

Using El Niño Insurance to Mitigate Losses of an Exporting Firm

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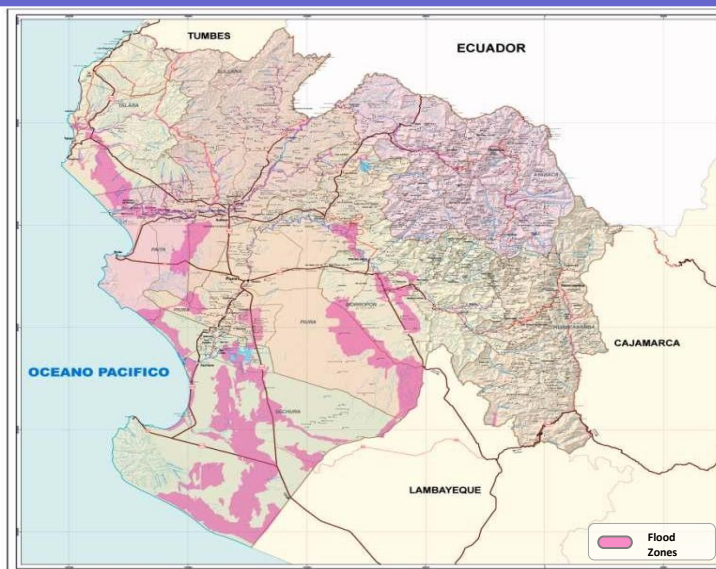
Extreme Flooding and El Niño

- Extreme flooding in Piura is directly tied to El Niño
 - Warm Pacific trade winds meet cold air coming down Andes Mountains
 - Result — Extreme, prolonged rainfall
 - Severe El Niño occurs roughly 1 in 15 years
- Most recent severe El Niño events: 1982/83 and 1997/98
 - Rainfall was 40x normal for January to April
 - For 1997/98, volume of Piura River was 41x median value
 - For 1982/83, volume of Piura River was 36x median value
- El Niño is the biggest risk event for agriculture, also affects many other sectors due to infrastructure breakdowns

ENSO Insurance for Extreme Flooding in Piura, Peru

- Regulator has approved the a product that will pay in January whereas extreme flooding occurs in Feb–May
- MoU to work with LaPositiva Insurance Company of Peru to offer ENSO Insurance
- PartnerRE will provide reinsurance
- Strong and growing interest among many stakeholders in Peru
- Detailed risk assessment to advance the understanding of how to use an ENSO Insurance payment by lenders to reduce their consequential losses during El Niño

