Optimal Climate Crop Insurance Strategy: Contrasting Insurer and Farmer Interests

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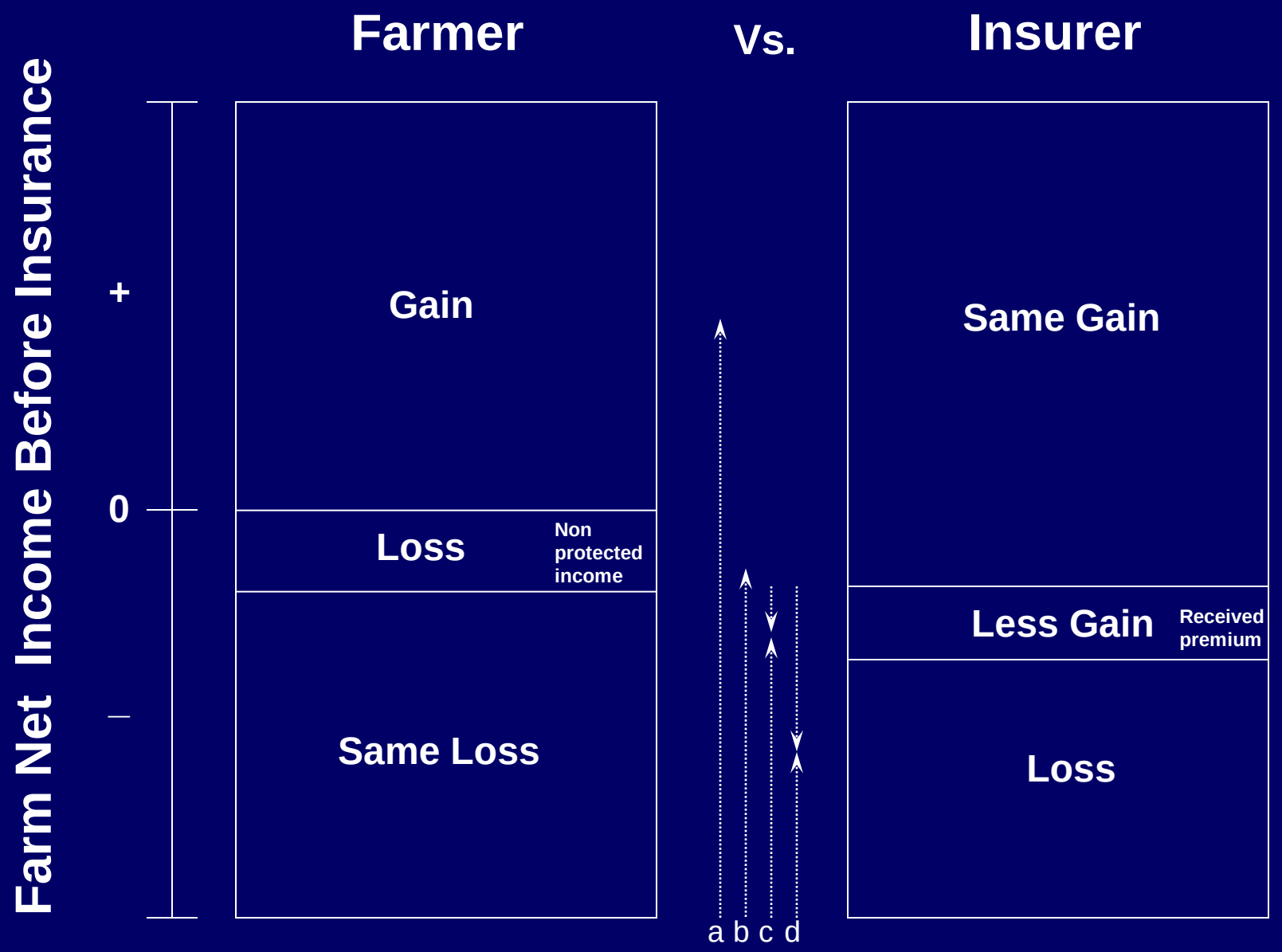

Farmer
Vs.
Insurer
Farm Net Income Before Insurance
+
0
–
Gain
Loss
Non protected income
Same Loss
Same Gain
Less Gain
Received premium
Loss
a b c d
Strategy:
Maximize Gain
Minimize Loss

