



Risk management - summary and manual solution

Asset liability management (Dogu Akdeniz Üniversitesi)

Chapter Eight

Interest Rate Risk I

Chapter Outline

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Summary

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Solutions for End-of-Chapter Questions and Problems

1. How do monetary policy actions made by the Federal Reserve impact interest rates?

Through its daily open market operations, such as buying and selling Treasury bonds and Treasury bills, the Fed seeks to influence the money supply, inflation, and the level of interest rates. When the Fed finds it necessary to slow down the economy, it tightens monetary policy by raising interest rates. The normal result is a decrease in business and household spending (especially that financed by credit or borrowing). Conversely, if business and household spending decline to the extent that the Fed finds it necessary to stimulate the economy it allows interest rates to fall (an expansionary monetary policy). The drop in rates promotes borrowing and spending.

2. How has the increased level of financial market integration affected interest rates?

Increased financial market integration, or globalization, increases the speed with which interest rate changes and volatility are transmitted among countries. The result of this quickening of global economic adjustment is to increase the difficulty and uncertainty faced by the Federal Reserve as it attempts to manage economic activity within the U.S. Further, because FIs have become increasingly more global in their activities, any change in interest rate levels or volatility caused by Federal Reserve actions more quickly creates additional interest rate risk issues for these companies.

3. What is the repricing gap? In using this model to evaluate interest rate risk, what is meant by rate sensitivity? On what financial performance variable does the repricing model focus? Explain.

The repricing gap is a measure of the difference between the dollar value of assets that will reprice and the dollar value of liabilities that will reprice within a specific time period, where repricing can be the result of a roll over of an asset or liability (e.g., a loan is paid off at or prior to maturity and the funds are used to issue a new loan at current market rates) or because the asset or liability is a variable rate instrument (e.g., a variable rate mortgage whose interest rate is reset every quarter based on movements in a prime rate). Rate sensitivity represents the time interval where repricing can occur. The model focuses on the potential changes in the net interest income variable. In effect, if interest rates change, interest income and interest expense will change as the various assets and liabilities are repriced, that is, receive new interest rates.

4. What is a maturity bucket in the repricing model? Why is the length of time selected for repricing assets and liabilities important when using the repricing model?

The maturity bucket is the time window over which the dollar amounts of assets and liabilities are measured. The length of the repricing period determines which of the securities in a portfolio are rate-sensitive. The longer the repricing period, the more securities either mature or will be repriced, and, therefore, the more the interest rate risk exposure. An excessively short repricing period omits consideration of the interest rate risk exposure of assets and liabilities that

repriced in the period immediately following the end of the repricing period. That is, it understates the rate sensitivity of the balance sheet. An excessively long repricing period includes many securities that are repriced at different times within the repricing period, thereby overstating the rate sensitivity of the balance sheet.

5. What is the CGAP effect? According to the CGAP effect, what is the relation between changes in interest rates and changes in net interest income when CGAP is positive? When CGAP is negative?

The CGAP effect describes the relations between changes in interest rates and changes in net interest income. According to the CGAP effect, when CGAP is positive the change in NII is positively related to the change in interest rates. Thus, an FI would want its CGAP to be positive when interest rates are expected to rise. According to the CGAP effect, when CGAP is negative the change in NII is negatively related to the change in interest rates. Thus, an FI would want its CGAP to be negative when interest rates are expected to fall.

6. Which of the following is an appropriate change to make on a bank's balance sheet when GAP is negative, spread is expected to remain unchanged and interest rates are expected to rise?

According to the CGAP effect, when CGAP is positive the change in NII is positively related to the change in interest rates. Thus, an FI would want its CGAP to be positive when interest rates are expected to rise.

a. replace fixed rate loans with rate sensitive loans

Yes. This change will increase RSAs, which will increase GAP.

b. replace marketable securities with fixed rate loans

No. This change will decrease RSAs, which will decrease GAP.

c. replace fixed rate CDs with rate sensitive CDs

No. This change will increase RSLs, which will decrease GAP.

d. replace equity with demand deposits

No. This change will have no impact on either RSAs or RSLs. So, no impact on GAP either.

e. replace vault cash with marketable securities

Yes. This change will increase RSAs, which will increase GAP.

- 7. If a bank manager was quite certain that interest rates were going to rise within the next six months, how should the bank manager adjust the bank's six-month repricing gap to take advantage of this anticipated rise? What if the manager believed rates would fall in the next six months.**

When interest rates are expected to rise, a bank should set its repricing gap to a positive position. In this case, as rates rise, interest income will rise by more than interest expense. The result is an increase in net interest income. When interest rates are expected to fall, a bank should set its repricing gap to a negative position. In this case, as rates fall, interest income will fall by less than interest expense. The result is an increase in net interest income.

8. Consider the following balance sheet positions for a financial institution:

- Rate-sensitive assets = \$200 million. Rate-sensitive liabilities = \$100 million
 - Rate-sensitive assets = \$100 million. Rate-sensitive liabilities = \$150 million
 - Rate-sensitive assets = \$150 million. Rate-sensitive liabilities = \$140 million
- a. Calculate the repricing gap and the impact on net interest income of a 1 percent increase in interest rates for each position.
- Rate-sensitive assets = \$200 million. Rate-sensitive liabilities = \$100 million.

$$\text{Repricing gap} = \text{RSA} - \text{RSL} = \$200 - \$100 \text{ million} = +\$100 \text{ million.}$$

$$\Delta \text{NII} = (\$100 \text{ million})(.01) = +\$1.0 \text{ million, or } \$1,000,000.$$
 - Rate-sensitive assets = \$100 million. Rate-sensitive liabilities = \$150 million.

$$\text{Repricing gap} = \text{RSA} - \text{RSL} = \$100 - \$150 \text{ million} = -\$50 \text{ million.}$$

$$\Delta \text{NII} = (-\$50 \text{ million})(.01) = -\$0.5 \text{ million, or } -\$500,000.$$
 - Rate-sensitive assets = \$150 million. Rate-sensitive liabilities = \$140 million.

$$\text{Repricing gap} = \text{RSA} - \text{RSL} = \$150 - \$140 \text{ million} = +\$10 \text{ million.}$$

$$\Delta \text{NII} = (\$10 \text{ million})(.01) = +\$0.1 \text{ million, or } \$100,000.$$
- b. Calculate the impact on net interest income on each of the above situations assuming a 1 percent decrease in interest rates.
- $\Delta \text{NII} = (\$100 \text{ million})(-.01) = -\$1.0 \text{ million, or } -\$1,000,000.$
 - $\Delta \text{NII} = (-\$50 \text{ million})(-.01) = +\$0.5 \text{ million, or } \$500,000.$

- $\Delta \text{NII} = (\$10 \text{ million})(-.01) = -\$0.1 \text{ million, or } -\$100,000.$

c. What conclusion can you draw about the repricing model from these results?

