodity purchasing firms, local cooperatives, and local elevators			
	Launch a link to the pamphlet posted on the SDSU extension iGrow website to access the electronic pamphlet and thesis	Agricultural lenders at financial institutions in the Midwest			
		Agricultural publications			

THANK YOU!

Chad Te Slaa

chad.teslaa@sdstate.edu

South Dakota State University

Brookings, SD 57007

Berg Hall 126

REFERENCES

- Barry, P. J. & Micheels, E. (2005). How Midwestern Farmers Rate Risk Management Practices. *Journal of the ASFMRA*. 1-7. Accessible at <http://purl.umn.edu/190705>
- MacDonald, J. M. & Perry, J. & Ahearn, M. C. & Banker, D. & Chambers, W. & Dimitri, C. & Key, N. & Nelson, K. E. & Southard, L. W. (2004). Contracts, Markets, and Prices: Organizing the Production and Use of Agricultural Commodities. *USDA*. Accessible at <https://www.ers.usda.gov/publications/pub-details/?pubid=41704>
- National Agricultural Statistics Service (NASS). (2016). Crop Production 2015 Summary. *USDA*. Washington D.C. Accessible at <https://www.usda.gov/nass/PUBS/TODAYRPT/cropan16.pdf>

APPENDIX

ZERO-COST PRODUCER ACCUMULATOR

- **Zero-Cost Producer Accumulator Portfolio**

- -2 down-and-out call options on a forward contract
- +1 down-and-out put option on a forward contract

- **Zero-Cost Producer Accumulator Payoffs**

0	if $\max_{0 \leq \tau \leq t_i} F_\tau \leq H_d$
$X - F_{T_i}$	if $\max_{0 \leq \tau \leq t_i} F_\tau > H_d, F_{t_i} \leq X$
$2(X - F_{T_i})$	if $\max_{0 \leq \tau \leq t_i} F_\tau > H_d, F_{t_i} > X$

- **Zero-Cost Producer Accumulator**

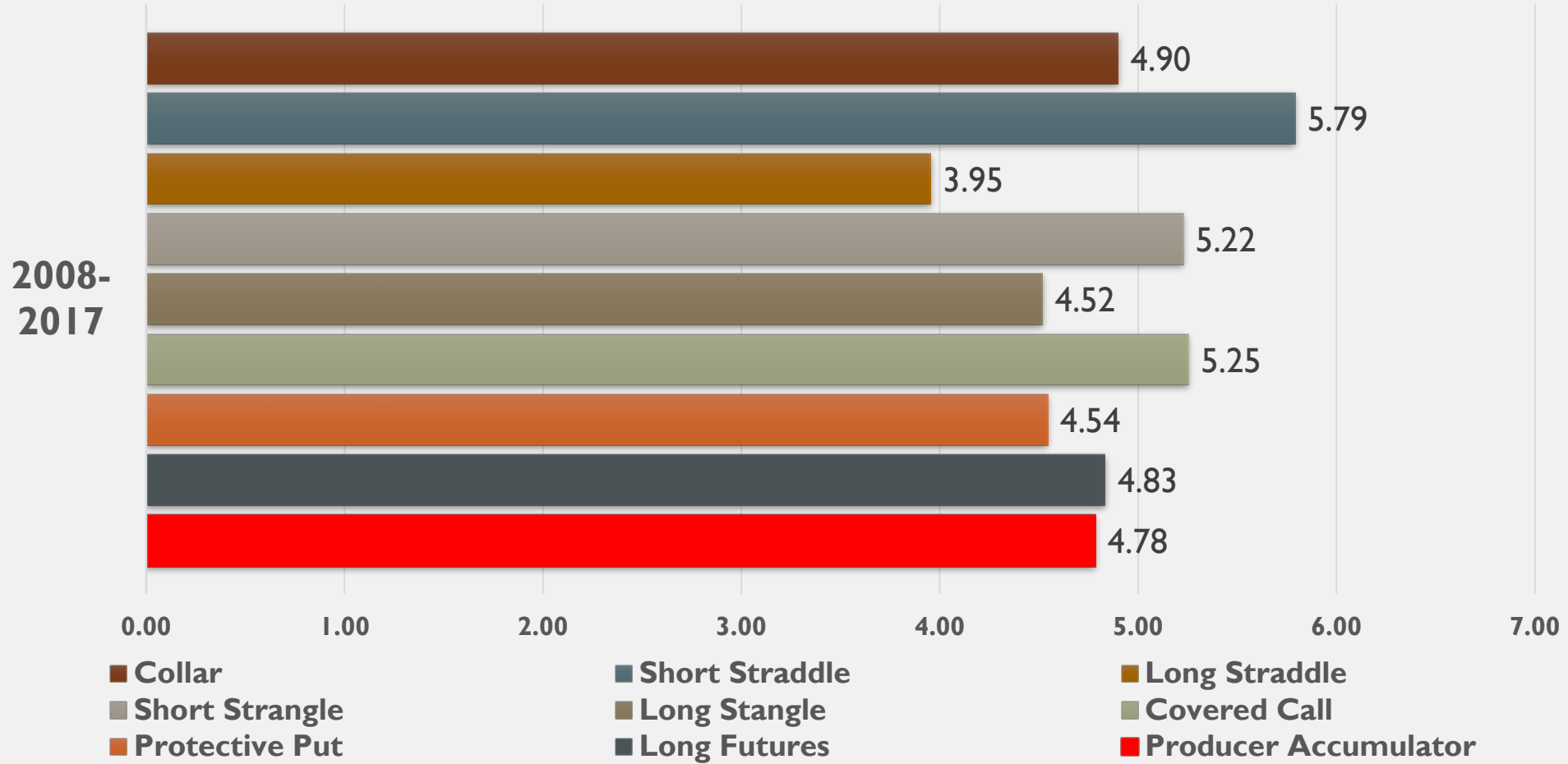
- $V^{Delay} = \sum_{i=1}^n \{P_{do}^F(X, H_d, t_i, T_i) - 2 \cdot C_{do}^F(X, H_d, t_i, T_i)\}$
- V^{Delay} = value of the zero-cost producer accumulator portfolio under delayed settlement
- $P_{do}^F(X, H_d, t_i, T_i)$ = down-and-out put price on a forward contract
- $C_{do}^F(X, H_d, t_i, T_i)$ = down-and-out call price on a forward contract
- X = strike price
- H_d = discretely monitored knock-out barrier price
- T_i = forward contract maturity date
- t_i = observation date

SYNTHETIC PRODUCER ACCUMULATOR CONTRACTS

- **Based on INTL FCStone Indications**
- **Total Contracts**
 - Corn – 5,150 synthetic contracts simulated
 - Soybeans – 5,166 synthetic contracts simulated
 - Range – 1/18/2008-2/23/2017
- **Contract Months**
 - Corn - March (H), July (N), December (Z)
 - Soybeans - March (H), July (N), November (X)
- **Bushel Accumulation Quantity**
 - Originated Quantity: 5,000 bushels
 - Potential Quantity: 0-10,000 bushels
- **Accumulator Contract Duration**
 - Start Date: 60-20 weeks from the futures contract month expiry
 - End Date: referenced futures contract month expiration
- **Knock-Out Barrier Estimation**
 - Multiple Linear Regression
 - $y_i = \beta_i x_i + \beta_j x_j + e_i$

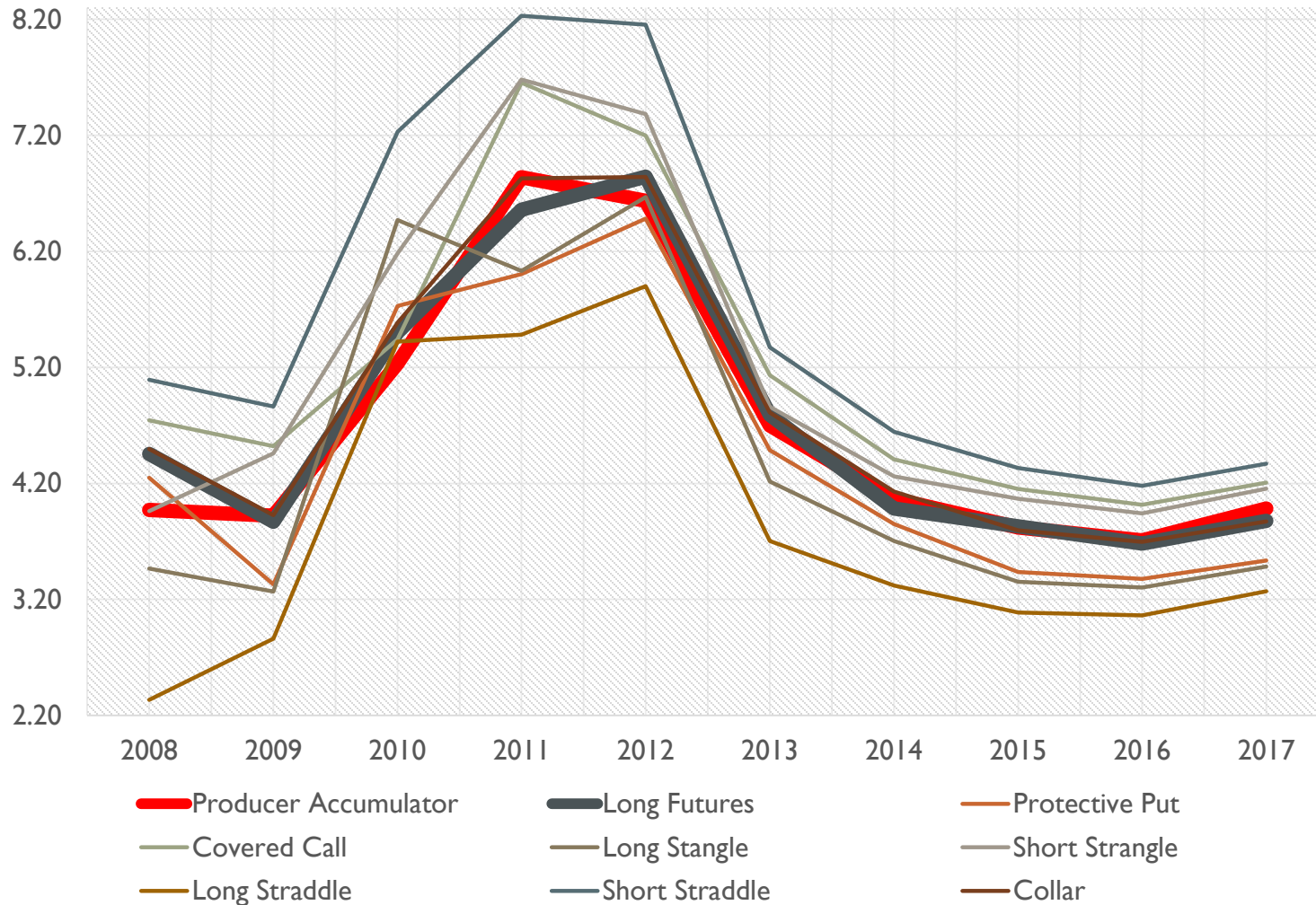
Portfolio Strategy	Portfolio Type	Futures	Options	Related Industry Contracts
Producer Accumulator	Hedging Portfolio	Long 2 Futures Contracts	Short 2 OTM Down-and-Out Barrier Calls (X = Accumulation Level, H = Barrier Level) Long 1 ITM Down-and-Out Barrier Put (X = Accumulation Level, H = Barrier Level)	
Long Futures	Hedging Portfolio	Long 2 Futures Contracts		ADM's Average Seasonal Price Contract, Cargill's PaceSetter Contract
Protective Put	Long Option Portfolio	Long 2 Futures Contracts	Long 2 OTM Vanilla Puts (X = Barrier Level)	Cargill's PaceSetter Ultra, Cargill's PriceProtector Put Contract
Covered Call	Short Option Portfolio	Long 2 Futures Contracts	Short 2 OTM Vanilla Calls (X = Accumulation Level)	ADM's Minimum Price Contract, CHS's Minimum Price Contract, Cargill's PriceProtector Call Contract
Long Strangle	Long Option Portfolio	Long 2 Futures Contracts	Long 1 OTM Vanilla Call (X = Accumulation Level) Long 1 OTM Vanilla Put (X = Barrier Level)	
Short Strangle	Short Option Portfolio	Long 2 Futures Contracts	Short 1 OTM Vanilla Call (X = Accumulation Level) Short 1 OTM Vanilla Put (X = Barrier Level)	
Long Straddle	Long Option Portfolio	Long 2 Futures Contracts	Long 1 ATM Vanilla Call (X = Futures Price Level) Long 1 ATM Vanilla Put (X = Futures Price Level)	
Short Straddle	Short Option Portfolio	Long 2 Futures Contracts	Short 1 ATM Vanilla Call (X = Futures Price Level) Short 1 ATM Vanilla Put (X = Futures Price Level)	
Collar	Hedging Portfolio	Long 2 Futures Contracts	Short 1 OTM Vanilla Call (X = Accumulation Level) Long 1 OTM Vanilla Put (X = Barrier Level)	ADM's Min/Max Price Contract, CHS's Min/Max Price Contract

