



Risk Assessment, Reinsurance, and Financial Performance

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Key Objectives for this Presentation

- Demonstrate the risk and the business opportunity for BIP insurance into the future
- Review the risk profile of the 9 Aimags for next year
- Emphasize the importance of reinsurance and the basic reinsurance arrangements that are now available
- Develop a vision for how to approach global reinsurers
- Review basic recommendations for new ratemaking procedures



Different Types of Insurance Require Totally Different Approaches in Pricing and Risk Sharing

- Most common — Automobile, life, etc.
- The risks are independent — insurance payments from many will generally pay for the losses of a few (risk can be spread among insureds even within the same year)
- Most extreme — MIAT — Any air disaster will require very LARGE payments — There is simply no way that the annual premium will pay for the very large losses (risk must be spread over time)
- IBLI — Much closer to insuring MIAT than to common insurance for automobiles, life, etc. Annual losses can easily exceed annual premiums collected by several times (risk must be spread across space and time)



Herder Risk-Loaded Premium

- Some will be retained by the insurance companies in the LIIP for underwriting gains and losses
- Some will be used to pay for reinsurance from the government of Mongolia
- Some will be used to pay for reinsurance from global reinsurers

Note: Administrative loads for premium are not part of this discussion



The Insurance Product

Base Insurance Product — BIP

- This is a catastrophic insurance product
- Herders will be paid anytime the NSO data from the mid-year survey estimate that mortality rates for the species in the soum are above the BIP threshold of 8%

$$\text{Payment} = \text{value insured} \times (\text{MR} - 8)$$

$$\text{Max payment} = \text{value insured} \times (30 - 8)$$

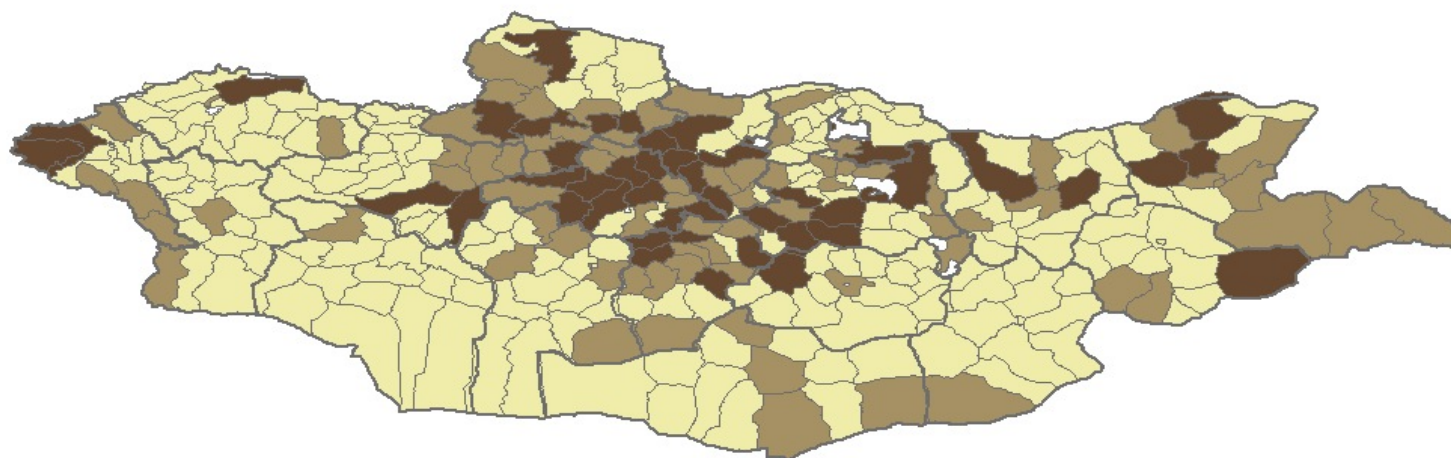
- For losses above 30, the government of Mongolia pays based on the value insured



Portfolio Modeling by Soum and by Species

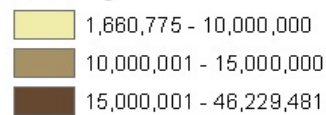
- Value at risk
Number of animals in December, 2008 x Price of animal x Percent insured
- Cleaned mortality data from 1972 to 2008
- First, we can examine the loss cost on a value weighted basis
- Loss cost = Indemnities / Value insured

