



AMERICAN ACADEMY *of* ACTUARIES

Catastrophe Exposures
& Insurance Industry
Catastrophe Management Practices

American Academy of Actuaries
Catastrophe Management Work Group

Overview

- Introduction
- What is a Catastrophe?
- Insurer Capital Considerations
- How Insurers Manage Cat Exposures
- Reinsurance & Risk Transfer
- How Reinsurers Manage Cat Exposures
- Public Policy Implications
- Conclusion

Introduction

- The NAIC formed the Coordinating with Federal Regulators Subgroup on Financial Issues at June 2000 NAIC Meeting.
- The purpose of the Subgroup was to:
 - Define catastrophe, underwriting, insurance risk
 - Identify relevant insurance regulatory tools
 - Determine information needs of other regulators
 - Make recommendations for information sharing

Introduction

- Subgroup asked American Academy of Actuaries to provide technical assistance by developing a white paper discussing:
 - Insurance company management of cat risks
 - Risk transfer mechanisms

What is a Catastrophe?

General Definition

- Infrequent event
- Severe loss, injury or property damage
- Affect large population of exposures
- Natural or man-made events

What is a Catastrophe?

- Not all catastrophes are covered by property and casualty insurers
 - Difficulties in quantifying and pricing hazard
 - Adverse selection
- Government program or facility may be available

Insurer Capital Considerations

- Catastrophe exposures place special demands on insurer capitalization.
- Catastrophe risk management is a component of a company's overall risk management program.
- Catastrophe risk management requires a distinct risk management approach.
 - Demonstrated by contrasting non-catastrophic and catastrophic exposures

Insurer Capital Considerations

- Insurance is priced before coverage is sold.
- Future insurance losses must be estimated.
- Accuracy of loss estimate improved if:
 - Predictable claim frequency
 - Each exposure experiences loss independently

Insurer Capital Considerations

Non-Catastrophe Exposures

- Non-catastrophe exposures are independent.
- By writing more business, claim occurrence becomes more predictable.
- Historic data can be used to calculate reliably predictive statistics.

Insurer Capital Considerations

Non-Catastrophe Exposures

- Goal is to insure large numbers of exposures at prices sufficient to cover expected losses and expenses that achieve an adequate rate of return on capital commensurate with the risk inherent in the exposure portfolio.

Insurer Capital Considerations

Catastrophe Exposures

- Catastrophe exposures do not meet conditions of predictable frequency & independent exposures:
 - Infrequent events & high correlation among exposures.
- Insurer must bear the cost of holding sufficient capital or create a catastrophe risk management plan to deal with existing exposure.
- The insurance process, if left unmonitored during lengthy catastrophe-free intervals, can produce high concentrations of catastrophe exposure.

How Insurers Manage Cat Exposures

“A Five-Step Continuous Learning Process”

- Identifying Catastrophe Risk Appetite
- Measuring Catastrophe Exposure
- Pricing for Catastrophe Exposure
- Controlling Catastrophe Exposure
- Evaluating Ability to Pay Cat Losses

Identifying Catastrophe Risk Appetite

Defining Appetite

- How much loss, over a given period of time, can insurer absorb without unacceptable adverse impact?
- Maximum acceptable reduction to surplus (or income) from a single event or multiple events per year
- “\$XXM Cat Loss once in 100 years”

Identifying Catastrophe Risk Appetite

What Determines Appetite?

- Earnings volatility
- Market pricing
- Availability & cost of reinsurance
- Cost of capital
- Solvency regulation
- Capital allocated to catastrophe exposures
- Rating agency evaluations
- Tax considerations
- Cash flow needs
- Finance requirements
- Rate regulation
- Other business written by insurer

Identifying Catastrophe Risk Appetite

- The risk appetite is used to give underwriters a maximum guideline for monitoring whether catastrophe risk in the insured portfolio is within acceptable limits.
- Each insurer's risk appetite is unique.