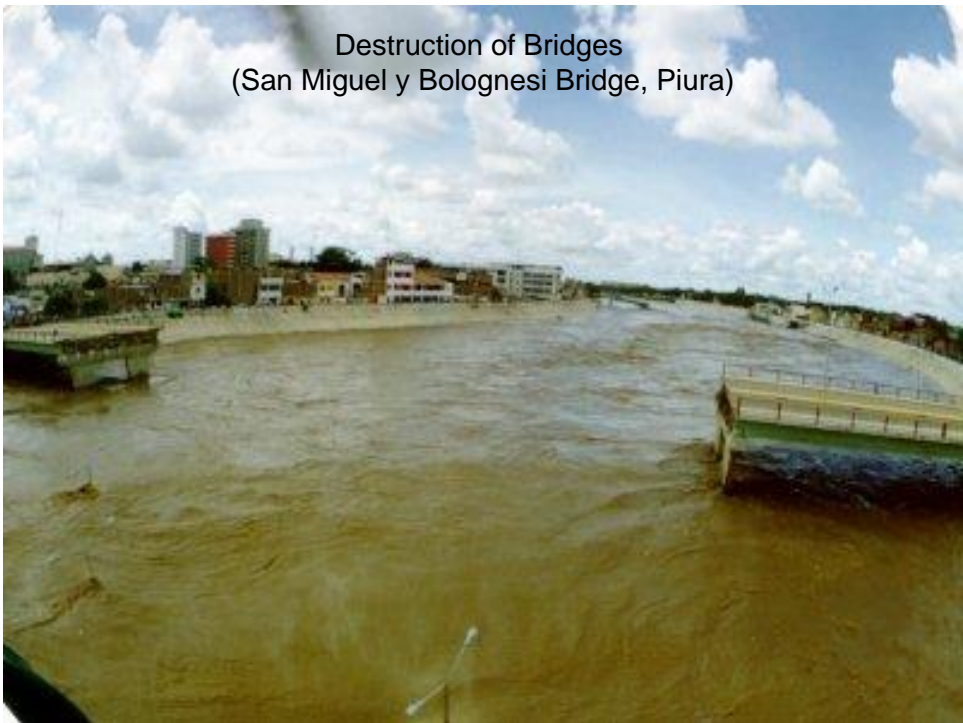
Flood Zones in Piura, Peru



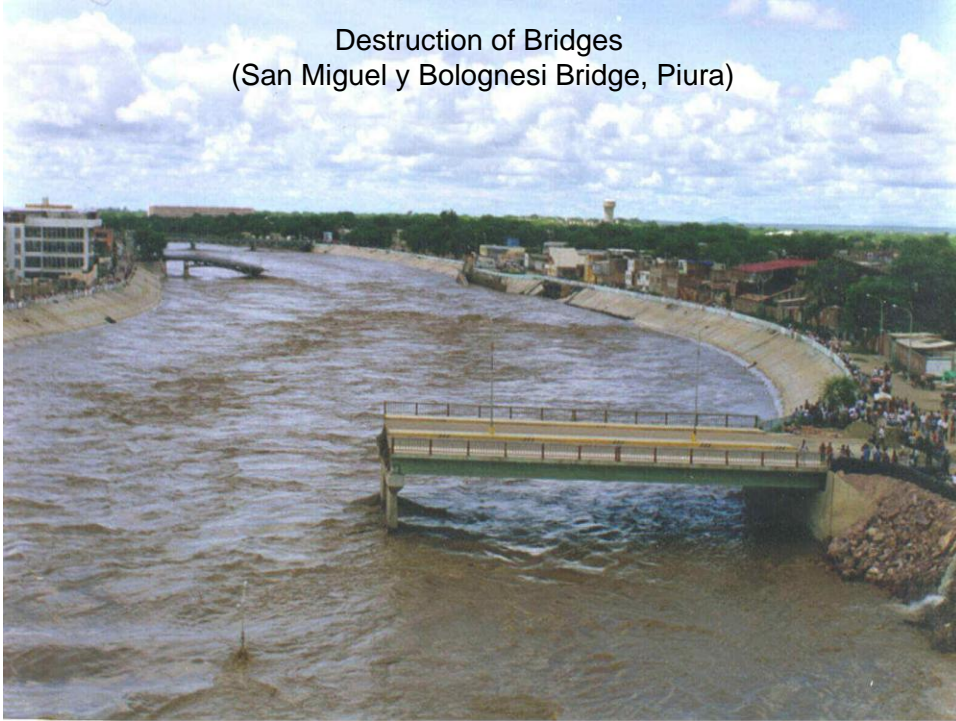




Destruction of Bridges
(San Miguel y Bolognesi Bridge, Piura)



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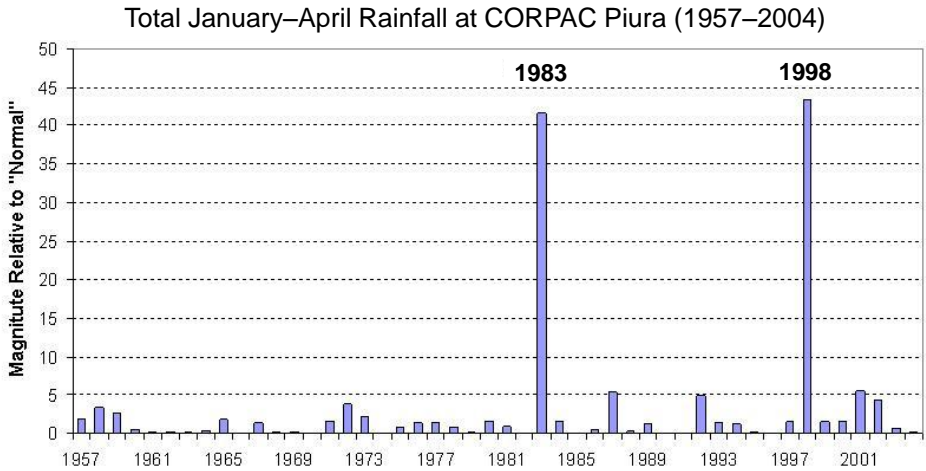
Damages from El Niño Events in the Piura Region
(1982/83 and 1997/98)

Values in
millions de soles and percent (%)