Jackson Co., FL (30.774N, 85.226W) farm

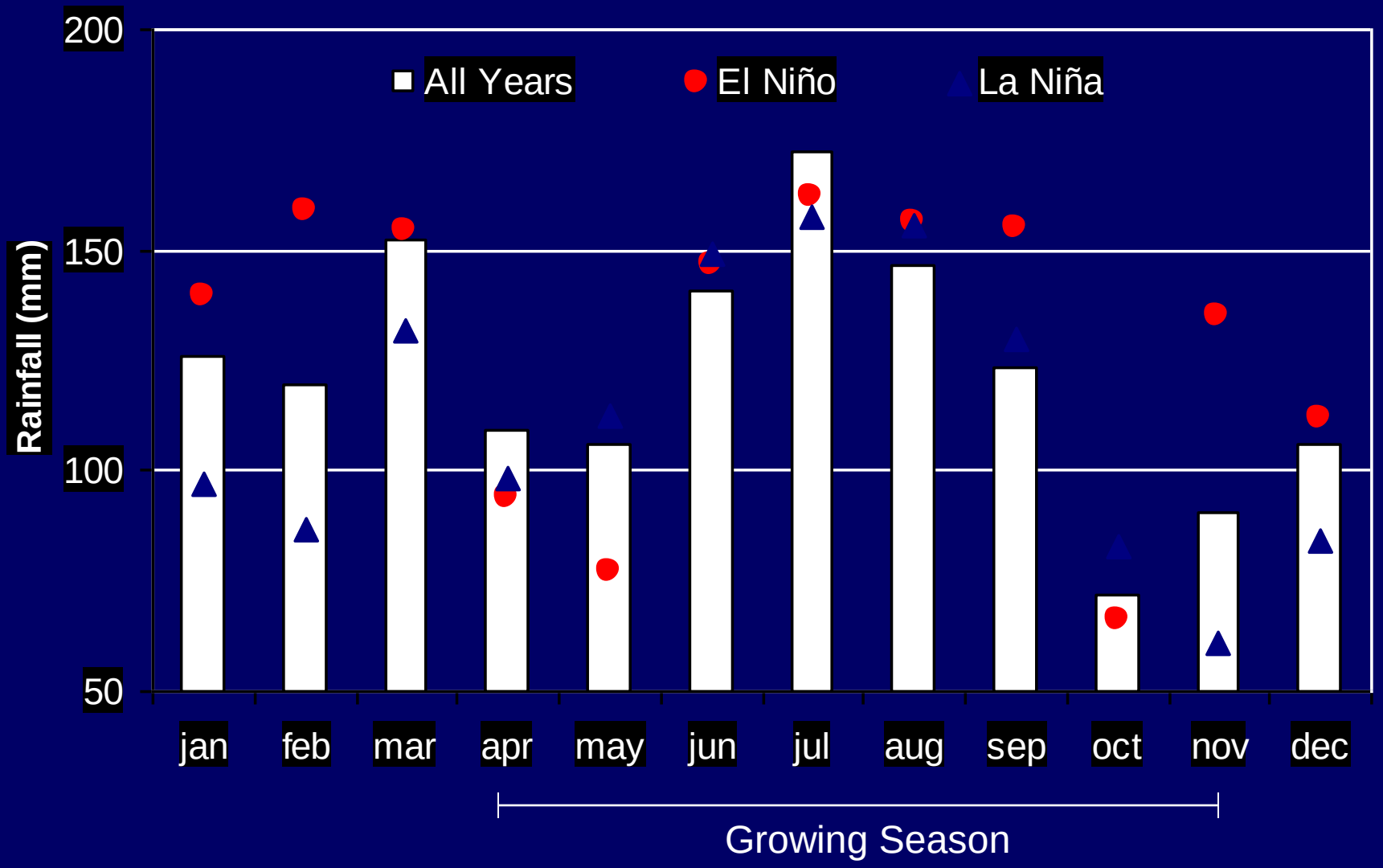
40 ha, non-irrigated, 50% peanut, 50% cotton