AVERAGE PRICE - CORN



Range	Producer Accumulator	Long Futures	Protective Put	Covered Call	Long Stangle	Short Strangle	Long Straddle	Short Straddle	Collar	Accumulator Rank
2008-2017	4.78	4.83	4.54	5.25	4.52	5.22	3.95	5.79	4.90	6

AVERAGE PRICE - CORN

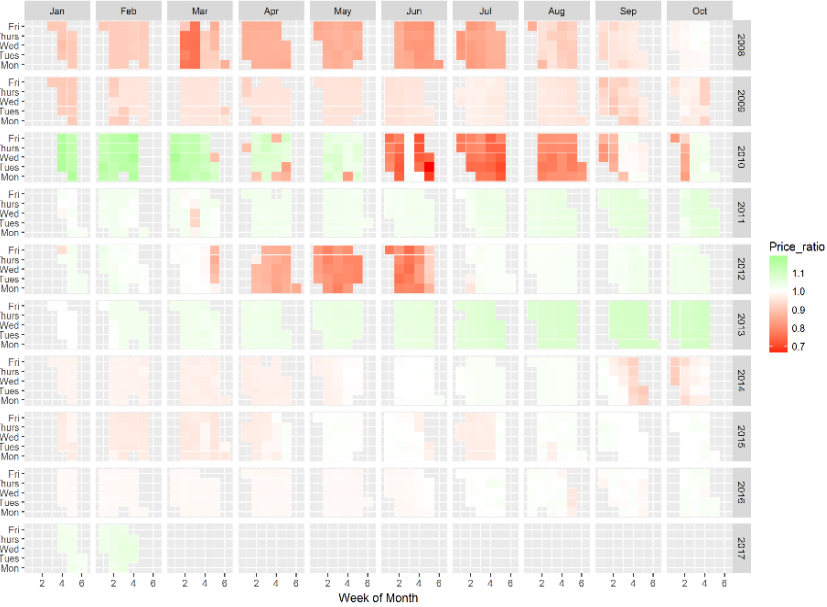


Month	Corn – Producer Accumulator	Corn – Long Futures
January	\$4.87	\$4.79
February	\$4.89	\$4.80
March	\$4.83	\$4.86
April	\$4.69	\$4.82
May	\$4.69	\$4.89
June	\$4.57	\$4.87
July	\$4.69	\$4.84
August	\$4.83	\$4.91
September	\$4.82	\$4.82
October	\$4.87	\$4.80
November	\$4.87	\$4.80
December	\$4.83	\$4.76
Growing Season (April-September)	\$4.72	\$4.86
Non-Growing Season (October-March)	\$4.86	\$4.80

PRICE RATIO - CORN

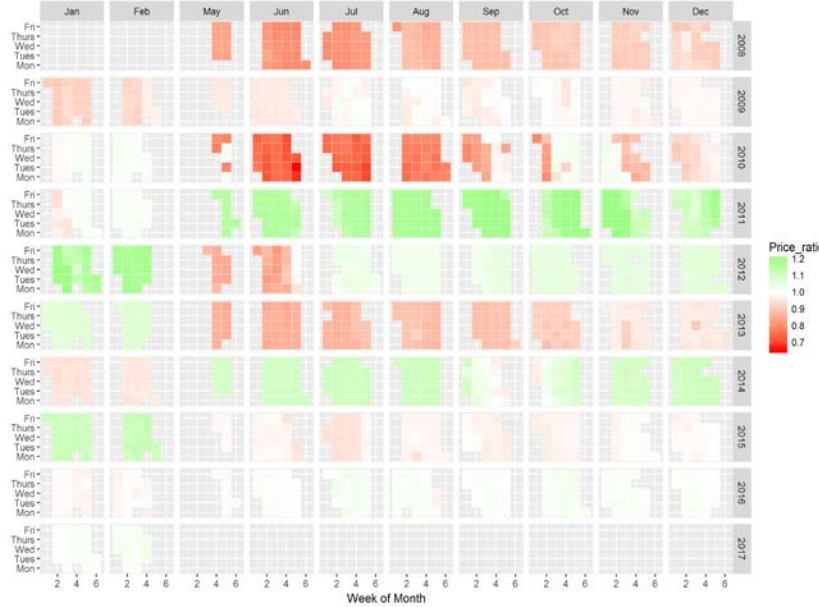
MARCH

Corn Accumulator Average Price Per Bushel as a Ratio of the Average Futures Price During the Contract Period (March Expiration)
Bushels Accumulated Priced at Accumulator Strike and Unaccumulated Bushels Sold at Futures Price on the Expiration Day



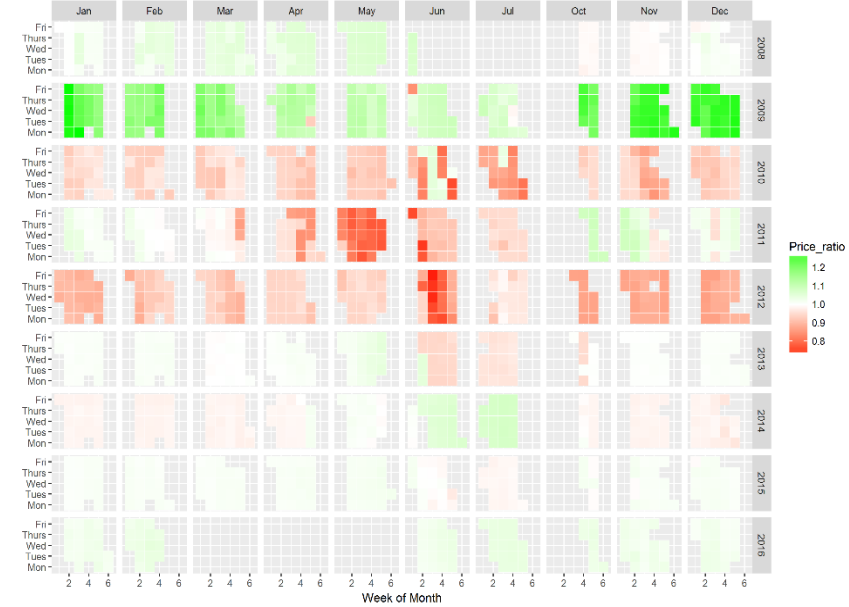
JULY

Corn Accumulator Average Price Per Bushel as a Ratio of the Average Futures Price During the Contract Period (July Expiration)
Bushels Accumulated Priced at Accumulator Strike and Unaccumulated Bushels Sold at Futures Price on the Expiration Day