Total Value of Livestock as of Jan 1, 2009

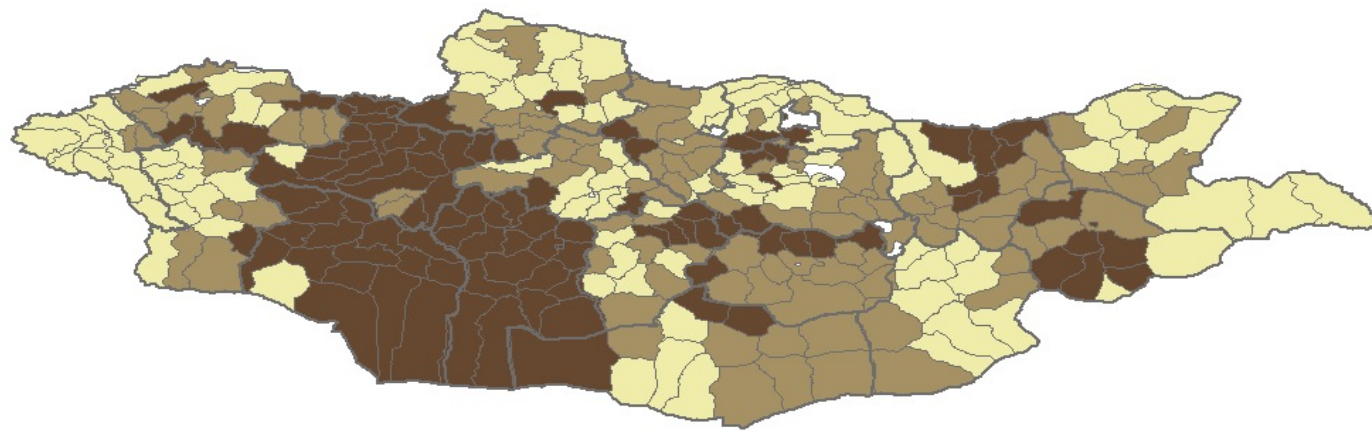


Total Value of Livestock

1,000 Tg



Distribution of Risk-Loaded Premiums for Sheep



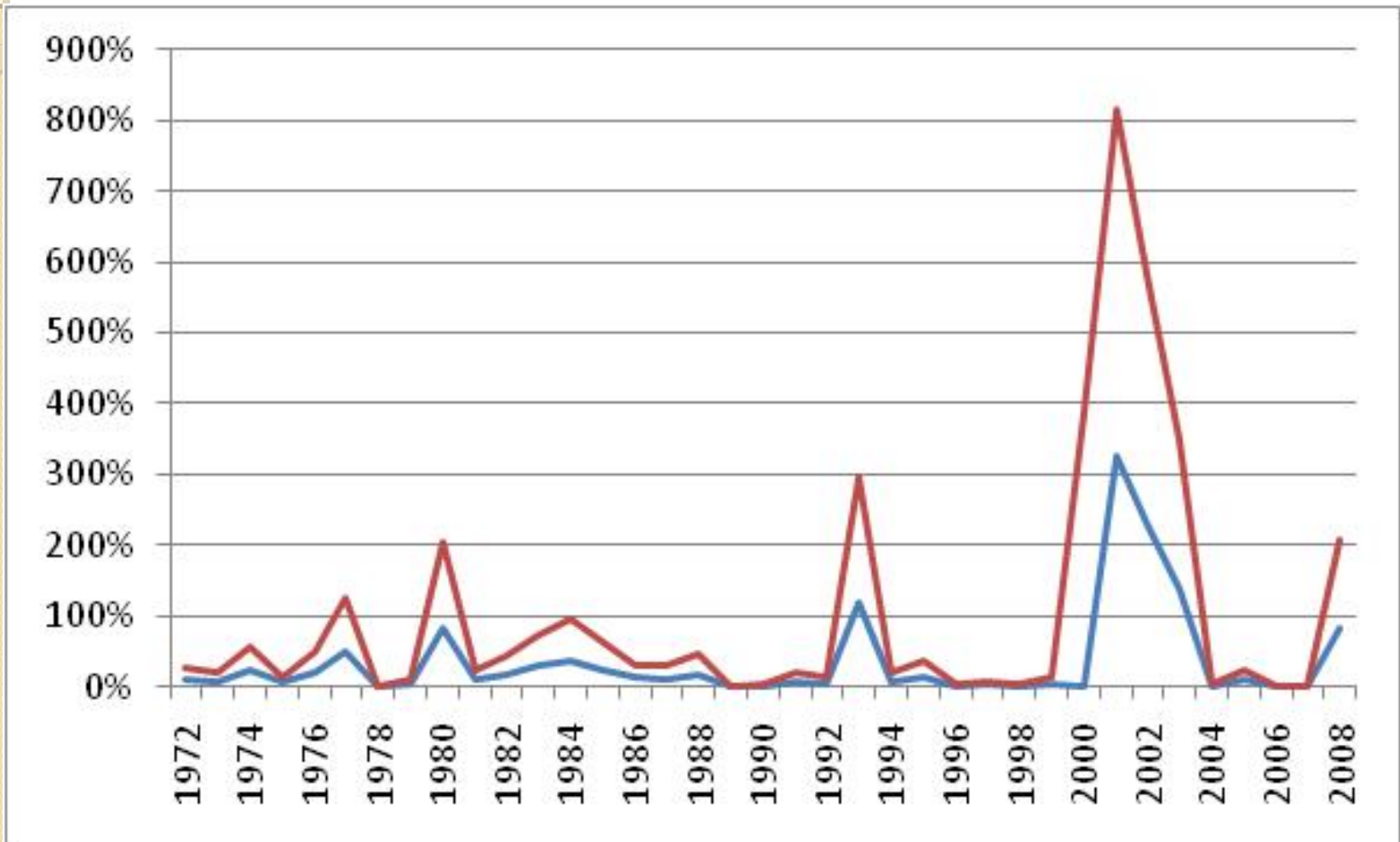
Risk-loaded Premium Rate

Sheep

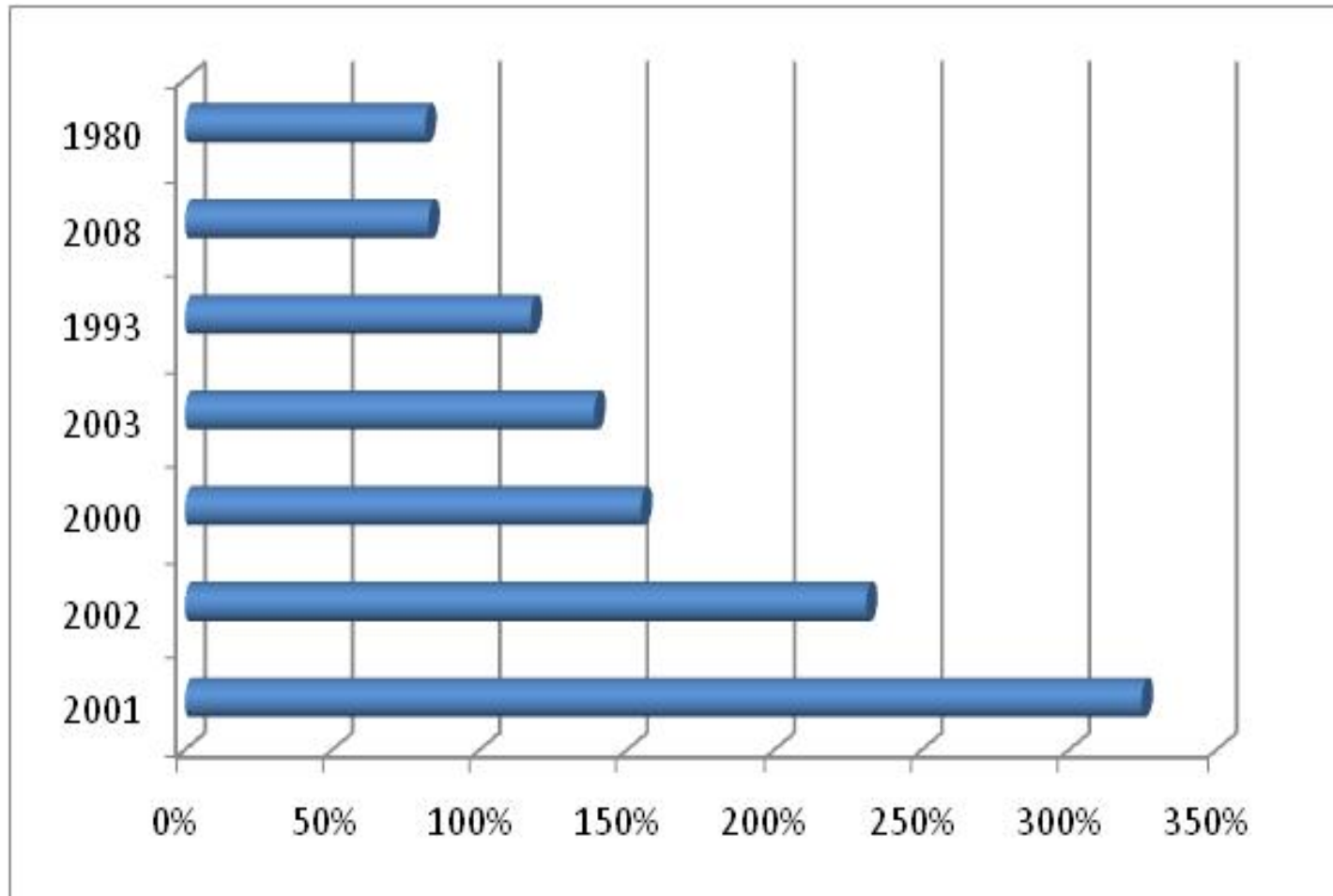


Historic Loss Cost for 9 Aimags

Pure Risk versus Risk-Loaded Rates



Extreme Years for 9 Aimag Portfolio





Objectives of Financing Structure

- 1) Protect insurance companies from high financial exposure when selling BIP
- 2) Segment BIP from other lines of insurance so that potentially large losses from IBLI do not impact other lines of insurance or the overall insurance sector
- 3) Secure BIP premium to guarantee that funds are available to pay any and all BIP indemnities



Livestock Insurance Indemnity Pool (LIIP)

- Contractual arrangement between the participating insurance companies and the government
- All BIP premiums are placed in the LIIP and fully protected until indemnity payments are made — a pre-paid indemnity pool
- Insurance companies can sell BIP with protection against large losses — above 105% of herder premiums + a new aimag stop loss at 125%
- Insurance companies pay an Insurance Participation Fee (IPF) for the right to underwriting gains from the LIIP
- The IPF = Capital at risk for insurance



Design Characteristics of the LIIP

1. Protect and reassure herders
2. Protect and give confidence to participating insurers
3. Protect government as reinsurer
4. Provide confidence to FRC as regulator
5. Provide confidence to international reinsurers
6. Transparency



Insurance Participation Fee (IPF)

- Participating insurers required to pay Insurance Participation Fee (IPF) into LIIP
 - Estimated IPF paid before start of sales season
 - Balance paid (or refund made) after close of sales season