The FIs in parts (1) and (3) are exposed to interest rate declines (positive repricing gap), while the FI in part (2) is exposed to interest rate increases. The FI in part (3) has the lowest interest rate risk exposure since the absolute value of the repricing gap is the lowest, while the opposite is true for the FI in part (1).

9. **What are the reasons for not including demand deposits as rate-sensitive liabilities in the repricing analysis for a commercial bank? What is the subtle but potentially strong reason for including demand deposits in the total of rate sensitive liabilities? Can the same argument be made for passbook savings accounts?**

The regulatory rate available on demand deposit accounts is zero. Although many banks are able to offer NOW accounts on which interest can be paid, this interest rate seldom is changed and thus the accounts are not really interest rate sensitive. However, demand deposit accounts do pay implicit interest in the form of not charging fully for checking and other services. Further, when market interest rates rise, customers draw down their demand deposit accounts, which may cause the bank to use higher cost sources of funds. The same or similar arguments can be made for passbook savings accounts.

10. **What is the gap ratio? What is the value of this ratio to interest rate risk managers and regulators?**

The gap ratio is the ratio of the cumulative gap position to the total assets of the FI. The cumulative gap position is the sum of the individual gaps over several time buckets. The value of this ratio is that it tells the direction of the interest rate exposure and the scale of that exposure relative to the size of the FI.

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

3-month U.S. Treasury bills	Yes
1-year U.S. Treasury notes	Yes
20-year U.S. Treasury bonds	No
20-year floating-rate corporate bonds with annual repricing	Yes
30-year floating-rate mortgages with repricing every two years	No
30-year floating-rate mortgages with repricing every six months	Yes
Overnight fed funds	Yes
9-month fixed rate CDs	Yes
1-year fixed-rate CDs	Yes
5-year floating-rate CDs with annual repricing	Yes
Common stock	No

12. What is the spread effect?

The spread effect is the effect that a change in the spread between rates on RSAs and RSLs has on net interest income as interest rates change. The spread effect is such that, regardless of the direction of the change in interest rates, a positive relation exists between changes in the spread and changes in NII. Whenever the spread increases (decreases), NII increases (decreases).

13. A bank manager is quite certain that interest rates are going to fall within the next six months. How should the bank manager adjust the bank's six-month repricing gap and spread to take advantage of this anticipated rise? What if the manager believes rates will rise in the next six months.

When interest rates are expected to fall, a bank should set its repricing gap to a negative position. Further, the manager would want to increase the spread between the return on RSAs and RSLs. In this case, as rates fall, interest income will fall by less than interest expense. The result is an increase in net interest income. When interest rates are expected to rise, a bank should set its repricing gap to a positive position. Again, the manager would want to increase the spread between the return on RSAs and RSLs. In this case, as rates rise, interest income will rise by more than interest expense. The result is an increase in net interest income.

14. Consider the following balance sheet for WatchoverU Savings, Inc. (in millions):

<u>Assets</u>		<u>Liabilities and Equity</u>	
Floating-rate mortgages		1-year time deposits	
(currently 10% annually)	\$50	(currently 6% annually)	\$70
30-year fixed-rate loans		3-year time deposits	
(currently 7% annually)	<u>\$50</u>	(currently 7% annually)	<u>\$20</u>
Total assets	<u>\$100</u>	Equity	<u>\$10</u>
		Total liabilities & equity	<u>\$100</u>

a. What is WatchoverU's expected net interest income at year-end?

Current expected interest income: $\$50m(0.10) + \$50m(0.07) = \$8.5m$. Expected interest expense: $\$70m(0.06) + \$20m(0.07) = \$5.6m$. Expected net interest income: $\$8.5m - \$5.6m = \$2.9m$.

b. What will net interest income be at year-end if interest rates rise by 2 percent?

After the 200 basis point interest rate increase, net interest income declines to: $50(0.12) + 50(0.07) - 70(0.08) - 20(0.07) = \$9.5m - \$7.0m = \$2.5m$, a decline of \$0.4m.

c. Using the cumulative repricing gap model, what is the expected net interest income for a 2 percent increase in interest rates?

Wachovia's repricing or funding gap is $\$50\text{m} - \$70\text{m} = -\$20\text{m}$. The change in net interest income using the funding gap model is $(-\$20\text{m})(0.02) = -\0.4m .

- d. What will net interest income be at year-end if interest rates on RSAs increase by 2 percent but interest rates on RSLs increase by 1 percent? Is it reasonable for changes in interest rates on RSAs and RSLs to differ? Why?

After the unequal rate increases, net interest income will be $50(0.12) + 50(0.07) - 70(0.07) - 20(0.07) = \$9.5\text{m} - \$6.3\text{m} = \3.2m , an increase of $\$0.3\text{m}$. It is not uncommon for interest rates to adjust in an unequal manner on RSAs versus RSLs. Interest rates often do not adjust solely because of market pressures. In many cases the changes are affected by decisions of management. Thus, you can see the difference between this answer and the answer for part a.

15. Use the following information about a hypothetical government security dealer named M.P. Jorgan. Market yields are in parenthesis, and amounts are in millions.