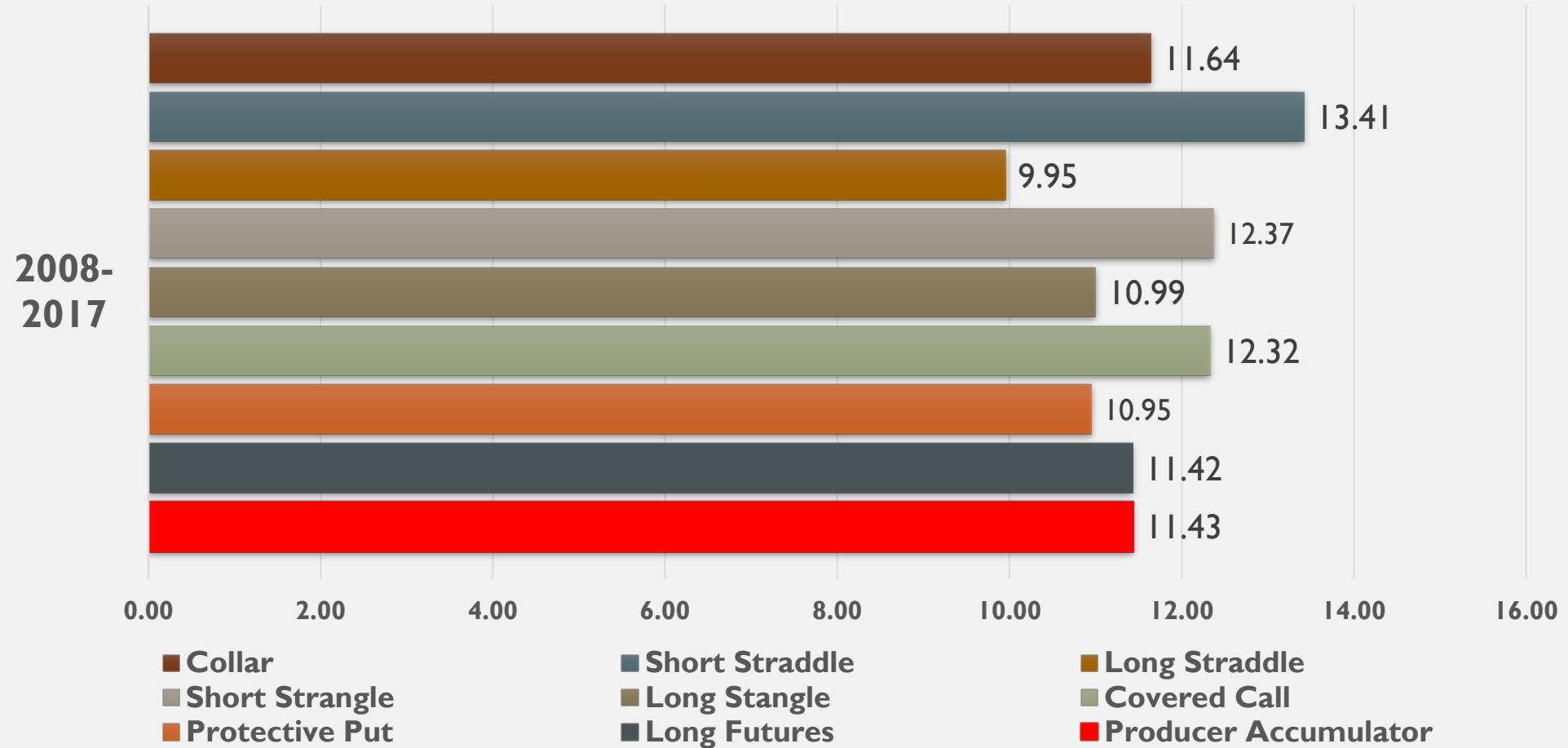


DECEMBER

Corn Accumulator Average Price Per Bushel as a Ratio of the Average Futures Price During the Contract Period (December Expiration)
Bushels Accumulated Priced at Accumulator Strike and Unaccumulated Bushels Sold at Futures Price on the Expiration Day

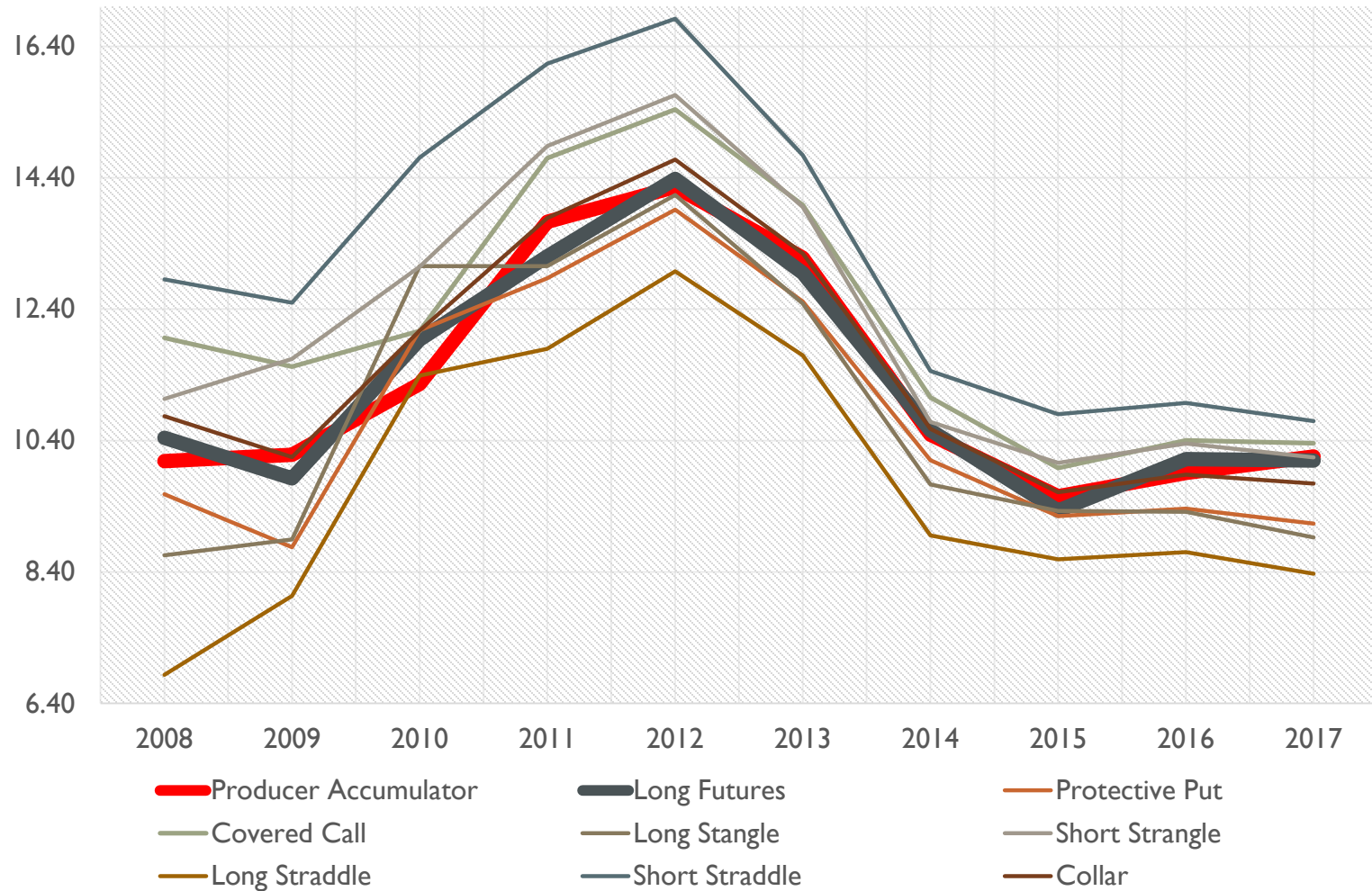


AVERAGE PRICE - SOYBEANS



Range	Producer Accumulator	Long Futures	Protective Put	Covered Call	Long Stangle	Short Strangle	Long Straddle	Short Straddle	Collar	Accumulator Rank
2008-2017	11.43	11.42	10.95	12.32	10.99	12.37	9.95	13.41	11.64	5

AVERAGE PRICE - SOYBEANS

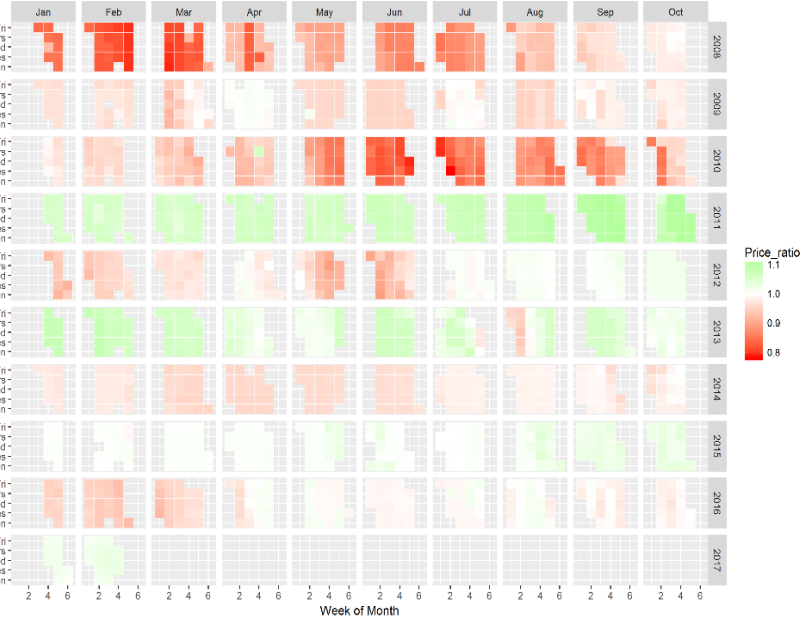


Month	Soybeans – Producer Accumulator	Soybeans – Long Futures
January	\$11.41	\$11.44
February	\$11.26	\$11.44
March	\$11.13	\$11.40
April	\$11.35	\$11.42
May	\$11.33	\$11.55
June	\$11.32	\$11.49
July	\$11.55	\$11.44
August	\$11.67	\$11.49
September	\$11.51	\$11.30
October	\$11.51	\$11.31
November	\$11.61	\$11.42
December	\$11.50	\$11.39
Growing Season (April-September)	\$11.46	\$11.45
Non-Growing Season (October-March)	\$11.40	\$11.40

PRICE RATIO - SOYBEANS

MARCH

Soy Accumulator Average Price Per Bushel as a Ratio of the Average Futures Price During the Contract Period (March Expiration)
Bushels Accumulated Priced at Accumulator Strike and Unaccumulated Bushels Sold at Futures Price on the Expiration Day



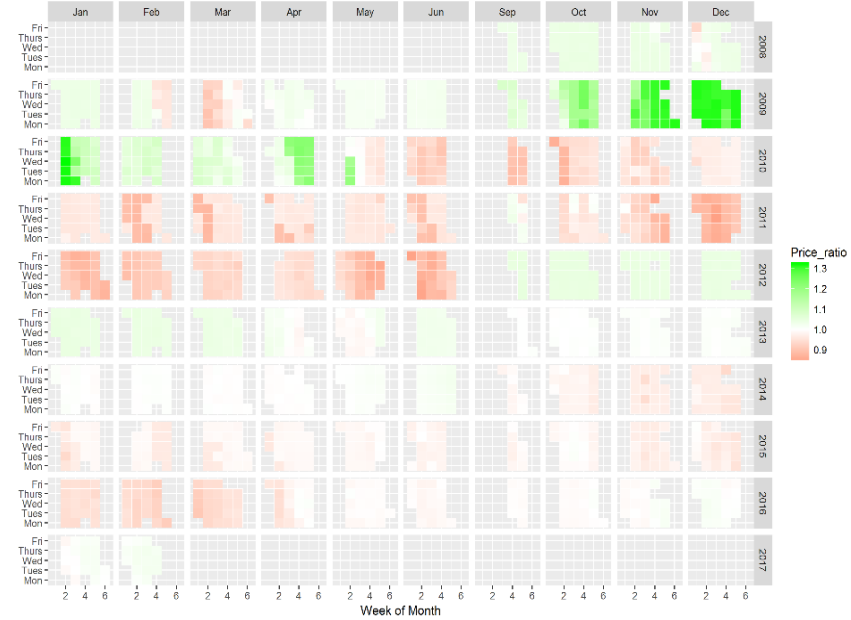
JULY

Soy Accumulator Average Price Per Bushel as a Ratio of the Average Futures Price During the Contract Period (July Expiration)
Bushels Accumulated Priced at Accumulator Strike and Unaccumulated Bushels Sold at Futures Price on the Expiration Day