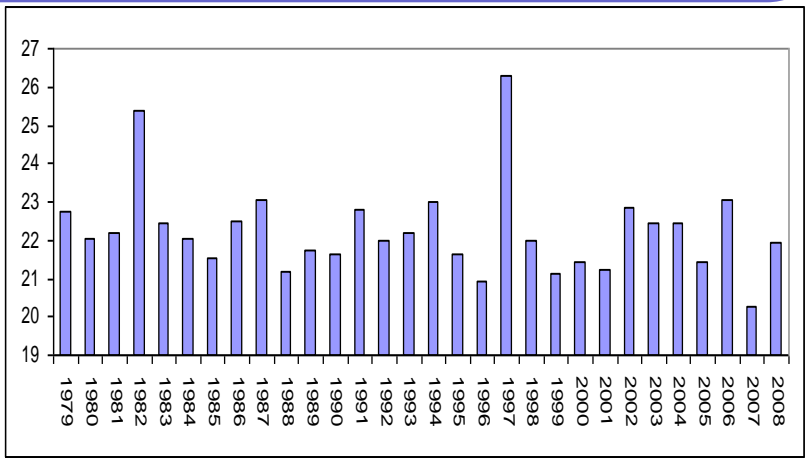
Sector	1982/83	1997/98
Agriculture	116,923 (31,5%)	118,399 (19%)
Transportation	183,277 (49%)	374,216 (60%)
Health	1,355 (0,5%)	1,276 (0,5%)
Housing	63,240 (17%)	37,456 (6%)
Education	6,910 (2%)	30,487 (5%)
Total Soles	371,705 (100%)	621,157 (100%)
Total US \$	116 Million	177 Million

Sources: CISMID and INEI

Extreme El Niño Events of 1982/83 : 1997/98

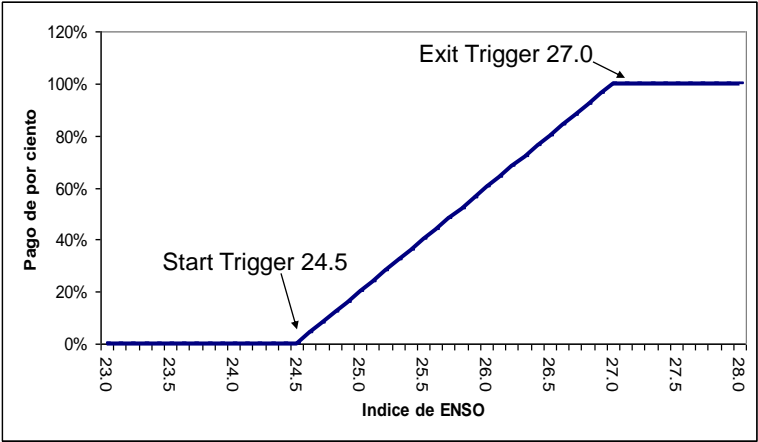


ENSO Index from 1979 to 2008



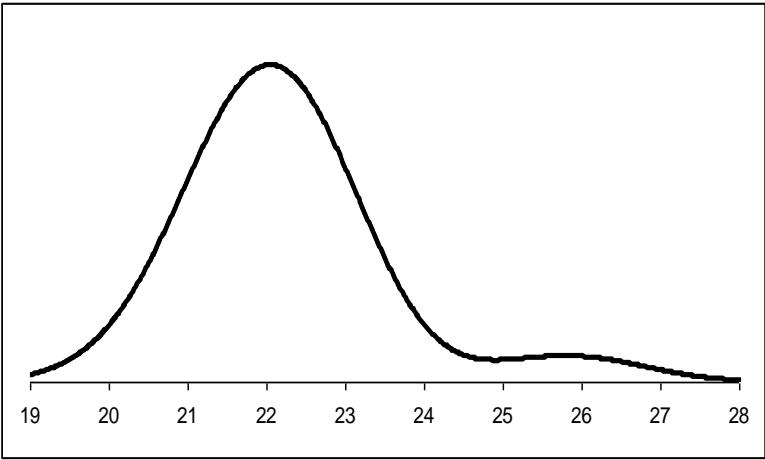
1982 payment rate = 34 percent; 1997 payment rate = 71 percent
 Start Threshold = 24.5; Exit Threshold = 27

Payout Structure



Linear payout so that if temperature is ½ the way between 24.5 and 27 or 25.75, the payout rate is 50 percent