<u>Assets</u>		<u>Liabilities and Equity</u>	
Cash	\$10	Overnight repos	\$170
1-month T-bills (7.05%)	75	Subordinated debt	
3-month T-bills (7.25%)	75	7-year fixed rate (8.55%)	150
2-year T-notes (7.50%)	50		
8-year T-notes (8.96%)	100		
5-year munis (floating rate)			
(8.20% reset every 6 months)	25	Equity	15
Total assets	<u>\$335</u>	Total liabilities & equity	<u>\$335</u>

- a. What is the repricing gap if the planning period is 30 days? 3 months? 2 years? Recall that cash is a non-interest-earning asset.

Repricing gap using a 30-day planning period = $\$75 - \$170 = -\$95$ million. Repricing gap using a 3-month planning period = $(\$75 + \$75) - \$170 = -\20 million.

Repricing gap using a 2-year planning period = $(\$75 + \$75 + \$50 + \$25) - \$170 = +\55 million.

- b. What is the impact over the next 30 days on net interest income if interest rates increase 50 basis points? Decrease 75 basis points?

If interest rates increase 50 basis points, net interest income will decrease by $\$475,000$.
 $\Delta\text{NII} = \text{CGAP}(\Delta R) = -\$95\text{m}(.005) = -\$0.475\text{m}$.

If interest rates decrease by 75 basis points, net interest income will increase by $\$712,500$.
 $\Delta\text{NII} = \text{CGAP}(\Delta R) = -\$95\text{m}(-.0075) = \$0.7125\text{m}$.

- c. The following one-year runoffs are expected: \$10 million for two-year T-notes and \$20 million for eight-year T-notes. What is the one-year repricing gap?

The repricing gap over the 1-year planning period = (\$75m. + \$75m. + \$10m. + \$20m. + \$25m.) - \$170m. = +\$35 million.

- d. If runoffs are considered, what is the effect on net interest income at year-end if interest rates increase 50 basis points? Decrease 75 basis points?

If interest rates increase 50 basis points, net interest income will increase by \$175,000.

$$\Delta \text{NII} = \text{CGAP}(\Delta R) = \$35\text{m.}(0.005) = \$0.175\text{m.}$$

If interest rates decrease 75 basis points, net interest income will decrease by \$262,500.

$$\Delta \text{NII} = \text{CGAP}(\Delta R) = \$35\text{m.}(-0.0075) = -\$0.2625\text{m.}$$

16. A bank has the following balance sheet:

<u>Assets</u>			<u>Liabilities/Equity</u>		
		<u>Avg. Rate</u>			<u>Avg. Rate</u>
Rate sensitive	\$550,000	7.75%	Rate sensitive	\$375,000	6.25%
Fixed rate	755,000	8.75	Fixed rate	805,000	7.50
Nonearning	<u>265,000</u>		Nonpaying	<u>390,000</u>	
Total	\$1,570,000		Total	\$1,570,000	

Suppose interest rates rise such that the average yield on rate-sensitive assets increases by 45 basis points and the average yield on rate-sensitive liabilities increases by 35 basis points.

- a. Calculate the bank's repricing GAP and gap ratio.

$$\text{Repricing GAP} = \$550,000 - \$375,000 = \$175,000$$

$$\text{Gap ratio} = \$175,000 / \$1,570,000 = 11.15\%$$

- b. Assuming the bank does not change the composition of its balance sheet, calculate the resulting change in the bank's interest income, interest expense, and net interest income.

$$\Delta \text{II} = \$550,000(.0045) = \$2,475$$

$$\Delta \text{IE} = \$375,000(.0035) = \$1,312.50$$

$$\Delta \text{NII} = \$2,475 - \$1,312.50 = \$1,162.50$$

- c. Explain how the CGAP and spread effects influenced the change in net interest income.

The CGAP affect worked to increase net interest income. That is, the CGAP was positive while interest rates increased. Thus, interest income increased by more than interest expense. The result is an increase in NII. The spread effect also worked to increase net interest income. The spread increased by 10 basis points. According to the spread affect, as spread increases, so does net interest income.

17. A bank has the following balance sheet:

<u>Assets</u>			<u>Liabilities/Equity</u>		
		<u>Avg. Rate</u>			<u>Avg. Rate</u>
Rate sensitive	\$550,000	7.75%	Rate sensitive	\$575,000	6.25%
Fixed rate	755,000	8.75	Fixed rate	605,000	7.50
Nonearning	<u>265,000</u>		Nonpaying	<u>390,000</u>	
Total	\$1,570,000		Total	\$1,570,000	

Suppose interest rates fall such that the average yield on rate-sensitive assets decreases by 15 basis points and the average yield on rate-sensitive liabilities decreases by 5 basis points.

a. Calculate the bank's CGAP and gap ratio.

$$\text{CGAP} = \$550,000 - \$575,000 = -\$25,000$$

$$\text{Gap ratio} = -\$25,000 / \$1,570,000 = -1.59\%$$

b. Assuming the bank does not change the composition of its balance sheet, calculate the resulting change in the bank's interest income, interest expense, and net interest income.

$$\Delta \text{II} = \$550,000(-.0015) = -\$825$$

$$\Delta \text{IE} = \$575,000(-.0005) = -\$287.50$$

$$\Delta \text{NII} = -\$825 - (-\$287.50) = -\$537.50$$

c. The bank's CGAP is negative and interest rates decreased, yet net interest income decreased. Explain how the CGAP and spread effects influenced this decrease in net interest income.

The CGAP affect worked to increase net interest income. That is, the CGAP was negative while interest rates decreased. Thus, interest income decreased by less than interest expense. The result is an increase in NII. The spread effect, on the other hand, worked to decrease net interest income. The spread decreased by 10 basis points. According to the spread affect, as spread decreases, so does net interest income. In this case, the increase in NII due to the CGAP effect was dominated by the decrease in NII due to the spread effect.

18. The balance sheet of A. G. Fredwards, a government security dealer, is listed below. Market yields are in parentheses, and amounts are in millions.

