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%

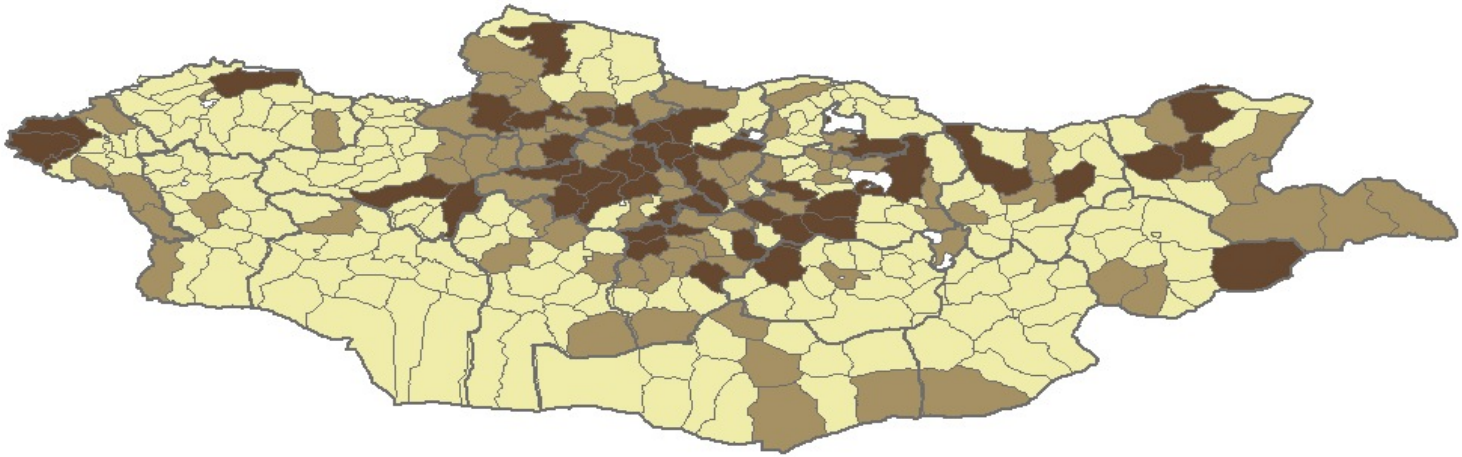
  Payment = value insured x (MR-8)

  Max payment = value insured x (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