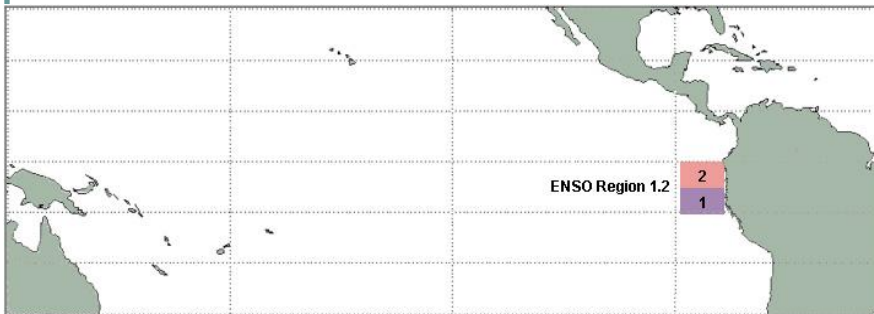
Estimated Probability Density Function for ENSO Index Using Data 1979 to 2007



Events in excess of 24 may occur as frequently as 1 in 11 years

ENSO 1.2

- Measured and reported by NOAA Climate Prediction Center for over 50 years
- ENSO Region 1.2
 - (0°-5°S, 90°W-80°W and 5°S-10°S, 90°W-80°W)



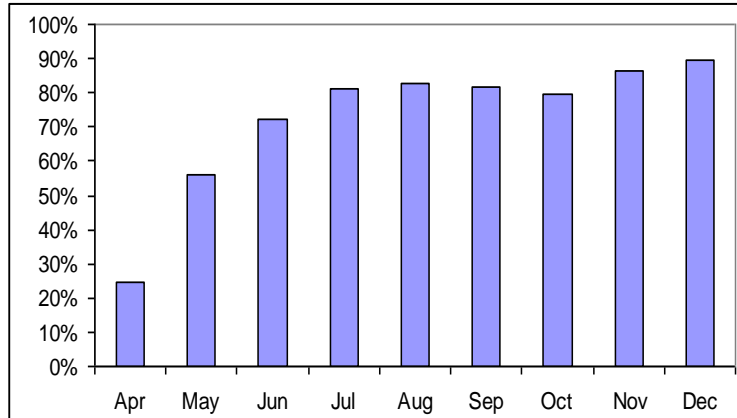
Timing of the Contract

	Year 1		Year 2	
January	Feb–October	Nov–Dec	Early January	February–April
Marketing period with a sales closing date of January 31	The EBIII is in force for possible upcoming severe event	SST data from ENSO 1.2 is used to calculate payments	Payments can be made before flooding as lenders begin to incur costs	Catastrophic flooding in the region

- Sales closing date must occur before buyers can predict an El Niño — Target January 31
- Insurance contract covers ENSO 1.2 (Nov–Dec)
- Payments will be made in early January as business interruptions are occurring

ENSO Forecast Can Be Made Early and Forecasts Are Improving

Simple correlation between Jan–March ENSO 1.2 and previous year by month using only Jan–March ENSO 1.2 average values above the median



Exporting Firm in Perú Exporting Fair Trade Products

- Exports high value product that has a continuous harvest (All months of the year, exporting roughly the same amount)
- Organized small farmers into farmer associations to supply the product on a contract basis
- Receives a premium for the labeled products (Fair Trade; organic; other labels)
- Owned by private interest and the farmer associations

Consequential Losses for an Exporter of a High Value Product

- **Starting Point (Immediate Effects)**
 - Profits = Volume x Margins – Fixed Costs
 - Volume = f (Farm yields, infrastructure break downs)
 - Margin = f (Quality, processing costs)
- **Longer-Term Effects**
 - Fixed cost dimensions of a trained labor force
 - Losing access to markets
 - Reputational risk as an unreliable supplier
 - Some trees may be lost causing a longer period to recover to the position prior to the event