<u>Assets</u>		<u>Liabilities and Equity</u>	
Cash	\$20	Overnight repos	\$340
1-month T-bills (7.05%)	150	Subordinated debt	
3-month T-bills (7.25%)	150	7-year fixed rate (8.55%)	300
2-year T-notes (7.50%)	100		
8-year T-notes (8.96%)	200		
5-year munis (floating rate)			
(8.20% reset every 6 months)	<u>50</u>	Equity	<u>30</u>
Total assets	<u>\$670</u>	Total liabilities and equity	<u>\$670</u>

- a. What is the repricing gap if the planning period is 30 days? 3 month days? 2 years?

Repricing gap using a 30-day planning period = \$150 - \$340 = -\$190 million .Repricing gap using a 3-month planning period = (\$150 + \$150) - \$340 = -\$40 million.

Repricing gap using a 2-year planning period = (\$150 + \$150 + \$100 + \$50) - \$340 = \$110 million.

- b. What is the impact over the next three months on net interest income if interest rates on RSAs increase 50 basis points and on RSLs increase 60 basis points?

$$\Delta II = (\$150\text{m.} + \$150\text{m.})(.005) = \$1.5\text{m.}$$

$$\Delta IE = \$340\text{m.}(.006) = \$2.04\text{m.}$$

$$\Delta NII = \$1.5\text{m.} - (\$2.04\text{m.}) = -\$0.54\text{m.}$$

- c. What is the impact over the next two years on net interest income if interest rates on RSAs increase 50 basis points and on RSLs increase 75 basis points?

$$\Delta II = (\$150\text{m.} + \$150\text{m.} + \$100 + \$50)(.005) = \$2.25\text{m.}$$

$$\Delta IE = \$340\text{m.}(.0075) = \$2.04\text{m.}$$

$$\Delta NII = \$2.25\text{m.} - (\$2.04\text{m.}) = \$0.21\text{m.}$$

- d. Explain the difference in your answers to parts (b) and (c). Why is one answer a negative change in NII, while the other is positive?

For the 3-month analysis, the CGAP affect worked to decrease net interest income. That is, the CGAP was negative while interest rates increased. Thus, interest income increased by less than interest expense. The result is a decrease in NII. For the 3-year analysis, the CGAP affect worked to increase net interest income. That is, the CGAP was positive while interest rates increased. Thus, interest income increased by more than interest expense. The result is an increase in NII.

19. A bank has the following balance sheet:

<u>Assets</u>			<u>Liabilities/Equity</u>		
Rate sensitive	\$225,000	Avg. Rate 6.35%	Rate sensitive	\$300,000	Avg. Rate 4.25%
Fixed rate	550,000	7.55	Fixed rate	505,000	6.15
Nonearning	<u>120,000</u>		Nonpaying	<u>90,000</u>	
Total	\$895,000		Total	\$895,000	

Suppose interest rates rise such that the average yield on rate-sensitive assets increases by 45 basis points and the average yield on rate-sensitive liabilities increases by 35 basis points.

a. Calculate the bank's repricing GAP.

$$\text{Repricing GAP} = \$225,000 - \$300,000 = -\$75,000$$

b. Assuming the bank does not change the composition of its balance sheet, calculate the net interest income for the bank before and after the interest rate changes. What is the resulting change in net interest income?

$$\begin{aligned} \text{NII}_b &= (\$225,000(.0635) + \$550,000(.0755)) - (\$300,000(.0425) + \$505,000(.0615)) \\ &= \$55,812.50 - \$43,807.50 = \$12,005 \end{aligned}$$

$$\begin{aligned} \text{NII}_a &= (\$225,000(.0635 + .0045) + \$550,000(.0755)) - (\$300,000(.0425 + .0035) + \\ &\quad \$505,000(.0615)) = \$56,825 - \$44,857.50 = \$11,967.50 \end{aligned}$$

$$\Delta \text{NII} = \$11,967.50 - \$12,005 = -\$37.5$$

c. Explain how the CGAP and spread effects influenced this increase in net interest income.

The CGAP affect worked to decrease net interest income. That is, the CGAP was negative while interest rates increased. Thus, interest income increased by more than interest expense. The result is an decrease in NII. In contrast, the spread effect worked to increase net interest income. The spread increased by 10 basis points. According to the spread affect, as spread increases, so does net interest income. However, in this case, the increase in NII due to the spread effect was dominated by the decrease in NII due to the CGAP effect.

20. What are some of the weakness of the repricing model? How have large banks solved the problem of choosing the optimal time period for repricing? What is runoff cash flow, and how does this amount affect the repricing model's analysis?

The repricing model has four general weaknesses:

- (1) It ignores market value effects.
- (2) It does not take into account the fact that the dollar value of rate-sensitive assets and liabilities within a bucket are not similar. Thus, if assets, on average, are repriced earlier in the bucket than liabilities, and if interest rates fall, FIs are subject to reinvestment risks.
- (3) It ignores the problem of runoffs. That is, that some assets are prepaid and some liabilities are withdrawn before the maturity date.
- (4) It ignores income generated from off-balance-sheet activities.

Large banks are able to reprice securities every day using their own internal models so reinvestment and repricing risks can be estimated for each day of the year.

Runoff cash flow reflects the assets that are repaid before maturity and the liabilities that are withdrawn unexpectedly. To the extent that either of these amounts is significantly greater than expected, the estimated interest rate sensitivity of the FI will be in error.

The following questions and problems are based on material in Appendix 8A, located on the Web site (www.mhhe.com/saunders7e).

21. What is a maturity gap? How can the maturity model be used to immunize an FI's portfolio? What is the critical requirement that allows maturity matching to have some success in immunizing the balance sheet of an FI?

Maturity gap is the difference between the average maturity of assets and liabilities. If the maturity gap is zero, it is possible to immunize the portfolio so that changes in interest rates will result in equal but offsetting changes in the value of assets and liabilities. Thus, if interest rates increase (decrease), the fall (rise) in the value of the assets will be offset by an identical fall (rise) in the value of the liabilities. The critical assumption is that the timing of the cash flows on the assets and liabilities must be the same.

