



# Emerging Risk Management



September 27, 2010

# Agenda

- Introduce a factor model approach to modeling emerging risks
- Setting up and calibrating the model
- Sample model output
- Conclusion

# Defining The Model

**“All models are wrong. Some are useful.”**

**George Box**

## We Start by Defining Emerging Risk

- Risks that do not currently exist (S&P Definition)
  - Slow to appear, difficult to identify, represent idea more than factual circumstances
  - Result from changing political, legal, economic, market or physical environment
  - Most industry identified Emerging Risks are already known but their impact on society, economy, and insurance is not known yet

## We Then Classify Types of Emerging Risks

- Need to understand where Emerging Risks can come from
  - Macroeconomic
  - Political/Legal
  - Physical (weather, etc.)
  - Etc.
  
- Need to understand how each type of Emerging Risk affects insurer
  - Liability side, asset side, both?
  - One or multiple lines of business affected?
  - One or multiple industries affected (understand streams of commerce)?
  - Does it affect competition, buying patterns and/or entire marketplace?
  - Is future business affected?
  - Are suppliers affected?
  - Is there operational exposure?
  
- Multiple processes require multiple identification and risk management systems

## The Model

- Arbitrage Pricing Theory
  - Multi-factor model
  - Factors are systemic risks that we know are correlated to some or all of our portfolio
  - Do not have to identify specific factor
  - Simply need to know correlations
  - Factors measure risk premiums
  
- Factor Portfolios
  - Chose general factors which represent different types of emerging risks
  - Create a matrix of correlations between risky areas within firm and factors based on impact of each emerging risk
  - Over-precision in factor development not practical since we aren't identifying exactly what the factor is
  
- Incorporate in economic capital model and use Monte Carlo simulation to simulate effect on economic capital of factors representing various emerging risks

# Setting Up The Model

## Define Factors

- Three categories of factors:
  - Past events
    - 9/11, financial crisis, etc.
  - Events which are known but whose impact is not known
    - Global warming
    - Product risk from emerging nations
    - Aging population
  - Future events which are not known
    - Possible erosion of tort reform
    - Natural catastrophes
    - Political unrest
    - Deregulation
- Factors are systemic to industry, not just to firm
  - As firm's risk profile changes, only need to update correlations

## Parameterizing Factors

- Frequency
  - Binomial whose mean is a random variable
- Severity
  - Loss ratio approach is generally appropriate as size of market and risk profile of firm change over time
  - May need more detailed model for low frequency businesses
- Correlations
  - Correlation between business and industry, for each factor
    - Miss factor applies to some emerging risks
  - Correlation within and between parts of the business
    - Underwriting lines of business
    - Assets
    - Credit
    - Loss reserves
    - Franchise value

## Parameterization Support

- Historical information about past events
  - Annual statement – remember it is only 10 years of history, a very small sample
    - Schedule P
      - Be careful of effect of rate adequacy
      - Net vs. Gross
      - Regression analysis can help assess correlations between lob's for both non-event years and event years
    - Schedule D to study impact on investments
  - Industry reports
- Known events with unknown impact
  - Lloyd's Disaster Scenarios
  - Industry studies
- Unknown events
  - Cascade failures – stream of commerce, supply chain
  - Near misses
  - Similar /Opposite events

## Parameterization Cautions

- High level of uncertainty in modeling impact of Emerging Risks
- Understand sources of reducible uncertainty – a few lessons from behavioral finance can improve our ability to calibrate
  - The law of large numbers does not apply to small sets of numbers – means and variances
  - Experience biases tend to lead to underestimation of risk
  - Overconfidence
  - Don't discard outlier data because you think it can't happen again
  - Don't have a selective memory
- Assuming an appropriate tail probability is more important than the mean assumption
- “Ceaselessly search for possible correlations among seemingly unrelated risks.”  
Warren Buffet in 2001 Letter to Shareholders
  - Correlations between underwriting years for occurrence business
  - Correlations between creditors (ceded re recoverables)
  - Rhode Island Night Club fire
- Think about your cone of uncertainty - The tail is fatter than we think

