Outline

1. The repricing model
2. Disadvantages of the Repricing model
3. Tutorial exercises

Recap

Interest rate risk

"The risk incurred by an FI when the maturities of its assets and liabilities are mismatched".

- Refinancing risk: *"The risk that the cost of rolling over or reborrowing funds will rise above the returns being earned on asset investments"* (Saunders and Cornett, 2017, p. 179).

The maturity of Liabilities < The maturity of Assets

- Reinvestment risk: *"The risk that the return on funds to be reinvested will fall below the cost of funds"* (Saunders and Cornett, 2017, p. 179).

The maturity of Liabilities > The maturity of Assets

Refinancing risk

Example 1: An FI that issues \$ 100 million of Liabilities of one-year maturity to finance the purchase of \$ 100 million of Assets with a two-year maturity.

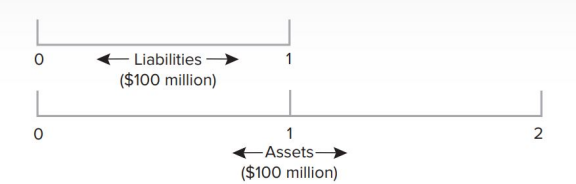

Figure: The maturity of Liabilities < The maturity of Assets.

Refinancing risk

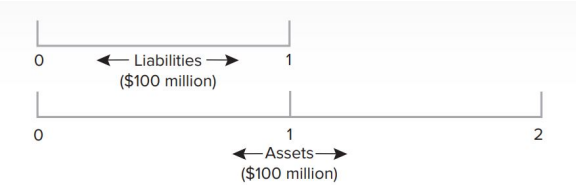

Figure: The maturity of Liabilities < The maturity of Assets.

Year 1:

- Cost of fund = 9%/year; Return on assets = 10%/year.
- Profit = \$1 million.

Refinancing risk

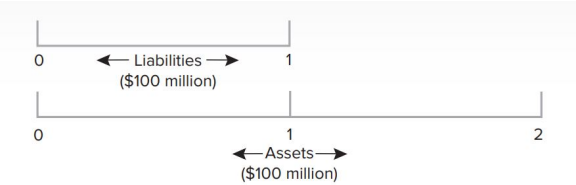

Figure: The maturity of Liabilities < The maturity of Assets.

Year 2:

- Cost of fund = 9%/year; Return on assets = 10%/year.
  Profit = \$1 million.

Refinancing risk

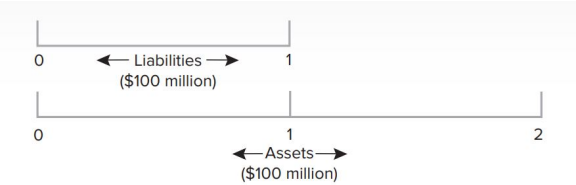

Figure: The maturity of Liabilities < The maturity of Assets.

However, if in Year 2:

- Cost of fund = **11%/year**; Return on assets = 10%/year.
- Profit = -$1 million.

Refinancing risk

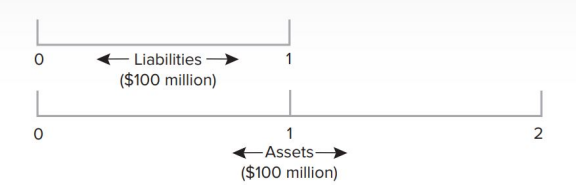

Figure: The maturity of Liabilities < The maturity of Assets.

Refinancing risk: *"The risk that the cost of rolling over or reborrowing funds will rise above the returns being earned on asset investments"* (Saunders and Cornett, 2017, p. 179).

Reinvestment risk

Example 2: An FI borrows $100 million for a longer term than the $100 million of assets in which it invests.

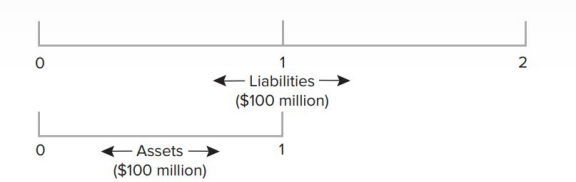

Figure: The maturity of Liabilities > The maturity of Assets.