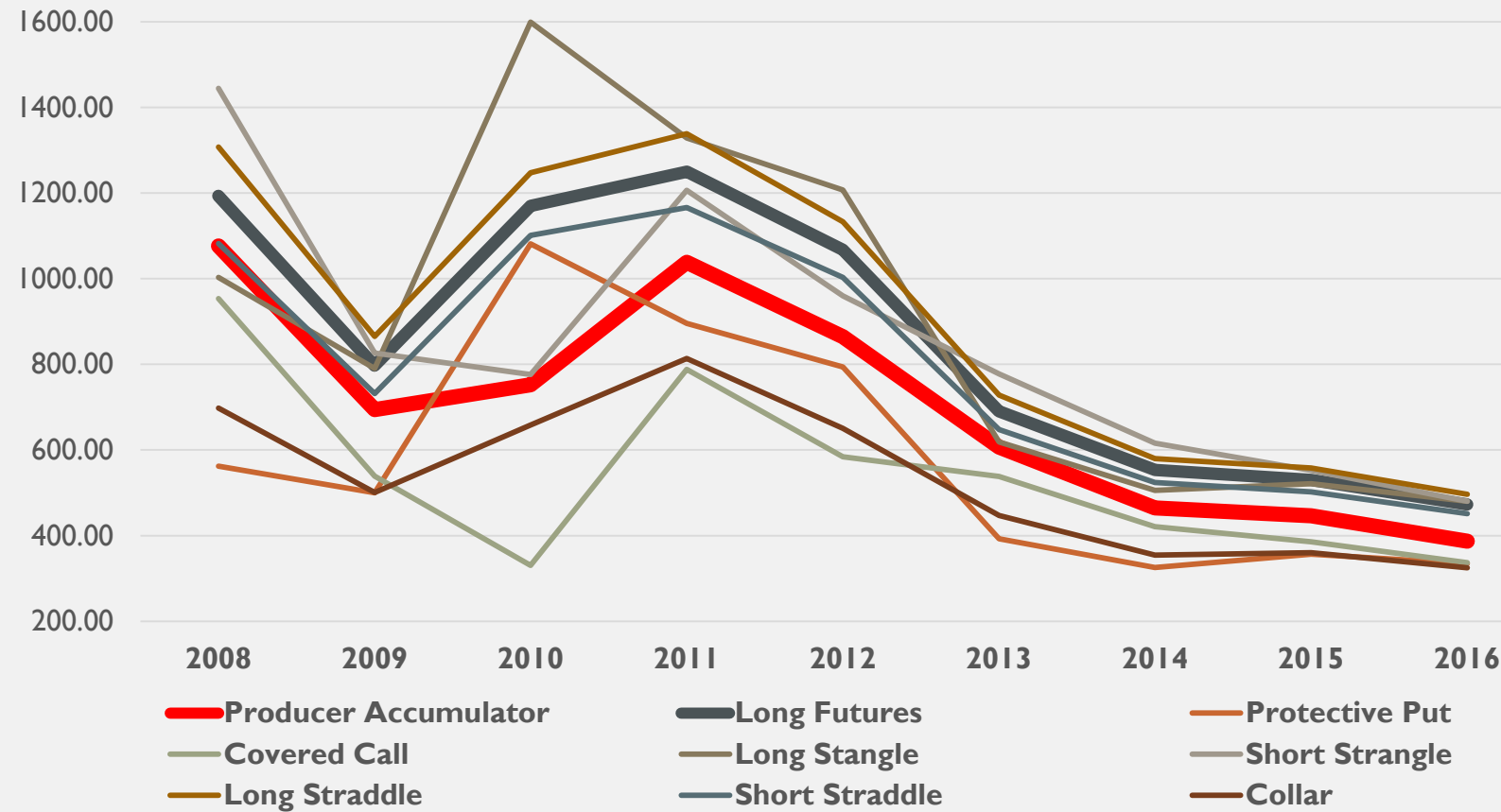


NOVEMBER

Soy Accumulator Average Price Per Bushel as a Ratio of the Average Futures Price During the Contract Period (Nov Expiration)
Bushels Accumulated Priced at Accumulator Strike and Unaccumulated Bushels Sold at Futures Price on the Expiration Day



PORTFOLIO RISK - CORN



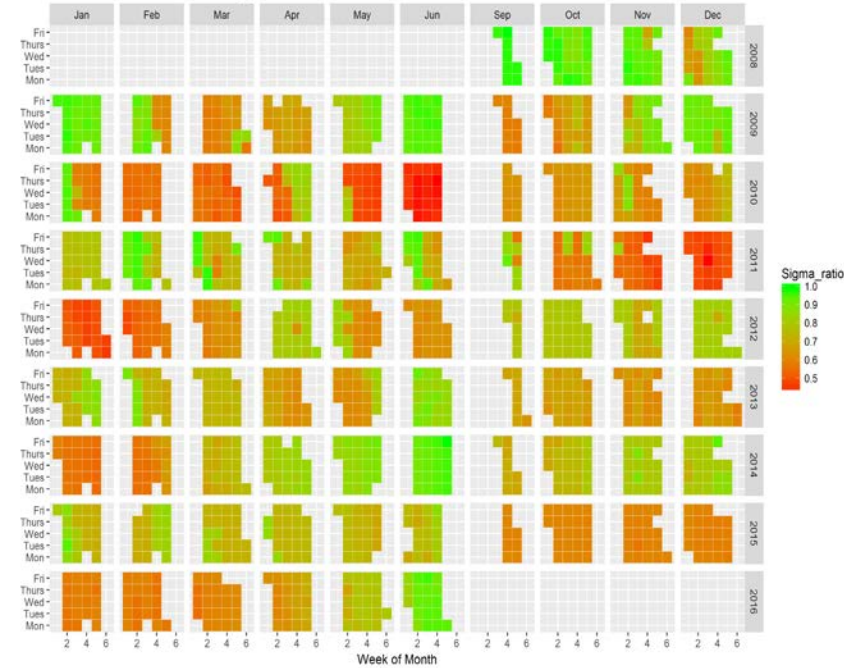
Month	Corn – Producer Accumulator	Corn – Long Futures
January	\$630.36	\$805.65
February	\$663.21	\$825.51
March	\$710.02	\$865.68
April	\$723.27	\$871.28
May	\$743.95	\$888.15
June	\$748.49	\$889.20
July	\$688.56	\$842.66
August	\$696.42	\$837.57
September	\$681.04	\$822.15
October	\$643.94	\$779.23
November	\$635.82	\$798.77
December	\$601.11	\$801.87
Growing Season (April-September)	\$713.62	\$858.50
Non-Growing Season (October-March)	\$647.41	\$812.79

Range	Producer Accumulator	Long Futures	Protective Put	Covered Call	Long Stangle	Short Strangle	Long Straddle	Short Straddle	Collar	Accumulator Rank
2008-2017	681.90	836.69	577.89	522.54	880.85	818.15	892.72	782.34	523.88	4

SIGMA RATIO - CORN

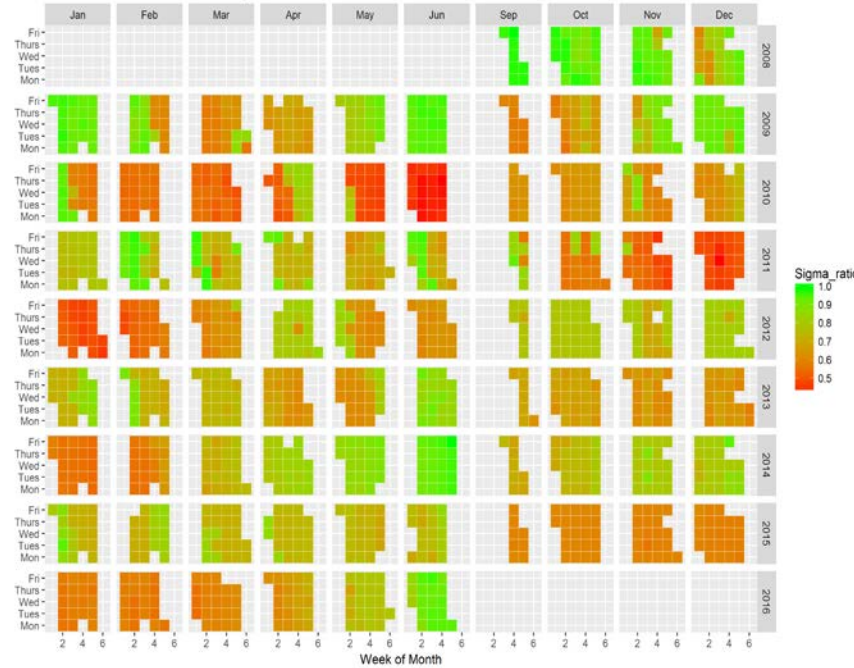
MARCH

Corn Accumulator Sigma Ratio(March Expiration)
Ratio of Accumulator Portfolio Risk to Long Futures Risk



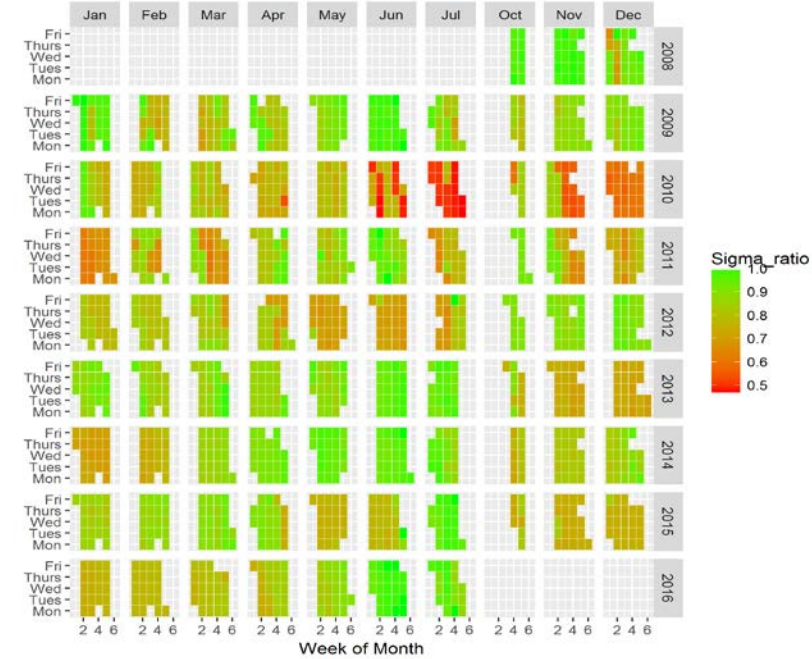
JULY

Corn Accumulator Sigma Ratio(July Expiration)
Ratio of Accumulator Portfolio Risk to Long Futures Risk

