

CHAPTER 8

Interest Rate Risk I



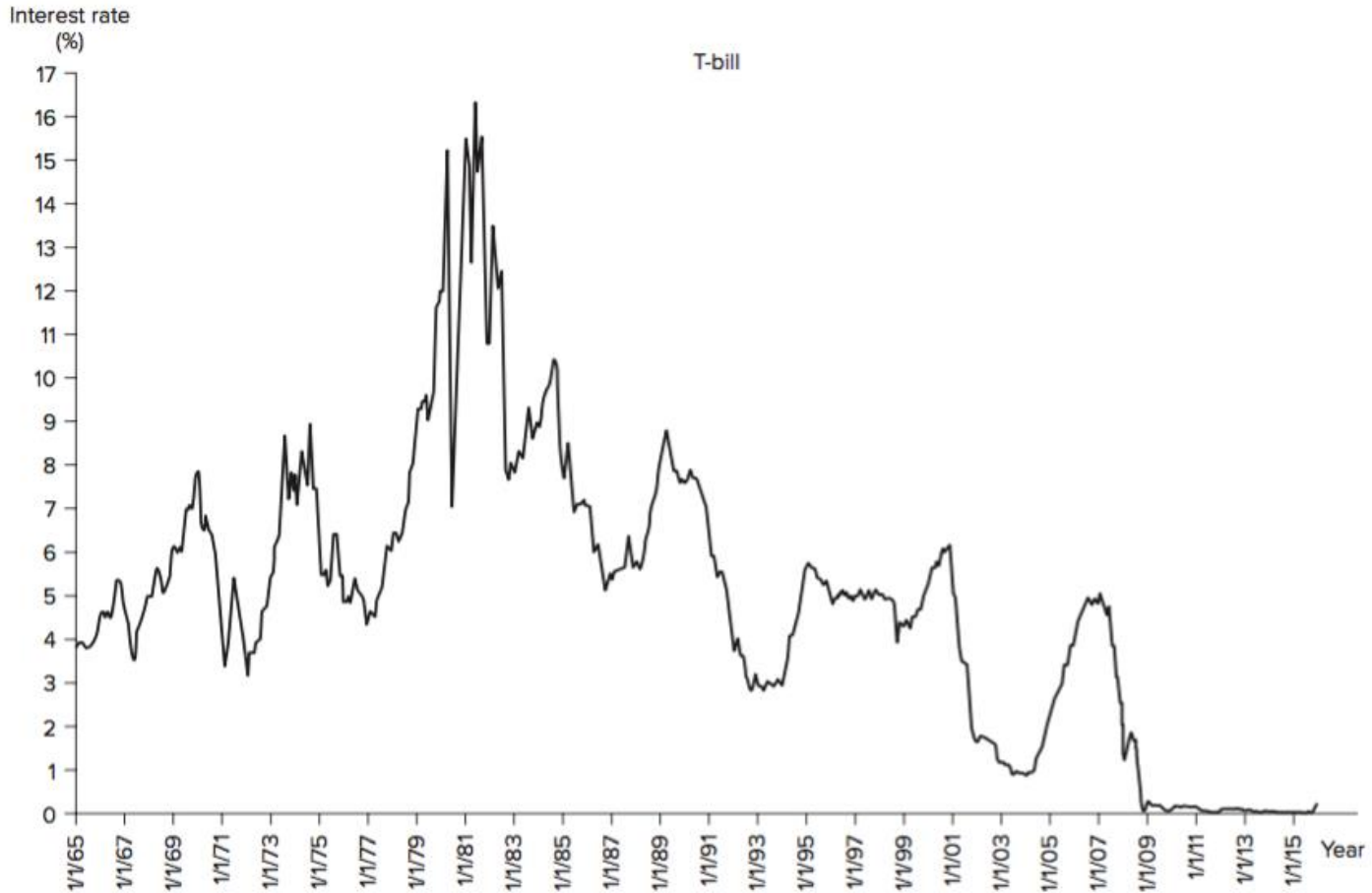
Overview

- This chapter discusses the interest rate risk associated with FIs:
 - Federal Reserve monetary policy
 - Repricing model
- Appendices 8A and 8B:
 - The Maturity Model
 - www.mhhe.com/saunder9e
 - Term Structure of Interest Rates

