ENSO Business Interruption Index Insurance (EBIII)

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GlobalAgRisk

- *Our mission is to improve access to financial services for the rural poor through innovative approaches for transferring weather risk*
- GlobalAgRisk has worked in some 20 countries
- Currently we have projects in:

  Mongolia

  Vietnam

  Mali

We were previously involved in Peru from 2005 to 2006 with a USAID project

Mejorando el Acceso a Los Servicios Financieros

El acceso de los hogares rurales a servicios financieros constituye una pieza clave en el desarrollo económico

Los Servicios Financieros están basados en 3 componentes:

1. Ahorros
2. Préstamos
3. Transferencia de Riesgo – Seguro

Los beneficios de un servicio financiero fortalecido:

- ✓ Los individuos pueden manejar mejor sus riesgos
- ✓ Los hogares al margen puede que no sean empujados a la pobreza
- ✓ Incentiva la inversión en tecnologías avanzadas

El Niño in Peru

- El Niño has more negative effects in Peru than any other country in the world!
- Some regions have extreme flooding; others have extreme drought
- Agriculture, homes, fishery catches, infrastructure, transportation, markets, exports, small trade, and the overall economy of Peru are all negatively affected
- The 1997/98 El Niño affected 200,000 hectares across Peru

Piura is One of the Areas Most Affected

- Agriculture employs 37% of the labor force, and is the major source of livelihoods for the rural poor
- 57% of farmers in Piura have less than 3 Ha
- The use of formal financial services among farmers is quite limited and it is highly likely that El Niño risk is one reason
  - 70% report access to credit
  - Yet only 28% use formal credit
  - 25% report no access to credit

ENSO Business Interruption Index Insurance
Our Focus First — Business Interruption of Lenders

- Covers lost profits or extra costs due to extreme flooding as indicated by high average sea surface temperatures in November–December
  - Liquidity risk…
  - Savings are being withdrawn
  - Decrease in certificates of deposits
  - Loans are being refinanced
  - Cost of capital will increase
  - Defaults will follow
  - Increased need for more capital for provisioning

ENSO Business Interruption Index Insurance
Future Applications Are Also Significant

- Relevant to others exposed to El Niño losses in Piura
  - Disruptions in major markets
    - Agricultural value chain — fertilizer sales down 27% in 1998
  - Damaged infrastructure
    - Transportation sector — accounted for 59% of losses in 1998
  - Disruptions in small trade
  - Significant declines in exports
  - Loss of GDP and tax base of government
  - Destruction of homes and other private property
  - Significant declines in the anchovy catch
  - Disruptions in the livelihoods of smallholder households

Losses for 1997/98 El Niño in Piura

- Heavy rainfall, flooding, and landslides
- 3x increase in malaria and many other water related disease and pest problems
- Agricultural production reduced by 1/3
  - 11,000 ha of farmland (15% of total) destroyed
  - Almost total loss of cotton crop
  - Losses in high value commodities: bananas, papayas, asparagus, rice, and yellow corn
  - Total agricultural losses: USD 40 million (19% of total losses in Piura)
- Public infrastructure losses
- Many disrupted markets
- Cash-flow, debt repayment problems

Farm Households Vulnerable to Extreme Flooding During Growing Season

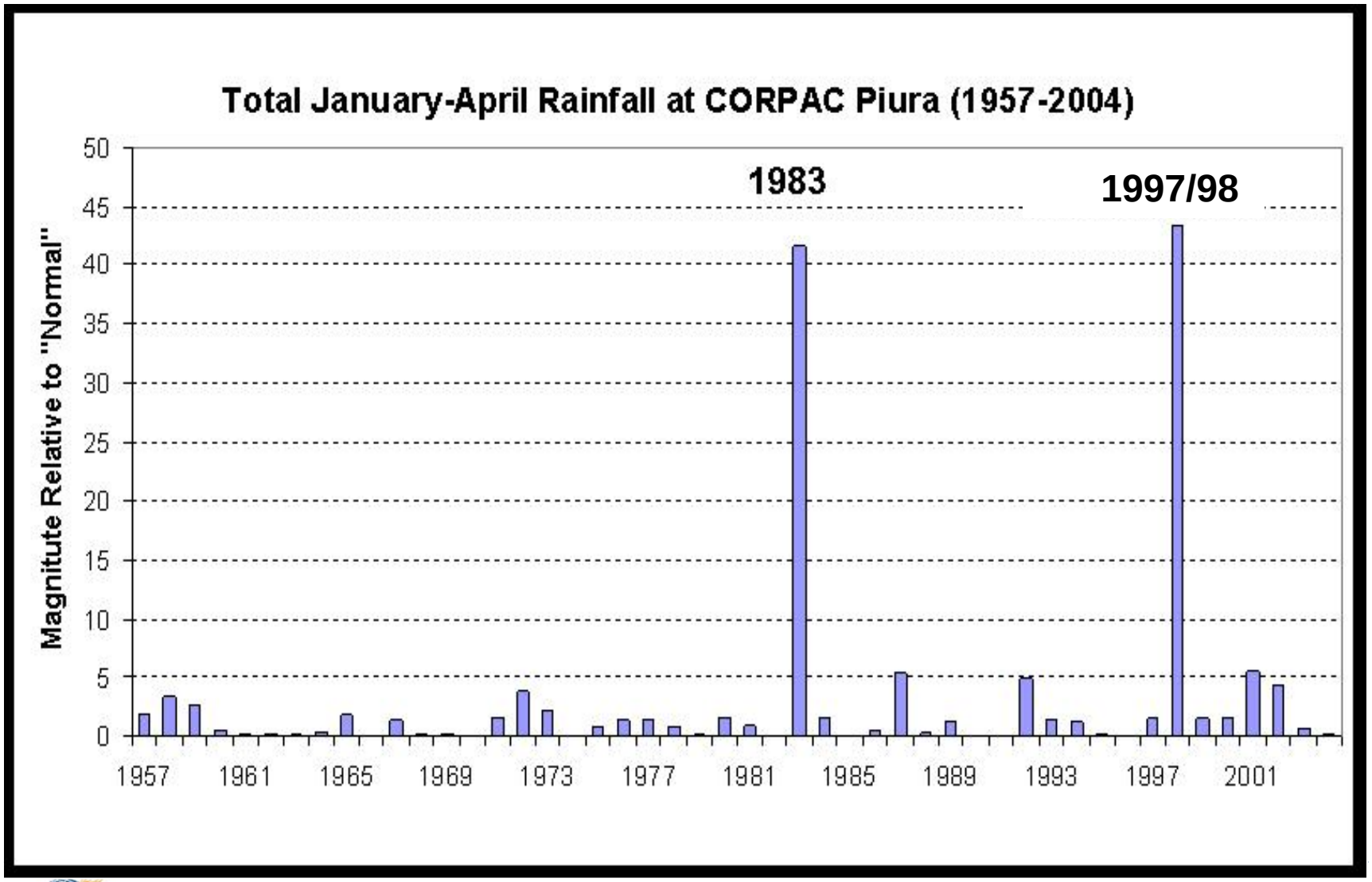
- Households are engaged in a variety of labor-intensive activities susceptible to extreme rainfall and flood risk
- To cope with the effects of a disaster
  - Households rely on family and friends
  - Some sell livestock
  - These strategies are not effective when an entire community is affected such as with El Niño
- The use of savings and credit to smooth cash flow problems is not commonly used by smallholders

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
  - Results in 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 by far the biggest risk event for agriculture

En un evento “Niño” severo aumenta

la cantidad, frequencia y cobertura espacial de las precipitaciones — pueden sobrepasar 40 veces el nivel normal!