Reinvestment risk

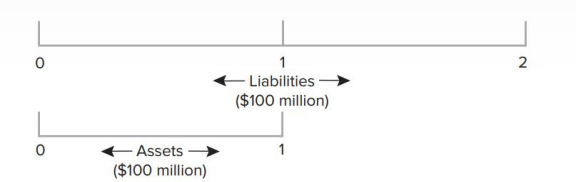

Figure: The maturity of Liabilities > The maturity of Assets.

Year 1:

- Cost of fund = 9%/year; Return on assets = 10%/year
- Profit = $1 million

Reinvestment risk

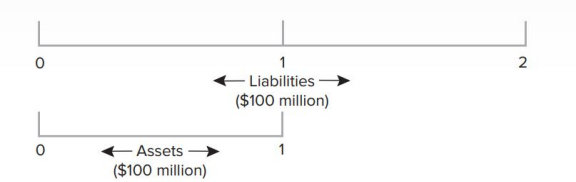

Figure: The maturity of Liabilities > The maturity of Assets.

Year 2:

- Cost of fund = 9%/year; Return on assets = **8%/year**
- Profit = -$1 million

Reinvestment risk

Example 2: An FI borrows $100 million for a longer term than the $100 million of assets in which it invests.

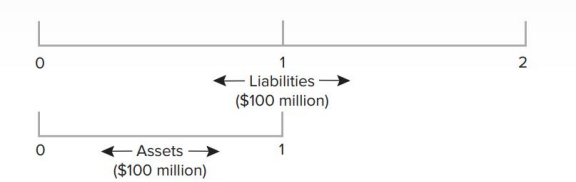

Figure: The maturity of Liabilities > The maturity of Assets.

Reinvestment risk: *"The risk that the return on funds to be reinvested will fall below the cost of funds"* (Saunders and Cornett, 2017, p. 179).

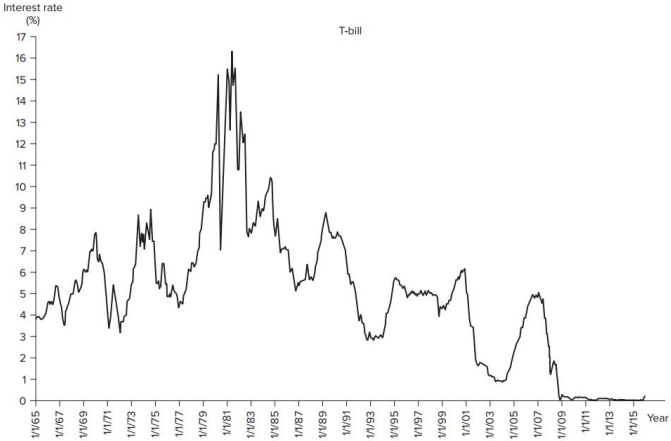

Figure: Interest Rate on U.S. 91-Day Treasury Bills, 1965–2015

Saunders & Cornett (2017, p. 202)

The repricing model

Repricing model: Book value accounting cash flow analysis of the *repricing gap* between the interest income earned on an FI's assets and the interest expense paid on its liabilities (or its net interest income) over a particular period of time.

> **Repricing gap**: The difference between assets whose interest rates will be repriced or changed over some future period and liabilities whose interest rates will be repriced or changed over some future period.
>
> **Rate-sensitive asset/liability**: An asset or liability that is repriced at or near current market interest rates within a maturity bucket.
>
> Will or can this asset or liability have its interest rate changed within the next year? If the answer is "YES", it is a rate-sensitive asset or liability. If the answer is "NO", it is not rate sensitive!
>
> GAP = Rate-sensitive assets (RSAs) – Rate-sensitive liabilities (RSLs)

The Repricing model

Example 1: Identify one-year RSAs and RSLs

Assets		Liabilities	
1. Short-term consumer loans (one-year maturity)	$ 50	1. Equity capital (fixed)	$ 20
2. Long-term consumer loans (two-year maturity)	25	2. Demand deposits	40
3. Three-month Treasury bills	30	3. Passbook savings	30
4. Six-month Treasury notes	35	4. Three-month CDs	40
5. 3-year Treasury bonds	70	5. Three-month bankers acceptances	20
6. 10-year, fixed-rate mortgages	20	6. Six-month commercial paper	60
7. 30-year, floating-rate mortgages (rate adjusted every nine months)	40	7. 1-year time deposits	20
		8. 2-year time deposits	40
	$270		$270

Rate sensitive assets [one year]

- Short-term consumer loans (one-year maturity)
- Three-month T-bills
- Six-month T-notes
- 30-year floating-rate mortgages (rate adjused every nine months)

The Repricing model

Example 1: Identify one-year RSAs and RSLs.