Interest Rates and Net Worth

- FIs exposed to interest rate risk due to maturity mismatches between assets and liabilities
- Interest rate changes can have severe impact on net worth
 - Thrifts, during 1980s

US Treasury Bill Rate, 1965 - 2015



Level and Movement of Interest Rates

- Federal Reserve: U.S. central bank
 - Open market operations influence money supply, inflation, and interest rates
 - Actions of Fed (December, 2008) in response to economic crisis
 - ◆ Target rate between 0.0 and $\frac{1}{4}$ percent

Central Bank and Interest Rates

- Actions mostly target short term rates
 - Focus on federal funds rate, in particular
- Interest rate changes and volatility increasingly transmitted from country to country due to increased globalization of financial markets
 - Statements by Janet Yellen can have dramatic effects on world interest rates

Repricing Model

- Repricing, or funding gap, model based on book value
- Contrasts with market value-based maturity and duration models in appendix

Repricing Model Continued

- Rate sensitivity means repricing at (or near) current market interest rates within a specified time horizon
- Repricing gap is the difference between rate-sensitive assets (RSAs) and rate-sensitive liabilities (RSLs)
- Refinancing risk
- Reinvestment risk

Maturity Buckets

- Commercial banks must report quarterly repricing gaps for assets and liabilities with maturities of:
 - One day
 - More than one day to three months
 - More than three months to six months
 - More than six months to twelve months
 - More than one year to five years
 - More than five years

Repricing Gap Example

	<u>Assets</u>	<u>Liabilities</u>	<u>Gap</u>	<u>Cum.</u> <u>Gap</u>
1-day	\$ 20	\$ 30	\$-10	\$-10
>1 day-3mos.	30	40	-10	-20
>3mos.-6mos.	70	85	-15	-35
>6mos.-12mos.	90	70	+20	-15
>1 yr.-5yrs.	40	30	+10	-5
>5 years	10	5	+5	0

Applying the Repricing Model

$$\Delta NII_i = (GAP_i) \Delta R_i = (RSA_i - RSL_i) \Delta R_i$$

- Example 1:

In the one day bucket, gap is -\$10 million. If rates rise by 1%,

$$\Delta NII_i = (-\$10 \text{ million}) \times .01 = -\$100,000$$

Applying the Repricing Model Continued

- Example 2:

If we consider the cumulative 1-year gap,

$$\begin{aligned}\Delta NII_i &= (CGAP) \Delta R_i = (-\$15 \text{ million})(.01) \\ &= -\$150,000\end{aligned}$$

Rate-Sensitive Assets

- Examples from *hypothetical* balance sheet:
 - Short-term consumer loans: Repriced at year-end, would just make one-year cutoff
 - Three-month T-bills: Repriced on maturity every 3 months
 - Six-month T-notes: Repriced on maturity every 6 months
 - 30-year floating-rate mortgages: Repriced (rate reset) every 9 months

Rate-Sensitive Liabilities

- RSLs bucketed in same manner as RSAs
- Demand deposits warrant special attention
 - Generally considered rate-*insensitive* (act as core deposits), but there are arguments for their inclusion as rate-sensitive liabilities

GAP Ratio

- May be useful to express interest rate sensitivity in ratio form as $CGAP/Assets$, referred to as “gap ratio”
 - Provides direction and scale of exposure
- Example:
 - Gap ratio = $CGAP/A = \$15 \text{ million} / \$270 \text{ million} = 0.056$, or 5.6 percent

Equal Rate Changes on RSAs, RSLs

- Example 8-1: Suppose rates rise 1% for RSAs and RSLs. Expected annual change in NII,

$$\begin{aligned}\Delta NII &= CGAP \times \Delta R \\ &= \$15 \text{ million} \times .01 \\ &= \$150,000\end{aligned}$$

- CGAP is positive, change in NII is positively related to change in interest rates
- CGAP is negative, change in NII is negatively related to change in interest rates

