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Session 6

Asset Modeling Concepts

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Session Outline

- Introduction
- Asset model validation
- Modeling considerations for derivatives and assets with embedded options
- Using models to assist with portfolio management

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Introduction

- Striking a balance
- Avoid oversimplification

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Validation of Assets

- Threshold depends upon purpose of model
- Static validation of starting amounts
- Dynamic validation of cash flow and investment income

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Static Validation of Balances

- Validate non-input items
- Portfolio level
- Asset class level
- Individual security level

Dynamic Validation of Output

- Cash flows
- Investment income
- Activity related to embedded options

Validation of Assets

- Top down validation
- 2I / (A+B-I)
- Can validate inforce assets against annual statement schedules D and B
- Can use price curves as validation tool

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Top Down Validation

- Compare annual statement, investment accounting system and other sources to asset model
- Can be done at asset class and individual security level

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Individual Security Validation

- Can use book yields and market value discount spreads as reasonableness check
- Validate electronically against annual statement schedules and investment accounting system

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Individual Security Validation

- Yield for Mortgage backed securities and CMOs depends upon prepayment assumption
- Validation is easier if assets are modeled on seriatim basis

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Price Curves as Validation Tool

- Plot parallel interest rate shift on horizontal axis
- Plot market value on vertical axis

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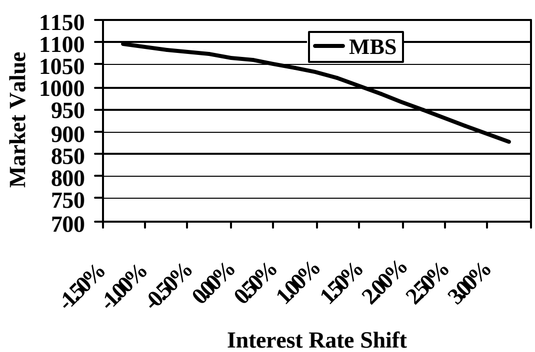
Price Curve Example



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Sources of Modeling Errors

- Bad data
- Misunderstood assets
- Treatment of accrued interest
- Timing of asset cash flows

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Modeling considerations for derivatives and assets with embedded options

- Capturing risks within the model

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Prepayment Assumptions

Bond calls

Mortgage prepayment assumptions

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Bond Calls

- Ability to refinance
- Incentive to refinance

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Bond Calls

- Rate at which debt can be refinanced function of
  - Credit rating of issuer
  - Yield curve
  - Economic environment
- Often simplified in modeling

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Mortgage Prepayments

- Economic
- Non-economic
- Vary seasonally
- Motivated by economics, and investor behavior

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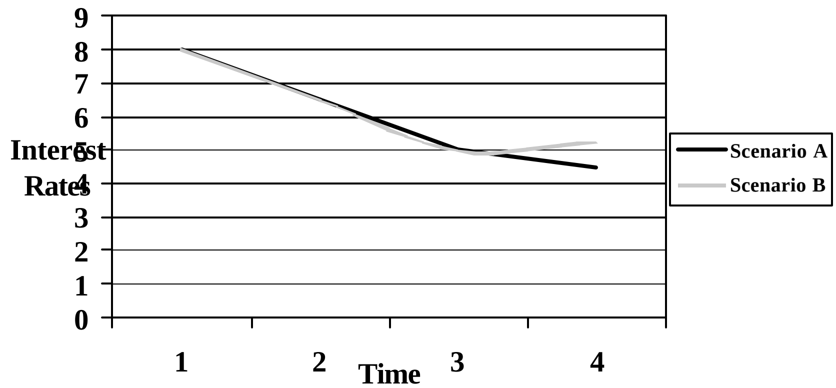
Investor Behavior in Prepayments