- IPF is cost of participating in IBLIP
- Represents participating insurance company's capital at risk to support BIP business
- Used to be called Guaranteed Indemnity Contribution — Name changed to IPF as better description



Insurance Participation Fee (IPF)

- Essentially, purchases right to participate in IBLIP and to share in any underwriting gains
- Capital at risk — Therefore depleted by underwriting losses (subject to interest earned)
- IPF is not the reinsurance premium
- As with traditional insurance, reinsurance premium paid out of BIP Premiums



Insurance Participation Fee (IPF)

- BIP premiums paid into LIIP as collected (and IPF)
- IBLI Cooperation Agreement provides that government owns all monies in LIIP
- LIIP
 - Operates as pooling mechanism; and
 - Protects IPF and Premiums



Steps to IBLI Financing

March — Insurers pay an estimated payment (minimum IPF of 20 m. Tg) into the LIIP account based on their expected sales

Sales Closing July 15 — BIP herder premiums from all companies are deposited into the LIIP during sales season

August — The IPF is recalculated based on actual sales and the final balance is settled

August — Reinsurance premium is paid from herder premium in the LIIP into the BIP Reserve account — Reinsurance cost is based on each companies distribution of sales

July following year — Indemnities are calculated and paid from the LIIP — Any remaining balance in the LIIP is distributed to each company based on their share of premium sold



Financing

- BIP premiums and insurer capital (IPF) are used to fund the LIIP and the LIIP is used as the first mechanism for payments
- BIP reserve is funded by reinsurance premium that is paid each year from herder premiums
- Contingent loan from the World Bank to finance losses beyond the capacity of the BIP reserve



