

Hedging at Your Insurance Company

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Winter Liu, FSA, MAAA, CFA

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Primary Benefits and Motives of Establishing Hedging Programs

- Hedging can mitigate some of the volatility in earnings, especially for VA and EIA business and has become standard practice for many companies
- Rating agencies are increasing their scrutiny of a company's risk management practices. An effective hedging strategy will support a company's ERM efforts.
- Analysts will view an effective hedge program as a positive aspect of a company's operations, thereby enhancing shareholder value.
 - Peer pressure from largest companies as stock analysts understand effects of hedging on quality of earnings
- Potentially lower and more stable capital required
 - C-3 Phase II
 - Internal economic capital

Overview

- Risk identification
- What am I trying to achieve?
- Which strategy to use?
- Implementation
- Review effectiveness
- Risks after hedging

Identify Risks

Define Objectives

Choose Strategies

Implementation

Review Effectiveness

More Risks?

Identify Risks

- Insurance companies undertake risks for a living
 - Mortality, morbidity, longevity, etc.
- But we want to pick our battles
 - Do not have strength on certain risks
 - Do not want to take too much risks
- Hedging is no stranger to insurance industry
 - Reinsurance
 - Duration / convexity management
- Typical financial risks
 - Interest rate
 - Market
 - Credit
 - Currency

Examples of Financial Risks in Insurance Products – Interest Rate

- Interest rate example 1 – Deferred annuity
 - Expect large surrender at end of SC period, but assets won't mature yet
 - An interest rate spike would cause large capital loss
 - An interest rate forward contract can help lock in sell price
- Interest rate example 2 – Disability block in payout phase
 - Start with assets and no future product cash inflow
 - Liability much longer than assets
 - An interest rate drop when large assets mature would destroy yields
 - An interest rate swap (pay float / get fixed) can help lock in yield
- Both examples show asset/liability duration mismatch
- Sometimes duration match is difficult with on buying and selling assets

Examples of Financial Risks in Insurance Products – Market

- Market example 1 – Equity-index annuity
 - Offset some upside potential but no downside risk
 - Hold all equity vs. hold all bonds
 - Bonds + equity calls

- Market example 2 – Variable annuity
 - Low equity growth hurts fee-based revenue
 - Low equity growth puts various guarantees in the money
 - Equity + puts