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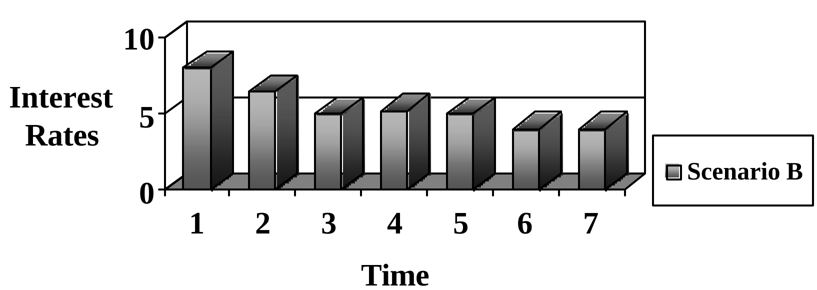
Burnout in Prepayments



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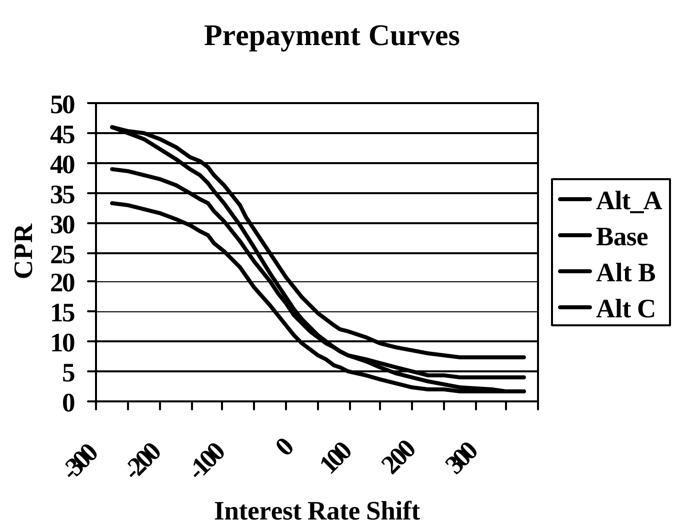
Sensitivity Testing with Alternative Prepayment Curves

- Attempt to strike a balance between too much complexity and oversimplification
- Yield and spread can depend upon prepayment assumptions



Put Options

- Mortgage borrower has put option
- Usually reflected in credit risk

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Modeling Volatility

- Interest rate and equity volatility
- Historical and implied volatility
- Constant
- Stochastic
- Regime switching

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Modeling Assumptions for Derivatives

- Pricing derivatives requires risk neutral model
- Realistic models often used for modeling
- Normalization

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Risk Neutral Models

- Used for pricing of assets and liabilities
- Give pricing consistent with capital markets

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Realistic Models

- Determine the range of results of a portfolio of assets and liabilities using historically based parameters

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Uses of Realistic Models

- Care must be used with realistic models to avoid exploitation of arbitrage opportunities that exist in the model

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Consistency between Asset and Liability Models

- Do hedge derivatives benefit policyholder or company?
- Important to consider intention of company

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Modeling Considerations for Equity Based Products

- Historical Volatility
- Implied Volatility
- Expected Return

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Using Models to Assist With Portfolio Management

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Stochastic Models as Risk Management Tools

- Ability to demonstrate interaction between assets and liabilities

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Duration Risk Example

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Portfolio Risk Management Tools

- Value at risk (VaR)
- Contingent Tail Expectation (CTE)
- Benchmarking

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Value At Risk (VaR)

- Maximum loss at given confidence level over defined period
- Percentile of distribution of negative results

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CTE

- Contingent Tail Expectation
- Average result for selected group of worst performing scenarios

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Benchmarking

- Uses model and actual experience to evaluate portfolio manager
- Compares manager’s performance to that of hypothetical low (or no) risk benchmark portfolio

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Benchmark Portfolios:

- Liability duration matched portfolio of investment grade corporate bonds
- Portfolio of bonds, calls, and puts that exactly replicates liabilities

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Benchmarking

- Manager has authority to deviate from benchmark portfolio within certain risk limits and regulatory and rating agency considerations

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Benchmarking

- Manager is evaluated on performance of portfolio relative to benchmark portfolio

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