# Example

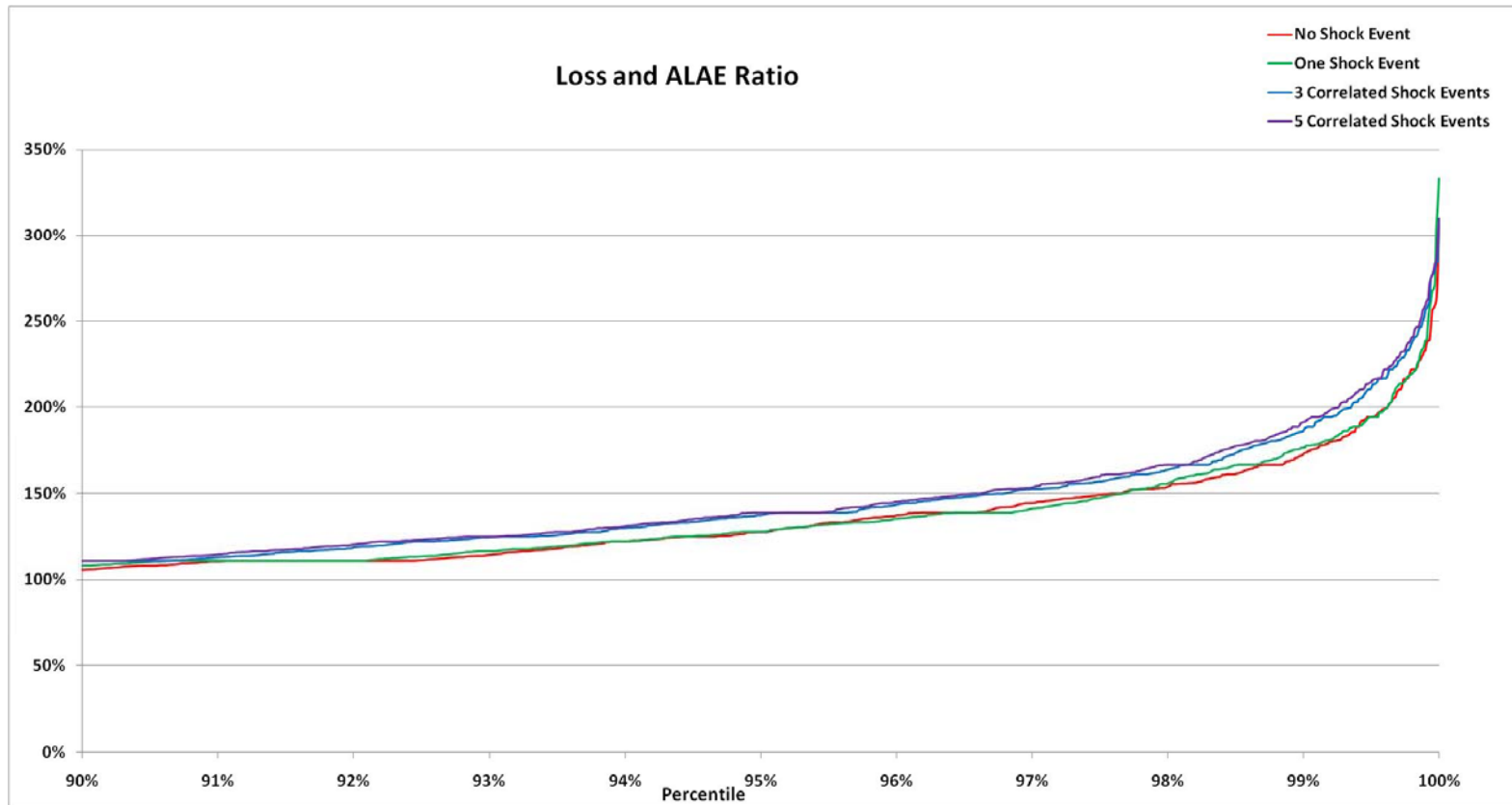
# Sample Factor Model

Risk Area	Factor A	Factor B	Factor C
Assets	0	+	+
Credit 1	0	0	+
Credit 2	+	0	+
LOB 1 Current	0	0	+
LOB 1 Reserves	0	0	0
LOB 2 Current	+	0	0
LOB 2 Reserves	0	0	0
LOB 3 Current	0	+	0
LOB 3 Reserves	0	+	0
LOB 4 Current	0	+	0
LOB 4 Reserves	0	+	0
Franchise	+	+	+

## Sample Economic and Shock Model

- Underwriting results for current year
- 9 seemingly uncorrelated lines of business
- Low frequency, high severity lines of business
- Initial shock scenarios were adding  $E(n)$  to claim count 1 in 10 years