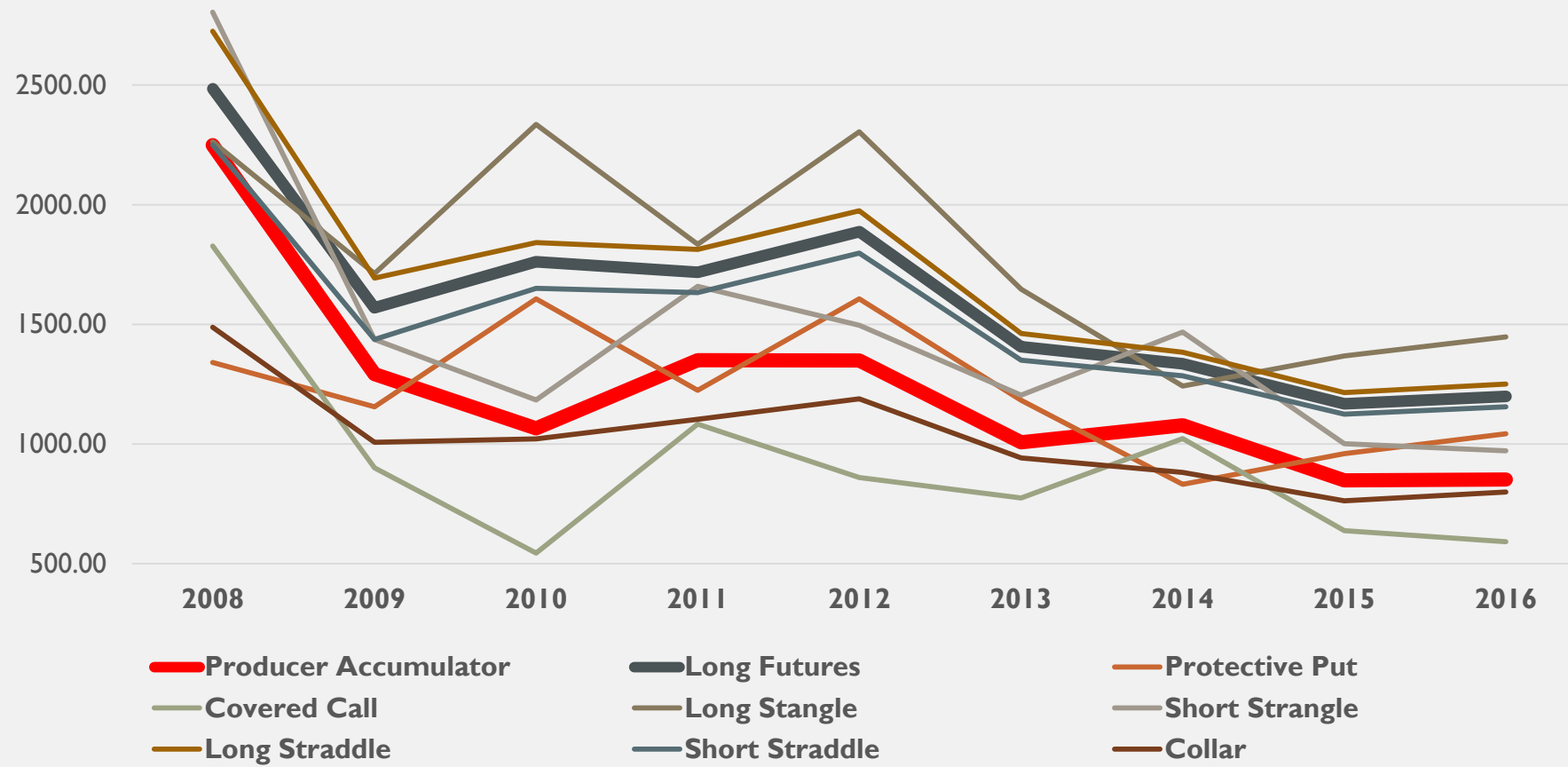


DECEMBER

Corn Accumulator Sigma Ratio(Dec Expiration)
Ratio of Accumulator Portfolio Risk to Long Futures Risk



PORTFOLIO RISK - SOYBEANS



Month	Soybeans – Producer Accumulator	Soybeans – Long Futures
January	\$1,062.58	\$1,483.69
February	\$1,077.51	\$1,519.27
March	\$1,150.56	\$1,627.48
April	\$1,225.77	\$1,659.67
May	\$1,275.16	\$1,691.65
June	\$1,379.96	\$1,694.13
July	\$1,350.77	\$1,628.07
August	\$1,301.36	\$1,585.24
September	\$1,237.51	\$1,548.63
October	\$1,112.96	\$1,488.12
November	\$1,063.91	\$1,468.34
December	\$1,026.02	\$1,477.41
Growing Season (April-September)	\$1,295.09	\$1,634.57
Non-Growing Season (October-March)	\$1,082.26	\$1,510.72

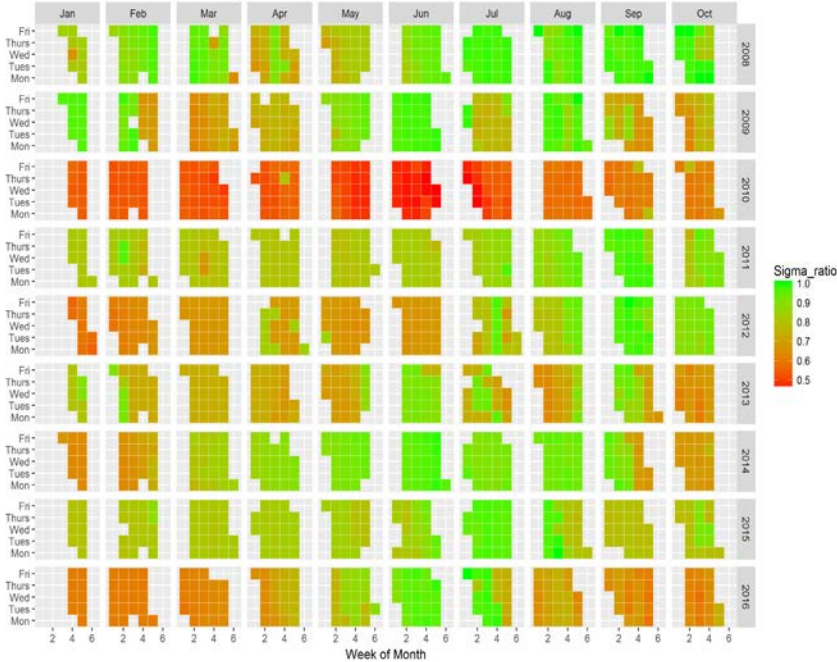
Range	Producer Accumulator	Long Futures	Protective Put	Covered Call	Long Strangle	Short Straddle	Long Straddle	Short Straddle	Collar	Accumulator Rank
2008-2017	1189.14	1571.26	1201.49	881.92	1760.88	1414.80	1657.49	1482.98	999.35	3

SIGMA RATIO - SOYBEANS

MARCH

Soybean Accumulator Sigma Ratio(March Expiration)

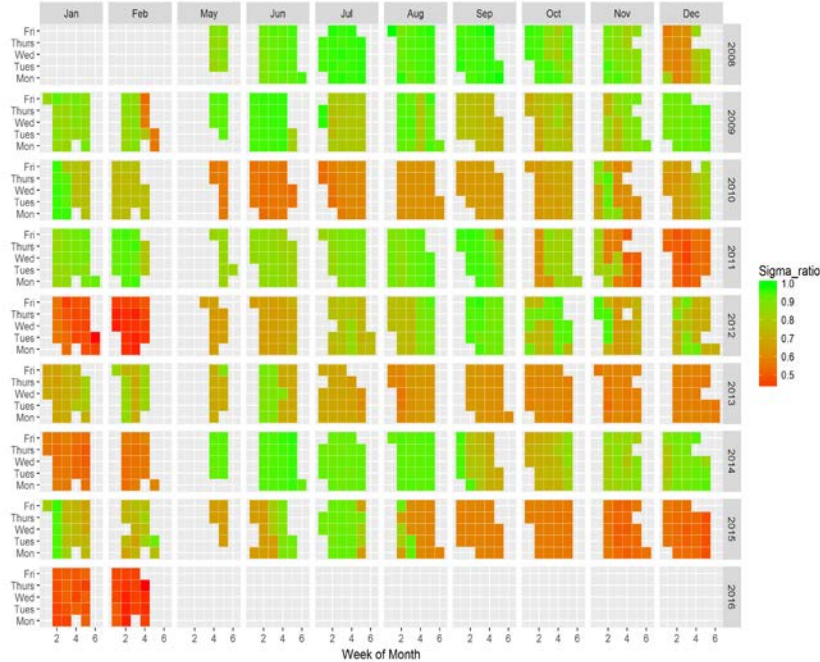
Ratio of Accumulator Portfolio Risk to Long Futures Risk



JULY

Soybean Accumulator Sigma Ratio(July Expiration)

