Immunization

Veronesi, Chapter 3
Tuckman, Chapter 7

Asset-Liability Management

• Suppose you have liabilities or obligations consisting of a stream of fixed cash flows you must pay in the future.
  • Bond defeasance
  • Pension liabilities
  • Insurance liabilities
• How can you structure an asset portfolio to fund these liabilities?
Dedication

• The only completely riskless approach is to construct an asset portfolio with cash flows that exactly match the liability cash flows.
• This funding method is called dedication.
• This approach may be infeasible or excessively costly.
• In some situations, risk managers may want more flexibility.

Immunization

• Consider a more flexible but more risky approach, called immunization:
  • The liabilities have a certain market value.
  • That market value changes as time passes and as interest rates change.
• Construct an asset portfolio with
  • the same market value and
  • the same duration as the liabilities
  • so that the asset value tracks the liability value over time.
• Can include derivatives as well as fixed cash flows.
Typical Duration Mismatches

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<th>Assets</th>
<th>Liabilities</th>
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<td>Commercial banks (+)</td>
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<td>Insurance companies (-)</td>
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<td>Pension funds (-)</td>
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<td>Corporations (+)</td>
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From Veronesi, p. 97.

Duration/Market Value Matching

• Change in value ~ dollar duration x change in rates

• Matching the dollar duration of assets and liabilities means matching their changes in value if all rates change by the same amount—hedges against parallel yield curve shifts.

• Matching market value means liabilities are fully funded.

• Hedging against parallel shifts is really just a first step.
**Structuring an Asset Portfolio**

- Suppose your liabilities have market value of $100M and duration of 6.
- You want to structure an asset portfolio with the same market value and duration.
- Construct an asset portfolio with just two securities:
  - A bond with price $110 and duration 8
  - A CMO with price $70 and duration 4
- **Class Problem**: What are the number of units of the bond and CMO, N1 and N2, in the immunizing asset portfolio?

**Simply Dollar Duration Matching**

- Suppose your liabilities have dollar duration of 100M and your assets have dollar duration 500M
- You want to leave your existing assets in place and close the gap by selling forward contracts (or swaps, or futures).
- Suppose each contract has present value zero and dollar duration of 10M.
- **Class Problem**: How many contracts must you sell to give your net position zero dollar duration?