El Niño Trends

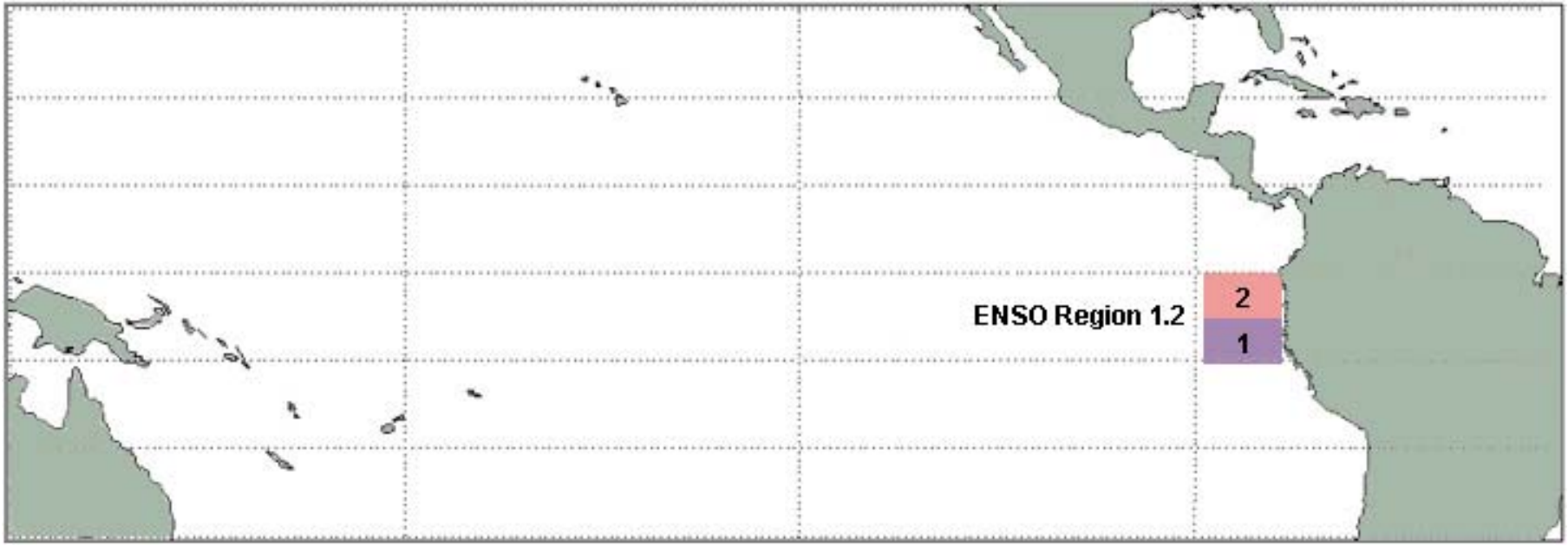
- Data from past 30 years, El Niño events may be increasing in frequency and severity
- In last 100 years, 4 strongest El Niño events have occurred since 1980
- While there is no consensus among scientists, there are some who believe global warming may be contributing to the increased frequency and severity
- 1982/83 and 1997/98 events may occur 1 in 15 years
- Increased upstream deforestation is likely responsible for increased flooding making the situation in Piura even more of a concern

ENSO Business Interruption Index Insurance (EBIII)

- Rainfall insurance not viable due to limited data
  - Short time period, sparse, difficult to interpret
  - Weather stations destroyed during previous catastrophic events
- ENSO 1.2 index of sea surface temperatures
  - Monthly average sea surface temperature (SST) from two areas off the coast of Peru
  - Published by the U.S. National Oceanic and Atmospheric Administration (NOAA) using a consistent and reliable methodology
  - ENSO 1.2 can be used to predict extreme flooding associated with El Niño

ENSO 1.2

- Measured and reported by the 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)



Developing ENSO Business Interruption Index Insurance

- Measure is fully transparent to all parties
  - Can be made free of moral hazard and adverse selection
- Concept for ENSO Insurance approved by SBS in 2005
- Work performed in 2009 indicates
  - Average ENSO 1.2 value for November–December captures the extreme event with high confidence
  - A contract using ENSO 1.2 values for November–December pays for the same years at nearly the precise same values
  - Correlations between November–December and January–March are 91% for ENSO 1.2 values that are above the median
  - Indemnity payments could be made as the business interruptions are accelerating (in early January)

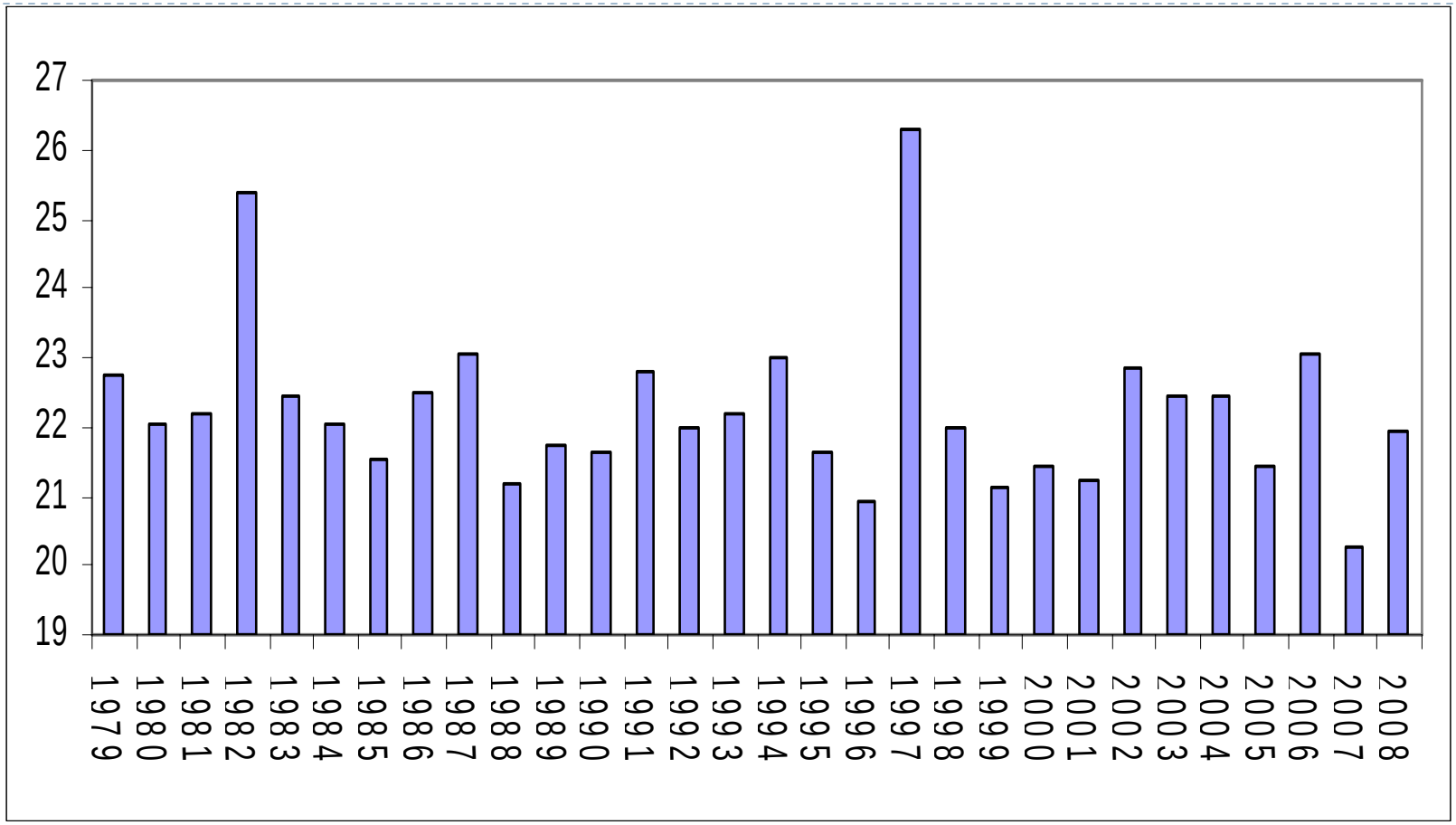
Easing Regulatory Concerns about Using an ENSO Index

- Classifying as business interruption insurance eases regulatory concerns
  - ENSO 1.2 serves as proxy for loss for those with insurable interest
  - Enhances indemnity process — pre-agreed metric for payouts rather than complicated loss adjustment process to estimate business interruption costs

- ENSO Index

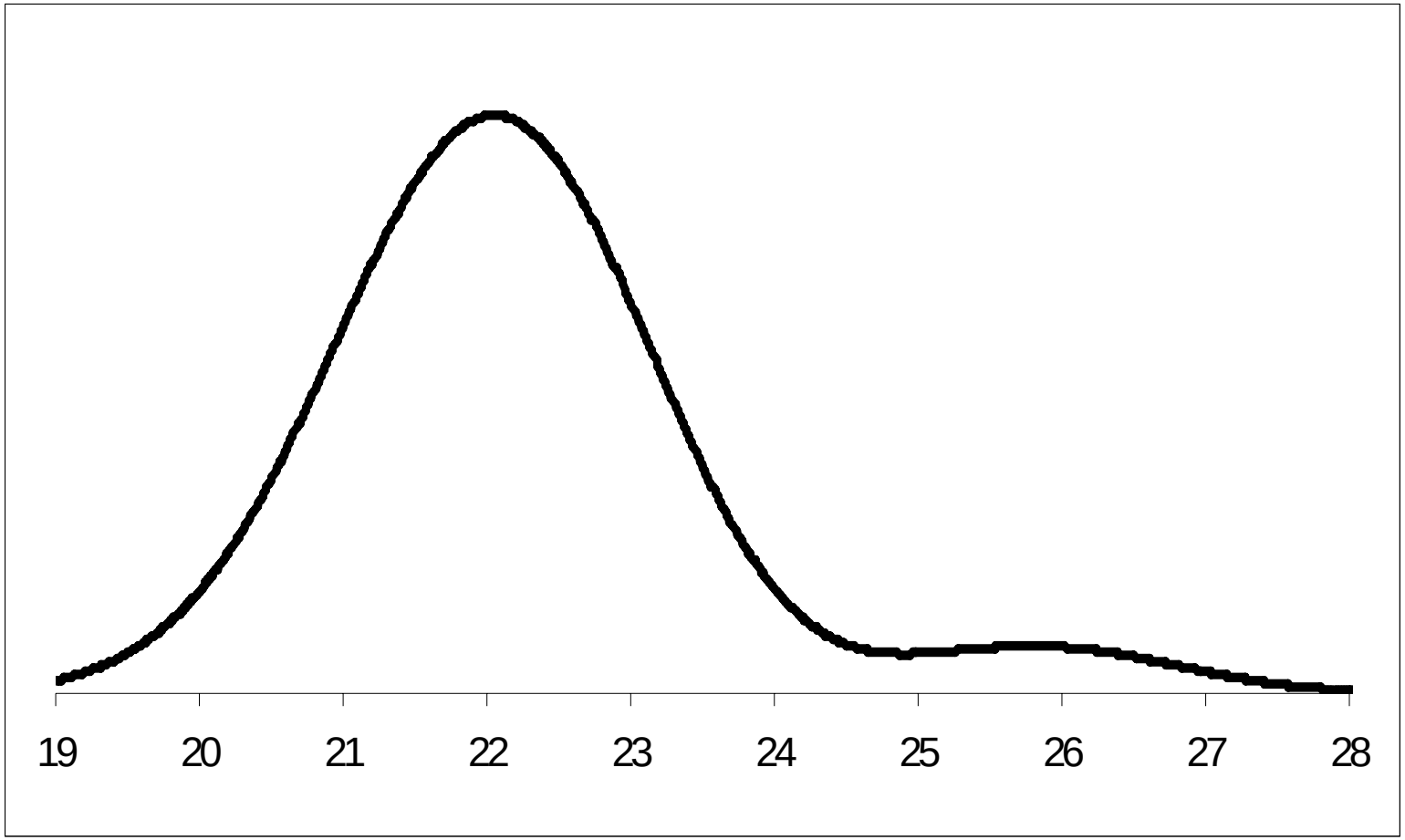
$$\frac{\overline{ENSO\ 1.2}_{November} + \overline{ENSO\ 1.2}_{December}}{2}$$