Ratio of Accumulator Portfolio Risk to Long Futures Risk



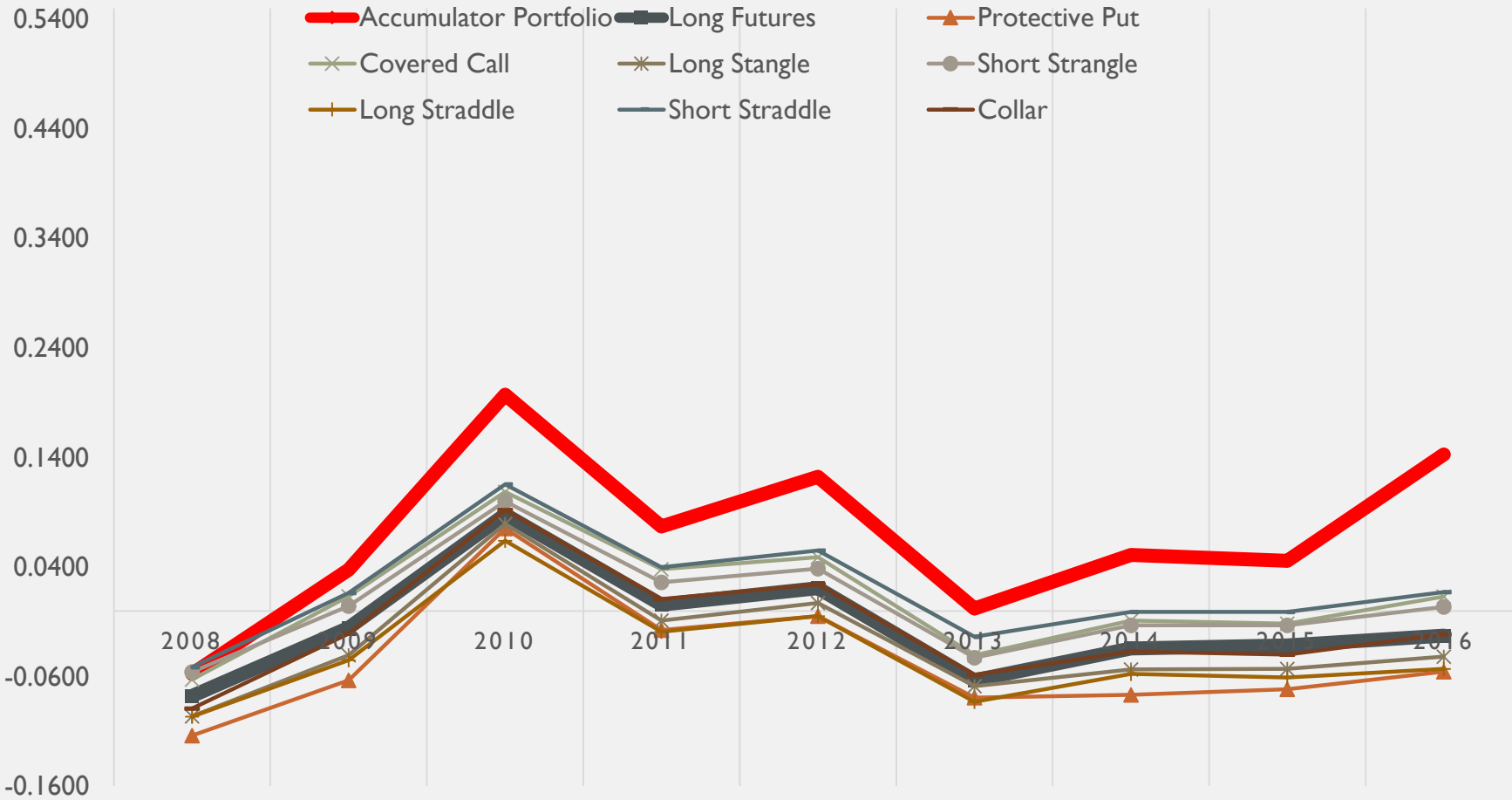
NOVEMBER

Soybean Accumulator Sigma Ratio(Nov Expiration)

Ratio of Accumulator Portfolio Risk to Long Futures Risk



SHARPE RATIO - CORN



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SHARPE RATIO - CORN

MARCH

Corn Accumulator Sharpe Ratio(March Expiration)



JULY

Corn Accumulator Sharpe Ratio(July Expiration)

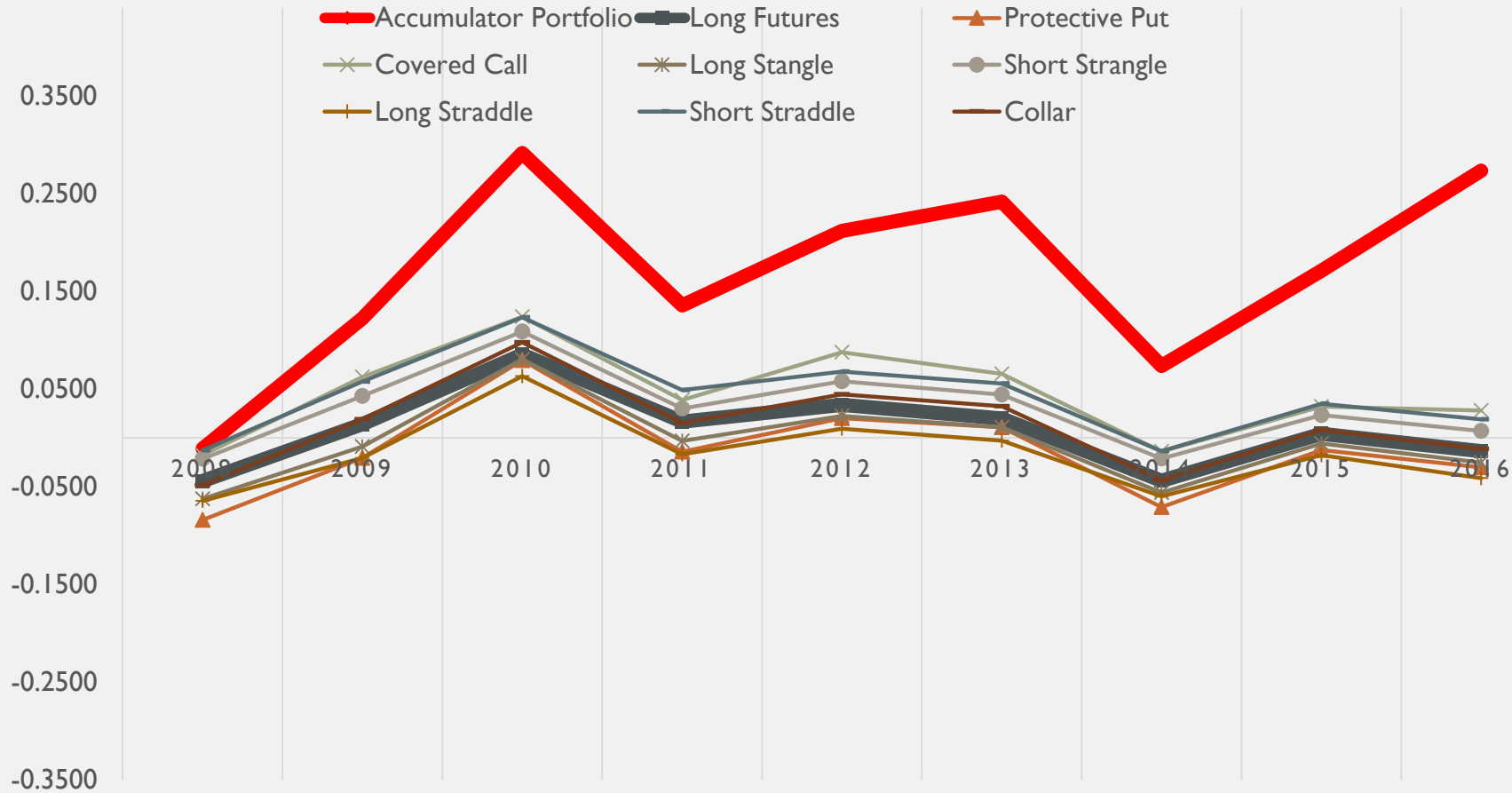


DECEMBER

Corn Accumulator Sharpe Ratio(December Expiration)



SHARPE RATIO - SOYBEANS



Month	Soybeans – Producer Accumulator	Soybeans – Long Futures
January	0.225	0.003
February	0.226	-0.007
March	0.171	0.008
April	0.156	-0.002
May	0.145	-0.001
June	0.096	-0.007
July	0.113	0
August	0.142	0.005
September	0.186	0.009
October	0.22	0.018
November	0.217	0.018
December	0.226	0.013
Growing Season (April-September)	0.14	0.001
Non-Growing Season (October-March)	0.214	0.009

Range	Producer Accumulator	Long Futures	Protective Put	Covered Call	Long Stangle	Short Strangle	Long Straddle	Short Straddle	Collar	Accumulator Rank
2008-2017	0.1776	0.0045	-0.0167	0.0410	-0.0088	0.0263	-0.0216	0.0396	0.0090	1

SHARPE RATIO - SOYBEANS

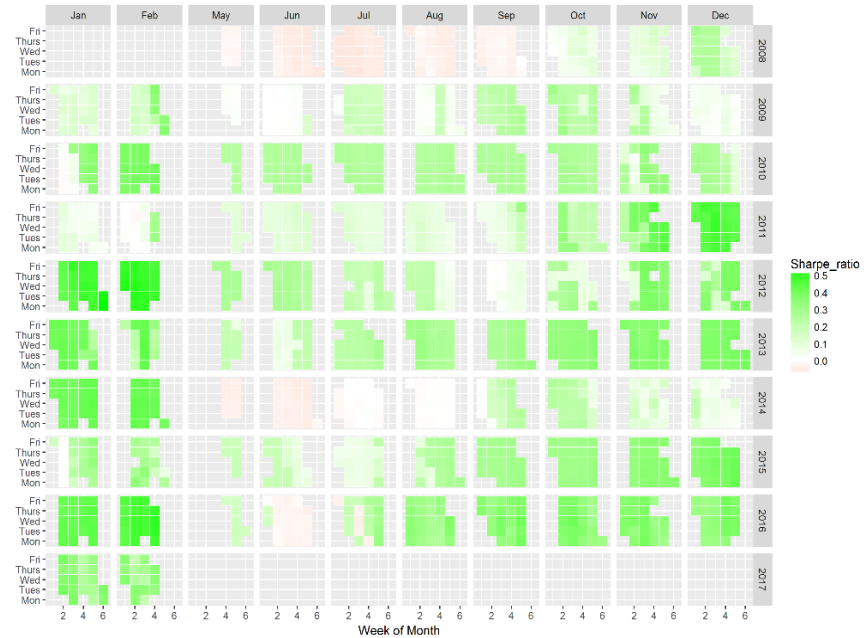
MARCH

Soybean Accumulator Sharpe Ratio(March Expiration)



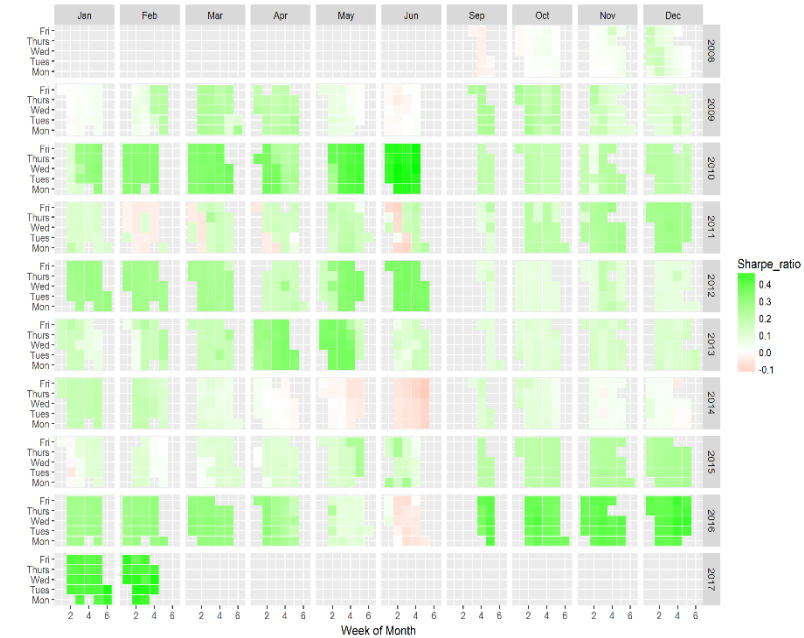
JULY

Soybean Accumulator Sharpe Ratio(July Expiration)