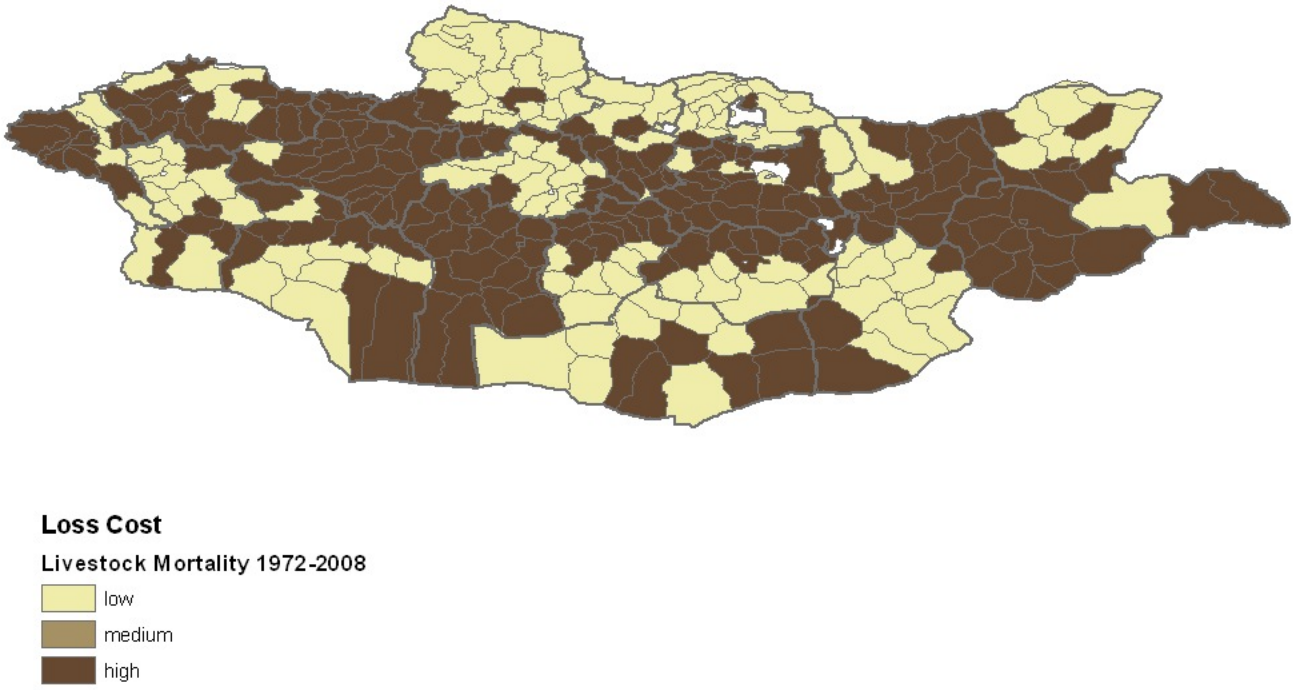


Total Value of Livestock

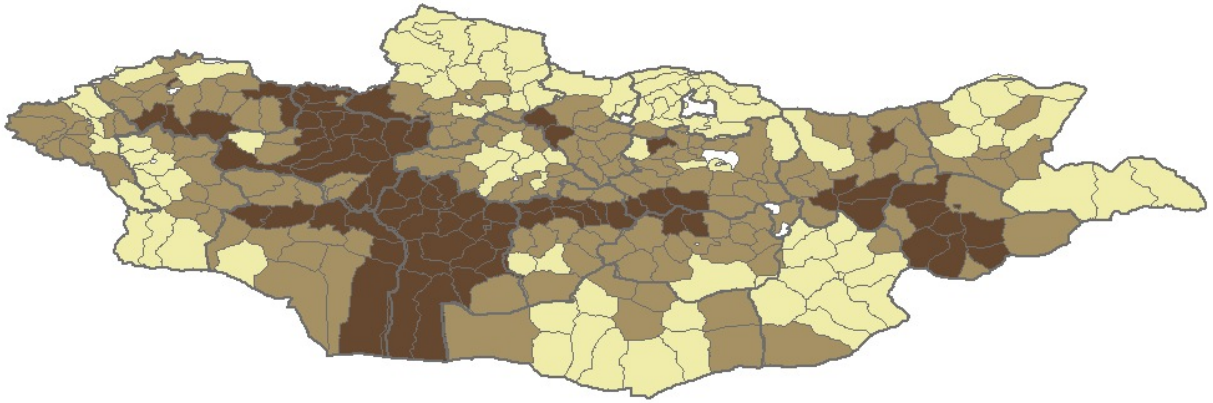
1,000 Tg

- 1,660,775 - 10,000,000
- 10,000,001 - 15,000,000
- 15,000,001 - 46,229,481

Loss Cost for Livestock from 1985-2009



Recommended Risk-Loaded Premiums Pooled Across All Species by Value

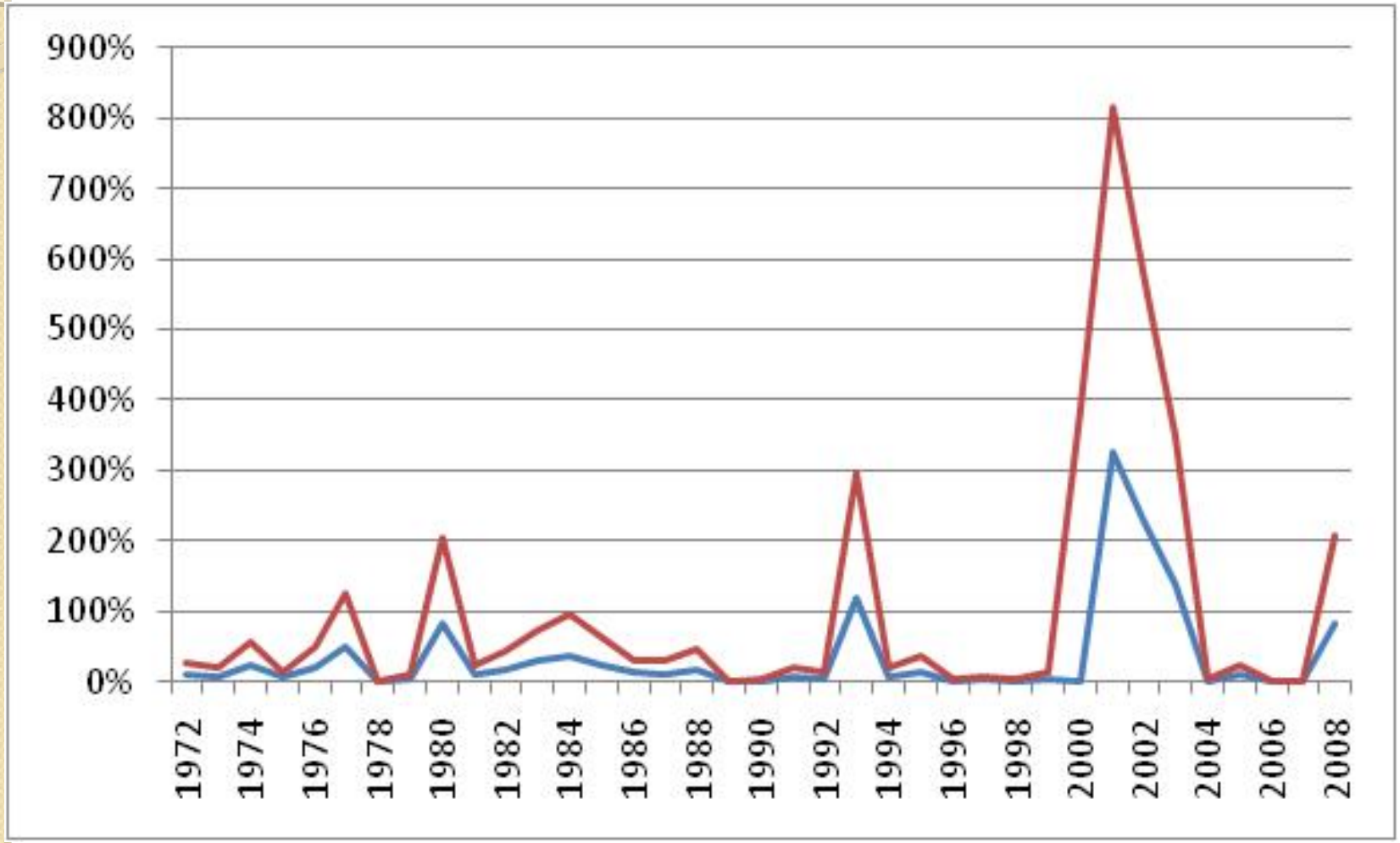


Recommended Risk-loaded Premium Rates

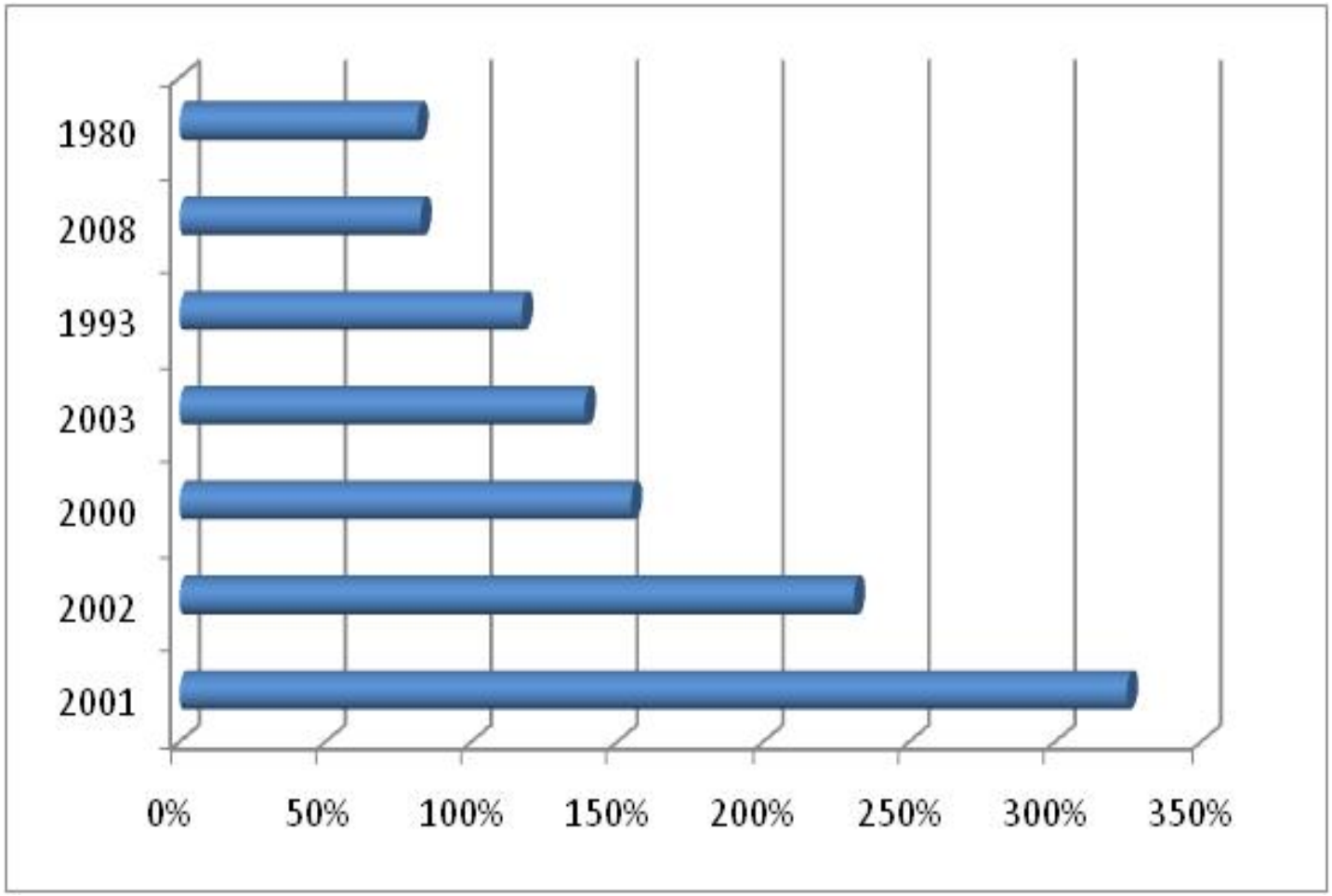
Combined Livestock

- 0.003 - 0.02
- 0.02 - 0.03
- 0.03 - 0.05

Historic Loss Ratio for 9 Aimags
Pure Risk versus Risk-Loaded Rates



Loss Ratio for 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

Steps in Getting Financing

Loss Ratio is calculated with risk loaded premium

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: Please note that the new loss ratio for the LIIP account is the residual risk after the aimag stop loss of 125%
4. If BIP reserve is not adequate, the World Bank contingent credit is used

Examples for Rate of Return to IPF

Assume IPF = Tg 40 M

Risk Loaded 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 = 110% x Pure Risk

Around 8% chance of negative return

90+% chance of return > 80%

IPF - Insurance Participation Fee

- The IPF is the capital at risk.
- It replaces the need for other reserves
- The IPF is calculated to completely fund the liabilities from the LIIP account
- Herder premium is used to pay reinsurance first

IPF Calculation Examples

- GoM reinsurance = 40 or 45 wo Global
- Global reinsurance =10
- Herder premium = 100