ENSO Index from 1979 to 2008



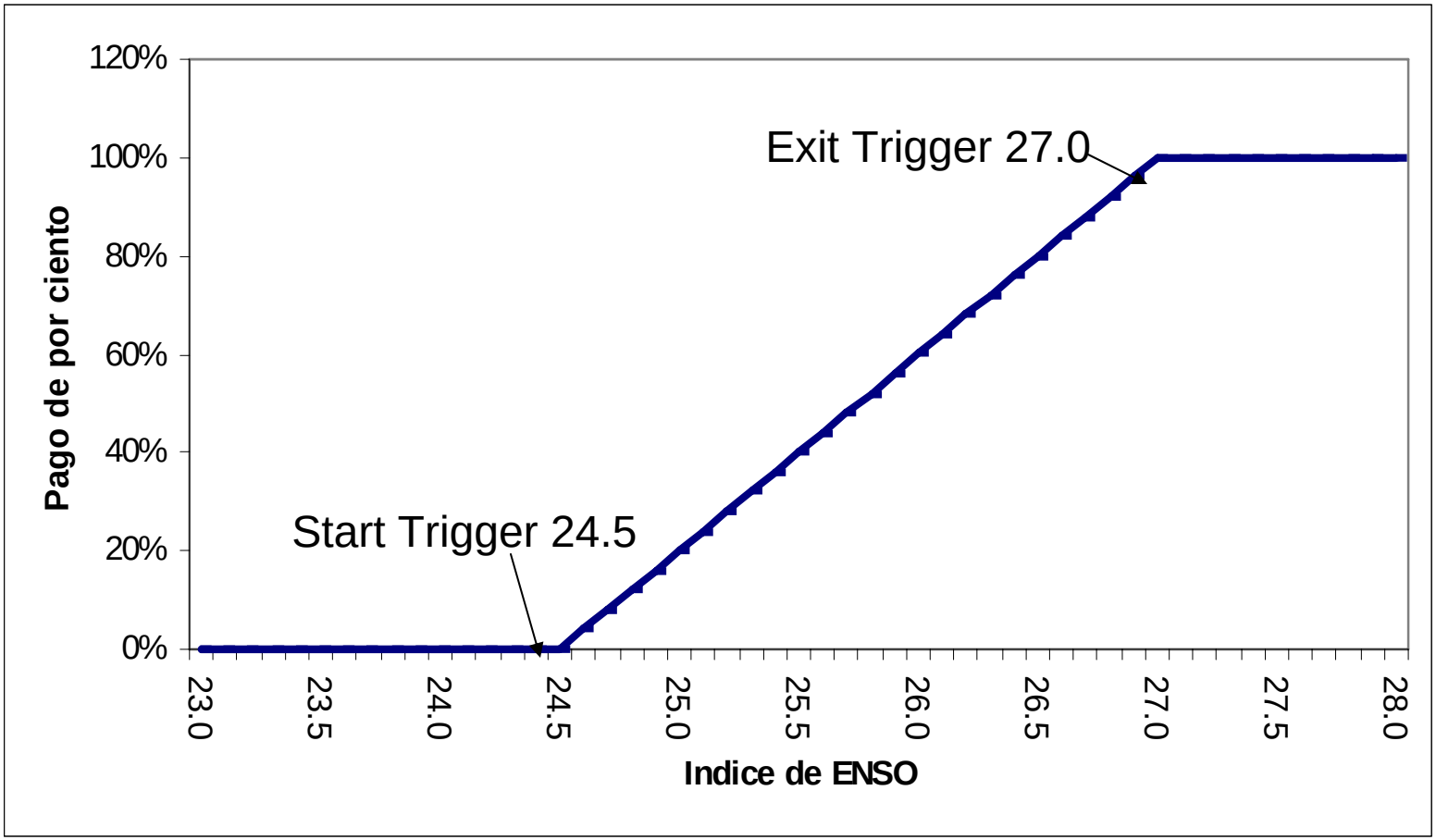
1982 payment rate = 34 percent; 1997 payment rate = 71 percent
Start Threshold = 24.5; Exit Threshold = 27

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

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

Payout Structure: La Positiva Is Offering Product with Start Trigger of either 24.0° C or 24.5°C)

$$\text{EBIII Payment} = \min\left\{\text{MSI} * \left(\frac{\text{ENSO Index} - \text{ST}}{\text{ET} - \text{ST}}\right) \text{ or MSI}\right\}$$

MSI – Maximum Sum Insured
ST – Start Trigger (24.5° C) (24.0° C trigger is also available)
ET – Exit Trigger (27° C)

For example for 1997/98 El Niño,

if MSI = USD 1 million

$$\text{EBIII Payment} = 1 \text{ million} * \left(\frac{26.38 - 24.5}{27 - 24.5}\right)$$
$$= 1 \text{ million} * (0.71)$$
$$= \text{USD } 710{,}000$$

Index Insurance for Weather Risks

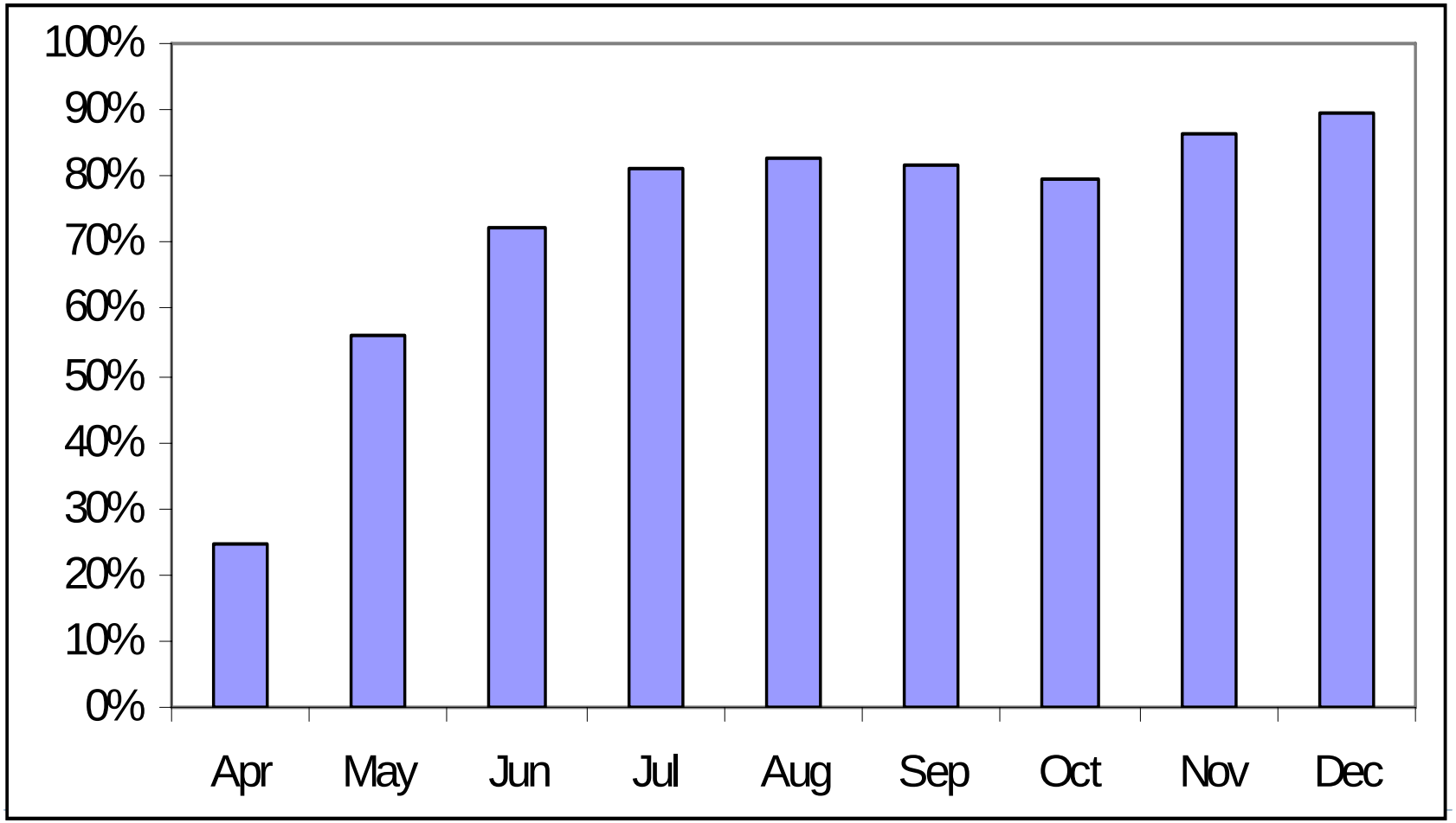
- Need
  - Reliable *historical* weather data developed by a 3rd party to develop product and premium rates
  - Secure and objective source of *current* weather measurements to make payments without disputes
- Don't need
  - Detailed information or monitoring of the insured
  - Compliance officers
  - Loss adjusters to measure losses