- Equity is a simplified term
 - More fund choices

- Equity growth is not the only market risk
 - volatility

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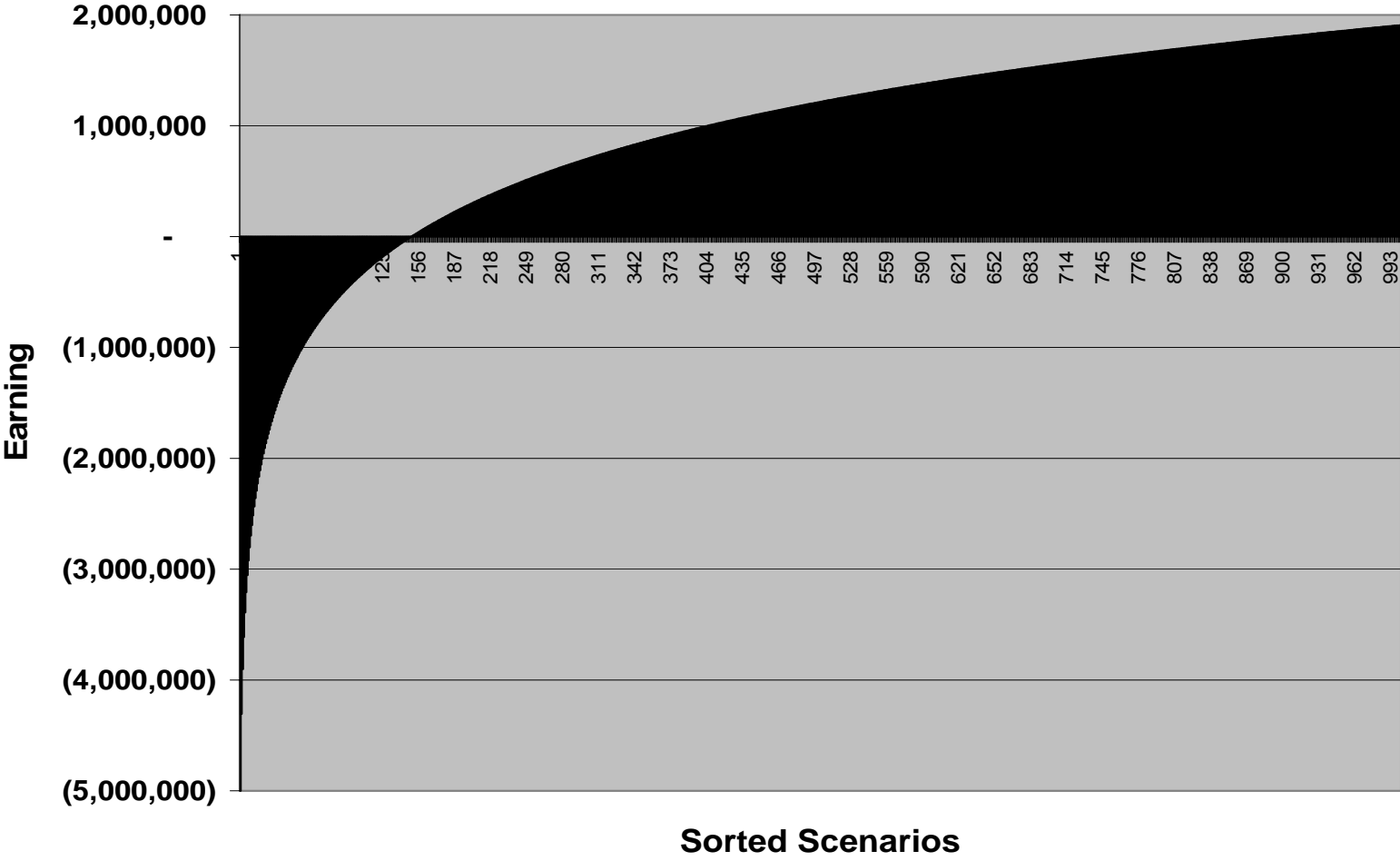
Review Effectiveness

More Risks?