Steps in Getting Financing

1. LIIP account (Less interest earnings)
2. If Loss Ratio for the aimag is $> 125\%$ of premium, the BIP reserve puts the excess losses into the LIIP account
3. If remaining funds in the LIIP account are not adequate (e.g., for losses above 105% of premium) the BIP reserve is used
4. If BIP reserve is not adequate, the World Bank contingent loan is used



Examples for Rate of Return to IPF

Assume IPF = Tg 40 M

IC Premium = Tg 100 M

LIIP at 105% = Tg 105 M

Interest rate earned = 14%

Interest earnings = Tg 14.7 M

LIIP at end of season = Tg 119.7 M

Loss Ratio = 50% = Indemnity payment Tg 50 M

Remaining value in LIIP = Tg 69.7 M

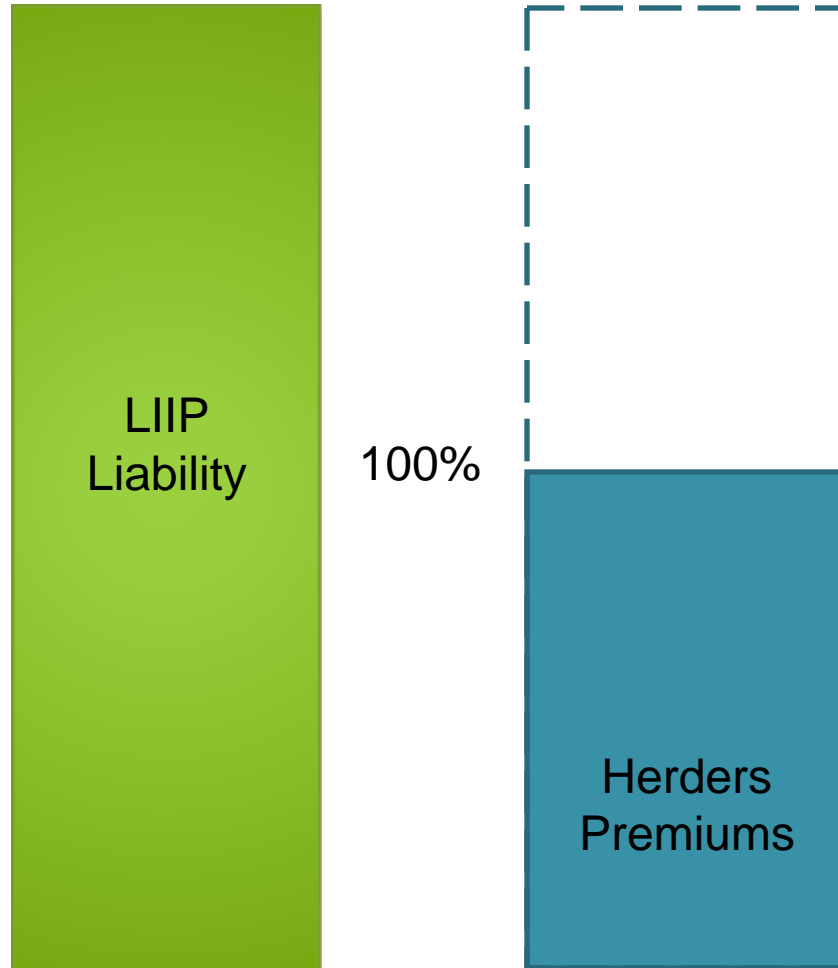
Rate of return = $(69.7 - 40) / 40 = 74\%$



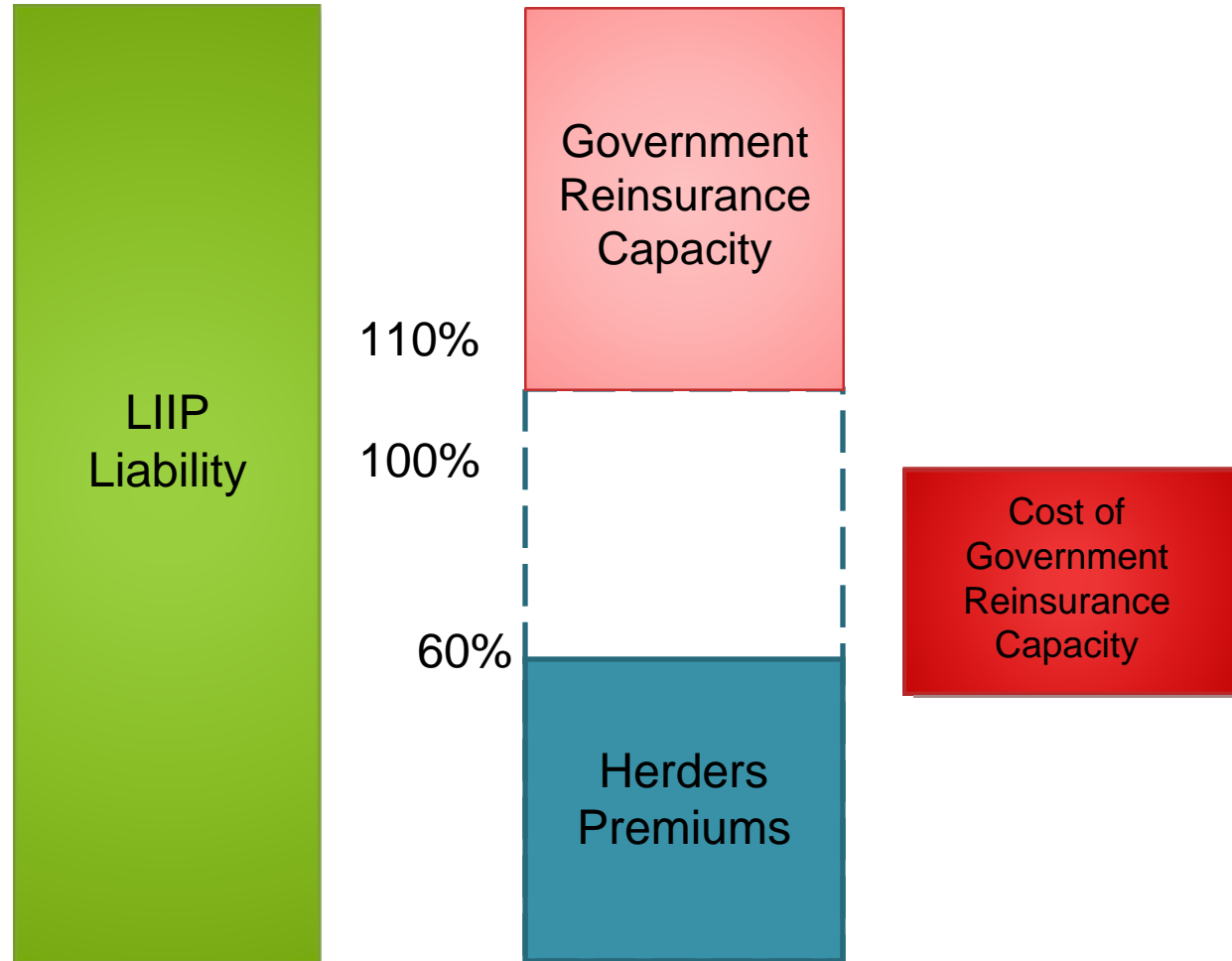
Scenario Analysis to Understand the Risk / Return Profile