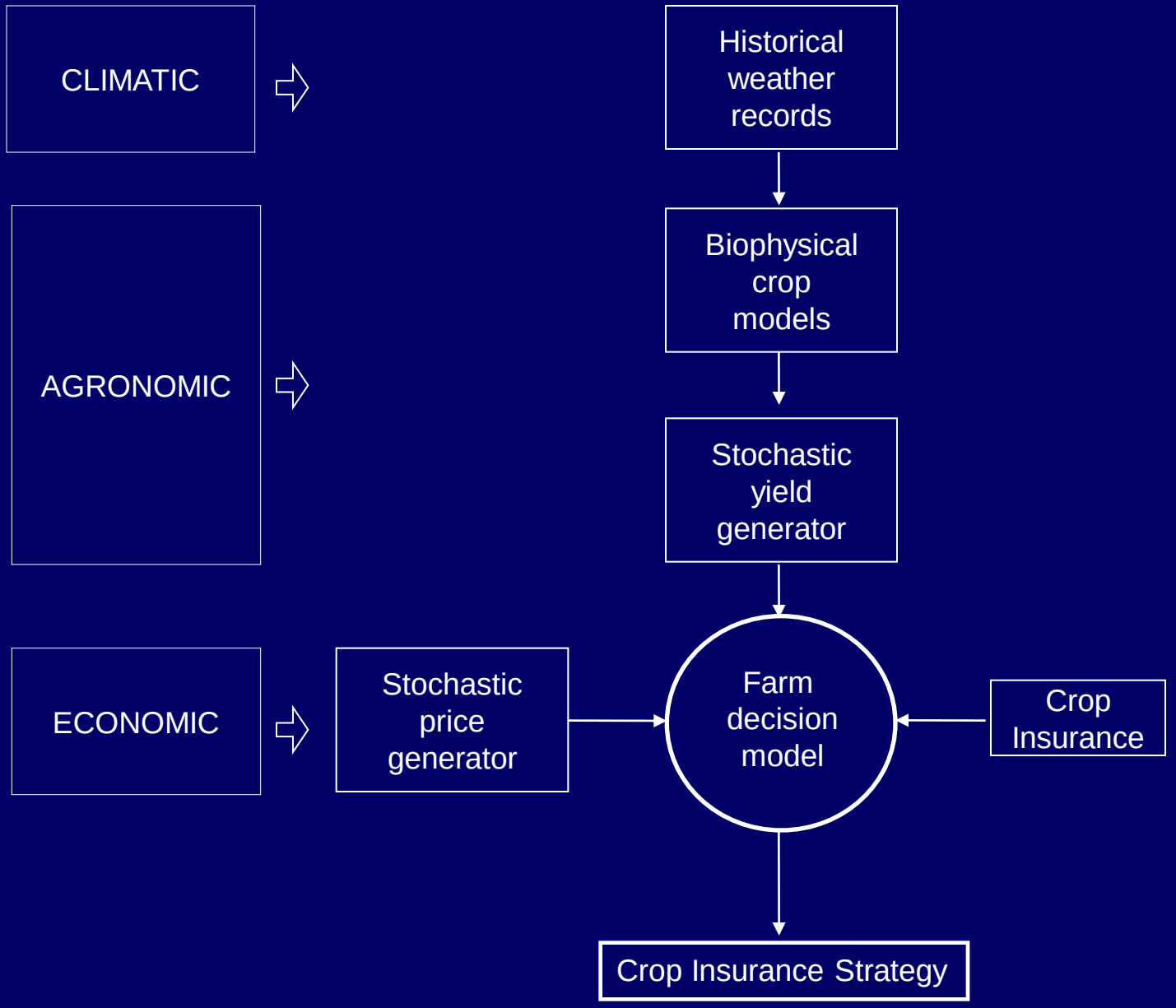
Dothan Loamy Sand soil type

65 (1939-2003) ENSO phases

Most popular crop insurance contracts

Premium subsidies included for insurer


200
150
100
50
Rainfall (mm)
All Years
El Niño
La Niña
jan
feb
mar
apr
may
jun
jul
aug
sep
oct
nov
dec
Growing Season


CLIMATIC
AGRONOMIC
ECONOMIC
Historical weather records
Biophysical crop models
Stochastic yield generator
Stochastic price generator
Farm decision model
Crop Insurance
Crop Insurance Strategy

Farmer

$$\max_{x} E\{U(W_f)\} = \sum_{n=1}^{N} U(W_0 + \sum_{j=1}^{2} Y_j P_j X_j + IY_j PB_j X_j - C_j X_j - \Pr_j X_j) / N$$

$$U(W_f) = W_f^{1-R_r} / (1 - R_r)$$

Insurer

$$\min_{x} E\{L\} = \sum_{n=1}^{N} \sum_{j=1}^{2} X_j IY_j PB_j - X_j \Pr_j / N$$