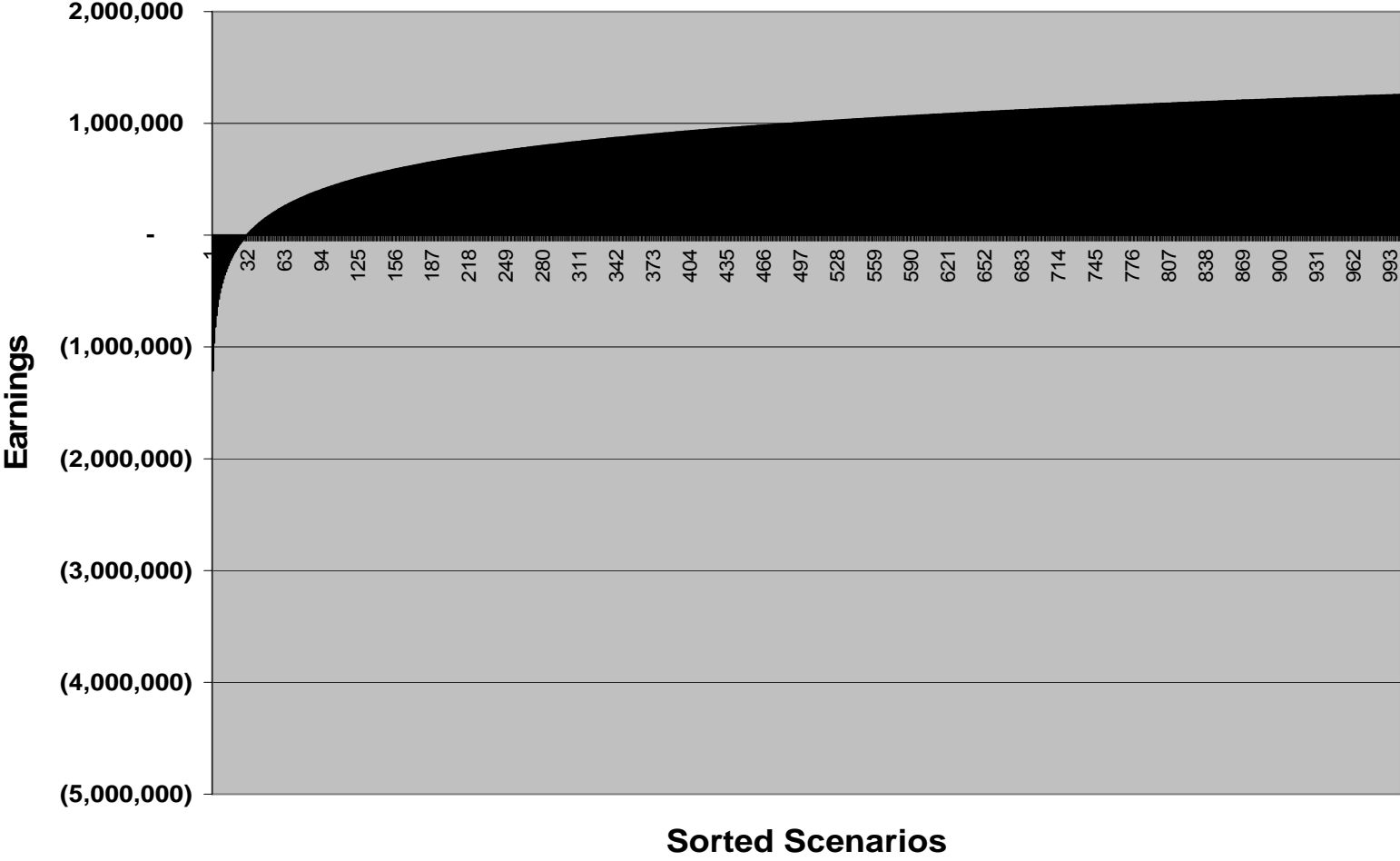
Defined Hedging Goal

- Typical goals
 - Smooth earning patterns
 - Reduce required capital
 - Manage catastrophic events
 - Appropriately price product features
- Hedging usually has a negative expected value
- Help determine strategy
- Help set benchmark to measure effectiveness
 - Need quantifiable goals

Unhedged Earning Profile



Hedged Earning Profile



Unhedged vs. Hedged

| | Unhedged | Hedged |
|----------------|-------------|-------------|
| Min | (5,000,000) | (1,210,915) |
| 1% | (2,603,058) | (354,864) |
| 5% | (1,069,164) | 192,955 |
| 10% | (385,875) | 436,987 |
| 35% | 859,788 | 881,866 |
| Median | 1,215,607 | 1,008,945 |
| Average | 912,128 | 900,559 |
| Stdev | 985,463 | 351,951 |

- Reserves and capitals are often defined by tail (CTE65, CTE90)

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Choose Hedging Strategy

- Some profiling of risk exposure is very helpful
 - Product features
 - Length of guarantees
 - Available fund options / Average fund size
 - Quantification of exposure
 - Risk tolerance
- Typical strategy
 - No hedging
 - Static hedging
 - Dynamic hedging
 - Delta hedging
 - Multiple Greek hedging

Static vs. Dynamic Hedging

- Static hedging
 - Similar to cash flow matching in bond portfolio management
 - Set up and let go
 - Buy from banks
 - Need Tom Hanks, get Tom Hanks
- Dynamic hedging (matching Δ only)
 - Similar to duration matching in bond portfolio management
 - Monitor and frequently rebalance
 - Do it yourself
 - Get someone that acts like Tom Hanks
- Dynamic hedging with multiple Greeks
 - Similar to duration and convexity matching in bond portfolio management
 - Monitor and frequently rebalance
 - Do it yourself (probably buy some from banks)
 - Get someone that looks and acts like Tom Hanks