Scenario 1: No Global Reinsurance

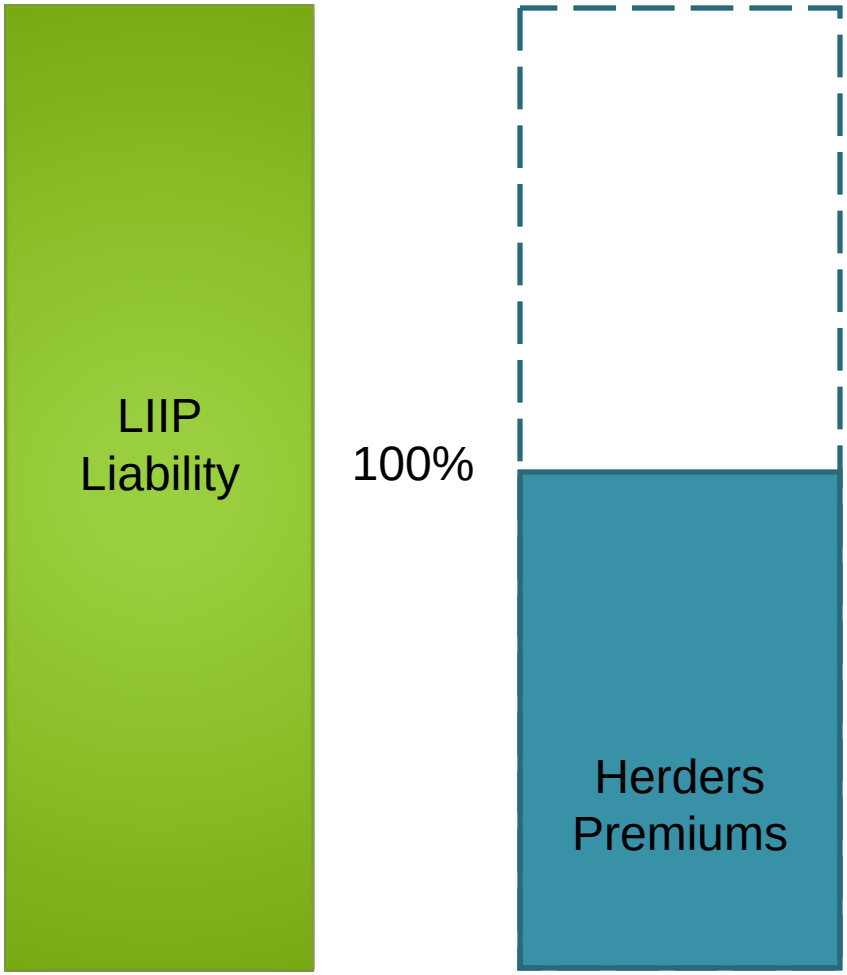
SL = 110

IPF = (45+0) + (110-100)*.01*100 = 55

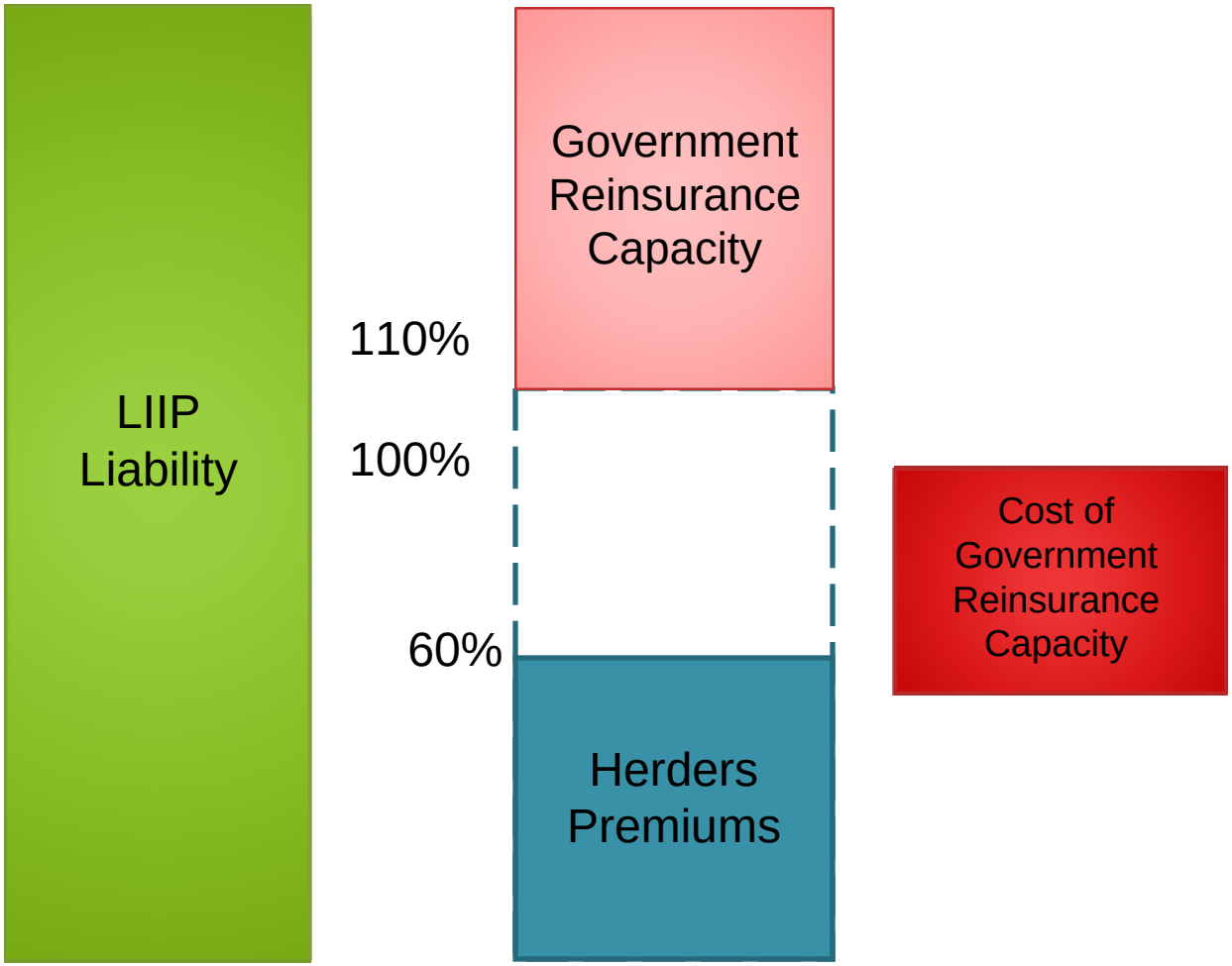
Scenario 2: with Global Reinsurance offering a stop loss at 60 to 110 on LIIP