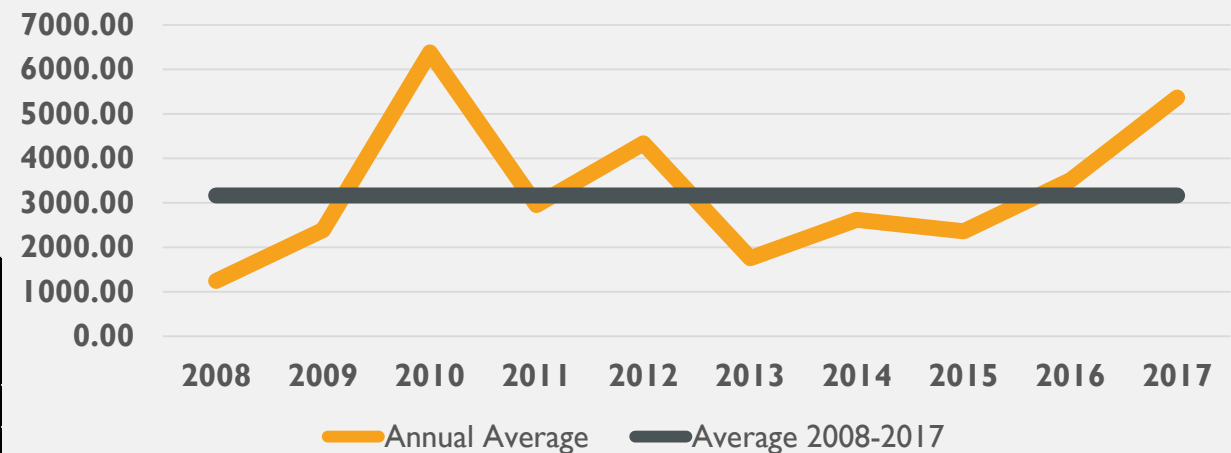
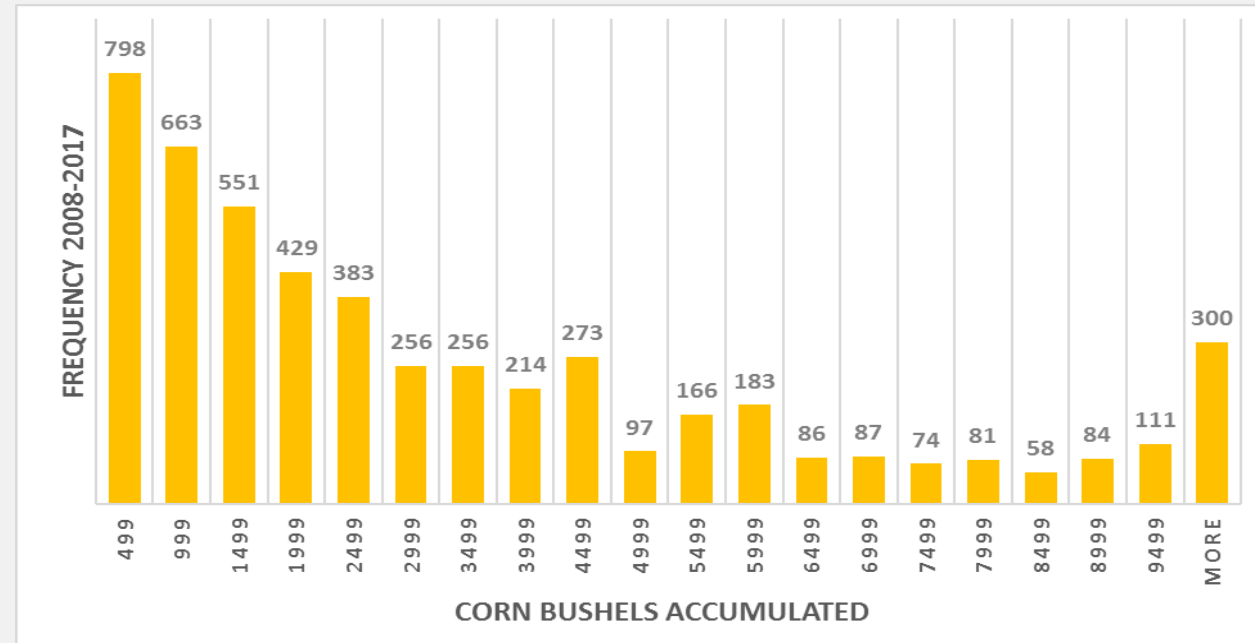
NOVEMBER

Soybean Accumulator Sharpe Ratio(Nov Expiration)



BUSHEL ACCUMULATED - CORN

Month	Corn – Producer Accumulator
January	3,489
February	3,214
March	2,855
April	2,713
May	2,950
June	2,861
July	2,770
August	3,011
September	3,870
October	3,222
November	3,409
December	3,839
Growing Season (April-September)	3,029
Non-Growing Season (October-March)	3,338

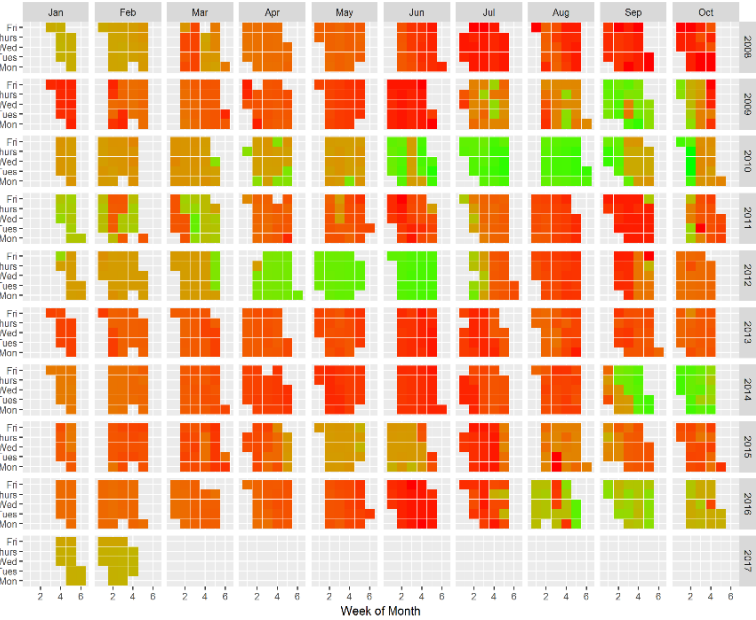


Timeframe	Bushels Accumulated	Number of Contracts with Bushels Accumulated <5000	Number of Contracts with Bushels Accumulated >5000
2008-2017	3165.34	3920.00	1197.00
		76.61%	23.39%

BUSHEL ACCUMULATED - CORN

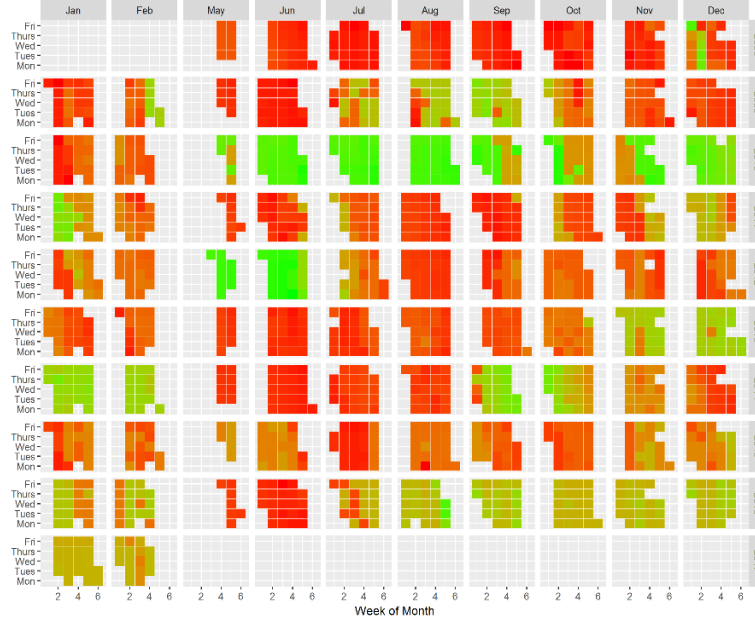
MARCH

Corn Accumulator Bushels Accumulated (March Expiration)



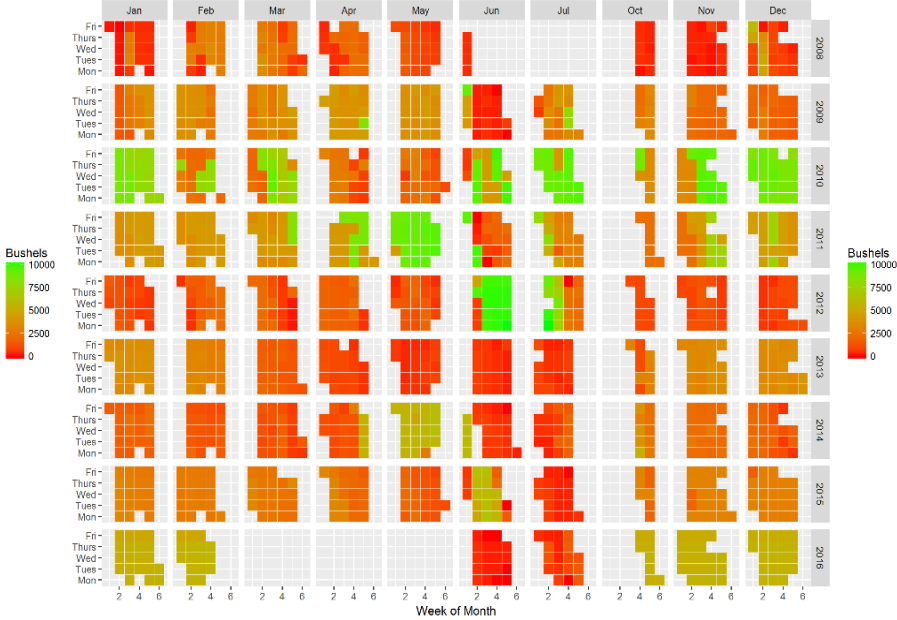
JULY

Corn Accumulator Bushels Accumulated (July Expiration)