Static Hedging vs. Dynamic Δ Hedging

- Have 1,000 stocks currently \$60 each. Need to guarantee no lower than \$50 in one year.
- Static hedging solution
 - Need 1,000 one-year put option on the stock @ strike price \$50
 - Buy and leave it
- Dynamic hedging solution
 - Replicate Δ of the put – construct a portfolio with equal sensitivity to stock price change as the put (like duration match)
 - Δ (put) = $N(d1) - 1 = -14.6\%$ (stock +1%, put - 0.146%)
 - Δ (short 14.6% stock) = $-14.6\% \times \Delta$ (stock) = -14.6%
 - Solution: sell 146 shares of stocks
- **1,000 Stock + 1,000 put Vs. 1,000 Stock – 146 Stock**

Delta hedging example

| | Stock price | | | | | |
|--------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | 50 | 55 | 58 | 59 | 59.5 | 60 |
| 1,000 Stock | 50,000 | 55,000 | 58,000 | 59,000 | 59,500 | 60,000 |
| 1,000 Put | 3,730 | 2,210 | 1,590 | 1,420 | 1,340 | 1,260 |
| Total | 53,730 | 57.21 | 59,590 | 60,420 | 60,840 | 61,260 |
| | | | | | | |
| 854 Stock | 42,700 | 46,970 | 49,530 | 50,390 | 50,810 | 51,240 |
| Cash | 10,020 | 10,020 | 10,020 | 10,020 | 10,020 | 10,020 |
| Total | 52,720 | 56,990 | 59,560 | 60,410 | 60,840 | 61,260 |

Problems with Static & Dynamic Hedging

- Static hedging
 - Too expensive
 - Limited availability
- Dynamic hedging
 - Hedging never perfect, even with multiple Greeks
 - Transaction cost due to frequent rebalance – buy low and sell high
 - Monitoring requires sophisticated modeling
 - Weak defense against catastrophic events

Dynamic hedging has become the winner.

How long will that last? Another “Black Monday”?