Unequal Changes in Rates

- If changes in rates on RSAs and RSLs are not equal, the spread changes

- In this case,

$$\Delta NII = (RSA \times \Delta R_{RSA}) - (RSL \times \Delta R_{RSL})$$

Unequal Rate Change Example

- Example 8-2:

RSA rate rises by 1.2% and RSL rate rises by 1.0%

$$\begin{aligned}\Delta NII &= \Delta \text{ interest revenue} - \Delta \text{ interest expense} \\ &= (\$155 \text{ million} \times 1.2\%) - (\$155 \text{ million} \times 1.0\%) \\ &= \$310,000\end{aligned}$$

Weaknesses of Repricing Model

- Weaknesses:
 - Ignores market value effects of interest rate changes
 - Overaggregative
 - ◆ Distribution of assets and liabilities within individual buckets is not considered
 - ◆ Mismatches within buckets can be substantial
 - Ignores effects of rate-insensitive runoffs
 - ◆ Bank continuously originates and retires consumer and mortgage loans
 - ◆ Runoff of rate-insensitive asset/liability is rate-sensitive

Weaknesses of Repricing Model Continued

- Off-balance-sheet items are not included when considering cash flows
 - Hedging effects of off-balance-sheet items not captured
 - Example: Futures contracts

The Maturity Model

- Explicitly incorporates market value effects
- For fixed-income assets and liabilities:
 - Rise (fall) in interest rates leads to fall (rise) in market value
 - The longer the maturity, the larger the fall (rise) in market value for interest rate increase (decrease)
 - Fall in value of longer-term securities increases at diminishing rate for given increase in interest rates

Maturity of Portfolio

- Maturity of portfolio of assets (liabilities) equals weighted average of maturities of assets (liabilities) that make up the portfolio
- Principles stated on previous slide regarding individual securities apply to portfolios, as well
- Typically, maturity gap, $M_A - M_L, > 0$ for most banks and thrifts

Effects of Interest Rate Changes

- Size of the gap determines the size of interest rate change that would drive net worth to zero
- Immunization
 - Maturity matching, $M_A - M_L = 0$
 - Note: Doesn't always protect FI against interest rate risk

Leverage

- Leverage affects ability to eliminate interest rate risk using maturity model
 - Example: \$100 million in assets invested in one-year, 10% coupon bonds and \$90million in liabilities in one-year deposits paying 10%.

Maturity gap is zero, but exposure to interest rate risk is not zero.

Duration

- Matching of maturities can still result in interest rate risk due to the timing of cash flows between assets and liabilities not being perfectly matched
- FI can only immunize against interest rate risk by matching average lives of an assets and liabilities
 - See Chap. 9

Term Structure of Interest Rates

- Compares market yields or interest rates on securities
 - Assumes all characteristics (i.e., default risk, coupon rate, etc.) are the same, except for maturity
- Most common shapes of yield curve for Treasury securities
 - Upward-sloping
 - Downward-sloping, or inverted
 - Flat

Unbiased Expectations Theory

- At a given point in time, yield curve reflects market's current expectations of future short-term rates
- Long-term rates are geometric average of current and expected short-term interest rates
- $(1 + {}_1R_N)^N = (1 + {}_1R_1)[1 + E({}_2r_1)] \dots [1 + E({}_Nr_1)]$