Measuring Catastrophe Exposure

- Company must inventory existing exposures
- Exposure measured in context of Probable Maximum Loss (PML)
- Rigorous versus subjective

Measuring Catastrophe Exposure

- Rigorous
 - Based on modeled result
 - PML must be considered in context of how it is being used
 - Amount of loss associated with a given exceedence probability over a specified period of time
 - May be described based on individual loss or aggregate loss over annual period
 - PML's may differ by type of catastrophe

Measuring Catastrophe Exposure

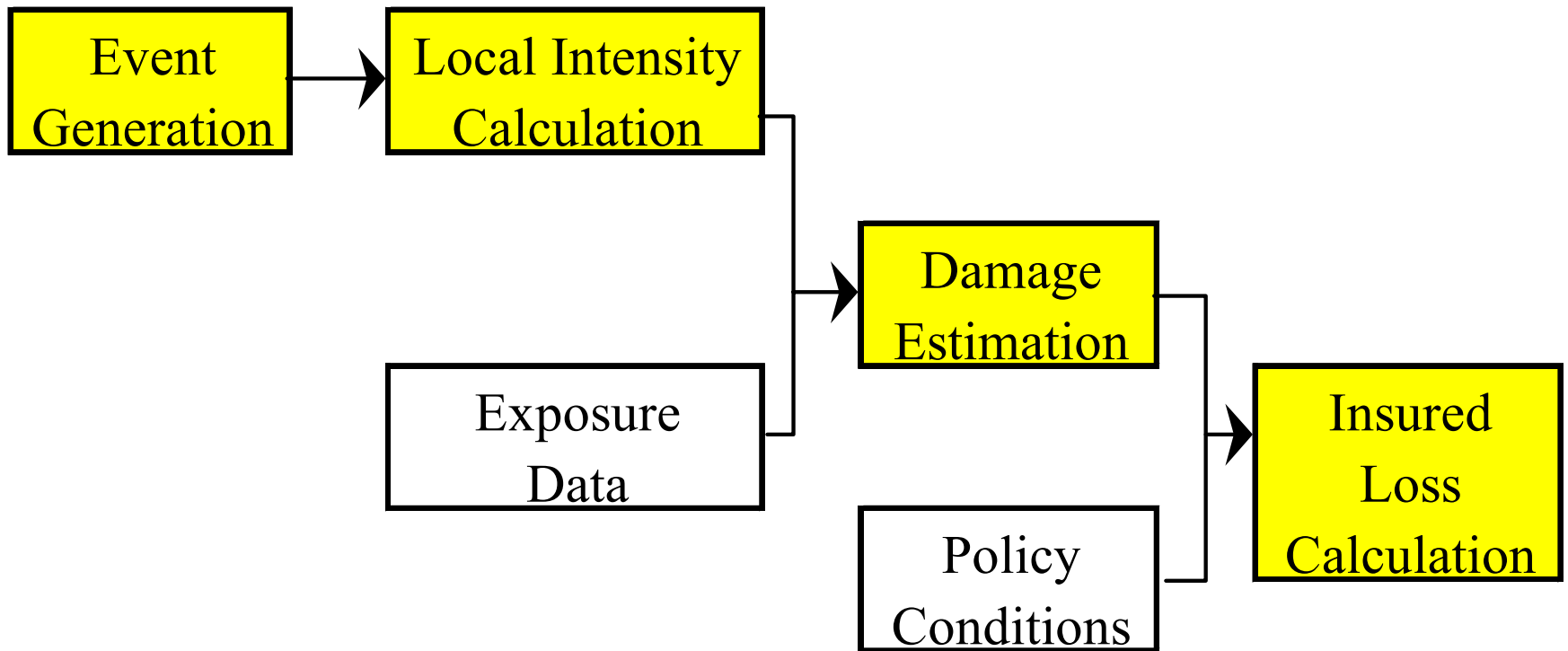
- Subjective
 - Exposure x Selected Percentage Loss
 - Where exposure is some measure such as
 - Total amount of written premium
 - Number of insured structures
 - Number of policies
 - Sum of limits on insured structures
 - Easily available, powerful intuitive measures
 - Typically used for perils where models are not yet available

Measuring Catastrophe Exposure

- Model-based and subjective PML estimates can be applied to manage catastrophe exposure and allocate capacity in geographic detail or by region.
- A company should regularly update PML estimates as part of ongoing monitoring.
- Objective: always to be aware of current exposure to catastrophes.