IPF = (40+10) + (60-100)*.01*100 = 10

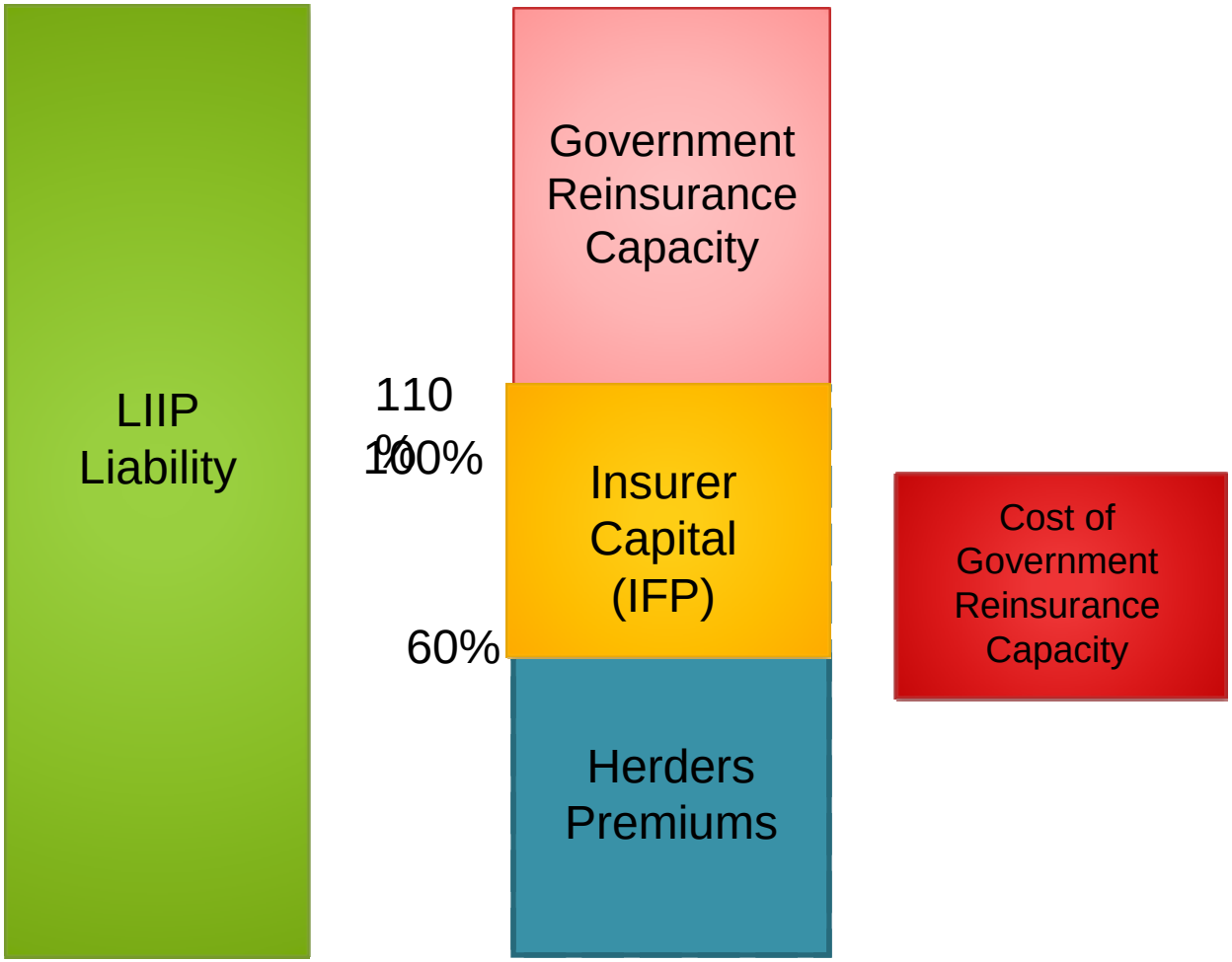
Coverage of LIIP Liability with Government Reinsurance (1)



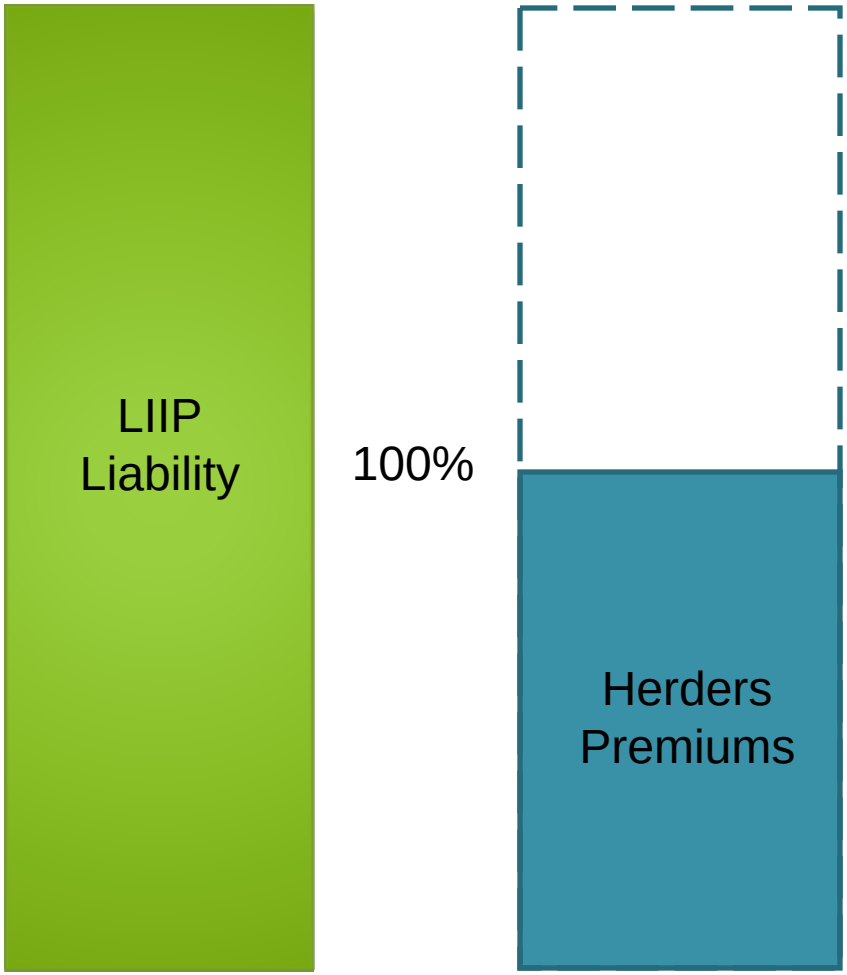
Coverage of LIIP Liability with Government Reinsurance (2)