- Recommended new premium rates
- Aimag Stop Loss = 125%
- LIIP Stop Loss = 105%
- Load for Gov't Reinsurance = 10% returns on IPF

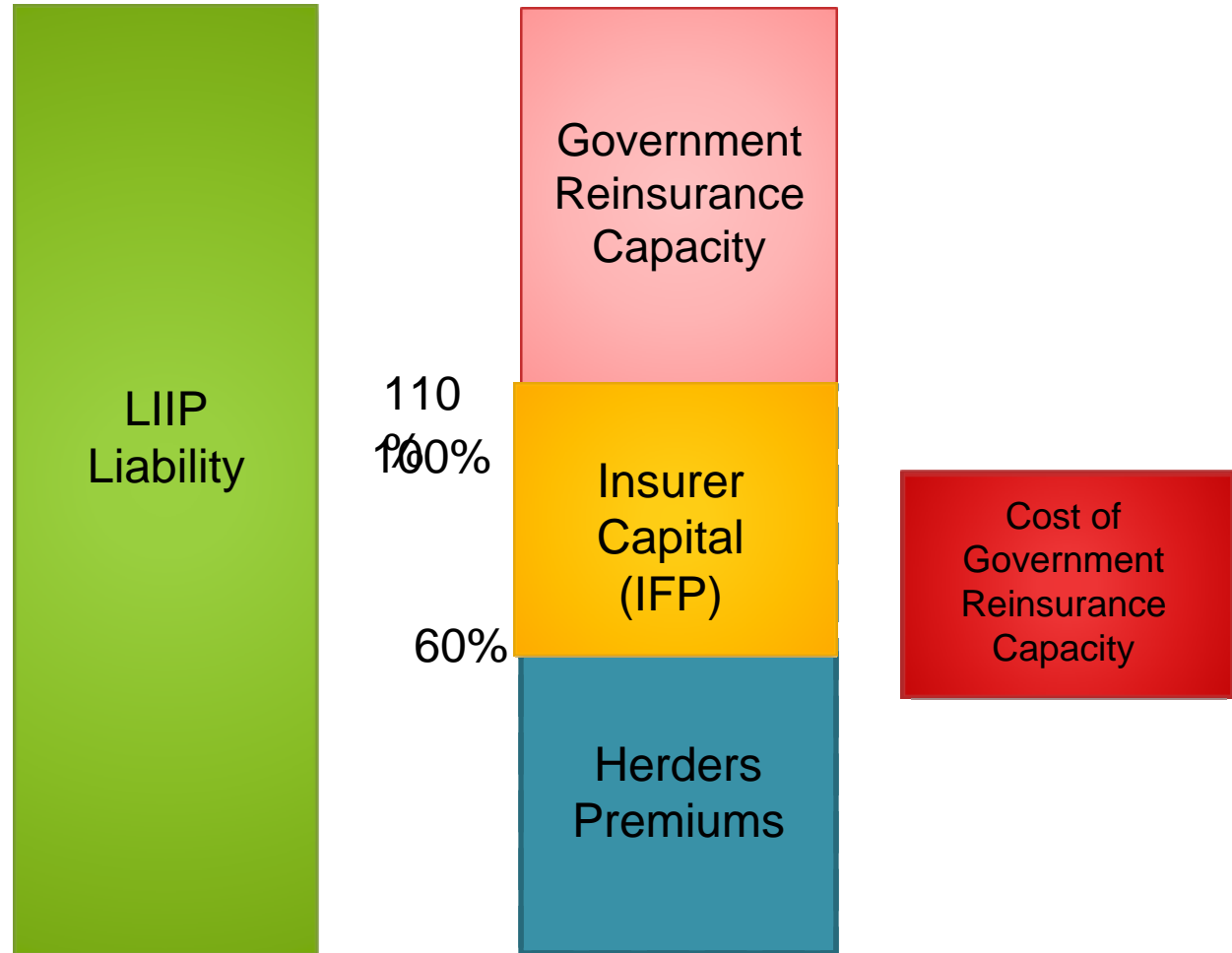
Coverage of LIIP Liability with Government Reinsurance (1)