$$CVaR_{\alpha}[L(x,\theta)] \leq v$$

Peanut

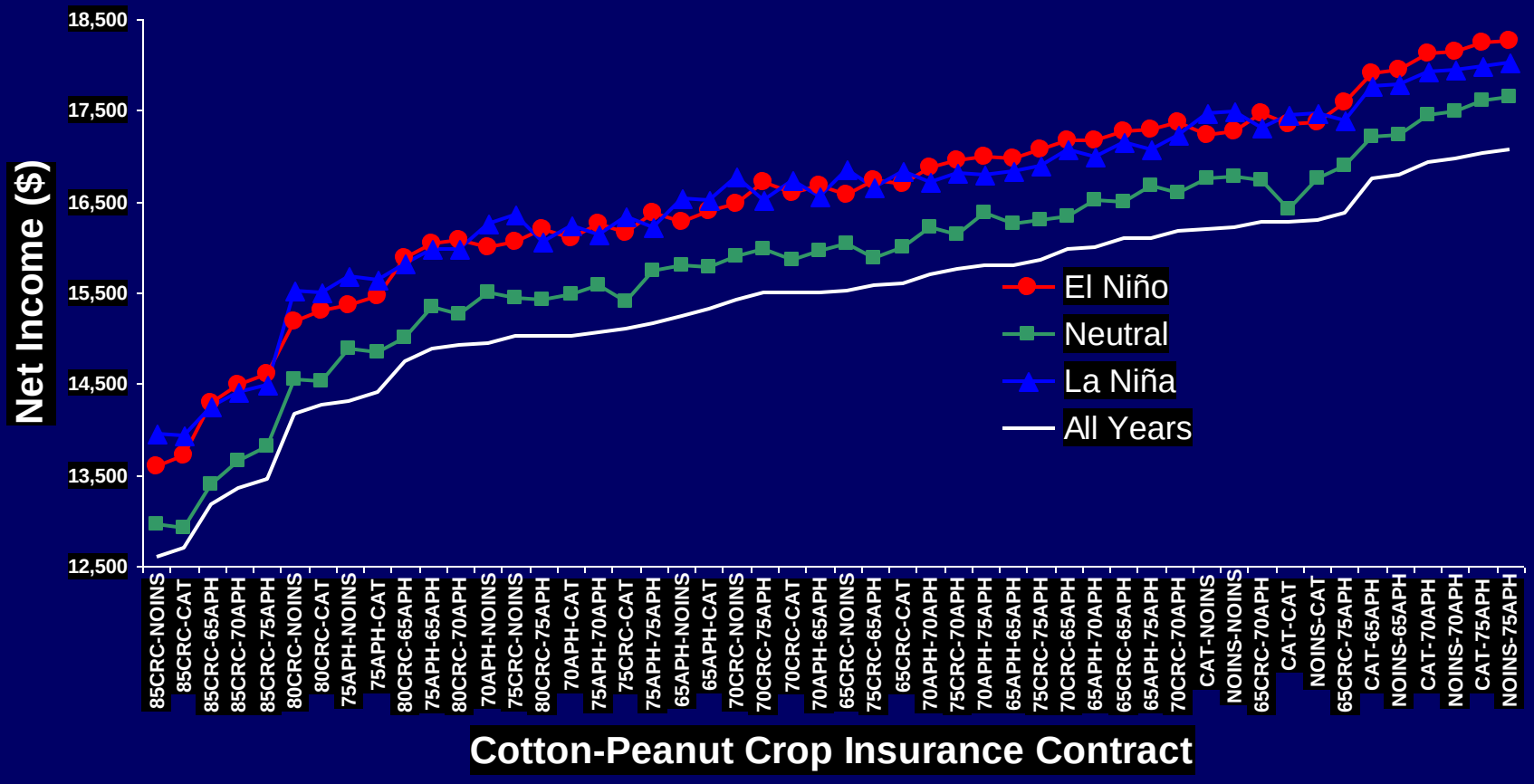
$$\sum_{m=1}^{9} X_{m,j} = 0.5$$

Cotton

$$\sum_{m=10}^{13} X_{m,j} = 0.5$$

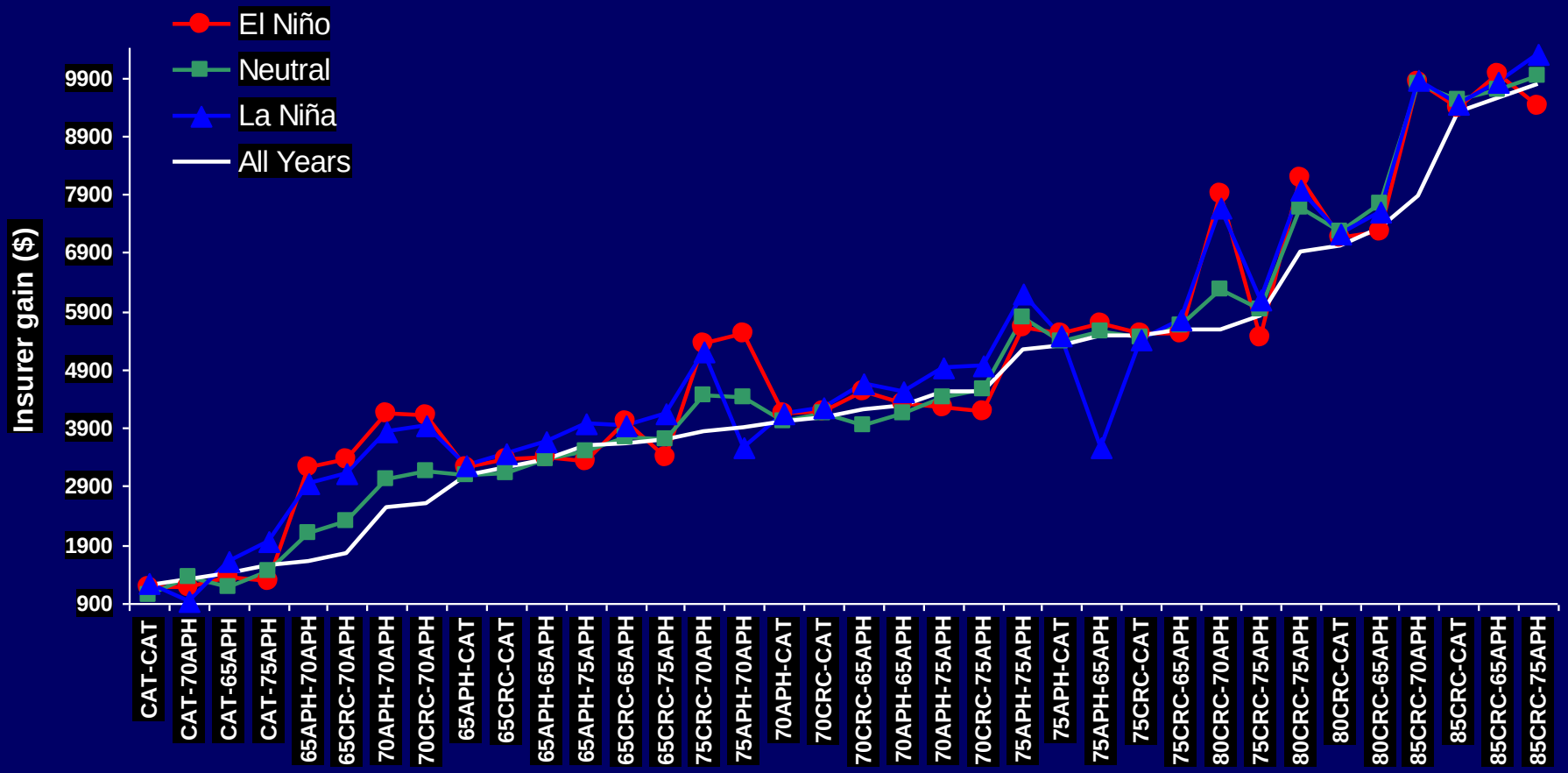
$$X_m \geq 0$$

Farmer



Insurance: APH or MPCI, CRC, and CAT

Insurer


El Niño
Neutral
La Niña
All Years
Insurer gain ($)
9900
8900
7900
6900
5900
4900
3900
2900
1900
900
CAT-CAT
CAT-70APH
CAT-65APH
CAT-75APH
65APH-70APH
65CRC-70APH
70APH-70APH
70CRC-70APH
65APH-CAT
65CRC-CAT
65APH-65APH
65APH-75APH