Underwriting and Rating Process

- Secure, reliable, and consistent system to develop the data for the index
- Time Series Stability
  - Statistical processes to test of trends
  - Objective to assess both Mean and Variance
- Distribution Selection and Fitting (1979 to 2007 data)
- Consideration of Additional Information
  - Physical Influences, Teleconnections, Long Range Forecasts
- Modeling Financial Structure
- Monitoring and Underwriting Improvements
- Price = f(Distribution fitting, catastrophic loads, commissions, and any government taxes {22% in Peru})

ENSO Forecast Can Be Made as Early as April

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



Timing of the Contract

Year 1			Year 2	
February–April	**May–October**	**Nov–Dec**	**Early January**	**February–April**
Marketing period with a sales closing date of April 30	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 April 30
- Insurance contract covers ENSO 1.2 (Nov–Dec)
- Payments will be made in early January as business interruptions are occurring

Regulatory Issues for Index Insurance

1) Does the purchaser have an insurable risk?
2) Will the index represent a reasonable proxy of loss?
3) Is there a clear plan to educate the user?
4) Is there a clear plan to educate the sale force about the unique features of the index insurance?
5) Is there a plan to protect the insurance industry form the risk of insolvency that may accompany insuring a correlated risk?
6) Is there assurance that the insured will be paid as the event and losses are described in the contract?

Insurer and Insured Must Agree

- ENSO 1.2 values are highly correlated with catastrophic flooding from El Niño in Piura
- ENSO Index is a reasonable proxy for cost incurred and losses suffered due to the catastrophic flooding
- Insured does not have to prove losses
- Maximum exposure is the sum insured in the contract
- Indemnities only paid when ENSO Index exceeds contract threshold during the period of coverage (Nov–Dec)
- Insurer is only responsible for losses triggered by ENSO Index

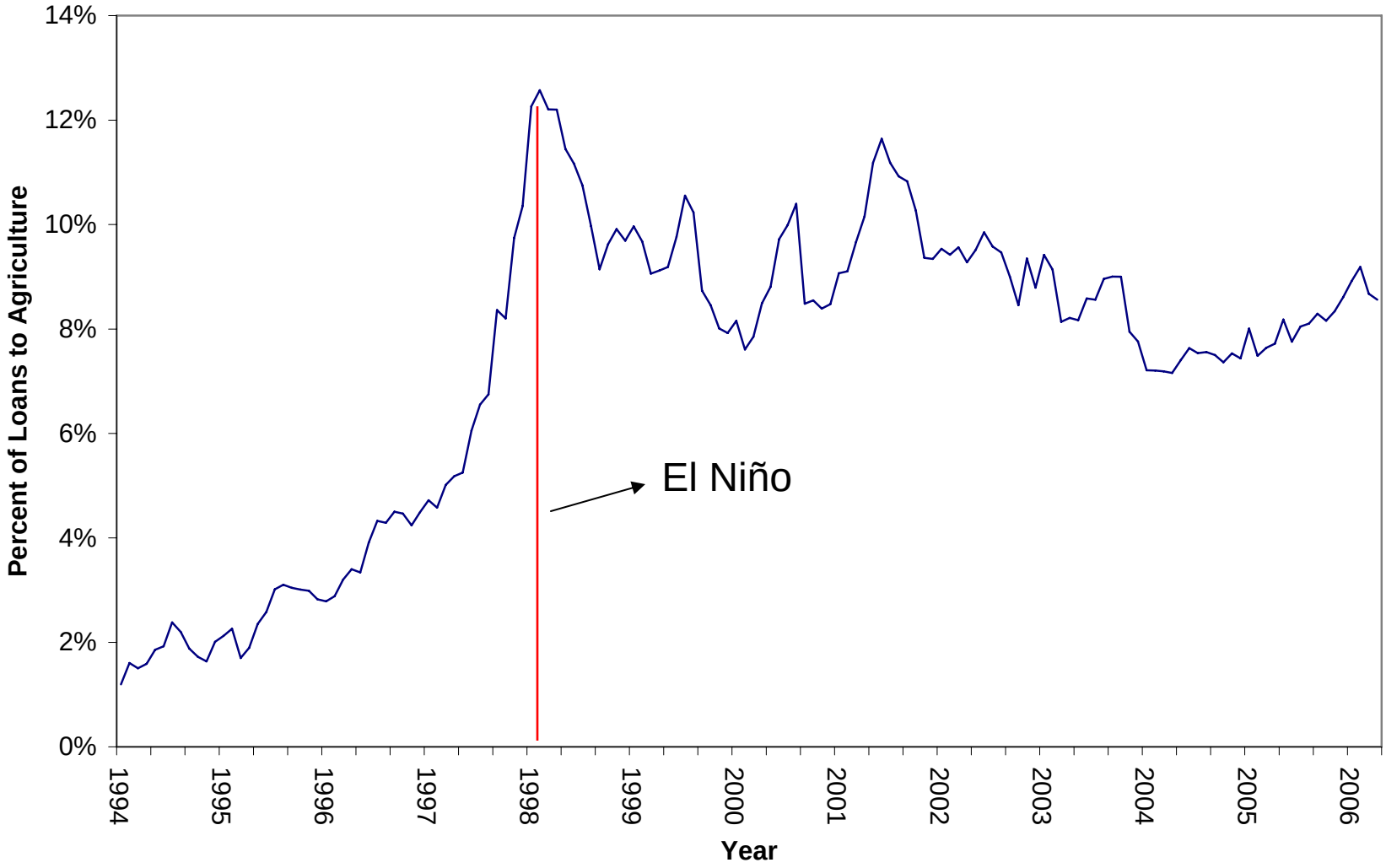
Evaluating the Value of ENSO Business Interruption Index Insurance for Lenders

- Some technical considerations for Credit Risk Management Specialists in the Cajas or other Lending Agencies
- Need to evaluate the short-term benefits of having ready cash when serious liquidity problems are developing!
- Need to evaluate the longer-term benefits of using this form of insurance to reduce the interest rates and improve access to capital and increase the volume of business for the bank
- Need to have a longer-term vision for how to use this form of insurance to properly address individual loans problems as El Niño is beginning