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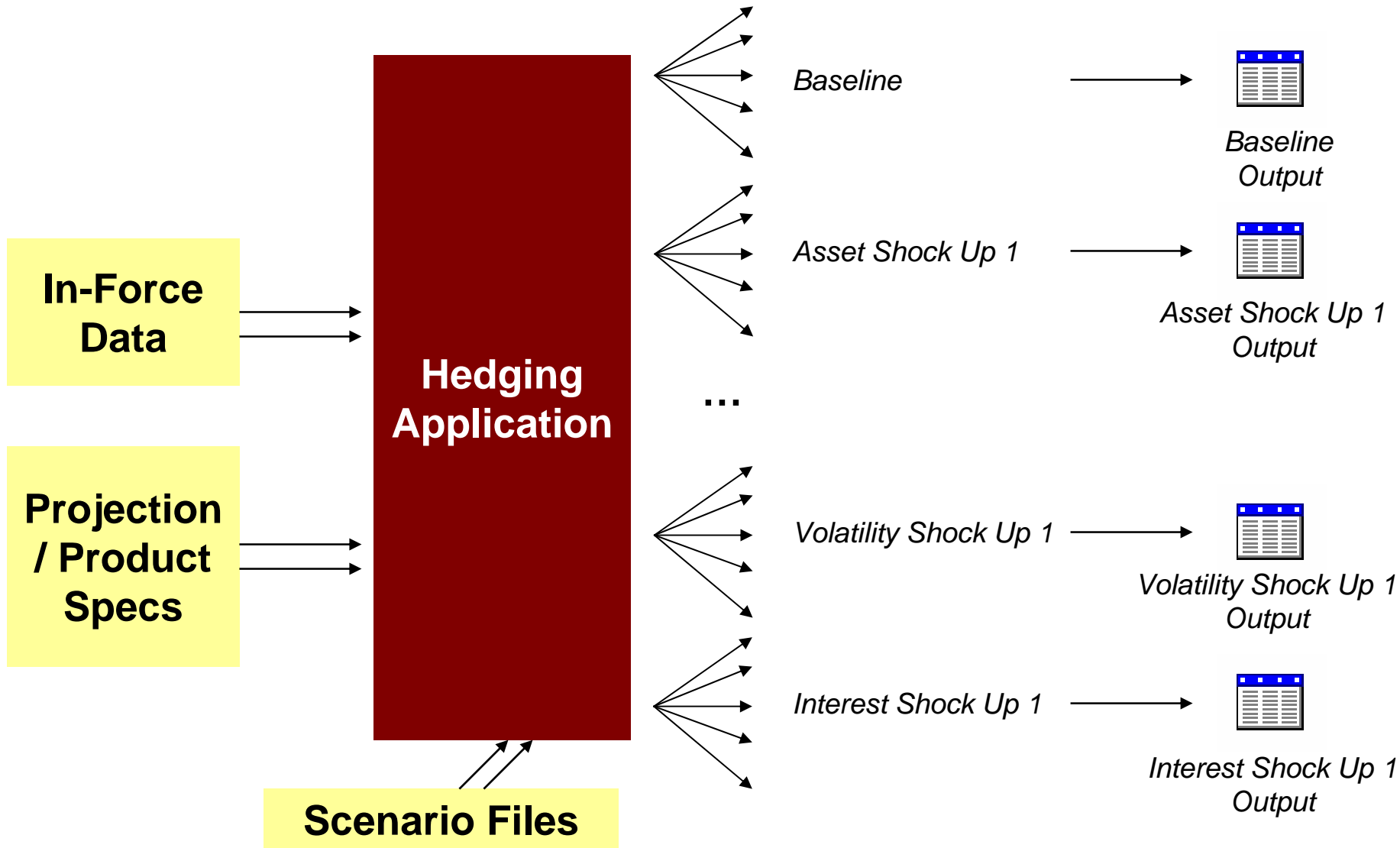
Review Effectiveness

More Risks?

Implementation

- Modeling - Inputs
 - Product / projection specifications
 - In force / new business data
 - Assumptions
 - Policyholder behavior
 - **Economic scenarios**
 - **Shock scenarios: like duration calculation**
- Modeling – Outputs
 - PV of claims and charges – used to estimate cost
 - Greeks at valuation date – used to drive hedging trades
- Execution