Assets		Liabilities	
1. Short-term consumer loans (one-year maturity)	$ 50	1. Equity capital (fixed)	$ 20
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	$270		$270

Rate sensitive liabilities [one year]

- Three-month CDs
- Three-month bankers acceptances
- Six-month commercial paper
- One-year time deposits

The Repricing model

Example 1: Identify one-year RSAs and RSLs

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1. Short-term consumer loans (one-year maturity)	$ 50	1. Equity capital (fixed)	$ 20
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Note: Demand deposits are not RSLs.

- The explicit interest rate on demand deposits is zero by regulation.
- Although explicit interest is paid on transaction accounts, the rates paid by FIs do not fluctuate directly with changes in the general level of interest rates.
- Demand deposits act as core deposits for FIs. So they are a long-term source of funds.

The repricing model

Problem 13 (Textbook)

Which of the following assets or liabilities fit the **one year** rate or repricing sensitivity test?

(a) 91-day Treasury Notes
(b) One year Treasury Bonds
(c) 20 year Treasury Bonds
(d) 20 year floating-rate corporate bonds with annual repricing
(e) 30 year floating-rate mortgages with annual repricing
(f) 30 year floating-rate mortgages with biannual repricing
(g) Overnight interbank funds
(h) Nine month fixed-rate term deposits
(i) One year fixed-rate term deposits
(j) Five year floating-rate corporate bonds with annual repricing
(k) Common equity

The repricing model

Problem 13 (Textbook)

Which of the following assets or liabilities fit the **one year** rate or repricing sensitivity test?

(a) 91-day Treasury Notes

(b) One year Treasury Bonds

(c) 20 year Treasury Bonds

(d) 20 year floating-rate corporate bonds with annual repricing

(e) 30 year floating-rate mortgages with annual repricing

(f) 30 year floating-rate mortgages with biannual repricing

every 2 years

(g) Overnight interbank funds

(h) Nine month fixed-rate term deposits

(i) One year fixed-rate term deposits

(j) Five year floating-rate corporate bonds with annual repricing

(k) Common equity

(a), (b), (d), (e), (g), (h), (i), (j).

The repricing model (cont.)

Maturity bucket:
* One day.
* More than 1 day to 3 months.
* More than 6 months to 12 months.
* More than 1 year to 5 years.
* More than 5 years.

$$GAP_i = RSA_i - RSL_i$$

The Repricing model

Example 2: Calculating GAP

Maturity bucket	**Assets**	**Liabilities**	**GAP**
1. One day	20	30	
2. > 1 day–3 months	30	40	
3. > 3 months–6 months	70	85	
4. > 6 months–12 months	90	70	
5. > 1 year–5 years	40	30	
6. > 5 years	10	5	
	260	**260**	

The Repricing model

Example 2: Calculating GAP (cont.)

Maturity bucket	**Assets**	**Liabilities**	**GAP**
1. One day	20	30	-10
2. > 1 day–3 months	30	40	-10
3. > 3 months–6 months	70	85	-15
4. > 6 months–12 months	90	70	20
5. > 1 year–5 years	40	30	10
6. > 5 years	10	5	5
	260	**260**	

Example 2: Calculating GAP (cont.)

Maturity bucket	Assets	Liabilities	GAP	CGAP
1. One day	20	30	-10	-10
2. > 1 day–3 months	30	40	-10	-20
3. > 3 months–6 months	70	85	-15	
4. > 6 months–12 months	90	70	20	
5. > 1 year–5 years	40	30	10	
6. > 5 years	10	5	5	
	260	**260**		

Example 2: Calculating GAP (cont.)