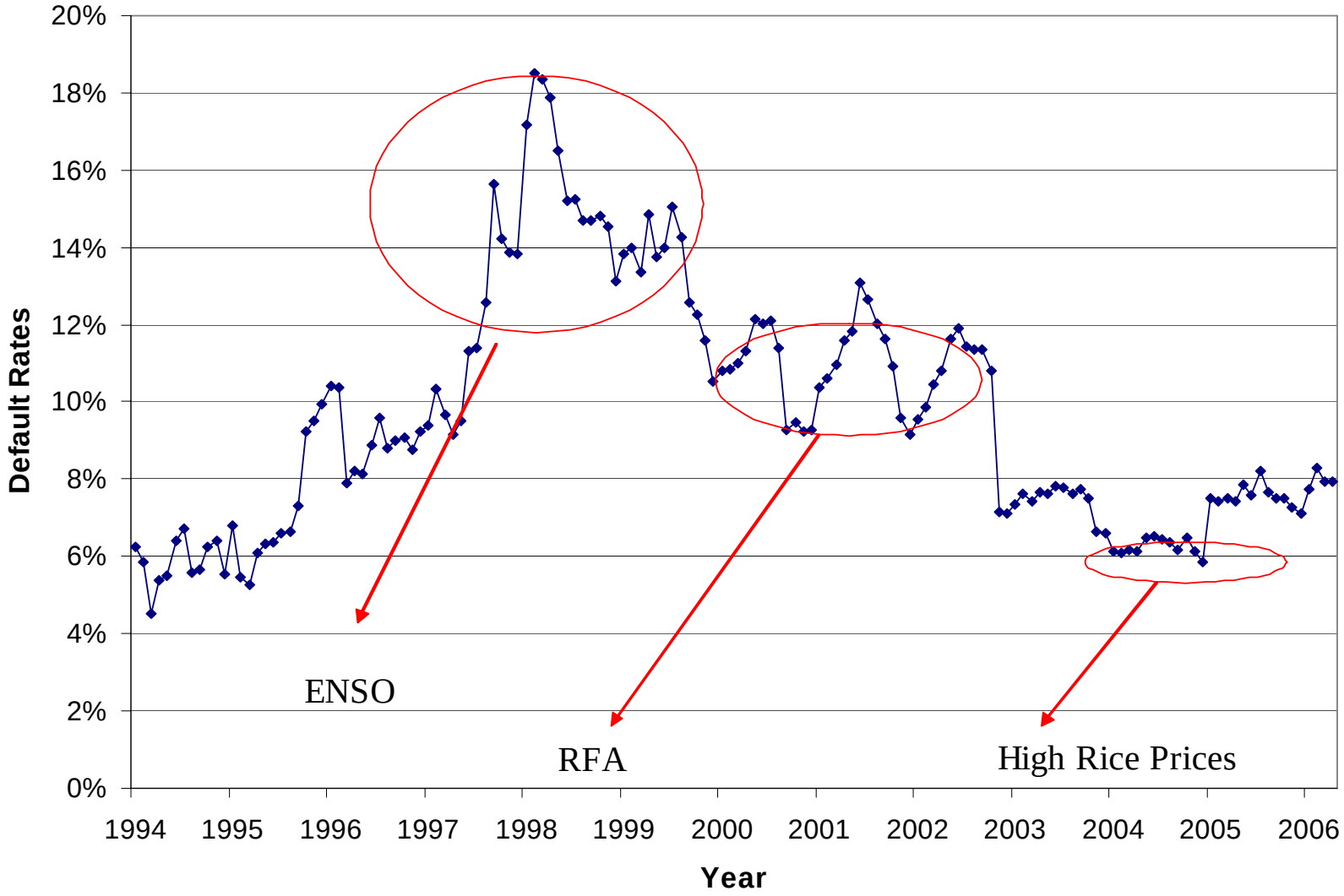
Our First Focus: Business Interruption Insurance for Lenders (Cajas and Others)

- Business Interruption Insurance pays for loss profits or added expenses when there is an insurable event
- Lenders in Piura will have significant disruptions to their business as early as January
- Major concern – Access to capital will be heavily constrained when everyone knows that El Niño is coming
  - Liquidity risk…
  - Savings are being withdrawn
  - Decrease in deposits
  - Loans are being refinanced
  - Cost of capital will increase
  - Defaults will follow
  - Increased need for more capital for provisioning

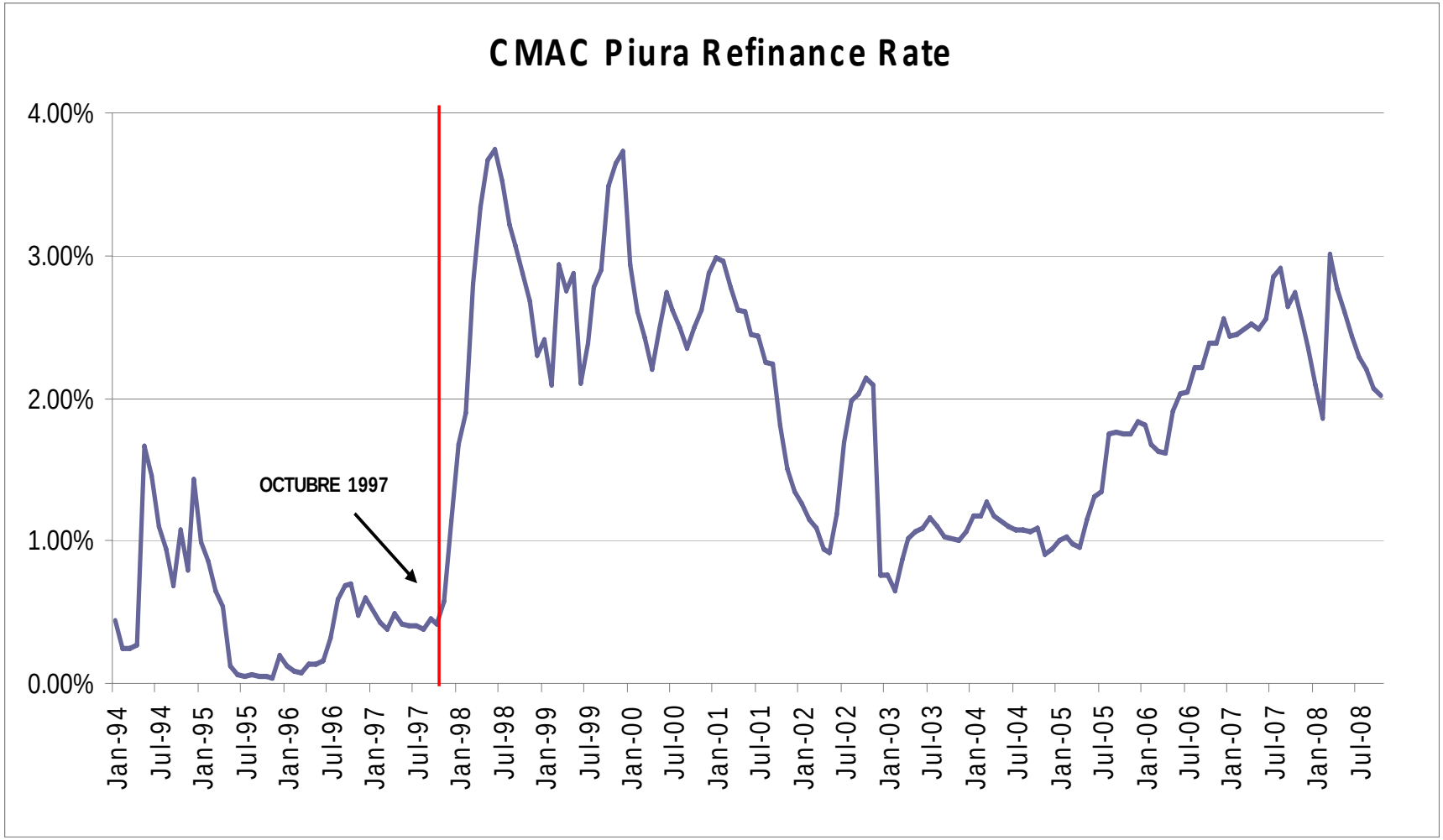
Historical Pattern of Agricultural Lending in Piura 1994–2006



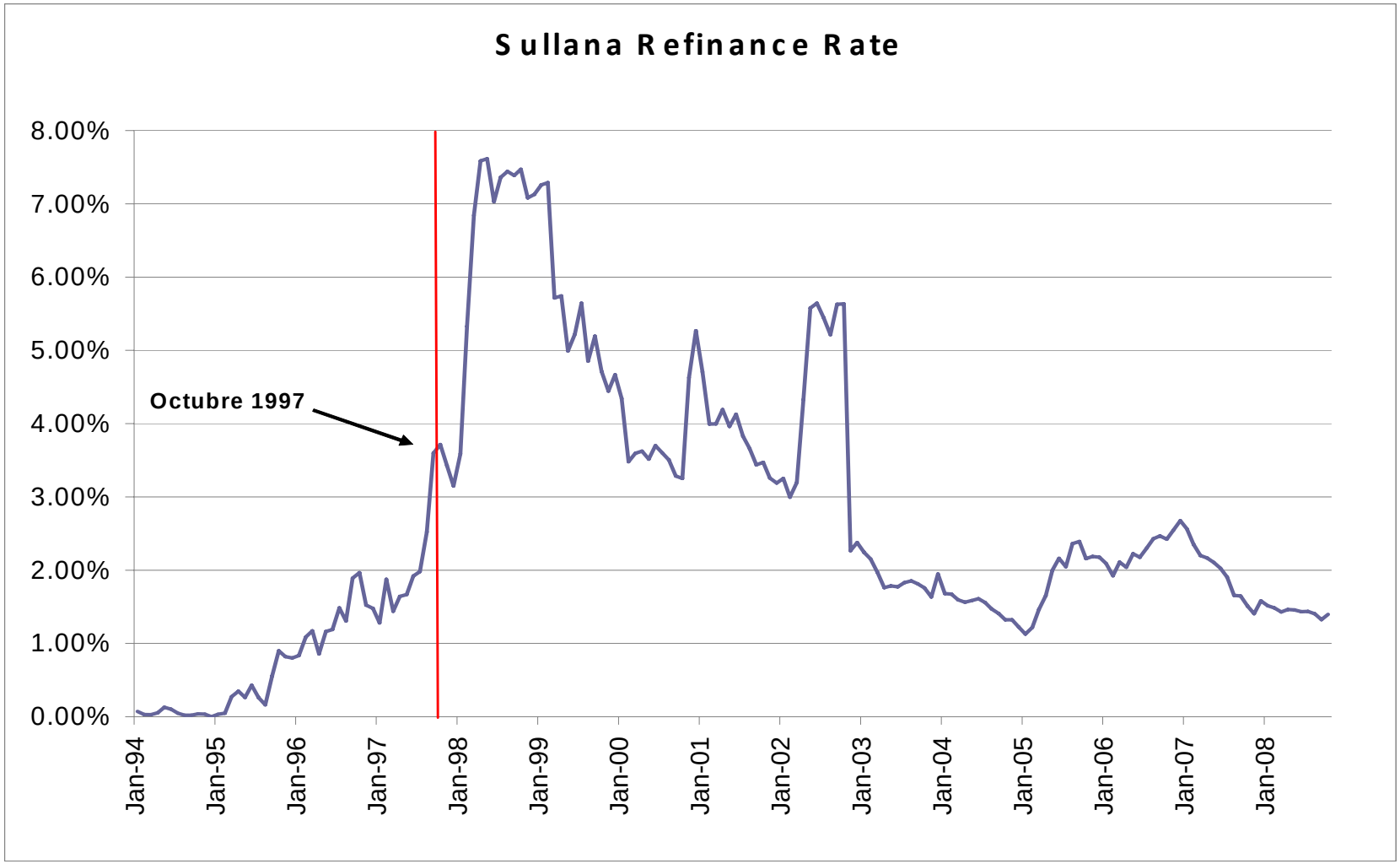
Default Pattern on All Loans in Piura, 1994–2006