22. Nearby Bank has the following balance sheet (in millions):

<u>Assets</u>		<u>Liabilities and Equity</u>	
Cash	\$60	Demand deposits	\$140
5-year Treasury notes	60	1-year certificates of deposit	160
30-year mortgages	<u>200</u>	Equity	<u>20</u>
Total assets	<u>\$320</u>	Total liabilities and equity	<u>\$320</u>

What is the maturity gap for Nearby Bank? Is Nearby Bank more exposed to an increase or decrease in interest rates? Explain why?

$M_A = [0*60 + 5*60 + 30*200]/320 = 19.6875$ years, and $M_L = [0*140 + 1*160]/300 = 0.5333$. Therefore, the maturity gap = $MGAP = 19.6875 - 0.5333 = 19.1542$ years. Nearby Bank is exposed to an increase in interest rates. If rates rise, the value of assets will decrease much more than the value of liabilities.

23. County Bank has the following market value balance sheet (in millions, all interest at annual rates). All securities are selling at par equal to book value.

<u>Assets</u>		<u>Liabilities and Equity</u>	
Cash	\$20	Demand deposits	\$100
15-year commercial loan at 10% interest, balloon payment	160	5-year CDs at 6% interest, balloon payment	210
30-year mortgages at 8% interest, balloon payment	300	20-year debentures at 7% interest, balloon payment	120
Total assets	<u>\$480</u>	Equity	<u>50</u>
		Total liabilities & equity	<u>\$480</u>

- a. What is the maturity gap for County Bank?

$$M_A = [0*20 + 15*160 + 30*300]/480 = 23.75 \text{ years.}$$

$$M_L = [0*100 + 5*210 + 20*120]/430 = 8.02 \text{ years.}$$

$$MGAP = 23.75 - 8.02 = 15.73 \text{ years.}$$

- b. What will be the maturity gap if the interest rates on all assets and liabilities increase by 1 percent?

If interest rates increase one percent, the value and average maturity of the assets will be:

Cash = \$20

$$\text{Commercial loans} = \$16 * PVIFA_{n=15, i=11\%} + \$160 * PVIF_{n=15, i=11\%} = \$148.49$$

$$\text{Mortgages} = \$24 * PVIFA_{n=30, i=9\%} + \$300 * PVIF_{n=30, i=9\%} = \$269.18$$

$$M_A = [0*20 + 148.49*15 + 269.18*30]/(20 + 148.49 + 269.18) = 23.54 \text{ years}$$

The value and average maturity of the liabilities will be:

Demand deposits = \$100

$$\text{CDs} = \$12.60 * PVIFA_{n=5, i=7\%} + \$210 * PVIF_{n=5, i=7\%} = \$201.39$$

$$\text{Debentures} = \$8.4 * PVIFA_{n=20, i=8\%} + \$120 * PVIF_{n=20, i=8\%} = \$108.22$$

$$M_L = [0*100 + 5*201.39 + 20*108.22]/(100 + 201.39 + 108.22) = 7.74 \text{ years}$$

The maturity gap = $MGAP = 23.54 - 7.74 = 15.80$ years. The maturity gap increased because the average maturity of the liabilities decreased more than the average maturity of the assets. This result occurred primarily because of the differences in the cash flow streams for the mortgages and the debentures.

- c. What will happen to the market value of the equity?

The market value of the assets has decreased from \$480 to \$437.67, or \$42.33. The market value of the liabilities has decreased from \$430 to \$409.61, or \$20.39. Therefore, the market value of the equity will decrease by $\$42.33 - \$20.39 = \$21.94$, or 43.88 percent.

- 24. If a bank manager is certain that interest rates were going to increase within the next six months, how should the bank manager adjust the bank's maturity gap to take advantage of this anticipated increase? What if the manager believes rates will fall? Would your suggested adjustments be difficult or easy to achieve?**

When rates rise, the value of the longer-lived assets will fall by more than the shorter-lived liabilities. If the maturity gap is positive, the bank manager will want to shorten the maturity gap. If the repricing gap is negative, the manager will want to move it towards zero or positive. If rates are expected to decrease, the manager should reverse these strategies. Changing the maturity or repricing gaps on the balance sheet often involves changing the mix of assets and liabilities. Attempts to make these changes may involve changes in financial strategy for the bank which may not be easy to accomplish. Later in the text, methods of achieving the same results using derivatives will be explored.

- 25. Consumer Bank has \$20 million in cash and a \$180 million loan portfolio. The assets are funded with demand deposits of \$18 million, a \$162 million CD, and \$20 million in equity. The loan portfolio has a maturity of 2 years, earns interest at the annual rate of 7 percent, and is amortized monthly. The bank pays 7 percent annual interest on the CD, but the principal will not be paid until the CD matures at the end of 2 years.**

- a. What is the maturity gap for Consumer Bank?**

$$M_A = [0 \times \$20 + 2 \times \$180] / \$200 = 1.80 \text{ years}$$

$$M_L = [0 \times \$18 + 2 \times \$162] / \$180 = 1.80 \text{ years}$$

$$MGAP = 1.80 - 1.80 = 0 \text{ years.}$$

- b. Is Consumer Bank immunized or protected against changes in interest rates? Why or why not?**

It is tempting to conclude that the bank is immunized because the maturity gap is zero. However, the cash flow stream for the loan and the cash flow stream for the CD are different because the loan amortizes monthly and the CD pays annual interest. Thus, any change in interest rates will affect the earning power of the loan more than the interest cost of the CD.

- c. Does Consumer Bank face interest rate risk? That is, if market interest rates increase or decrease 1 percent, what happens to the value of the equity?**

The bank does face interest rate risk. If market rates increase 1 percent, the value of the cash and demand deposits does not change. However, the value of the loan will decrease to \$178.19, and the value of the CD will fall to \$159.11. Thus, the value of the equity will be $(\$178.19 + \$20 - \$18 - \$159.11) = \$21.08$. In this case, the increase in interest rates causes the market value of equity to increase because of the reinvestment opportunities on the loan payments.

If market rates decrease 1 percent, the value of the loan increases to \$181.84, and the value of the CD increases to \$164.97. Thus the value of the equity decreases to \$18.87.

d. How can a decrease in interest rates create interest rate risk?

The amortized loan payments would be reinvested at lower rates. Thus, even though interest rates have decreased, the different cash flow patterns of the loan and the CD have caused interest rate risk.