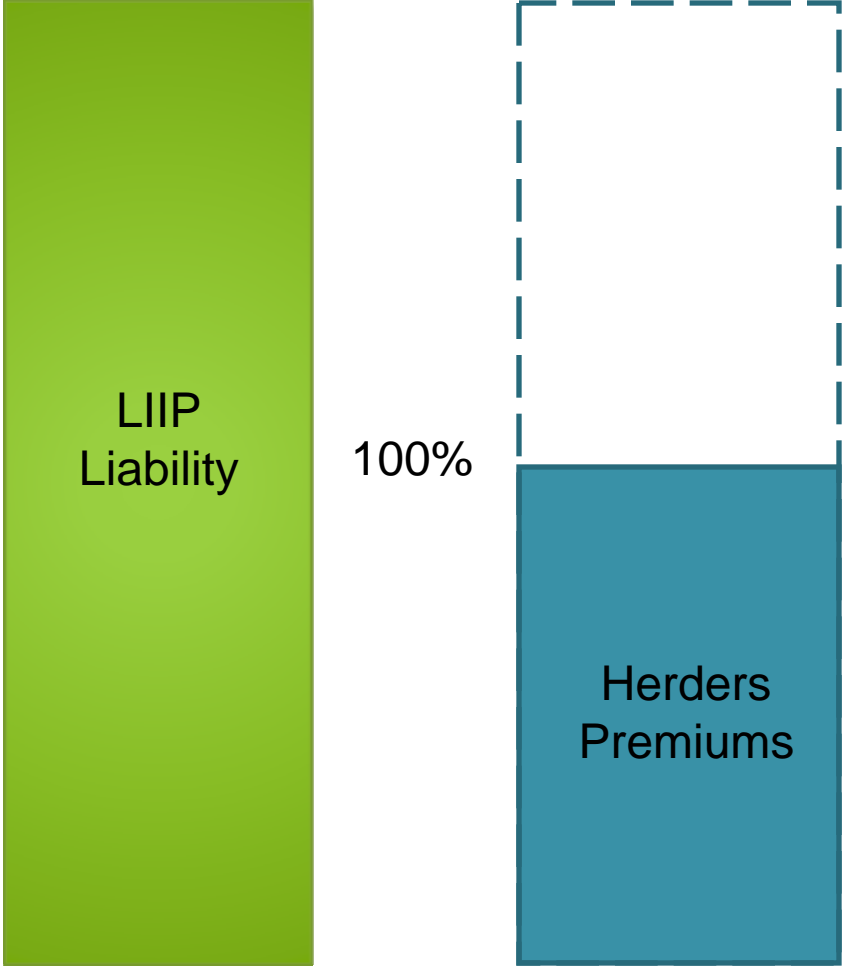
Coverage of LIIP Liability with Government Reinsurance (2)



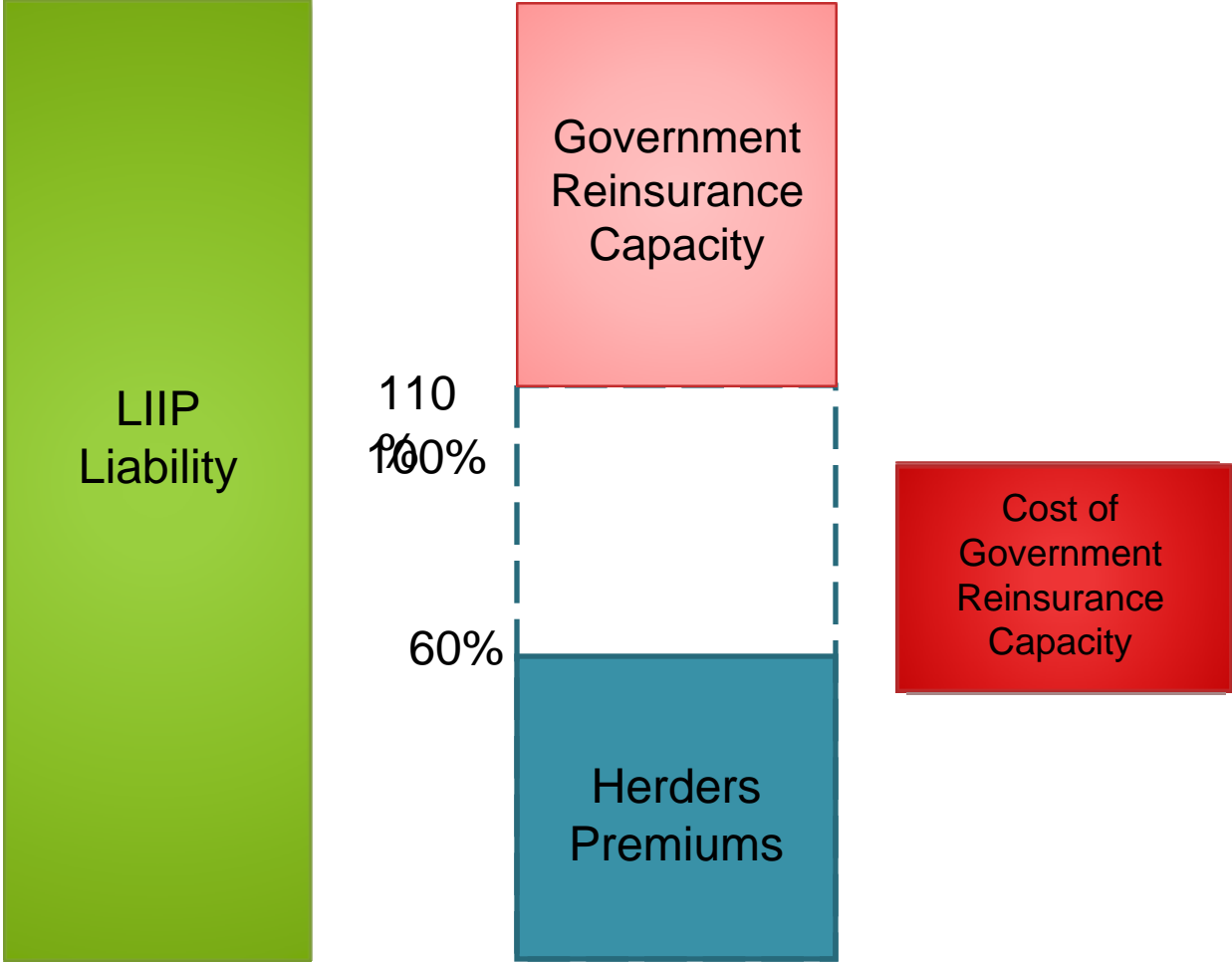
Coverage of LIIP Liability with Government Reinsurance (3)