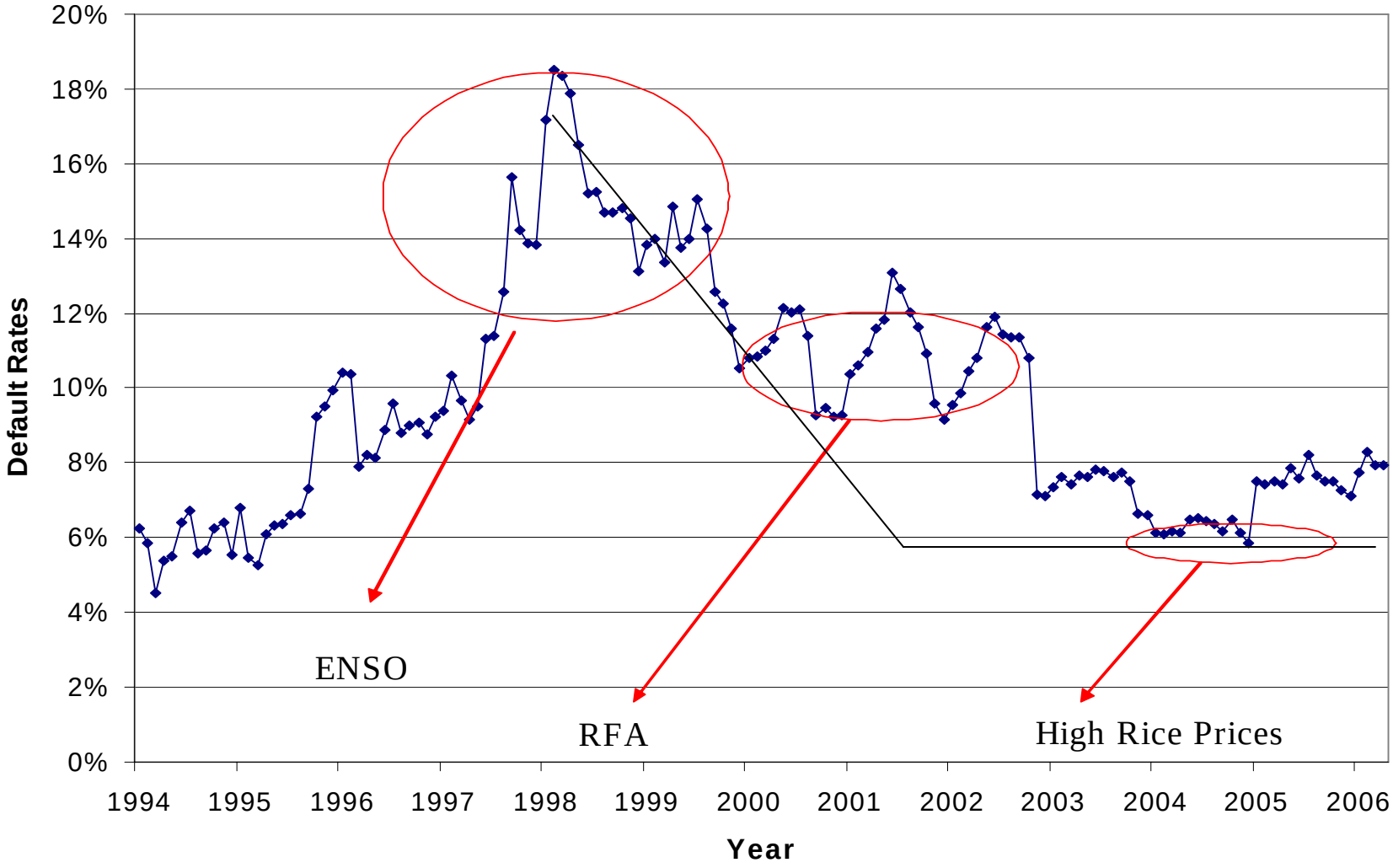
CMAC Piura Refinance Rates, 1994–2008



CMAC Sullana Refinance Rates, 1994–2008



Tiempo posible de recuperación de un El Niño en ausencia de RFA = 3.5–4 años



Longer Vision: Agricultural Lending in Piura

- Lenders in Peru cite El Niño risk as preventing them from making agricultural loans
  - Agricultural lending has not kept pace with other lending
  - From 1998 to 2003, MFIs in Piura increased total lending by 350% but agricultural lending has declined
  - Since the last El Niño agricultural lending decreased from 30% to 10 % of the portfolio
  - Lenders have told us they have 'fixed the problem' by not making production loans when they see El Niño coming
  - There is both a lender response and a farmer response
    - 70% report access to credit
    - Yet only 28% use formal credit
    - 25% report no access to credit

Interest Rates for Agricultural Loans: CMAC Piura

CMAC Piura (as of February, 2009)		
Range	Monthly Interest Rate	Annual Interest Rate
In Soles (S/.)	%	
Up to 3,000	3.9	57.4
3,001–5,000	3.6	52.9
5,001–10,000	3.6	52.0
10,001–15,000	3.5	51.1
15,001–25,000	3.5	50.2
25,001–30,000	3.4	49.4
30,000+	3.2	45.1
Simple Average	3.5	51.2

Interest Rates for Agricultural Loans: CMAC Sullana

CMAC Sullana (as of February, 2009)		
Range	Monthly Interest Rate	Annual Interest Rate*
In Soles	%	
Up to 2999	3.9	58.3
3,000–4,999	3.8	56.5
5,000–7,999	3.6	52.9
8,000–9,999	3.5	51.1
10,000–14,999	3.3	47.6
15,000–19,999	3.1	44.3
20,000–24,999	3.0	42.6
25,000–29,999	2.8	39.3
30,000+	2.7	37.7
Simple Average	3.3	47.8

Estimate of the Risk Loading

$$\pi = p(1+i)L - (1+r)L$$

$$i = \frac{1+r}{p} - 1$$

π – expected profits

p – exogenous probability of non-default

i – interest rate

r – lender's opportunity costs

L – amount of funds loaned

Example (no default risk)

r = 10%

p = 100%

$$i = \frac{1+0.10}{1} - 1 = 0.10$$

Example (10% default risk)

r = 10%

p = 90%

$$i = \frac{1+0.10}{0.90} - 1 = 0.22$$

Extending the Cost of Capital Formulas to El Niño Risk

- Costo de préstamos a los agricultores → 40%
- Costo del capital → -10%
- Costo administrativo → -20%
- Costo de carga de riesgo? → -10 (puntos porcentuales)

This example and numbers match with the current environment for Cajas if we assume the average default rate is 7 percent and that this default rate spikes to 18 or 20 percent due to El Niño and it takes 4 years to return to the equilibrium default of 7 percent

Without El Niño, *costo de carga de riesgo* would decline from 10 percentage points to 7 percentage points

Average interest rates would decline from 40 to 37 percent

Longer-Term Vision

- If interest rates could be reduced for all agricultural borrowers by 3 percentage points due to ENSO insurance products, how much increase would be there in the volume of lending in this market where credit is clearly NOT being used?
- How would increased use of credit affect the economic growth and, thus the volume of future business?