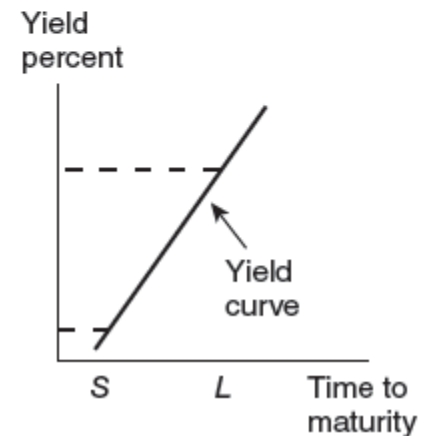
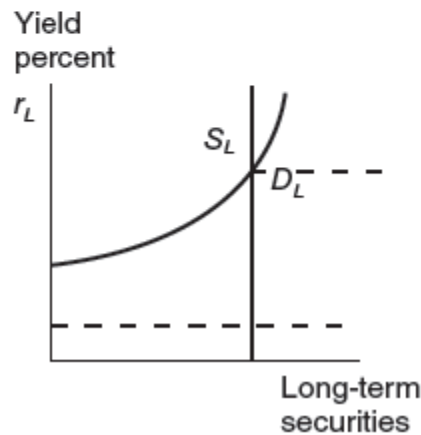
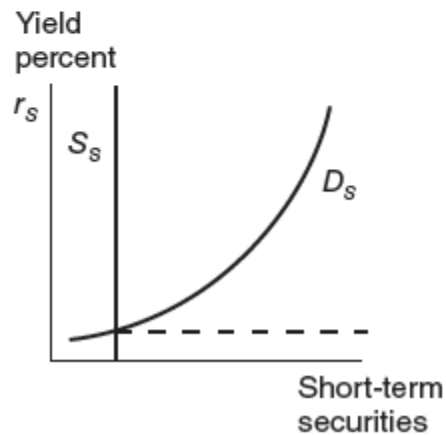
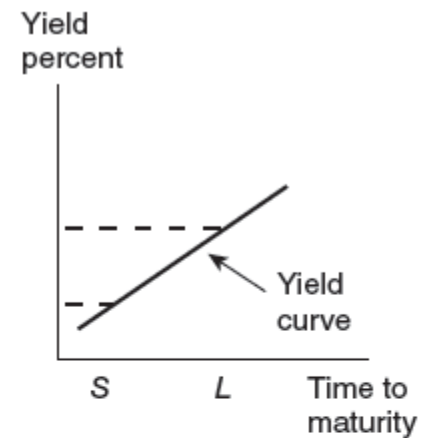
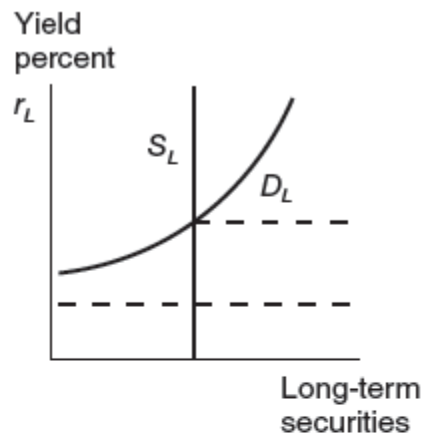
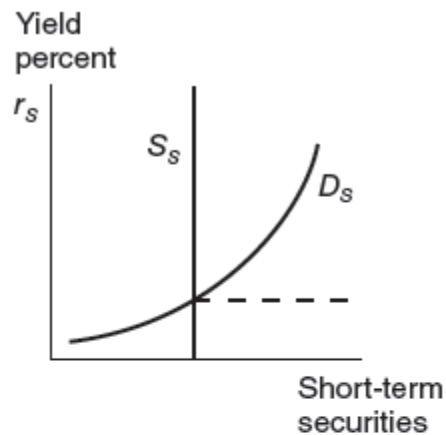
Liquidity Premium Theory

- Weaknesses of unbiased expectations theory
 - Assumes investors are risk-neutral
 - Doesn't recognize that forward rates aren't perfect predictors of future interest rates
- Liquidity premium theory
 - Allows for future uncertainty
 - Implicitly assumes that investors prefer short-term securities

Market Segmentation Theory

- Investors have specific preferences in terms of maturity
- Securities with different maturities are not perfect substitutes
 - Investors are risk averse to securities that do not meet their maturity preferences
- Yield curve reflects intersection of demand and supply of individual maturities

Market Segmentation and Determination of Slope of Yield Curve



Maturity Model Weaknesses

- Two major shortcomings
 - Does not account for the degree of leverage in the FI's balance sheet
 - Ignores the timing of the cash flows from the FI's assets and liabilities

Web Resources

- For information related to central bank policy, visit:

Bank for International Settlements

www.bis.org

Federal Reserve Bank

www.federalreserve.gov