Overview of Catastrophe Modeling (Appendix C)

Catastrophe Modeling



Event Generation Module

- Historic data used to build probability distributions for relevant variables.
- Probability distributions used to randomly generate catalog of simulated events.
- Random sampling from catalog gives simulated years with 0, 1, 1+ events.

Local Intensity Module

- Each simulated event is propagated across a random distribution of affected areas.
- At each location in each area, local intensity is estimated based on magnitude of event, distance from event source, and a variety of local conditions such as geologic and topographic features.

Damage Module

- Damageability functions describe interaction between buildings (structural, non-structural, contents) and local intensity.
- Damageability depends on construction and occupancy.
- Mean and variance of damage levels.
- Total Damage =
Damageability x Replacement Value.

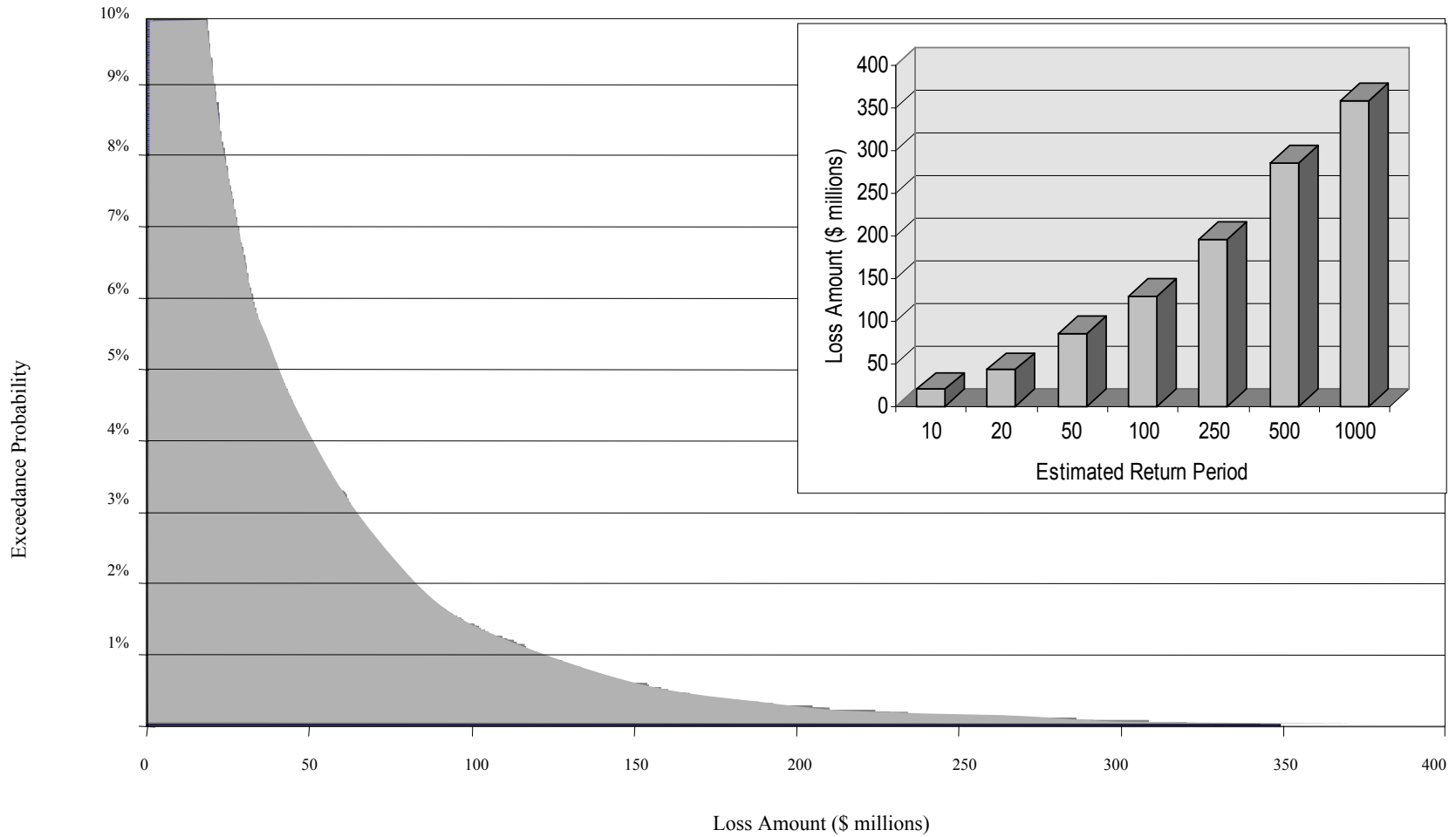
Insured Loss Module

- Policy conditions applied to total damage.
- Coverage-specific, site-specific, blanket deductibles.
- Coverage limits and sublimits, loss triggers, coinsurance, single vs. multiple location attachment points and limits, risk-specific reinsurance terms.

Model Output

- Exceedence probability curves or Return periods for
 - Overall loss
 - Gross vs. net of reinsurance
 - Occurrence vs. annual aggregate loss
- Customized by
 - Geographic resolution
 - Line of business
 - Construction class, coverage, etc.

Exceedence Probability Curve or Return Period



Validation of Catastrophe Models

- Compare model results to actual data from historical events.
- Construction of models relies on expertise of many disciplines.
- Actuaries are guided in use of catastrophe models by Actuarial Standard of Practice 38, *Using Models Outside the Actuary's Area of Expertise*.

Pricing for Catastrophe Exposure

- Price must be set before costs are known.
- Premium provides for
 - Expected loss & loss adjustment expense
 - All other expenses
 - Cost of capital
- Premium may be determined through regulatory process or by operation of competitive marketplace.
- Expected loss component for property insurance is priced in two parts, non-catastrophe loss and catastrophe loss.

Pricing for Catastrophe Exposure

Problems in Using Historic Experience for Cat Risks

- Low frequencies and volatile severity
- Historical exposure concentrations not representative of future policy periods
