Session 38 L, Economic Capital: Key Modeling Considerations

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Economic Capital: Key Modeling Considerations

Daniel Finn
Background

- “Economic Capital” usually refers to two things
  - Economic Capital calculation
  - Calculation of amount of “Required” Capital
Standard Accounting

- Standard Accounting tends to focus on the Income Statement
  - Matching Revenues and Expenses
  - May allow smoothing due to long-term nature of policies

- Balance Sheet is usually a result of Income assumptions
  - For US Stat, Income for most Bonds is based on solely Coupons
  - As a result, Bonds are held at Book Value
Standard Accounting

- Sometimes, this creates a difference between Accounting and Market Value
  - Can happen on Assets
  - More common on the Liability side
- When the difference is large enough, companies find a way around it
  - Finite Reinsurance
  - Term Insurance
Finite Reinsurance

Source: Conning
Term Insurance

Source: Conning
Standard Accounting Risk

- With Standard Accounting, Risk usually occurs when the assumptions are violated
- Consider 2008 and US Stat
Standard Accounting Risk

- Under US Stat accounting, most Bonds are carried at Book Value
  - Exceptions for High Yield and downgraded bonds
- During 2008, Corporate spreads gapped out to unprecedented levels
  - Some bonds got downgraded
  - Majority just dropped in value
  - Not a problem, though, for US Stat fillers
Then, a “funny” thing happened: the auditors got involved

- Under US GAAP, many of these bonds lost enough value to trigger an Other Than Temporary Investment (OTTI) write down
- Auditors stepped in and said: if you write it down for GAAP, we’re going to make you write it down for Stat, as well

Resulted in some companies taking huge write-downs

- Some, like the Hartford, even needed to raise additional capital
Economic Capital

- Since Economic Capital focuses on solvency, it flips the accounting approach on its head
  - Focus is on Balance Sheet
- Want something which is universal
  - Life and P&C
  - Across Multiple Economies
  - Comparable across Companies
  - Not easily manipulated
Economic Capital

- For universal, need to strip away accounting issues
  - Mark Assets and Liabilities to Market
  - Reflect all obligations (e.g. Taxes)
- Risk then arises from Asset and Liabilities moving differently
Economic Capital

- There are a number of issues with this definition
- Biggest is valuing Liabilities
  - Long term obligations
  - No market to “trade” them on
- Can lead to differences between companies
  - Different discount rates
  - Magnitude of Risk Margin
**Required Economic Capital**

- Calculating Economic Capital usually just the first step
  - Typically Followed by calculating “Required” Capital
- “Requirement” is based on why the Company holds Capital
  - Who are the Stakeholders? Regulators? Rating Agencies?
  - How much Capital do they require us to hold?
Consider a Typical example
- Company needs their “A” rating to write business
- To be “A” rated, Rating Agency wants chance of default to be remote (say 1 in 500 over the next year)

In this case, Company would
- Simulate a wide range of possible results
- Determine how much capital they lose in the 99.8% case.
- That amount is the “Required” Capital

Key component of this approach is a robust Economic Scenario Generator (ESG)
Modeling Approach

Diagram:
- Economic Scenario Generator
- Liability Projections
- Management Decision Module
- Financing Accounting Tax Regulatory
- Investment Module
Economic Scenario Generator

- So, what makes a good ESG?
- Clearly, it has to model all of the Company’s Major Economic Risks
  - Interest Rate
  - Spread Changes
  - Equity
  - Inflation
Economic Scenario Generator

- Key focus is this application is on the tails of distributions
- So, models must capture full range of possibilities
  - What has happened
  - What could happen
What Has Happened

UK Equity Returns Since 1694

Source: Bloomberg
What Could Happen

Japan vs. US 10 Year Yield

Source: Bloomberg
Modeling Interest Rate Risk

- Model must go beyond basic risks
- Consider Interest Rate risks
- 3 main sources

**Shift**, **Slope**, **Twist**
Managing Interest Rate Risk

- Most Companies can handle first two
  - Shift can be managed by Duration
  - Slope can be managed by adding key Rate Duration

- Twist is the one that can cause problems
  - Assets tend to be Negatively Convex
  - Liabilities tend to be Positively Convex
  - Can create huge mismatches in Twist Scenarios
Correlation

- Since we are focusing on total risk, another key factor is correlation
  - One bad outcome is a problem
  - Everything going wrong at once is a catastrophe

- Several ways to incorporate this is a model
  - Correlation matrices
  - Copulas
  - Dependency structures
Correlation

- Most common approach is correlation matrices
  - Easy to implement
  - Fairly well understood by non-modelers

- There are some key concerns
  - Become unwieldy for large variable sets
  - Control over tail relationships
Correlation

Consider two normal distributions with 70% correlation

Source: Conning
Correlation

Different picture when we focus on the tail

Source: Conning
Correlation

- Modelers are moving towards Dependency Structures
  - Results of one model feed into other downstream models
  - e.g. Simulated interest Rates impacting Equity Returns
- Results in much more robust relationships
  - Direct control over tail correlations
  - More robust correlation dynamics
Tail Correlation: Equity vs. Equity

Sources: Bloomberg, Conning
Correlation: Interest Rates and Inflation

There is a non-zero correlation between nominal rates and inflation

Sources: Bloomberg/Conning
Correlation: Interest Rates and Inflation

Structural models can create this type of variability in simulations

Simulated Instantaneous Correlation

Source: GEMS® simulation
Model Complexity

- One final consideration is how complex the models need to be
  - Answer really depends on the company

- Some lines have relatively little economic exposure
  - Most P&C lines
  - Whole Life Insurance
  - Will allow a less robust economic modeling platform

- Others, have much more complex needs
Model Complexity

- Consider a Variable Annuity writer
  - Lots of optionality built into the product
    - Minimum guarantees
    - Policyholder put options
  - Typically backed with riskier and more dynamic assets
    - Equities
    - Volatility managed funds
    - Foreign investments
  - Typically include very active risk management
    - Includes use of options to hedge Greeks
Model Complexity

- Need a very robust model to adequately measure the risk
  - Wide range of risky assets
  - Linked options
  - Variable management actions
- Without that, much more likely to miss the next big event
  - Just think back to 2008
Model Complexity

- Of course, 2008 saw huge drops in most Asset Classes
- Only partially offset by company’s hedging programs
- First problem: drops in underlying value brought more guarantees into play
  - Increased Greeks
  - Required purchase of lots additional options
- Second problem: huge spike in option pricing volatilities
  - Led to dramatic increase in cost of additional protection
Key Benefits

- Key question for many companies:
  - What do I get out of all of this?
- Better understanding of risk
  - What could get us in trouble
  - What can we do about it
- Improved ability to evaluate Risk/Reward tradeoffs
  - What happens if we invest more aggressively?
  - What if we bought less reinsurance?
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