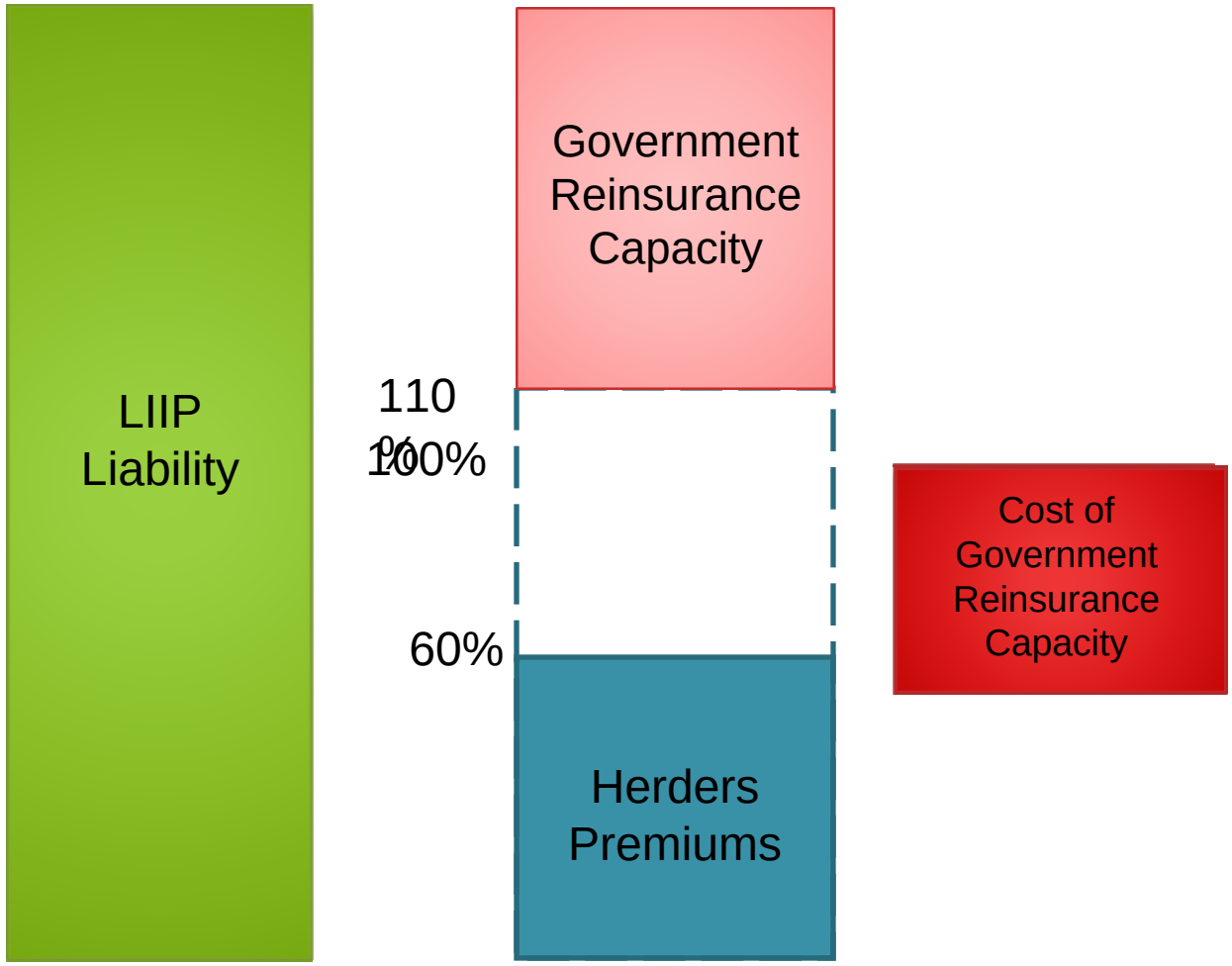
Coverage of LIIP Liability with Government Reinsurance (3)