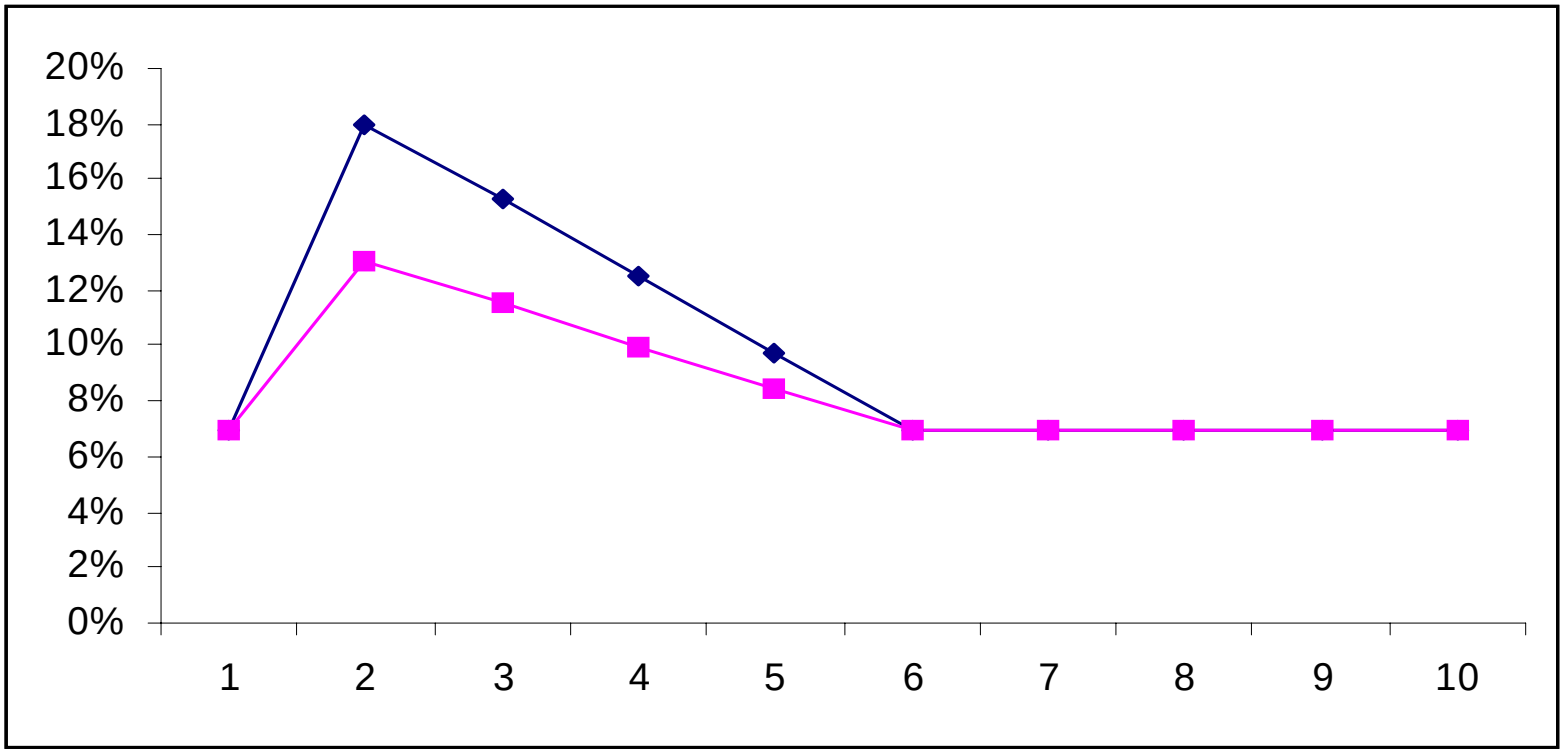
Possible Scenario

Assumptions:

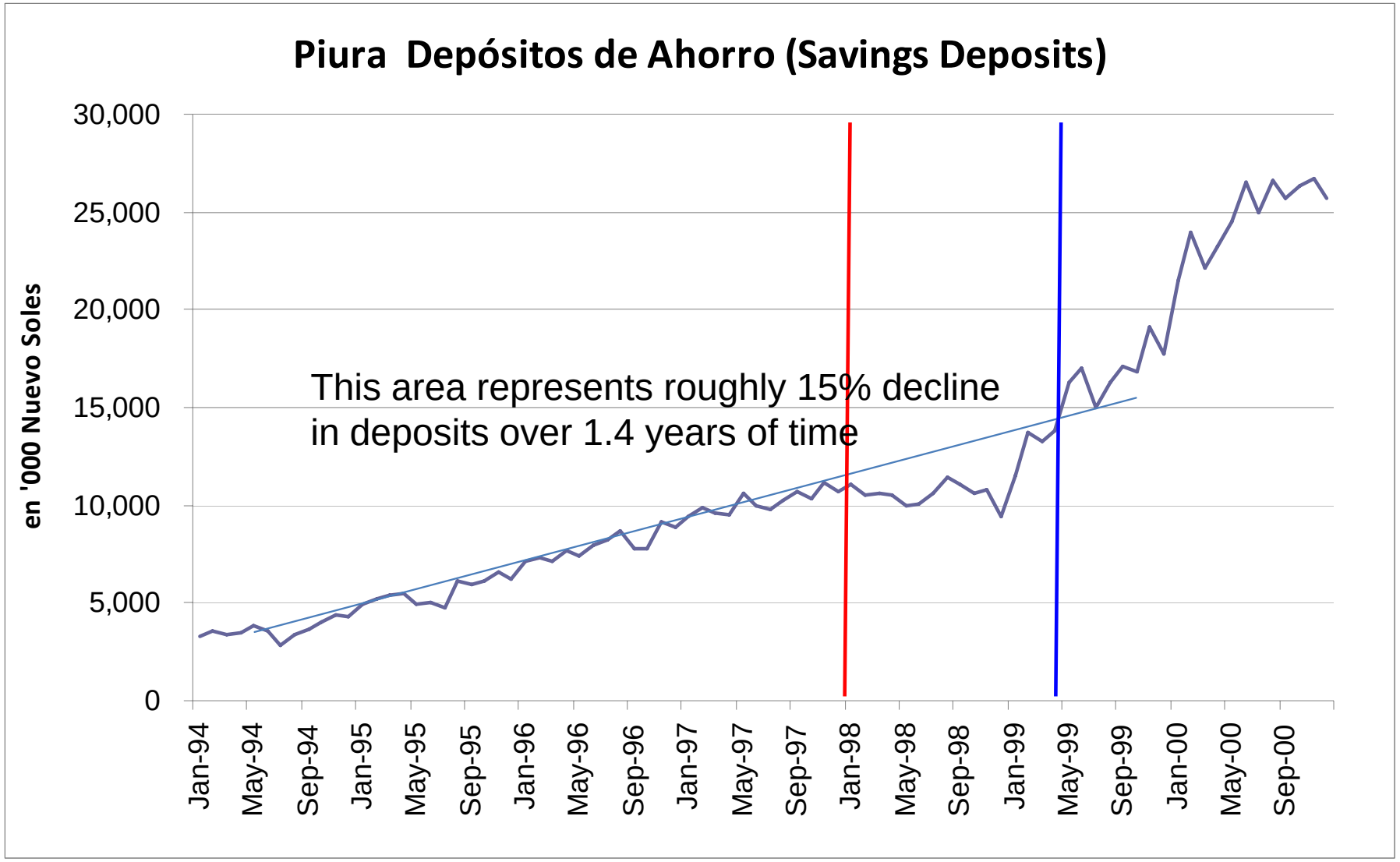
- USD 100 million portfolio
- Post El Niño default rate of 18 percent
- Normal default rate of 8 percent
- Maximum Sum Insured of 10 percent of USD 100 million
- Sum Insured = USD 10 million
- Assume that the premium rate were 15 percent
- Premium = USD 1.5 million

The very same number of 3 percentage points can be used to give a first approximation of the additional expected value of cost of capital for the lender given El Niño risk

Expected Value of Using USD 5 Million of the Payout to Reduce Default Rates



On a USD 100 million portfolio, the area between the two lines represents up to USD 13 million of potential savings. If you could do this only 1 in 20 years, the expected value of this benefit would pay for USD 0.7 million of premium