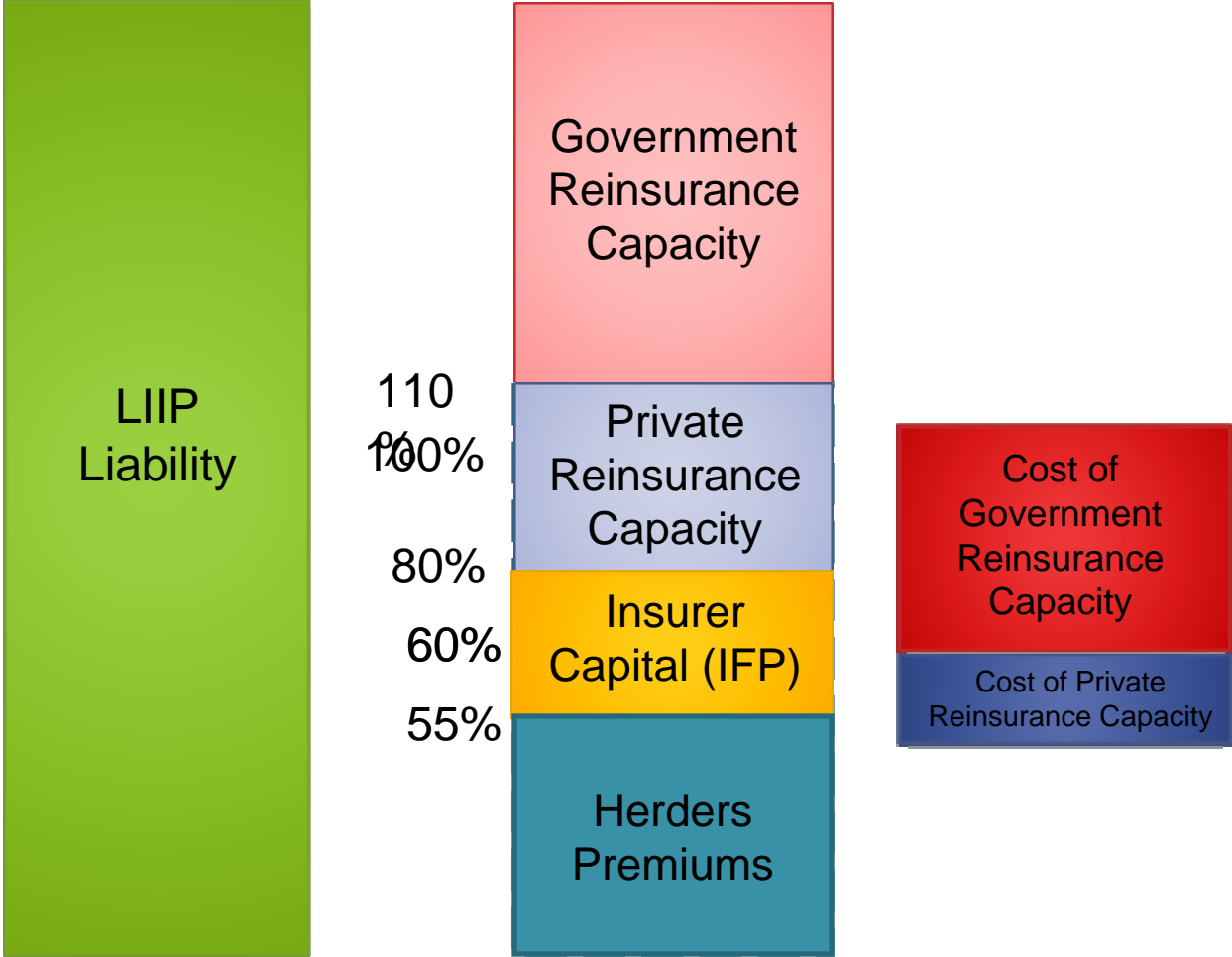
Coverage of LIIP Liability with Government Reinsurance and Private Reinsurance (1)



Coverage of LIIP Liability with Government Reinsurance and Private Reinsurance (2)



Coverage of LIIP Liability with Government Reinsurance and Private Reinsurance (3)



Analysis of the Residual Loss Ratio in the LIIP account

Compare 2 Aimag Stop Loss Values
150% and 125%

| | 150 | 125 |
|------|------|------|
| 1993 | 105% | 93% |
| 2000 | 86% | 74% |
| 2001 | 132% | 112% |



Ratemaking Steps

- 1) Clean the Data
- 2) Estimate Pure Premium
- 3) Smooth Premium Rates across Space
- 4) Load for Catastrophic Events



STEP 1 — Clean the Data

RMSI (India) used the soum mortality rate data to clean the data — 1971–2007

Estimated a new mortality rate any time the number of animals in the soum were less than 3,000 (data with less than 3,000 is not reliable — Estimation problems)



Data Limitations

Many *soum*-species have limited numbers; The error of the estimate is greater when there are fewer animals

Recommendation, use a sheep proxy for any species with less than 5,000 as of December, 2008



Data Building and Cleaning RMSI of India

Why data cleaning ?