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



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



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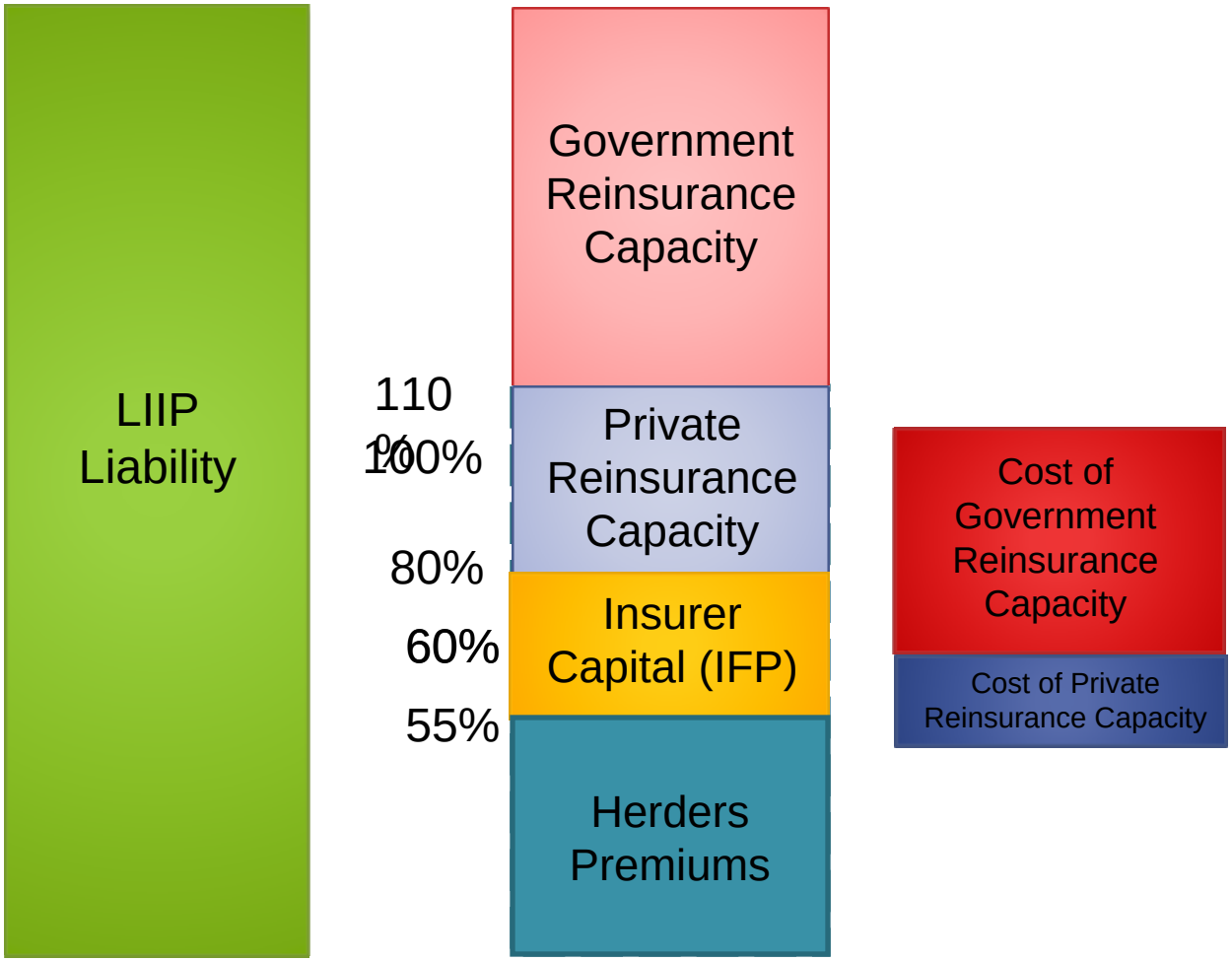
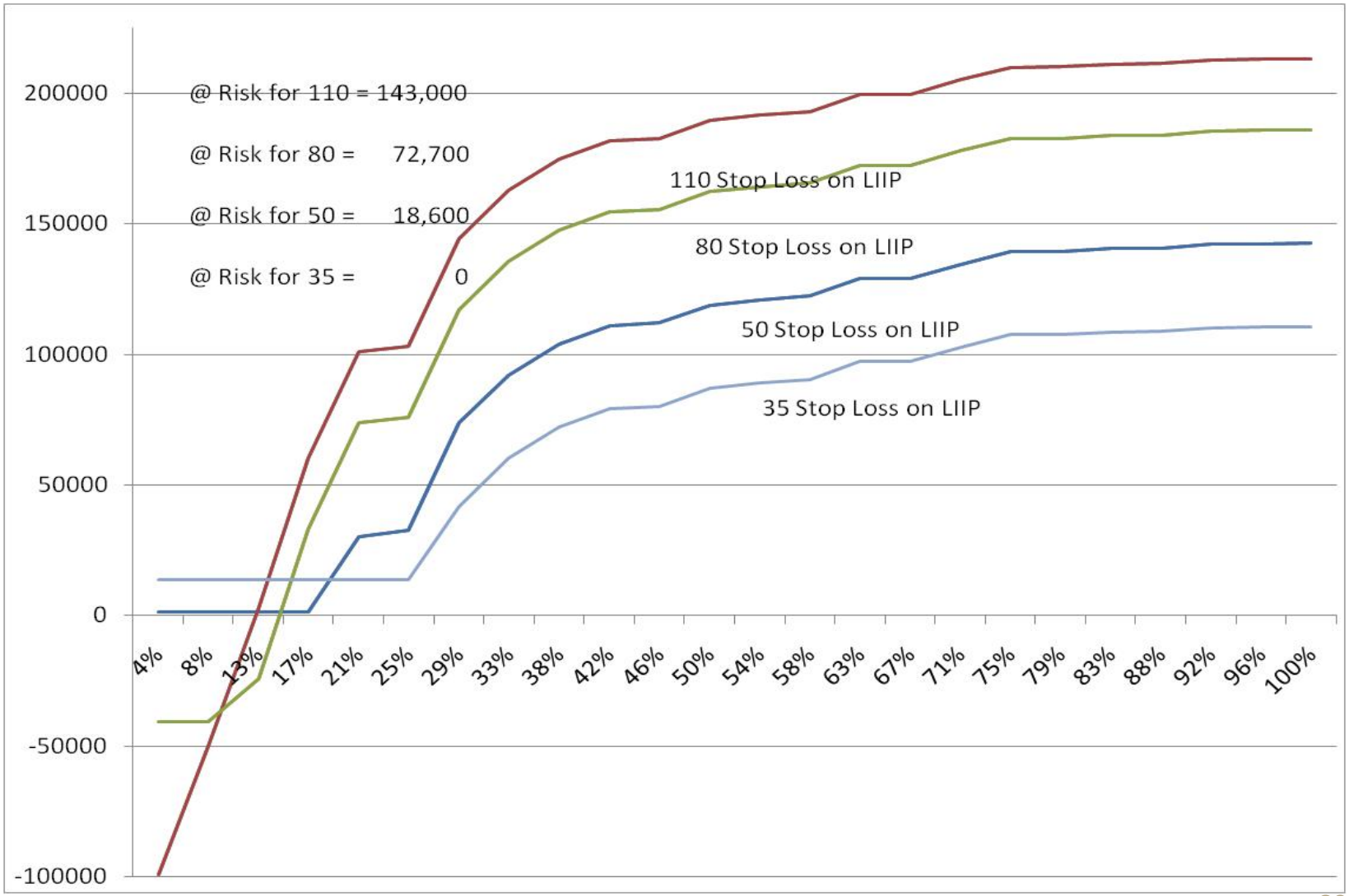