- 26. FI International holds seven-year Acme International bonds and two-year Beta Corporation bonds. The Acme bonds are yielding 12 percent and the Beta bonds are yielding 14 percent under current market conditions.**

- a. What is the weighted-average maturity of FI's bond portfolio if 40 percent is in Acme bonds and 60 percent is in Beta bonds?**

Average maturity = $0.40 \times 7 \text{ years} + 0.60 \times 2 \text{ years} = 4 \text{ years}$

- b. What proportion of Acme and Beta bonds should be held to have a weighted-average yield of 13.5 percent?**

Let $X(12\%) + (1 - X)(14\%) = 13.5\%$. Solving for X, we get 25 percent. In order to get an average yield of 13.5 percent, FI needs to hold 25 percent of Acme and 75 percent of Beta.

- c. What will be the weighted-average maturity of the bond portfolio if the weighted-average yield is realized?**

The average maturity of the portfolio will decrease to $0.25 \times 7 + 0.75 \times 2 = 3.25 \text{ years}$.

- 27. An insurance company has invested in the following fixed-income securities: (a) \$10,000,000 of 5-year Treasury notes paying 5 percent interest and selling at par value, (b) \$5,800,000 of 10-year bonds paying 7 percent interest with a par value of \$6,000,000, and (c) \$6,200,000 of 20-year subordinated debentures paying 9 percent interest with a par value of \$6,000,000.**

- a. What is the weighted-average maturity of this portfolio of assets?**

$$M_A = [5*\$10m + 10*\$5.8m + 20*\$6.2m]/\$22m = 232/22 = 10.55 \text{ years}$$

- b. If interest rates change so that the yields on all of the securities decrease 1 percent, how does the weighted-average maturity of the portfolio change?**

To determine the weighted-average maturity of the portfolio for a rate decrease of 1 percent, the new value of each security must be determined. This calculation will require knowing the yield to maturity of each security before the rate change.

T-notes are selling at par, so the yield to maturity = 5 percent. Therefore, the new value will be $PV = \$500,000 * PVIFA_{n=5, i=4\%} + \$10,000,000 * PVIF_{n=5, i=4\%} = \$10,445,182$.

10-year bonds: Par = \$6,000,000, PV = \$5,800,000, Cpn = 7 percent \Rightarrow YTM = 7.485%.
The new PV = $\$420,000 * PVIFA_{n=10, i=6.485\%} + \$6,000,000 * PVIF_{n=10, i=6.485\%} = \$6,222,161$.

Debentures: Par = \$6,000,000, PV = \$6,200,000, Cpn = 9 percent \Rightarrow 8.644 percent. The new PV = $\$540,000 * PVIFA_{n=20, i=7.644\%} + \$6,000,000 * PVIF_{n=20, i=7.644\%} = \$6,820,378$.

The total value of the assets after the change in rates will be \$23,487,721, and the weighted-average maturity will be $[5*10,445,182 + 10*6,222,030 + 20*6,820,378]/23,487,721 = 250,855,080/23,487,721 = 10.68 \text{ years}$.

- c. Explain the changes in the maturity values if the yields increase by 1 percent.**

When interest rates increase 1 percent, the value of the T-note is \$9,578,764, the value of the 10-year bond is \$5,414,885, and the value of the debenture is \$5,662,851, and the new value of the assets is \$20,656,500. The weighted-average maturity is 10.42 years.

- d. Assume that the insurance company has no other assets. What will be the effect on the market value of the company's equity if the interest rate changes in (b) and (c) occur?**

Assuming that the company is financed entirely with equity, the market value will increase \$1,487,721 when interest rates decrease 1 percent, and the market value will decrease \$1,343,500 when rates increase 1 percent. Notice that for the same absolute rate change, the increase in value is greater than the decrease in value.

28. The following is a simplified FI balance sheet:

<u>Assets</u>		<u>Liabilities and Equity</u>	
Loans	\$1,000	Deposits	\$850
	<u>0</u>	Equity	<u>\$150</u>
Total assets	<u>\$1,000</u>	Total liabilities & equity	<u>\$1,000</u>

The average maturity of loans is four years and the average maturity of deposits is two years. Assume loan and deposit balances are reported as book value, zero-coupon items.

- a. Assume that interest rate on both loans and deposits is 9 percent. What is the market value of equity?**

The value of loans = $\$1,000/(1.09)^4 = \708.4252 , and the value of deposits = $\$850/(1.09)^2 = \715.4280 . The net worth = $\$708.4252 - \$715.4280 = -\$7.0028$. (That is, net worth is negative.)

- b. What must be the interest rate on deposits to force the market value of equity to be zero? What economic market conditions must exist to make this situation possible?**

In this case the deposit value should equal the loan value. Thus, $\$850/(1 + x)^2 = \708.4252 . Solving for x , we get 9.5374%. That is, deposit rates will have to increase more because they have a shorter maturity. Note: for those using calculators, you need to compute I/YEAR after entering 850 = FV, -708.4252 = PV, 0 = PMT, 2 = N.

- c. Assume that interest rate on both loans and deposits is 9 percent. What must be the average maturity of deposits for the market value of equity to be zero?**

In this case, we need to solve the equation in part (b) for N . The result is 2.1141 years. If interest rates remain at 9 percent, then the average maturity of deposits has to be higher in order to match the value of a 4-year loan.

- 29. Gunnison Insurance has reported the following balance sheet (in thousands):**

<u>Assets</u>		<u>Liabilities and Equity</u>	
2-year Treasury note	\$175	1-year commercial paper	\$135
15-year munis	<u>165</u>	5-year note	<u>160</u>
		Equity	<u>45</u>
Total assets	<u>\$340</u>	Total liabilities & equity	<u>\$340</u>

All securities are selling at par equal to book value. The two-year notes are yielding 5 percent, and the 15-year munis are yielding 9 percent. The one-year commercial paper pays 4.5 percent, and the five-year notes pay 8 percent. All instruments pay interest annually.