65CRC-65APH
65CRC-75APH
75CRC-70APH
75APH-70APH
70APH-CAT
70CRC-CAT
70CRC-65APH
70APH-65APH
70APH-75APH
70CRC-75APH
75APH-75APH
75APH-CAT
75APH-65APH
75CRC-CAT
75CRC-65APH
80CRC-70APH
75CRC-75APH
80CRC-75APH
80CRC-CAT
80CRC-65APH
85CRC-70APH
85CRC-CAT
85CRC-65APH
85CRC-75APH

Farmer

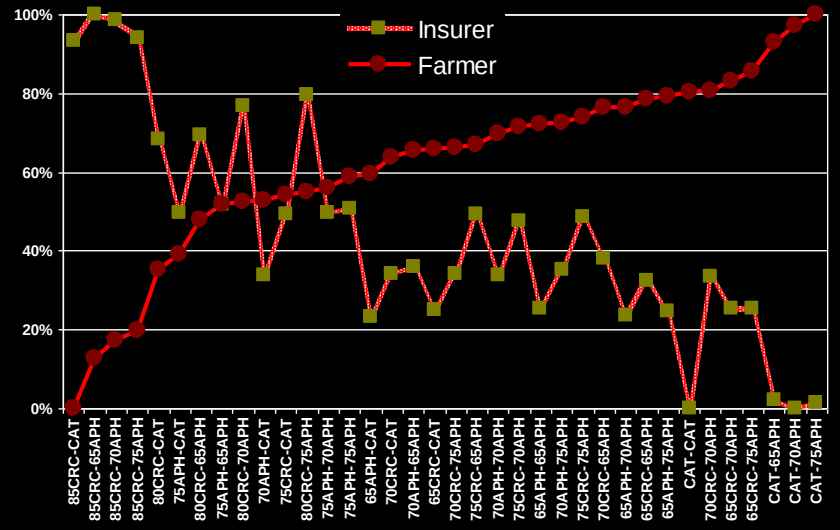
	CRRA				
	0	1	2	3	4
EL Niño	CAT-75APH	CAT-75APH	CAT-65APH	CAT-65APH	CAT-65APH
Neutral	CAT-75APH	CAT-75APH	CAT-70APH	CAT-70APH	CAT-70APH
La Niña	CAT-75APH	CAT-75APH	CAT-70APH	CAT-70APH	CAT-70APH