Piura Depósitos de Ahorro (Savings Deposits)
en '000 Nuevo Soles
30,000
25,000
20,000
15,000
10,000
5,000
0
This area represents roughly 15% decline
in deposits over 1.4 years of time
Jan-94
May-94
Sep-94
Jan-95
May-95
Sep-95
Jan-96
May-96
Sep-96
Jan-97
May-97
Sep-97
Jan-98
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Jan-99
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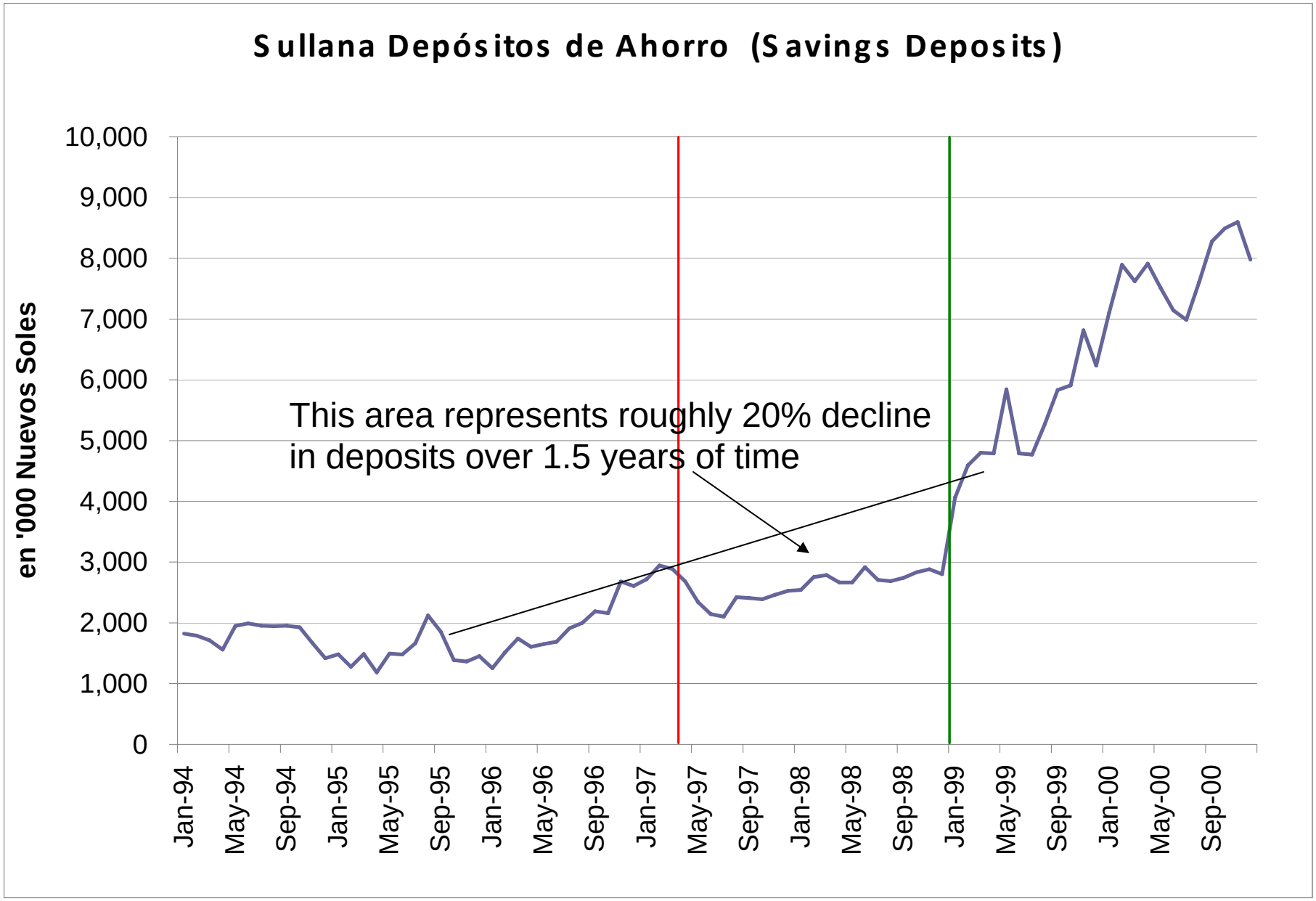
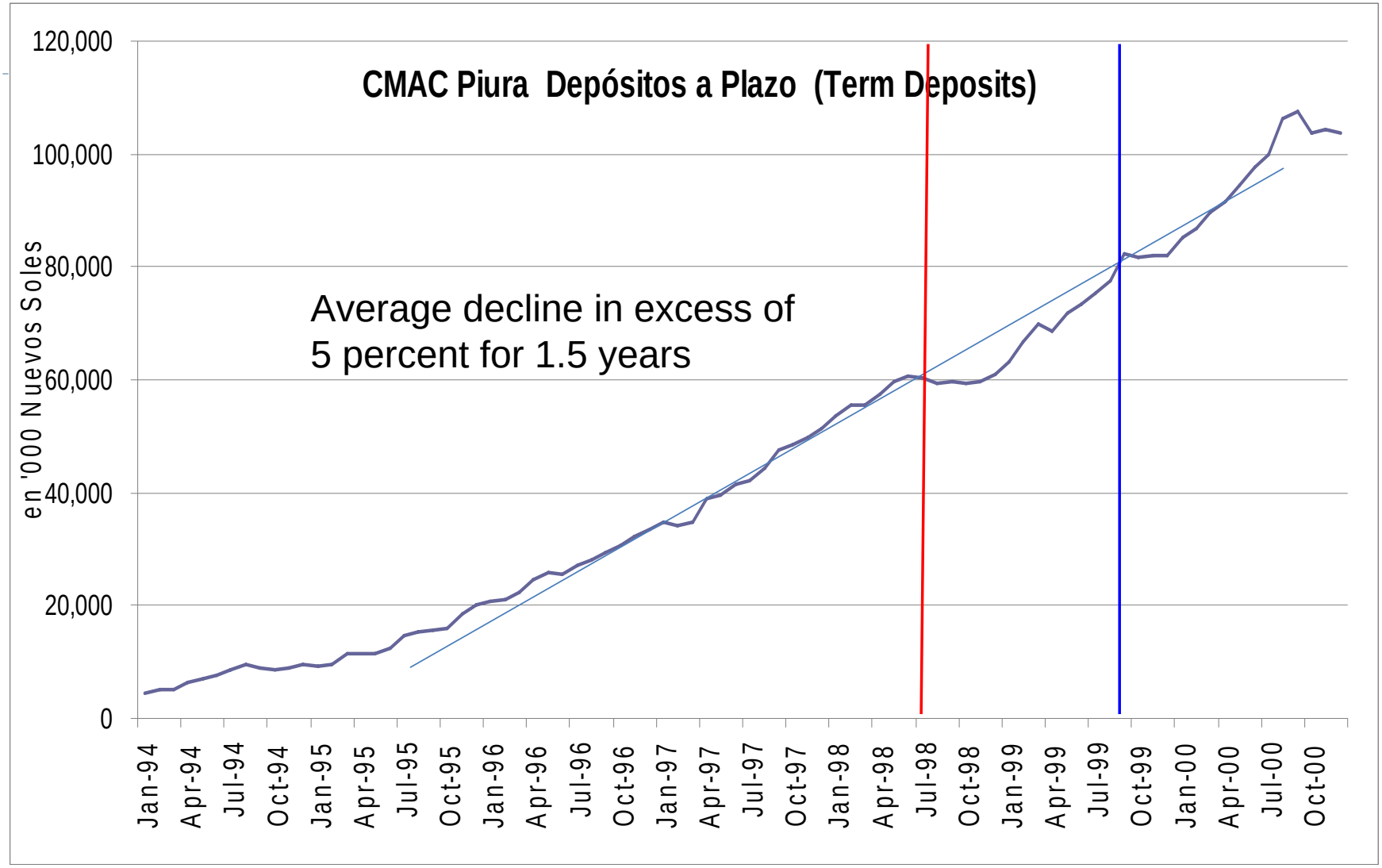
Sep-99
Jan-00
May-00
Sep-00


Sullana Depósitos de Ahorro (Savings Deposits)
en '000 Nuevos Soles
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
This area represents roughly 20% decline in deposits over 1.5 years of time
Jan-94
May-94
Sep-94
Jan-95
May-95
Sep-95
Jan-96
May-96
Sep-96
Jan-97
May-97
Sep-97
Jan-98
May-98
Sep-98
Jan-99
May-99
Sep-99
Jan-00
May-00
Sep-00


CMAC Piura Depósitos a Plazo (Term Deposits)
Average decline in excess of
5 percent for 1.5 years
en '000 Nuevos Soles
120,000
100,000
80,000
60,000
40,000
20,000
0
Jan-94
Apr-94
Jul-94
Oct-94
Jan-95
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Jan-97
Apr-97
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Oct-97
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Oct-99
Jan-00
Apr-00
Jul-00
Oct-00

Initial Estimate of Lost Capital

- Assumption – roughly 70 percent of the capital needs come from savings and certificates of deposit
- For a Caja with USD 100 million portfolio
  - USD 10 million in savings
  - Lost savings = .20% x 10 = USD 2 million
  - USD 60 million in certificates of deposit
  - Lost CDs = .05% x 60 = USD 3 million
- What is the opportunity cost of losing USD 5 million in savings and certificates of deposits for up to 1.5 years (keep in mind that this must be put in expected value terms assuming that the event will occur 1 in 15 years)

Crude Estimate of the Value of Having an Indemnity Payment using USD 100 Million Portfolio

- Cost of less capital due to withdrawal of savings and cut back in certificates of deposit
  - Estimated opportunity cost = USD 0.2 million
- Some estimate of value of using funds to ease the default and restructuring rates
  - Estimated cost = USD 0.7 million
- Crude estimate of the extra cost of capital is some significant percentage of the extra cost of interest due to El Niño Risk
  - Some portion of 30 percent x 3 percent increase in interest rates up to = USD 0.9 million?

Credit Risk Managers Must Consider the Many Business Interruption Costs of El Niño to Know the True Value!

Major concern — Access to capital will be heavily constrained when everyone knows that El Niño is coming

- Liquidity risk…
- Savings are being withdrawn
- Decrease in deposits
- Loans are being refinanced
- Cost of capital will increase
- Defaults will follow
- Increased need for more capital for provisioning

Next Steps

- Significantly more work is needed to decompose the potential value of this special form of insurance of Cajas and Banks in Piura and in Peru
- Significant thinking is needed about how to most effectively use the indemnity payments to mitigate and adapt to a period where the Cajas and Banks know that they will be incurring more cost and facing lower profits in the coming months
- Significant thinking is needed to sort out solutions for the borrowers — for example those who are told they cannot borrow when El Niño is coming — can you promise them more access to consumption loans and new production loans later — as the risk of flooding eases?