Scenario with 110 GoM Reinsurance vs Global Reinsurance at 80 to 110 and 50 to 110 Layer



Basic Results from Scenario Analysis

With no Global Reinsurance and a LIIP Stop Loss based on the new loss ratio (calculated after the 125 aimag stop loss), IPF would be Tg 143 M. The returns for this capital at risk are higher: however the companies could lose up to Tg 100 M. The insurance companies are supplying the reserve capital to pay for all losses from the LIIP up to 110 percent of the new loss ratio.

Making the Point: The IPF "IS NOT" Paying for Reinsurance

In this scenario analysis, if the global reinsurer were willing to provide a stop loss on the LIIP residual LR at 35 to 110 percent, the IPF would be equal to zero… **No IPF** would be needed to replace the reinsurance paid from herder premium. Net returns are lower.

Herder premium is used for everything

26% goes to global reinsurers; 40% goes to Gov't reinsurance; 35% is retained by insurance companies

Ratemaking Steps

1) Clean the Data
2) Estimate Pure Premium
3) Smooth Premium Rates across Space
4) Use 3 estimates to calculate pure risk
5) Add reserve loading to pay for reinsurance
6) Add an additional Catastrophic load to adjust the loads by region

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 Soum 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 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 to .72 x (core time period) +

.08 to .32 x (contiguous pure premium) +

.20 x (early time period)}

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

Recommended rate

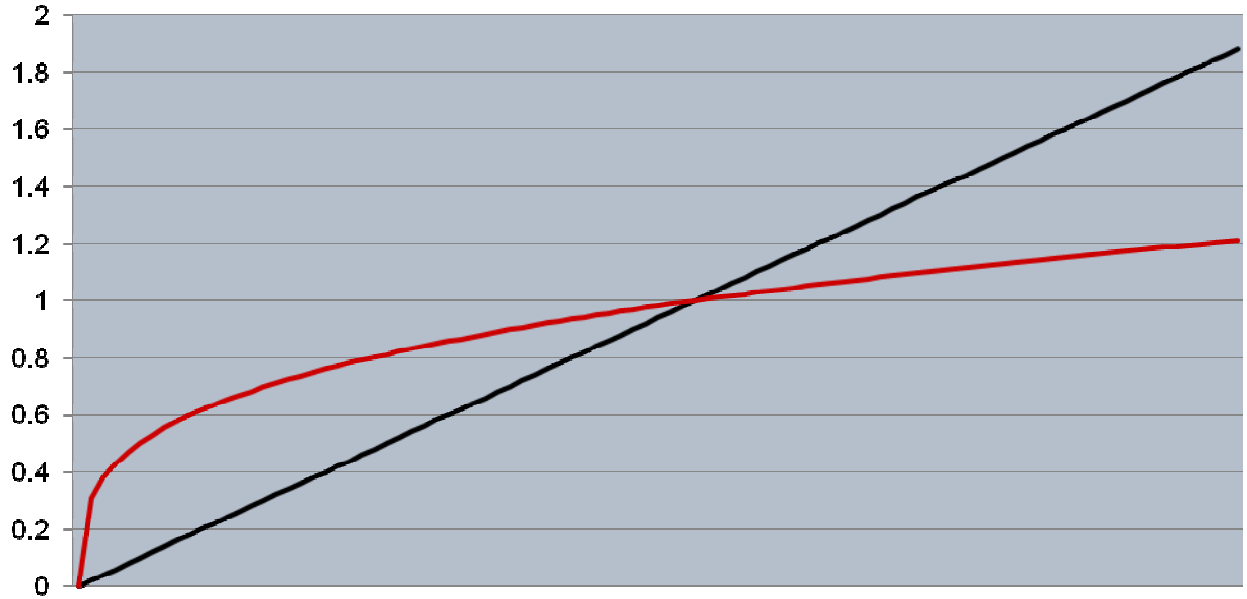
1.7 to 1.8

This could be adjusted by aimag to a target loss ratio

Estimates of Pure risk from steps 1 to 4 is simply multiple by the load factor

STEP 6 — CAT Load Calculations

The final step involves simply added a catastrophe load for losses above 30% are calculated and smoothed using all neighbors — $CAT^{.3}$



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