- Data issues
 - » Missing data
 - » Erroneous values — Outliers
 - » Inconsistencies — Missing / Wrong trends
- Impact of erroneous data
 - » Extreme values
 - » Simulation
 - » Insurance model

Mortality Rates Are Highly Correlated among Species in the Same Soum (RMSI)

| | Cattle | Sheep | Goat | Horse | Camel |
|--------|--------|-------|------|-------|-------|
| Cattle | 1.00 | 0.86 | 0.87 | 0.93 | 0.67 |
| Sheep | 0.86 | 1.00 | 0.92 | 0.86 | 0.78 |
| Goat | 0.87 | 0.92 | 1.00 | 0.91 | 0.80 |
| Horse | 0.93 | 0.86 | 0.91 | 1.00 | 0.69 |



STEP 2 — Estimate Pure Premium

Payment rate = $\max(0, MR-8, 30-8)$

This is done for all soums and all species given the rule for using the sheep proxy

The pure premium is the average of the payment rates over the selected time period

We have data from 1972–2008

Issue — How to most effectively use all information



STEP 2 — Estimate Pure Premium

Recommendation

Use two time periods to estimate the pure premium

1985–2008 Core Time Period

1972–1984 Early Time Period

Note: For about 1/3 of aimags the pure premium rate is greater using the Early Time Period



STEP 3 — Smooth Rates over Space

Nearby soums are used to smooth the pure premium

Note: This uses the nearby soum to provide more weight on soums that have not yet experienced high mortality rates.

Losses are correlated across soums; This uses the information of neighbors to capture some events that damaged neighbors, but not the core soum



STEP 4 — Use 3 Estimates to Develop the First Estimate of Pure Risk for the ^oSoum and the Species

- 1) Core Time Pure Premium 1985–2008
- 2) Early Time Pure Premium 1972–1984
- 3) Contiguous Pure Premium 1985–2008

STEP 4 — Use 3 Estimates to Develop the First Estimate of Pure Risk for the Soum and the Species

- Determine the weights to put on the 3 estimates
- Early weights get 20%
- Change the weight for the core soum based on the number of animals (Credibility theory is being used)

$$z = \sqrt{\frac{\#of\ animals_{species\ sum}}{50,000}}$$



STEP 4 — Use 3 Estimates + First CAT Load To Develop the Base Risk Rate by Soum and Species

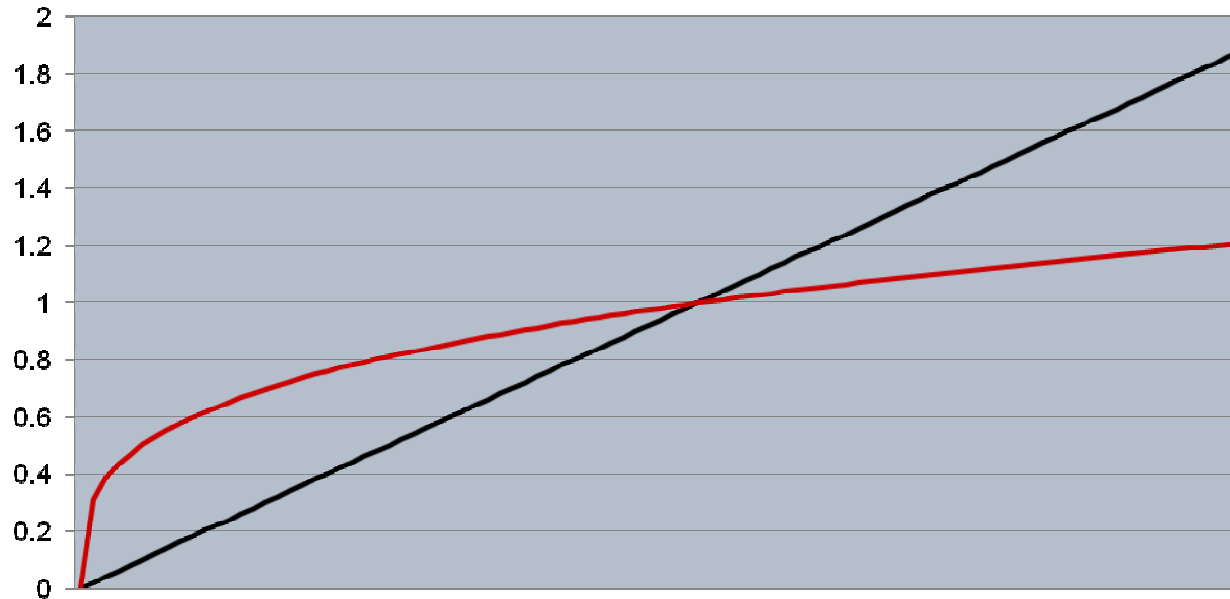
Example of weights

The core weight ranges from 48% to 72%
depending on the number of animals

$R = \{.48 \text{ to } .72 \times (\text{core time period}) +$
 $.08 \text{ to } .32 \times (\text{contiguous pure premium}) +$
 $.20 \times (\text{early time period})\} + \text{CAT Load}$

STEP 4 — CAT Load Calculations

Pure premium for losses above 30% are calculated and smoothed using all neighbors — CAT.³





**STEP 5 — Add a Final Load to Allow
Premium to Be Used to Pay for All
Reinsurance Cost**

Recommended rate

1.7 to 1.8

May adjust by aimag



Important Note Regarding Implicit Load Due to Use of Full Year Mortality Data When the Product Pays Based on the First 6 Months

- We had aimag data by species from 1992 to 2001 for the first 6 months of mortality
- A regression was fitted to forecast the early mortality as a function of the December mortality rates
- At 6% the spread is about 2%
- At 30% the spread is about 3%
- This regression was used to “reset” all historic mortality rates and the average loss ratio was examined to consider how much lower the loss ratio may be due to using the first 6 months
- The average loss ratio is more than 10% lower
- Thus, there is at least a 10% load in the data due to using December census