Insurer

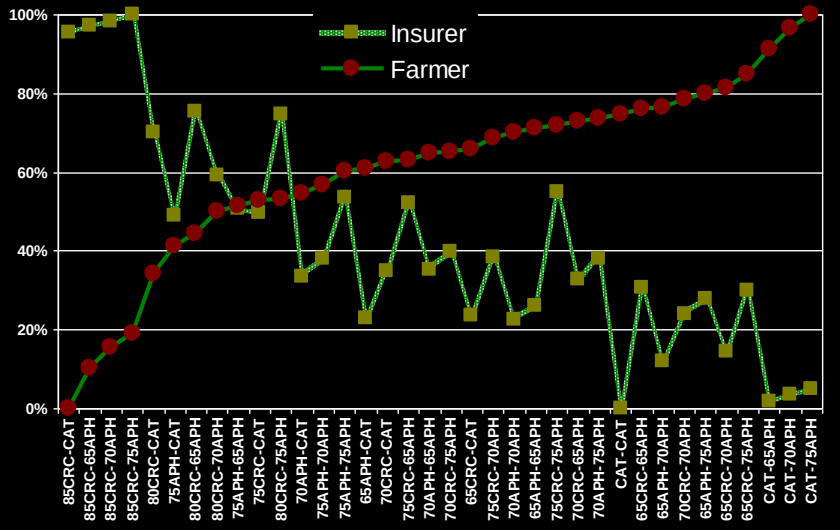
	Risk value	90%	95%	99%
El Niño	<4000	85CRC-65APH	85CRC-65APH	75APH-CAT
	>4000	85CRC-65APH	75APH-CAT	NA
Neutral	<2000	85CRC-75APH	85CRC-75APH	65APH-CAT
	2000-4000	85CRC-75APH	85CRC-75APH	75APH-CAT
	>4000	85CRC-75APH	75APH-CAT	NA
La Niña	<0	85CRC-75APH	85CRC-75APH	85CRC-CAT
	0-2000	85CRC-75APH	85CRC-75APH	70APH-CAT
	2000-4000	85CRC-75APH	85CRC-75APH	75APH-CAT
	>4000	85CRC-CAT	85CRC-CAT	NA