Maturity bucket	Assets	Liabilities	GAP	CGAP
1. One day	20	30	-10	-10
2. > 1 day–3 months	30	40	-10	-20
3. > 3 months–6 months	70	85	-15	-35
4. > 6 months–12 months	90	70	20	-15
5. > 1 year–5 years	40	30	10	-5
6. > 5 years	10	5	5	0
	260	**260**		

The repricing model

Indicates an FI's net interest income exposure (or profit exposure) to interest rate changes in different maturity buckets.

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

where:
- ΔNII: Change in net interest income in maturity bucket i.
- GAP_i: Dollar size of the gap between the book value of rate-sensitive assets and rate-sensitive liabilities in maturity bucket i.
- ΔR: Change in the level of interest rates impacting assets and liabilities in the ith bucket.

The repricing model

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

Maturity bucket	Assets	Liabilities	GAP	CGAP
1. One day	20	30	-10	-10
2. > 1 day–3 months	30	40	-10	-20
3. > 3 months–6 months	70	85	-15	-35
4. > 6 months–12 months	90	70	20	-15
5. > 1 year–5 years	40	30	10	-5
6. > 5 years	10	5	5	0
	260	**260**		

- If FED funds or overnight repo rates increases 1%. What will happen to the FI's ΔNII ?

  We have: $\Delta NII = -\$10\ mil * 0.01 = -\$100,000$

  $-\$0.1$ mil

The repricing model

Maturity bucket	Assets	Liabilities	GAP	CGAP
1. One day	20	30	-10	-10
2. > 1 day–3 months	30	40	-10	-20
3. > 3 months–6 months	70	85	-15	-35
4. > 6 months–12 months	90	70	20	-15
5. > 1 year–5 years	40	30	10	-5
6. > 5 years	10	5	5	0
	260	**260**		

- If interest rate (1 year) increases 1%. What will happen to the FI's ΔNII ?

  $GAP_1 * 0.01 + GAP_2 * 0.01 + GAP_3 * 0.01 + GAP_4 * 0.01$

  $[(-10) + (-10) + (-15) + 20] * 0.01 = (-15) * 0.01 = -\$150,000$

  CGAP * ΔR

The Repricing model

Back to Example 1:

Assets		Liabilities	
1. Short-term consumer loans (one-year maturity)	$ 50	1. Equity capital (fixed)	$ 20
2. Long-term consumer loans (two-year maturity)	25	2. Demand deposits	40
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7. 30-year, floating-rate mortgages (rate adjusted every nine months)	40	7. 1-year time deposits	20
		8. 2-year time deposits	40
	$270		$270

- **If interest rates [one year] rise by 1%.**

  RSAs = \$155 mil; RSLs = \$140 mil.

  $\Delta NII = CGAP * \Delta R = (\$155\ mil - \$140\ mil) * 0.01 = \$150,000$

The Repricing model

Back to Example 1:

Assets		Liabilities	
1. Short-term consumer loans (one-year maturity)	$ 50	1. Equity capital (fixed)	$ 20
2. Long-term consumer loans (two-year maturity)	25	2. Demand deposits	40
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7. 30-year, floating-rate mortgages (rate adjusted every nine months)	40	7. 1-year time deposits	20
		8. 2-year time deposits	40
	$270		$270

- **If interest rates [one year] drop by 1%.**

  RSAs = \$155 mil; RSLs = \$140 mil.

  $\Delta NII = CGAP * \Delta R = (\$155\ mil - \$140\ mil) * (-0.01) = -\$150,000$

The Repricing model

Back to Example 1:

Assets		Liabilities	
1. Short-term consumer loans (one-year maturity)	$ 50	1. Equity capital (fixed)	$ 20
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		8. 2-year time deposits	40
	$270		$270

- **Rates rise by 2% on RSAs and by 1% on RSLs.**

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

$$\Delta NII = (\$155\ mil * 0.02) - (\$140\ mil * 0.01)$$

$$\Delta NII = \$1,700,000$$

The Repricing model

Problem 6 (Textbook)
Calculate the repricing gap and impact on net interest income of a 1 per cent increase in interest rates for the following positions:

(a) **Rate-sensitive assets = \$100 million. Rate-sensitive liabilities = \$50 million.**

(b) **Rate-sensitive assets = \$50 million. Rate-sensitive liabilities = \$150 million.**

(c) **Rate-sensitive assets = \$75 million. Rate-sensitive liabilities = \$70 million.**

Disadvantages of the Repricing model

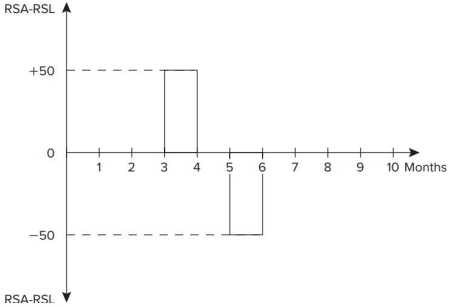
(1) It ignores market value effects.