- Homeowners insurance available claims record from 1960 to present
- Historical insurance data may not reflect current exposure, e.g., changes in land use
- Occurrence or absence of individual event can have a dramatic impact on results

Pricing for Catastrophe Exposure

Computer Modeling

- Insurers increasingly use computer models to estimate hurricane and earthquake losses.
- Regulator's concerns
 - Technical complexity
 - Proprietary models
 - Range of results
 - Perception that model results may be sensitive to changes in estimated parameters.
- National Association of Insurance Commissioners, *Catastrophe Computer Modeling Handbook*

Pricing for Catastrophe Exposure

Computer Modeling

- Florida Commission on Hurricane Loss Projection Methodology
 - Has established 52 standards to determine acceptability of model for ratemaking
- California Earthquake Authority
 - Sets policy rates using reviewed and modified model results
- Louisiana
 - Computer model interrogatories

Controlling Catastrophe Exposure

- Company may recognize need to limit risk.
- Steps may include:
 - Identify where company can grow property portfolio without exceeding capacity
 - Reduce property exposures where company has exceeded capacity for the region
 - Companies may reduce exposure through reinsurance, capital market alternatives, deductibles, and other efforts to mitigate loss

Controlling Catastrophe Exposure

Managing Geographic Distribution of Risk

- Balance existing risks with targeted growth
- Limit risk by quota or halt on growth
- Adopt minimum deductibles
- Review policy language for risks of post-catastrophe adverse judgements
- Exclude coverage for certain catastrophes
- Limit coverage for property prone to catastrophe damage
- Industry support of local/state government mitigation (e.g., strengthen building codes)

Evaluating Ability to Pay

- Cash demands vary depending on nature and intensity of event
- Obvious damage = faster payout
- Less obvious damage = slower payout
- Timing of cash needs is a function of the size of the event

Evaluating Ability to Pay

- If catastrophe exposures are small relative to ongoing cash supply, less need for a contingency plan.
- Such insurers can usually divert enough cash from operations and maturing investments to pay catastrophe losses.
- If the plan includes liquidating investments, insurer gives up some control over amount and timing of investment gains.