Synergies 75APH-75APH, 75CRC-CAT

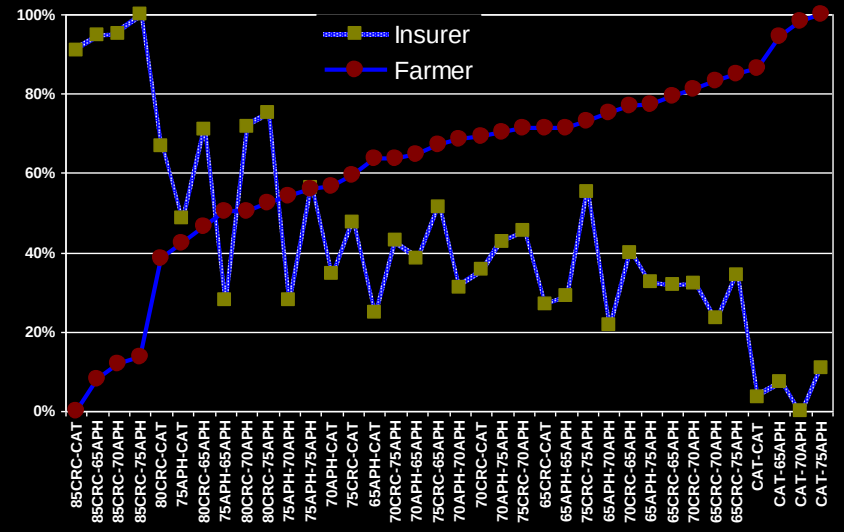
El Niño: 75APH-70APH



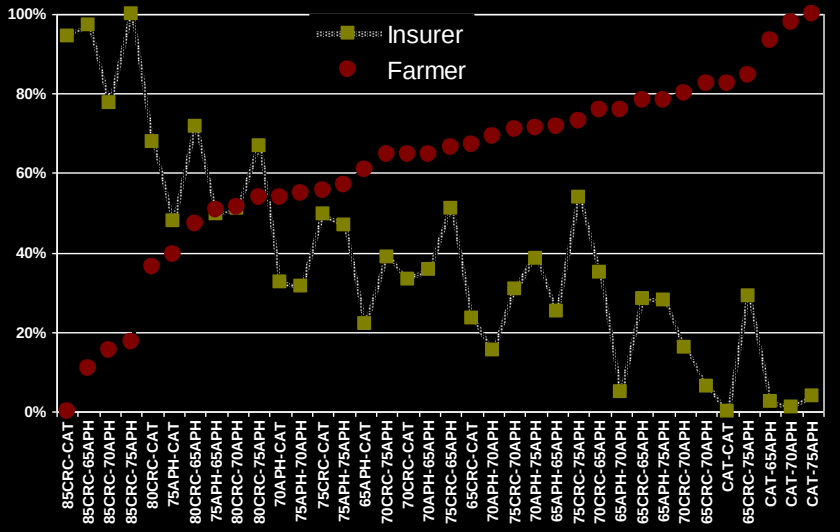
Neutral: 75APH-CAT, 80CRC-70APH, 75APH-65APH