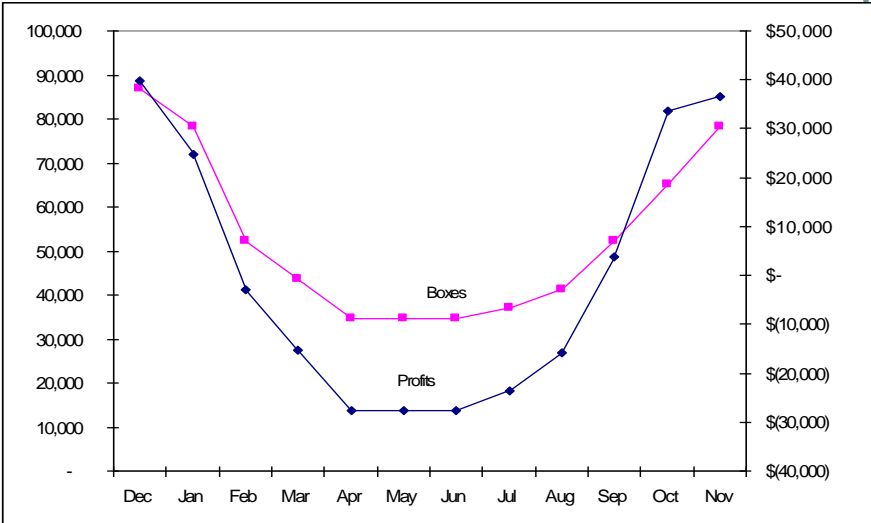
Monthly Profits in Normal Month

Profits = (Boxes Sold) * Margin		
Margin		
Gross Price / Box	\$	14.52
Quality Discount	-\$	0.29
Processing	-\$	3.30
Export + Packing	-\$	4.50
Farmer Share	-\$	5.12
Net Margin =	\$	1.31
At 34,760 Box per Month Revenue = \$ 113,563		
Fixed Cost (Mostly labor)		\$ 65,000
Debt Service per Month		\$ 8,700
Net Position		-\$ 31,872

Monthly Profits in Worst Month

Profits = (Boxes Sold) * Margin		
Margin	Normal	(ENSO)
Gross Price / Box	\$ 14.52	\$ 14.67
Quality Discount	-\$ 0.29	-\$ 0.59
Processing	-\$ 3.30	-\$ 3.69
Export + Packing	-\$ 4.50	-\$ 4.50
Farmer Share	-\$ 5.12	-\$ 5.28
Net Margin =	\$ 1.31	\$ 1.20
At 34,760 Box per Month Revenue =		\$ 41,828
Fixed Cost (Mostly labor)		\$ 65,000
Debt Service per Month		\$ 8,700
Net Position		-\$ 31,872

Volume and Quality Go Down as Flooding Problem Increases (Problems Ongoing for 9 Months)



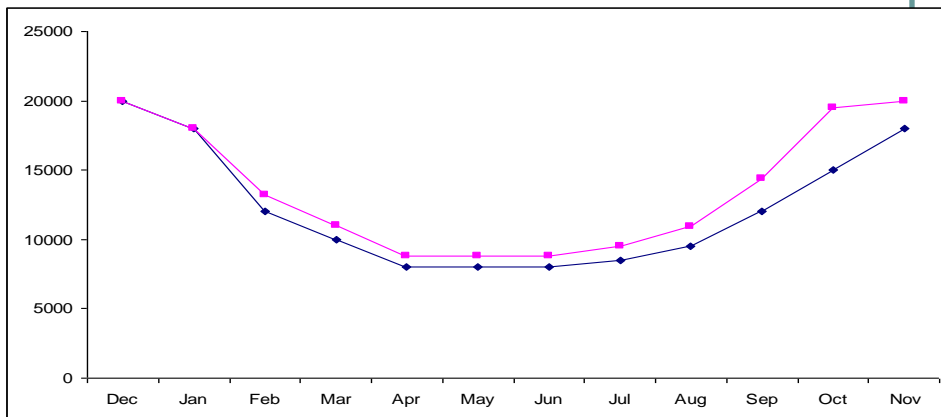
Key Objective: Cut the Time Needed to Return Volume and Profits to the Pre-event Level

Basic starting point

- Manager wants cash early as the event creates problems
- Manager has a major objective to retain all employees even as the volume goes down and profits suffer
- Need cash to cover the fixed costs of labor and debt service
- Manager has a plan to use excess labor during the shortfall time period to help farmers mitigate their problems and start sending quality product sooner — Getting back online has a large intrinsic benefit !