- a. What is the weighted-average maturity of the assets for Gunnison?**

$$M_A = [2 * \$175 + 15 * \$165] / \$340 = 8.31 \text{ years}$$

- b. What is the weighted-average maturity of the liabilities for Gunnison?**

$$M_L = [1*\$135 + 5*\$160]/\$295 = 3.17 \text{ years}$$

c. What is the maturity gap for Gunnison?

$$MGAP = 8.31 - 3.17 = 5.14 \text{ years}$$

d. What does your answer to part (c) imply about the interest rate exposure of Gunnison Insurance?

Gunnison Insurance is exposed to interest rate risk. If interest rates rise, net worth will decrease because the average maturity of the assets is higher than the average maturity of the liabilities. The opposite holds true if interest rates fall (That is, net worth will increase.)

e. Calculate the values of all four securities of Gunnison Insurance's balance sheet assuming that all interest rates increase 2 percent. What is the dollar change in the total asset and total liability values? What is the percentage change in these values?

$$\text{T-notes: PV} = 8.75 * PVIFA_{i=7\%, n=2} + 175 * PVIF_{i=7\%, n=2} = \$168.67$$

$$\text{Munis: PV} = 14.85 * PVIFA_{i=11\%, n=15} + 165 * PVIF_{i=11\%, n=15} = \$141.27$$

$$\text{Commercial Paper: PV} = 6.075 * PVIFA_{i=6.5\%, n=1} + 135 * PVIF_{i=6.5\%, n=1} = \$132.46$$

$$\text{Note: PV} = 12.80 * PVIFA_{i=10\%, n=5} + 160 * PVIF_{i=10\%, n=5} = \$147.87$$

$$\text{Total assets} = \$168.67 + \$141.27 = \$309.94 \Rightarrow \Delta A = -\$30.06 \text{ or } -8.84 \text{ percent change}$$

$$\text{Total liabilities} = \$132.46 + \$147.87 = \$280.33 \Rightarrow \Delta L = -\$14.67 \text{ or } -4.97 \text{ percent change}$$

f. What is the dollar impact on the market value of equity for Gunnison? What is the percentage change in the value of the equity?

$$\Delta E = \Delta A - \Delta L = -\$30.06 - (-\$14.67) = -\$15.39 \Rightarrow -34.2 \text{ percent}$$

g. What would be the impact on Gunnison's market value of equity if the liabilities paid interest semiannually instead of annually?

The value of liabilities will be lower with semi-annual compounding, increasing the value of net worth. The one-year CP will decline in value to \$132.43. The five-year note will decline in value to \$147.64. The value of equity will increase to \$29.87 = (\$168.67 + \$141.27) - (\$132.43 + \$147.64).

30. Scandia Bank has issued a one-year, \$1million CD paying 5.75 percent to fund a one-year loan paying an interest rate of 6 percent. The principal of the loan will be paid in two installments, \$500,000 in six months and the balance at the end of the year.

- a. What is the maturity gap of Scandia Bank? According to the maturity model, what does this maturity gap imply about the interest rate risk exposure faced by Scandia Bank?**

The maturity gap is 1 year – 1 year = 0. The maturity gap model would state that the bank is immunized against changes in interest rates because assets and liabilities are of equal maturity.

- b. What is the expected net interest income at the end of the year?**

Principal received in six months	\$500,000
Interest received in six months ($.03 \times \$1,000,000$)	<u>30,000</u>
Total	\$530,000

Principal received at the end of the year	\$500,000
Interest received at the end of the year ($.03 \times \$500,000$)	15,000
Future value of interest received in six months ($\$530,000 \times 1.03^*$)	<u>545,900</u>
Total principal and interest received	\$1,060,900

Principal and interest paid on deposits ($\$1,000,000 \times 0.0575$)	<u>\$1,057,500</u>
Net interest income received	\$3,400

* It is assumed that the money will be reinvested at current loan rates. Note that the principal is also included in the analysis because interest expense is based on \$1,000,000.

- c. What would be the effect on annual net interest income of a 2 percent interest rate increase that occurred immediately after the loan was made? What would be the effect of a 2 percent decrease in rates?**

If interest rates increase 2 percent, then the reinvestment benefits of cash flows in six months will be higher:

Principal received in six months	\$500,000
Interest received in six months ($.03 \times \$1,000,000$)	<u>30,000</u>
Total	\$530,000

Principal received at the end of the year	\$500,000
Interest received at the end of the year ($.03 \times \$500,000$)	15,000
Future value of interest received in six months ($\$530,000 \times 1.04$)	<u>551,200</u>
Total principal and interest received	\$1,066,200

Principal and interest paid on deposits ($\$1,000,000 \times 0.0575$)	<u>\$1,057,500</u>
Net interest income received	\$8,700

If interest rates decrease by 2 percent, then reinvestment income is reduced.

Principal received in six months	\$500,000
Interest received in six months (.03 x \$1,000,000)	<u>30,000</u>
Total	\$530,000

Principal received at the end of the year	\$500,000
Interest received at the end of the year (.03 x \$500,000)	15,000
Future value of interest received in six months (\$530,000 x 1.02)	<u>540,600</u>
Total principal and interest received	\$1,055,600

Principal and interest paid on deposits (\$1,000,000 x 0.0575)	<u>\$1,057,500</u>
Net income received	-\$1,900

d. What do these results indicate about the ability of the maturity model to immunize portfolios against interest rate exposure?

The results indicate that just matching assets and liabilities by maturity is not sufficient to immunize a portfolio against interest rate risk. If the timing of the cash flows within a period is different for assets and liabilities, the effects of interest rate changes are different. For a truly effective immunization strategy, one also needs to account for the timing of cash flows.

- 31. EDF Bank has a very simple balance sheet. Assets consist of a two-year, \$1 million loan that pays an interest rate of LIBOR plus 4 percent annually. The loan is funded with a two-year deposit on which the bank pays LIBOR plus 3.5 percent interest annually. LIBOR currently is 4 percent, and both the loan and the deposit principal will be paid at maturity.**

a. What is the maturity gap of this balance sheet?

Maturity gap = 2 - 2 = 0 years

b. What is the expected net interest income in year 1 and year 2?