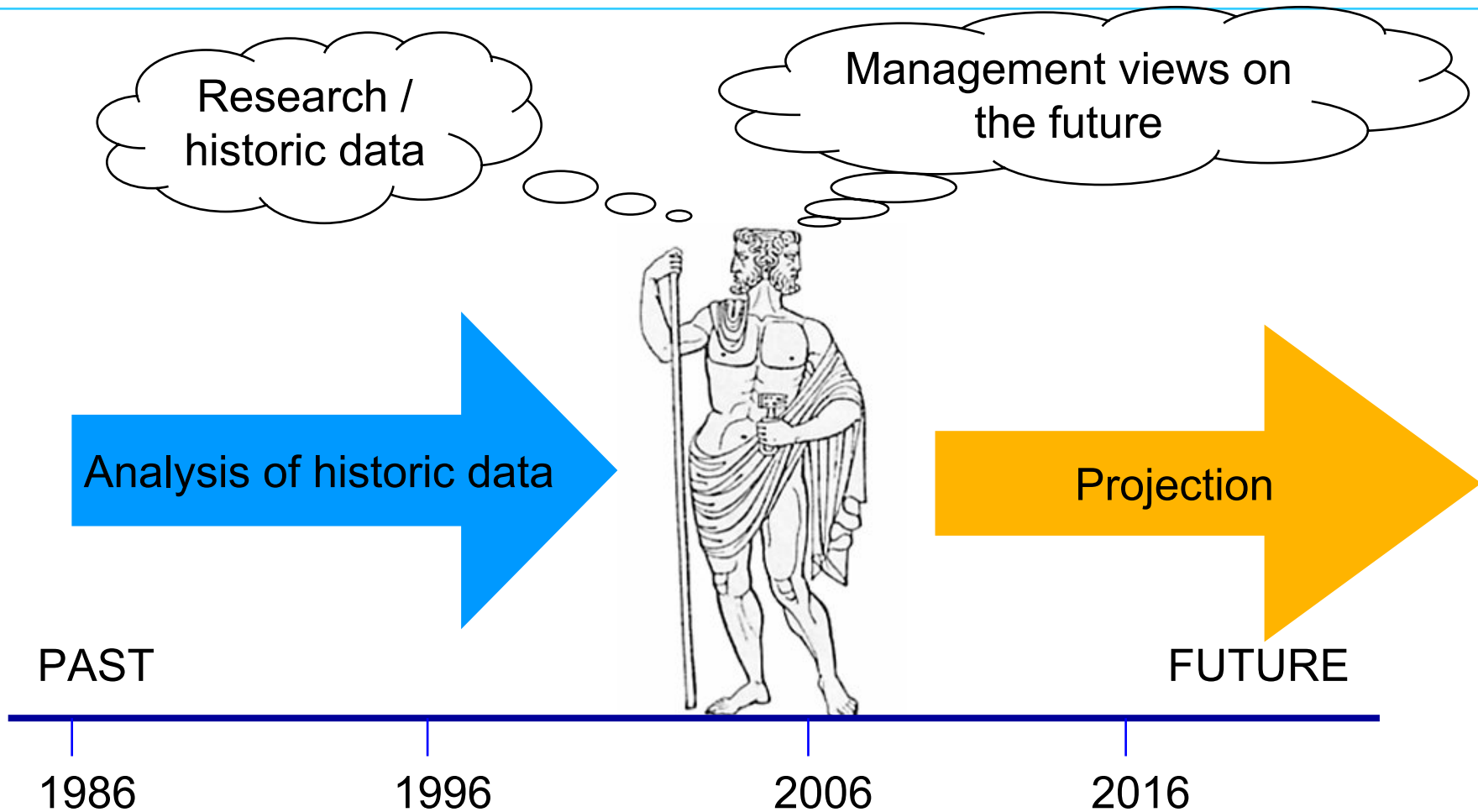
Modeling process



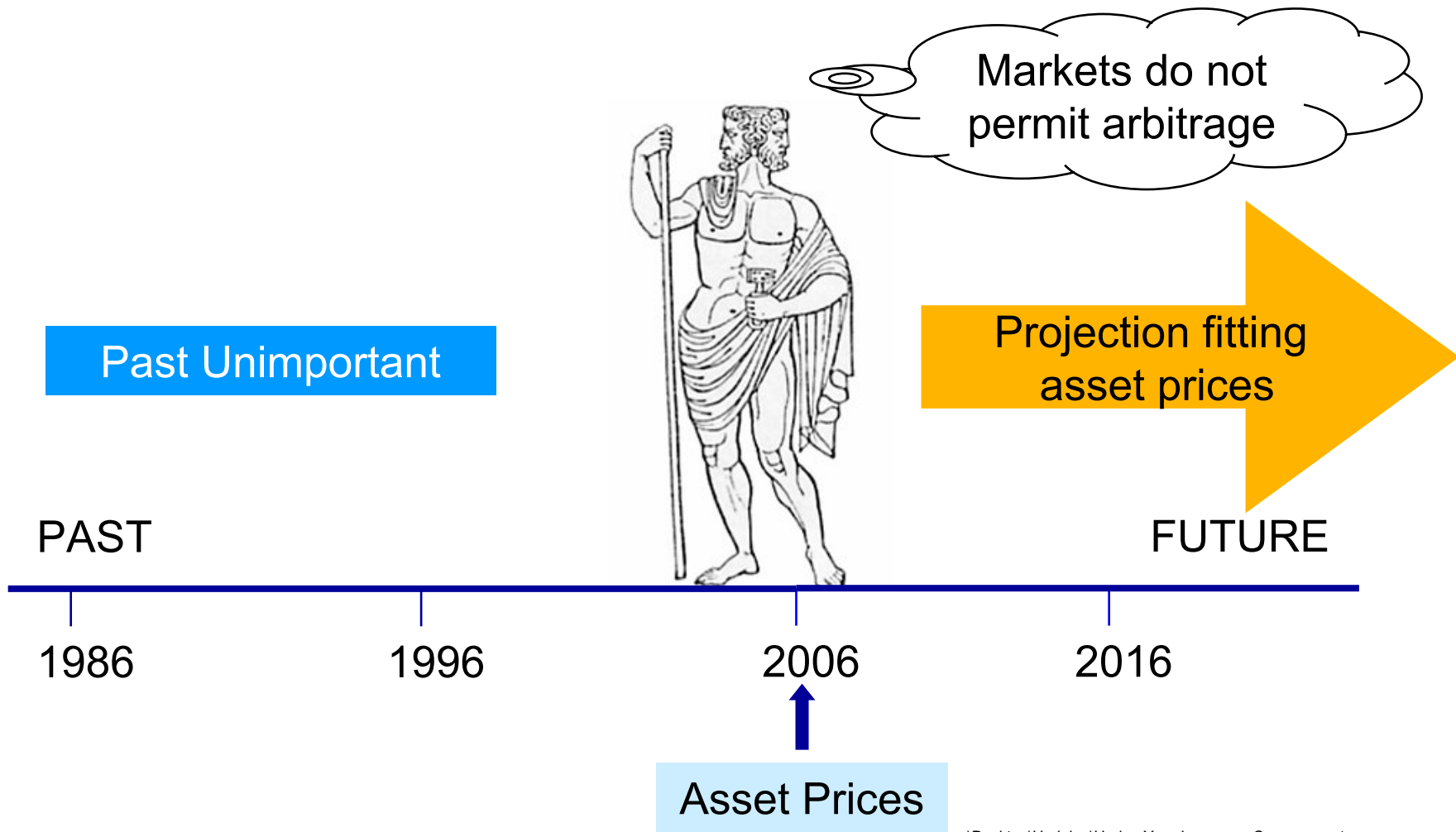
Economic Scenarios

- A hedging model is like any other model - “garbage in, garbage out” and scenario assumption is potentially the largest piece of garbage
- Real world vs. market consistent
- Elements covered
 - Asset indices
 - Asset volatilities
 - Interest rate curve
 - Interest rate volatilities
 - Foreign exchange rates

Real-world scenarios



Market-consistent scenarios



Each Element Needs to Be Calibrated

- Interest rate Yield curve
- Interest rate volatility Swaptions
- Corporate bond volatility Credit derivatives, historic data
- Equity volatility Equity options
- Property volatility exist Historic volatility – options do not exist
- Exchange rates Exchange rate options
- Inflation Index linked options, historic data

Practical Considerations

- Enhance speed performance
 - Scenario selection
 - Distributed processing
 - Smart modeling
- Rebalance frequency
 - Accuracy vs. cost
- Flexibility
 - Can be easily modified to reflect new product features
 - Can be easily modified to reflect new assets classes
 - Can be customized to reflect accounting regulations

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Two Sides of Hedging Effectiveness

- Benefits – Did it achieve the goals? How much value added?
 - Smooth earning patterns
 - Reduce required capital
 - Manage catastrophic events
 - Appropriately price product features
- Costs
 - Overhead cost – modeling, monitoring, etc.
 - Transaction cost
 - Overhedging vs. underhedging
 - Tracking error

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Hedging is NOT a Silver Bullet

- Pricing
 - Can the features be effectively hedged?
 - Is hedging cost incorporated in pricing?
- Basis risk
- Policyholder behavior
- Scenario simulation
 - Risks can be eliminated by assumptions
 - Is “abnormal” quite normal?
- Correlation, concentration & liquidity
 - Financial instruments are increasingly more correlated
 - Amaranth Advisors, New Century Financial
- Got a plan B?

Questions?