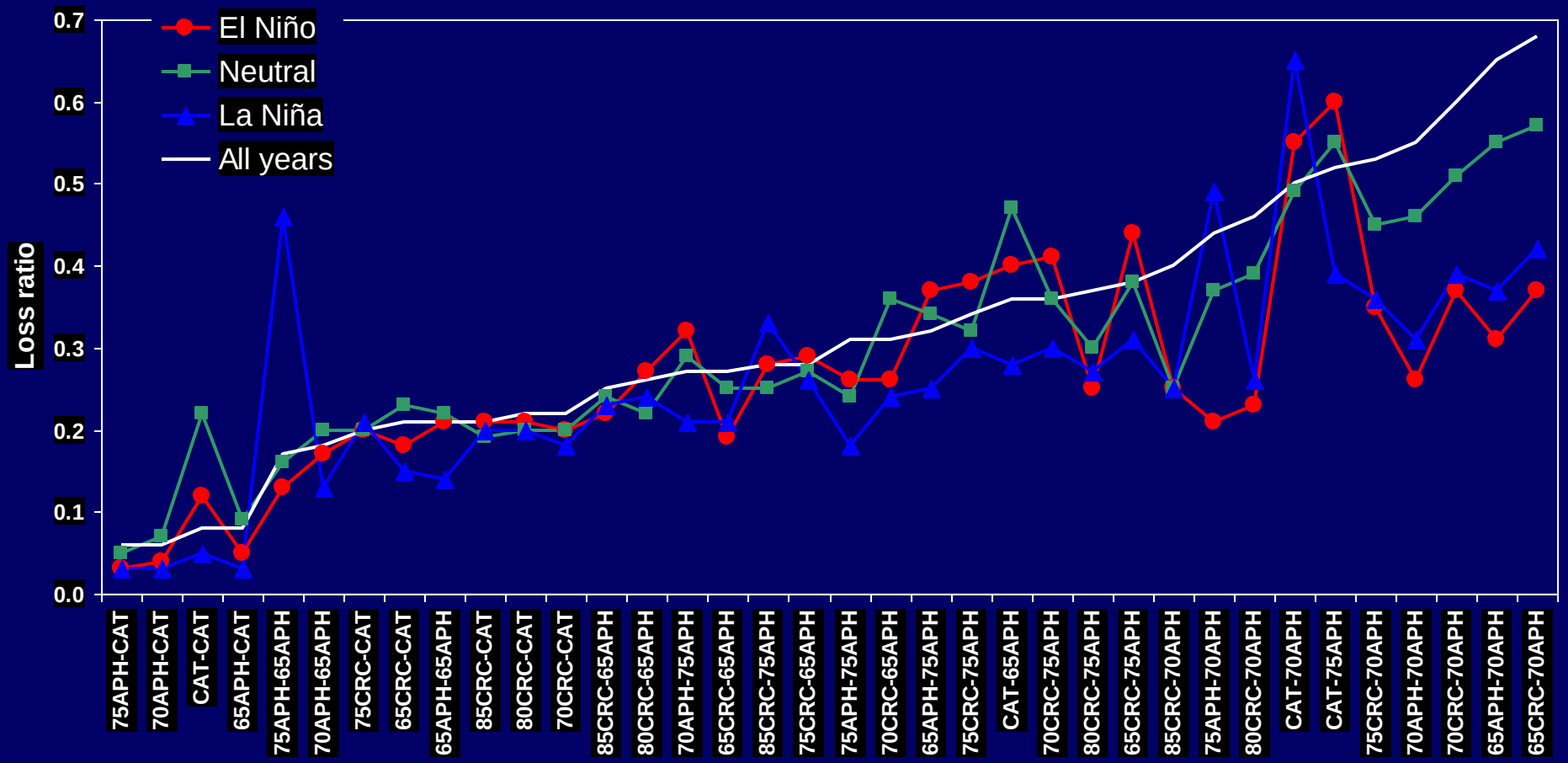
La Niña: 75APH-CAT



All Years: 75CRC-CAT, 75APH-75APH

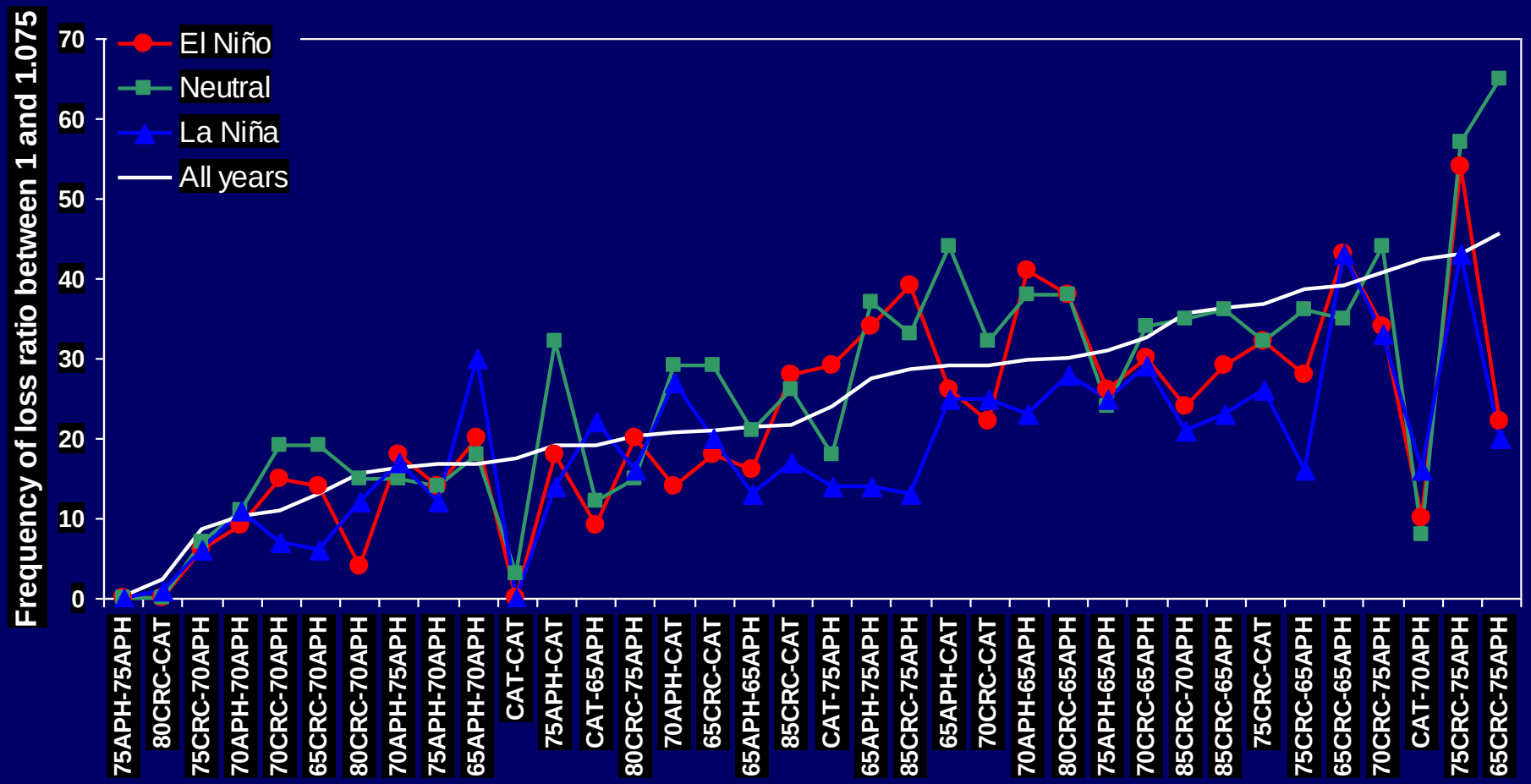


Indemnity paid / Premium received



Loss Ratio Target : 1.075 Average: 0.32

2004 RMA Cotton: 0.54 Peanut:1.29



Implications

- ENSO climate variability impacts farmer and insurer crop insurance selection
- Conflict of interest exists, but seems workable
- Premiums and/or subsidies could be decreased or better assigned
- Consistent with previous studies: Crop insurance could be privately promoted
- Further study including spatial distribution