- Interest rate changes have a market value effect in addition to an income effect on asset and liability values.
- The present values of the cash flows on assets and liabilities change.

Disadvantages of the Repricing model

(2) Overaggregation

- It does not take into account the fact that the dollar value of rate-sensitive assets and liabilities within a bucket are not similar.
- On average, liabilities may be repriced toward the end of the bucket's range, while assets may be repriced toward the beginning



Disadvantages of the Repricing model

withdraw or pay before maturity

(3) The Problem of Runoffs

- Some assets are prepaid and some liabilities are withdrawn before the maturity date.

  Example: Some 30-year original maturity mortgages may have only one year left before they mature; that is, they are in their 29th year.

  These loans may be listed as 30-year mortgages (and included as not rate sensitive)

Disadvantages of the Repricing model

(4) Cash Flows from Off-Balance-Sheet Activities

- Changes in interest rates will also affect the cash flows on many off-balance-sheet instruments.

  Example: FI might have hedged its interest rate risk with an interest rate futures contract.

Integrated Mini Case

Assets	Million	Liabilities and equity	Million
Cash	20	Demand deposits	250
Interbank lending (5.05%) *over9 (1 day - max 1 week)*	150	Savings accounts (1.5%) *very short*	20
3-month T-notes (5.25%)	150	Money market deposit accounts (4.5%) *1 month*	340
2-year T-Bonds (6.50%)	100	3-month CDs (4.2%)	120
8-year T-Bonds (7.50%)	200	6-month CDs (4.3%)	220
5-year corporate bonds (floating rate) (8.20%, repriced @ 6 months)	50	1-year CDs (4.5%)	375
6-month consumer loans (6%)	250	2-year CDs (5%)	425
1-year consumer loans (5.8%)	300	4-year CDs (5.5%)	330
5-year personal loans (7%)	350	5-year CDs (6%)	350
7-month commercial loans (5.8%)	200	Interbank borrowings (5%)	225
2-year commercial loans (floating rate) (5.15%, repriced @ 6-months)	275	Overnight repos (5%)	290
15-year variable rate mortgages (5.8%, repriced @ 6-months)	200	6-month bank accepted bills (5.05%)	300
15-year variable rate mortgages (6.1%, repriced @ year)	400	Subordinate notes: 3-year fixed rate (6.55%)	200
15-year fixed-rate mortgages (7.85%)	300	Subordinated debt: 7-year fixed rate (7.25%)	100
30-year variable rate mortgages (6.3%, repriced @ quarter)	225	Total liabilities	**3545**
30-year variable rate mortgages (6.4%, repriced @ month)	355		
30-year fixed-rate mortgages (8.2%)	400		
Premises and equipment	20	Equity	400
Total assets	**$3945**	Total liabilities and equity	**$3945**

What is the repricing gap if the planning period is 30 days? 6 months? 1 year? 2 years? 5 years?

Problem 16 (Textbook)

Consider the following balance sheet for WatchoverU Bank (in millions):

Assets	**Value**	**Liabilities and Equity**	**Value**
Floating-rate mortgages (10% annually)	50	1-year term deposits (6% annually)	70
30-year fixed-rate loans (7% annually)	50	3-year term deposits (7% annually)	20
		Equity	10
Total	100	**Total**	100

(a) What is WatchoverU's expected net interest income at year-end?
(b) What will net interest income be at year-end if interest rates rise by 2 per cent?
(c) Using the cumulative repricing gap model, what is the expected net interest income for a 2 per cent increase in [1 year] interest rates.
(d) What will net interest income be at year-end if interest rates on RSAs increase by 2 per cent but interest rates on RSLs increase by 1 per cent?