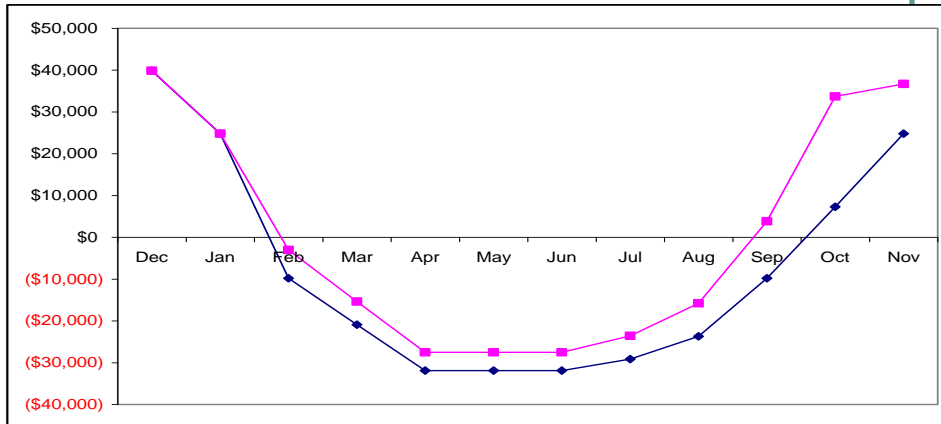
Key Objective: Cut the Time Needed to Return Volume and Profits to the Pre-event Level

Interviews gave us the basic information to build logical relationships regarding how mitigation can increase the volume



Key Objective: Cut the Time Needed to Return Volume and Profits to the Pre-event Level

Changing volume is evaluated using the net margin equations to demonstrate differences in profits given mitigation



Returning to Our Export Firm

	Without Adaptation	With Adaptation	Gain from Adaptation
	U. S. Dollars (\$)		
Dec	39,863	39,863	—
Jan	24,782	24,782	—
Feb	(9,793)	(3,018)	6,775
Mar	(20,929)	(15,385)	5,544
Apr	(31,872)	(27,518)	4,354
May	(31,872)	(27,518)	4,354
Jun	(31,872)	(27,518)	4,354
Jul	(29,154)	(23,573)	5,581
Aug	(23,683)	(15,803)	7,880
Sep	(9,793)	3,827	13,620
Oct	7,276	33,698	26,422
Nov	26,154	39,863	13,710
Year	(90,892)	1,701	92,594

Normal Year Earnings = \$478,360

Valuing the Insurance

- What value to insure?
- Recommendation — Select a sum insured that will give enough funds in January to cover the expected negative returns given adaptation = \$140,333
- ENSO Insurance cost for a contract that starts paying when ENSO = 24 degree Celsius is 11.25% of sum insured
- Payout rate in 1998 = 76% of sum insured
- To get \$140,333 in a year like 1998, you need to scale up $(140,333/.76) = \$184,689$
- Premium = \$20,733

Expected Value with and without Insurance

- Evaluate with expectations regarding frequency of extreme ENSO (e.g., 6.7%)
- $EV = \text{Normal Income} * (1 - .067) + \text{ENSO Year Income} * (.07)$
- EV with insurance — Subtract off premium for insurance in a normal year and consider the value of the insurance in an ENSO year (Gain from Adaptation + Indemnity Payment)
(Go to spreadsheet)

Framing to Understand Risk Aversion

With Adaptation		
	No Insurance	With Insurance
14 in 15 years	\$ 478, 000	\$ 458,000
1 in 15 years	\$ (-91,000)	\$ 142,000

Without Adaptation		
	No Insurance	With Insurance
14 in 15 years	\$ 478,000	\$ 458,000
1 in 15 years	\$ (-91,000)	\$ 50,000

Consequential Losses for an Exporter of a High Value Product

- **Starting Point (Immediate Effects)**
 - Profits = Volume x Margins – Fixed Costs
 - Volume = f (Farm yields, infrastructure break downs)
 - Margin = f (Quality, processing costs)

(The process of evaluating the expected returns with and without the insurance effect gives us insights into this part)
- **Longer-Term Effects**
 - Fixed cost dimensions of a trained labor force
 - Losing access to markets
 - Reputational risk as an unreliable supplier
 - Some trees may be lost causing a longer period to get back to the position prior to the event

Logical Extensions

Firms in the value chain work with

- $\text{Profits} = \text{Volume} * \text{Margins}$

Input suppliers and processing firms should be interested in weather index insurance when a correlated weather risk has the potential to affect both volume and the variables that influence margins (quality, changes in per unit cost as volume changes)

ENSO Insurance for Risk Aggregators

We are working directly with

- 4 Financial institutions
- 1 Business in the value chain
- 3–4 Farmer associations
- Perform risk assessment to inform risk aggregators about the potential value of ENSO Insurance
- Continue working with Peruvian banking and insurance regulator to understand more about how this fits as a warranty-like instrument
- Working with credit risk agencies in Peru to assess how this insurance can change the credit risk rating of financial institutions