Evaluating Ability to Pay

- Period between event and completion of repair allows time to fund the loss through
 - Underwriting and investment cash flow
 - Asset liquidation
 - Debt financing
 - Advance funding
- Insolvency is caused by insufficient surplus in relation to magnitude of event, not by company liquidity at time of catastrophe

Reinsurance and Risk Transfer

Why Insurers Purchase Reinsurance (App. E)

- Stability
- Capital Strength
- Cost of Capital
- Balance Sheet Protection
- Liquidity/Asset Management
- Perceived Exposure
- Regulatory Considerations
- Rating Agency Considerations

Reinsurance and Risk Transfer

- Reinsurance is the traditional method insurers use to reduce or transfer risk.
- Types of reinsurance arrangements
 - Treaty vs. Facultative
- Coverages
 - Pro-Rata vs. Excess of Loss

Reinsurance Mechanisms

Finite Risk Products

- Limited transfer of underwriting risk
- Multi-year smoothing of catastrophe losses
- Reserve fund grows or shrinks based on actual experience
- Deficit payback or profit sharing
- Must meet SSAP 62 and Chapter 22 requirements

Capital Market Mechanisms

Context

- As a result of Hurricane Andrew & Northridge Earthquake, insurers recognized need for increased capacity.
- Accounting rule changes
 - Reduced appeal of finite risk products
 - Especially affected loss-smoothing features
- Capital markets recognized as alternative source of capacity.

Capital Market Mechanisms

New Products

- Insurance-linked notes and bonds
 - “Cat Bonds”
 - Contingent Surplus Notes
- Exchange-traded products
 - “Cat Options”
 - Risk Exchanges
 - Weather Derivatives
- Other structured products

Reinsurer Considerations in Managing Catastrophe Exposures

- Same five-step process as for insurers.
- Challenges facing reinsurers:
 - Obtain adequate and detailed information from ceding companies on catastrophe exposures
 - Accurately measure aggregation of potential catastrophe losses across multiple ceding companies
 - Price the often highly-leveraged exposure

Reinsurer Considerations in Managing Catastrophe Exposures

- Reinsurers:
 - Require high levels of data disclosure from ceding companies
 - Increasingly using catastrophe modeling in pricing
 - May not be able to diversify their peak exposures and as a result their pricing must directly reflect the cost of additional capital required to support these exposures

Public Policy Implications

- How Much Capital?
 - Appropriate assurance that insurers will meet obligations to insureds, even in catastrophe
 - Requiring additional capital adds additional cost, which raises premium cost of coverage.
- “Ring Fenced” Capital
 - Dedicated capital must be paid for each year
 - Defeats advantage of holding capital for independent (uncorrelated) risks

Public Policy Implications

- Pre-event Catastrophe Reserves
 - Is it appropriate to recognize cat provision of the rate as income (profit) on an annual basis, when there is often no catastrophe
 - Pre-event catastrophe reserve allows additional funding in case of event
 - Multiple issues related to this reserve

Public Policy Implications

- Availability/Affordability
 - Business is written based on expected profits
 - Affected by price controls and underpriced competition from state funds
- Exit Restrictions
 - Exit restrictions are designed to maintain availability following a catastrophe
 - Possibility of trapped capital can itself lead to availability problems

Public Policy Implications

- Insurance Guaranty Funds
 - Goal is protection for policyholders of impaired or insolvent insurers
 - Risk is over-reliance on guaranty fund; irresponsibly inadequate pricing can drive responsible insurers from the market
- Use of Catastrophe Simulation Models
 - Goal is to find best estimate of expected losses
 - Rating agencies and regulators may apply simulation models to test insurer reserves

Conclusions

- Catastrophe exposures place special demands on insurer capitalization and require a distinct management approach.
- Catastrophe events are infrequent and claims for a given event are correlated.
- Catastrophes represent significant financial hazards to insurers.
- Insurers manage catastrophe risk through a five-step process.

Conclusions

- There is no one catastrophe risk management procedural template that applies to all insurers. However the conceptual elements are the same for any property and casualty insurer.
- Insolvency is caused by insufficient surplus in relation to magnitude of event, not by degree of liquidity at time of catastrophe.
- Catastrophe risk management is similar for insurers and reinsurers.

Conclusions

- Insurer catastrophe risk management is relevant to certain questions of public policy.
- Policy makers can use the five-step catastrophe risk management approach to anticipate primary and other consequences of proposals.