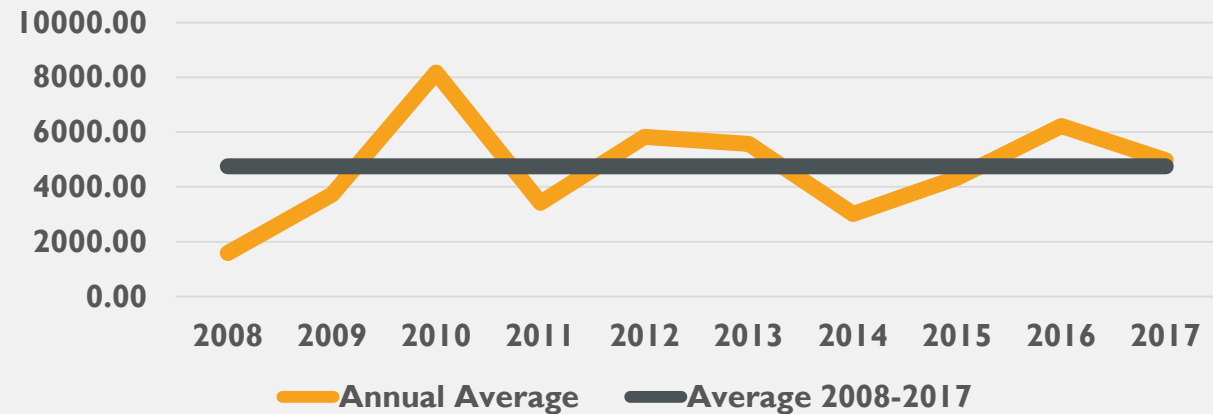
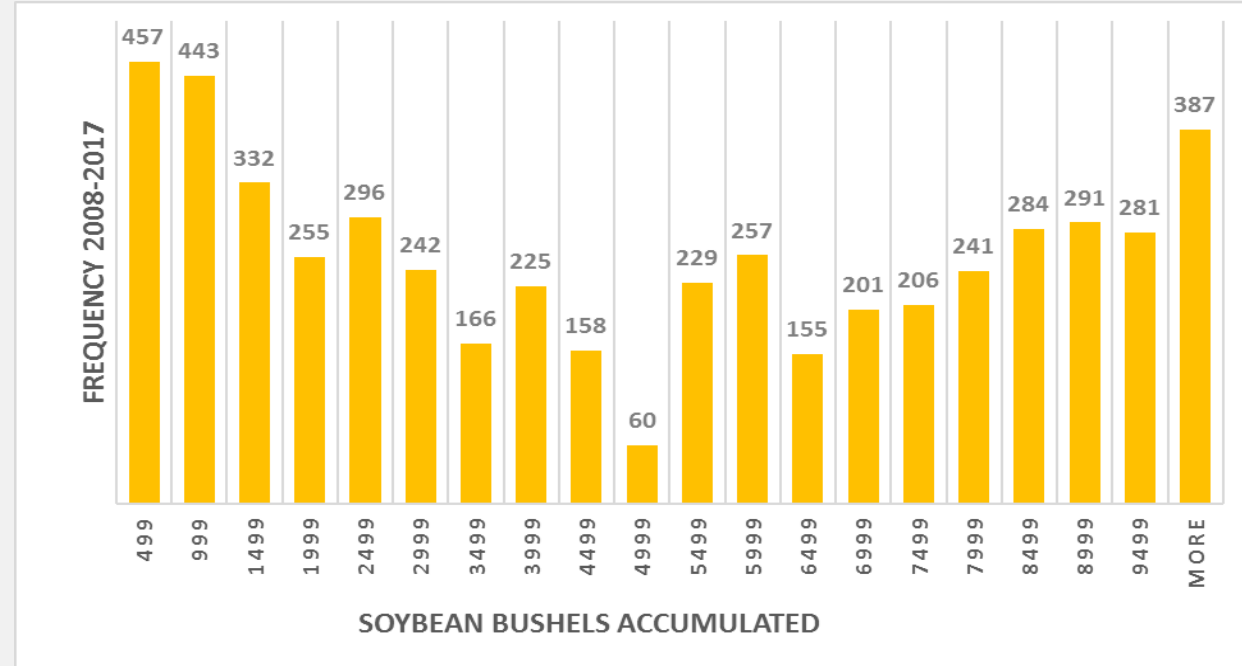
DECEMBER

Corn Accumulator Bushels Accumulated (December Expiration)



BUSHEL ACCUMULATED - SOYBEANS

Month	Soybeans – Producer Accumulator
January	5,025
February	5,428
March	5,667
April	4,927
May	4,463
June	3,381
July	3,720
August	3,880
September	4,789
October	5,359
November	5,167
December	5,323
Growing Season (April-September)	4,193
Non-Growing Season (October-March)	5,328

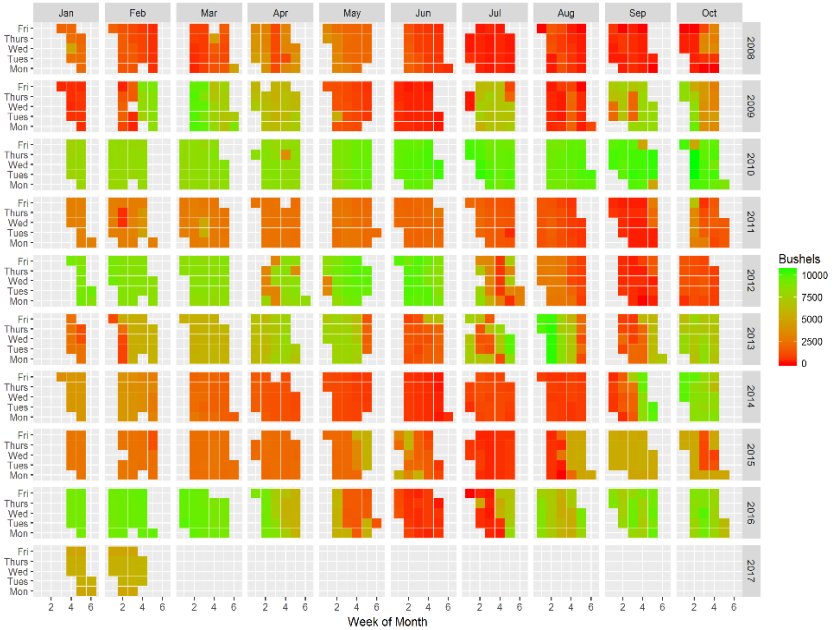


Timeframe	Bushels Accumulated	Number of Contracts with	
		Bushels Accumulated <5000	Bushels Accumulated >5000
2008-2017	4752.12	2635.00	2458.00
		51.74%	48.26%

BUSHEL ACCUMULATED - SOYBEANS

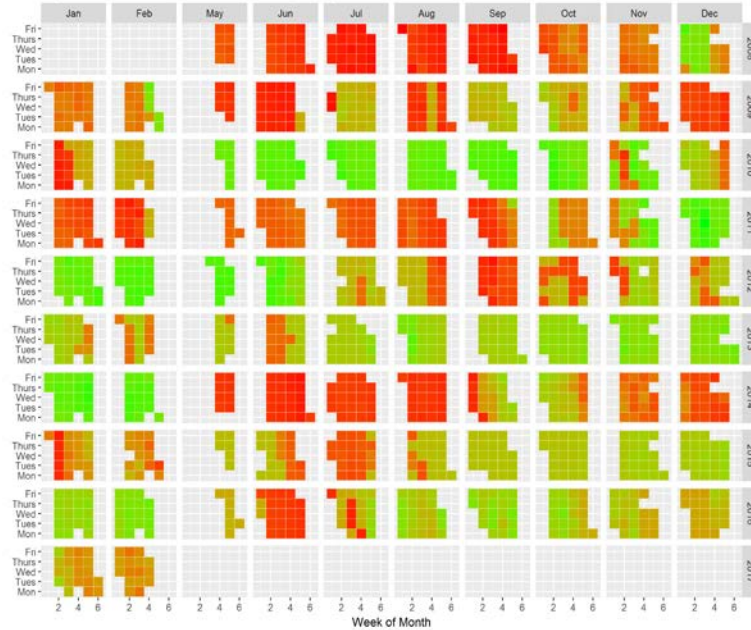
MARCH

Soy Accumulator Bushels Accumulated (March Expiration)



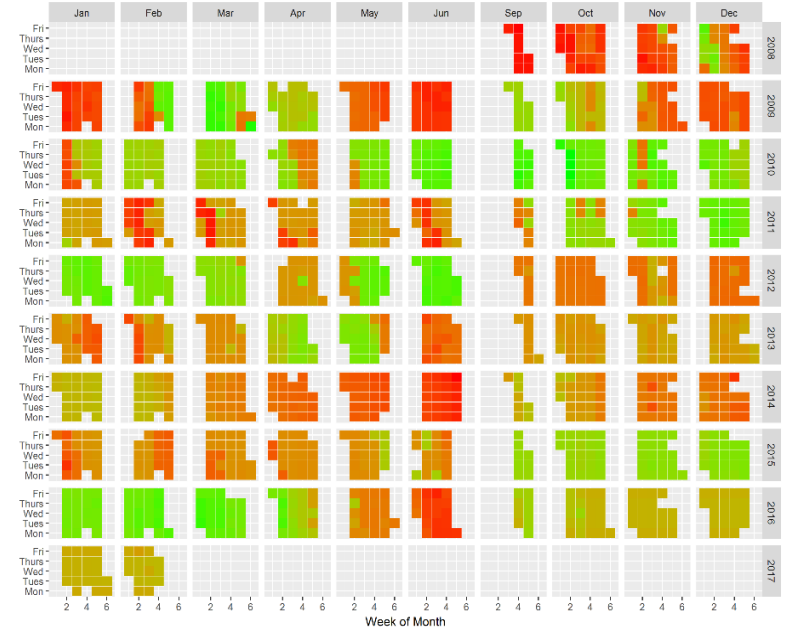
JULY

Soy Accumulator Bushels Accumulated (July Expiration)



NOVEMBER

Soy Accumulator Bushels Accumulated (Nov Expiration)



CONCLUSION – SUMMARY & PRODUCER IMPLICATIONS

- **Producer Accumulator = Efficient Risk Management Strategy**
 - Average Price – Producer Accumulator ~ Long Futures, \$-.05/bu in corn \$+.01/bu in soybeans
 - Sigma – Producer Accumulator < Long Futures, \$154.79 in corn and \$382.12 in soybeans
 - Sharpe Ratio – Producer Accumulator > Long Futures
 - According to Modern Portfolio Theory, producer accumulator is a more efficient portfolio.
- **Non-Growing Season (October-March) Execution is Optimal**
 - Average Price – Growing Season ~ Non-Growing Season
 - Sigma – Growing Season > Non-Growing Season
 - Sharpe Ratio – Growing Season < Non-Growing Season
 - Bushel Accumulation – Growing Season < Non-Growing Season
- **Hedging Account for Producer Accumulator Defense**
 - Corn – 3,165 average bushels accumulated 2008-2017, skewed toward lower bushel bins in histogram
 - Soybeans – 4,752 average bushels accumulated 2008-2017, skewed toward higher and lower bushel bins in histogram
- **Combine with a Basis Contract**

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