



Immunization



Fixed income

Bullet immunization

- Say you need to finance a payment of \$100k in 8 years
- You could invest in an 8-year zero, and you are done
- If not feasible, you could invest in a bond or portfolio of bonds with an 8 year duration
- *Bullet immunization*: duration=investment horizon



Balance-sheet immunization (stolen from Ivan)

Example 3: Hedging interest rate risk

- Consider the balance sheet of the financial institution:

Table 3.5 Asset and Liabilities of a Financial Institution

Assets				Liabilities			
Item	Amount	Duration	Dollar Duration	Item	Amount	Duration	Dollar Duration
Cash	100	0	0	Deposits	600	0	0
S.T. Loans	300	0.8	240	S.T. Debt	400	0.5	200
M.T. Loans	500	3	1500	M.T. Debt	400	4	1600
L.T. Loans	1500	12	18000	L.T. Debt	400	8	3200
Total	2400		19740	Total	1800		5000
				Equity	600		14740

- How much would the equity change due to a 1% shift in interest rates?

Insurance companies

- The liabilities of insurance and pension companies are or very much look like a predictable, growing annuity
- They can cash-flow match (expensive) or duration match (cheaper)
- But growing annuities become super convex at low interest rates (why?), so:
 1. Frequent readjustments are needed as rates fall
 2. Demand for safe assets from insurance companies rise as rates fall
- Appears borne out by the data (see BIS paper) and may create downward spiral for rates



The general idea

- A portfolio that features fixed-rate bonds is subject to interest risk
- Duration (first order) and convexity (second order) are measures of that risk
- This risk can be mitigated:
 1. Forward/futures (set the delivery price today)
 2. Buy bond put options, sell call options
 3. Cash-flow matching
 4. Duration matching



Option example

- A risk-free bond has duration of 5 and both a face value and market value of \$10M
- A T-bond put option on an underlying bond worth \$9.5 and of duration 10 has a delta of -0.5
- First order dollar risk (in \$M): 10×5
- Put option dollar risk (in \$M): $9.5 \times 10 \times 0.5$
- Buy $\frac{10 \times 5}{9.5 \times 10 \times 0.5}$ puts to eliminate all first-order risk



Using plain vanilla swaps

- Swapping fixed payments for floating payments reduces an intermediary's duration risk
- Indeed, floating instrument have very low duration (no higher than the time to the next reset)
- Intermediaries can measure their duration exposure and control it at will via swaps
- In fact they have to, by law, and swaps are the quickest way to get compliant



The Orange County bankruptcy, again

- In addition to investing in inverse floaters...
- ... they also engaged in massive duration mismatch (2-5 year treasuries on the asset side, 24h repos on the liability side)
- Both are bets on falling rates
- In 1994, rates rose, OC became insolvent, fire sale ensued, game over



Leverage mechanics: the case of M-Reits

- REITs are corporations that are exempt from corporate taxation as long as:
 1. They invest mostly in real estate assets
 2. They distribute most of their net income each quarter
 3. They have a diffuse shareholder base
 4. ...
- Mortgage REITs invest in mortgages and mortgage-backed securities
- Their dividend yield oscillates between 10 and 20 percent a year (!)
- How? Massive leverage