## My First Attempt at Adding Shock Loss



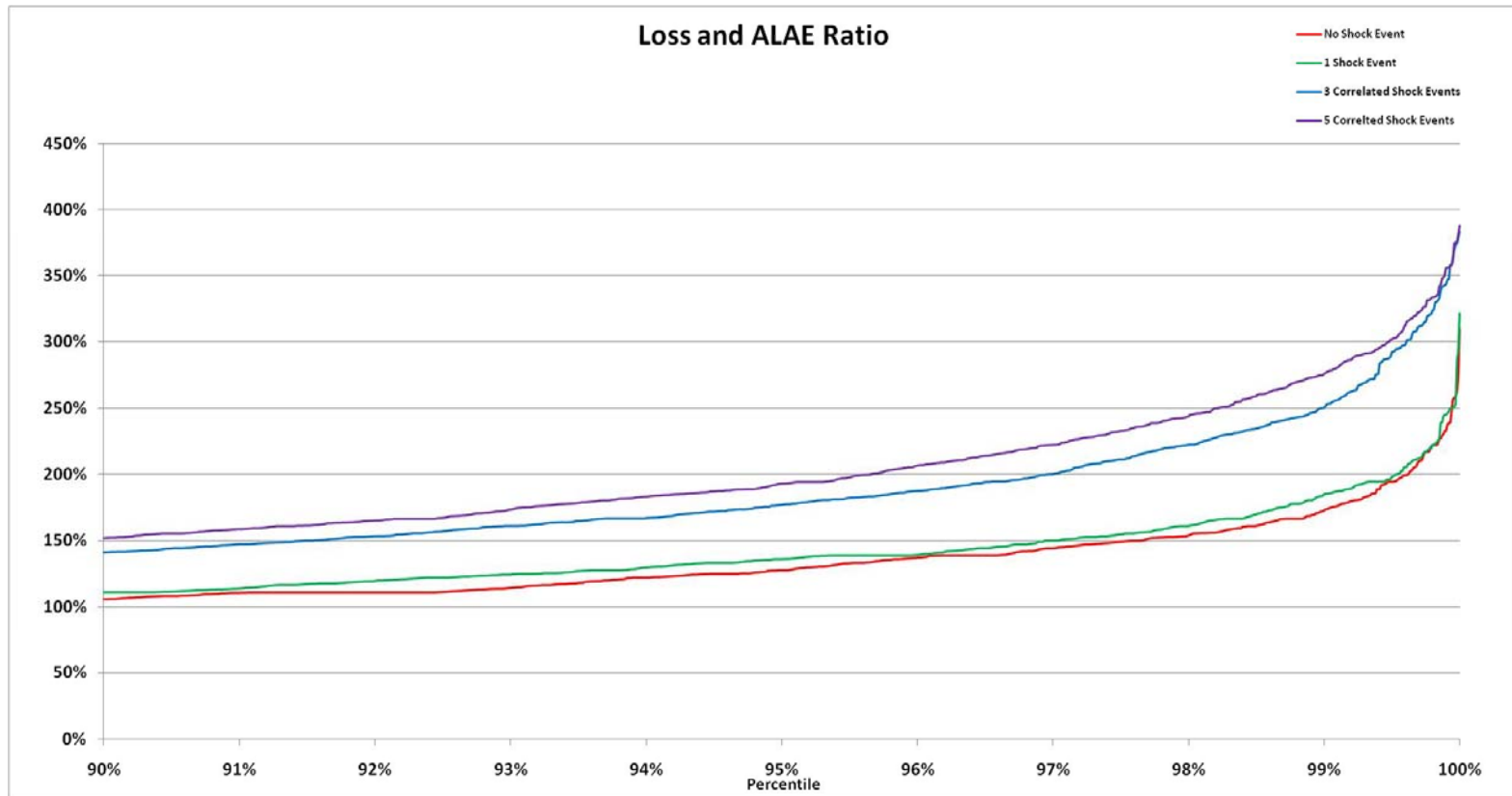
## First Questions to Ask Yourself

- Does the result seem reasonable? **NO!**
- If the output doesn't seem reasonable, is it because the model is flawed or because my gut instinct about the expected results is wrong? **In this case the shock scenarios have less impact than I would have thought and I assume my model is flawed.**

## Revising the Model

- What did I do wrong?
  - My frequency was binomial but I didn't vary the probability of the shock event.
  - My cone of uncertainty was too small – my shock scenarios were not “shocky” enough
  
- How to “correct” it?
  - Varied probability of each shock uniformly from 0.10 to 0.25
  - Shock scenario is 3 X E(n)

## More Reasonable Scenario



## Questions to Ask Yourself

- If the output doesn't seem reasonable, is it because the model is flawed or because your gut instinct about the expected results is wrong?
  - Look at reasonableness overall and on a relative basis
  
- Does the model accurately assess the impact of known past events?
  
- What is the sensitivity of the output to my assumptions?
  
- Is my cone of uncertainty big enough?

# Conclusion

## Conclusion

- You don't have to identify specific emerging risks to establish a stochastic framework for modeling their effect on a (re)insurer
- Requires a thorough job of cataloguing and categorizing types of emerging risks
- Forces an evaluation of correlations and accumulations within the business
- High level of uncertainty should not prevent the building of a model
  - There are ways to minimize some of the uncertainty
  - You can gain an understanding of the uncertainty through scenario testing
- Using the model to make decisions without an understanding of the uncertainty can be worse than using no model at all