Interest received in year 1	\$80,000	Interest received in year 2	\$80,000
Interest paid in year 1	<u>75,000</u>	Interest paid in year 2	<u>75,000</u>
Net interest income in year 1	\$5,000	Net interest income in year 2	\$5,000

- c. Immediately prior to the beginning of year 2, LIBOR rates increased to 6 percent. What is the expected net interest income in year 2? What would be the effect on net interest income of a 2 percent decrease in LIBOR?**

<u>Year 2: If interest rates increase 2 percent</u>		<u>Year 2: If interest rates decrease 2 percent</u>	
Interest received in year 2	\$100,000	Interest received in year 2	\$60,000
Interest paid in year 2	<u>95,000</u>	Interest paid in year 2	<u>55,000</u>
Net interest income in year 2	\$5,000	Net interest income in year 2	\$5,000

32. What are the weaknesses of the maturity model?

First, the maturity model does not consider the degree of leverage on the balance sheet. For example, if assets are not financed entirely with deposits, a change in interest rates may cause the assets to change in value by a different amount than the liabilities. Second, the maturity model does not take into account the timing of the cash flows of either the assets or the liabilities, and thus reinvestment and/or refinancing risk may become important factors in profitability and valuation as interest rates change.

The following questions and problems are based on material in Appendix 8B to the chapter.

33. The current one-year Treasury bill rate is 5.2 percent, and the expected one-year rate 12 months from now is 5.8 percent. According to the unbiased expectations theory, what should be the current rate for a two-year Treasury security?

$$(1.052)(1.058) = (1 + R_2)^2 = 1.113016; (1 + R_2) = 1.054996 \Rightarrow R_2 = .0550 \text{ or } 5.50 \text{ percent}$$

34. Suppose that the current one-year rate (one-year spot rate) and expected one-year T-bill rates over the following three years (i.e., years 2, 3, and 4, respectively) are as follows:

$${}_1R_1 = 6\% \quad E({}_2r_1) = 7\% \quad E({}_3r_1) = 7.5\% \quad E({}_4r_1) = 7.85\%$$

Using the unbiased expectations theory, calculate the current (long-term) rates for one-, two-, three-, and four-year-maturity Treasury securities. Plot the resulting yield curve.

$${}_1R_1 = 6.00\%$$

$${}_1R_2 = [(1 + .06)(1 + .07)]^{1/2} - 1 = 6.50\%$$

$${}_1R_3 = [(1 + .06)(1 + .07)(1 + .075)]^{1/3} - 1 = 6.83\%$$

$${}_1R_4 = [(1 + .06)(1 + .07)(1 + .075)(1 + .0785)]^{1/4} - 1 = 7.09\%$$

and the current yield to maturity curve will be upward sloping as shown:

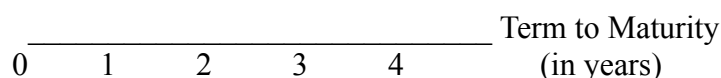
Yield to Maturity

7.09%

6.83%

6.50%

6.00%



- 35. The Wall Street Journal reported interest rates of 6 percent, 6.35 percent, 6.65 percent, and 6.75 percent for three-year, four-year, five-year, and six-year Treasury notes, respectively. According to the unbiased expectations theory, what are the expected one-year rates for years 4, 5, and 6?**

$$[1 + E(i_{t1})] = (1 + {}_1R_i)^i \div (1 + {}_1R_{i-1})^{i-1}$$

$$[1 + E({}_4r_1)] = (1.0635)^4 \div (1.06)^3 = 1.0741 \Rightarrow E({}_4r_1) = 7.41 \text{ percent for period 4}$$

$$[1 + E({}_5r_1)] = (1.0665)^5 \div (1.0635)^4 = 1.0786 \Rightarrow E({}_5r_1) = 7.86 \text{ percent for period 5}$$

$$[1 + E({}_6r_1)] = (1.0675)^6 \div (1.0665)^5 = 1.0725 \Rightarrow E({}_6r_1) = 7.25 \text{ percent for period 6}$$

- 36. The Wall Street Journal reports that the rate on three-year Treasury securities is 5.60 percent and the rate on four-year Treasury securities is 5.65 percent. According to the unbiased expectations hypothesis, what does the market expect the one-year Treasury rate to be in year 4, $E({}_4r_1)$?**

$${}_1R_4 = [(1 + {}_1R_1)(1 + E({}_2r_1))(1 + E({}_3r_1))(1 + E({}_4r_1))]^{1/4} - 1$$

$$\text{Thus, } 0.0565 = [(1 + .056)^3(1 + E({}_4r_1))]^{1/4} - 1$$

$$\text{and } E({}_4r_1) = [(1 + .0565)^4 / (1 + .056)^3] - 1 = 5.80\%$$

- 37. How does the liquidity premium theory of the term structure of interest rates differ from the unbiased expectations theory? In a normal economic environment, that is, an upward-sloping yield curve, what is the relationship of liquidity premiums for successive years into the future? Why?**

The unbiased expectations theory asserts that long-term rates are a geometric average of current and expected short-term rates. The liquidity premium theory asserts that long-term rates are a geometric average of current and expected short-term rates plus a liquidity risk premium. The premium is assumed to increase with the maturity of the security because the uncertainty of future returns grows as maturity increases.

38. Based on economists' forecasts and analysis, one-year Treasury bill rates and liquidity premiums for the next four years are expected to be as follows:

$${}_1R_1 = 5.65\%$$

$$E({}_2r_1) = 6.75\%$$

$$L_2 = 0.05\%$$

$$E({}_3r_1) = 6.85\%$$

$$L_3 = 0.10\%$$

$$E({}_4r_1) = 7.15\%$$

$$L_4 = 0.12\%$$

Using the liquidity premium hypothesis, plot the current yield curve. Make sure you label the axes on the graph and identify the four annual rates on the curve both on the axes and on the yield curve itself.

$${}_1R_1 = 5.65\%$$

$${}_1R_2 = [(1 + .0565)(1 + .0675 + .0005)]^{1/2} - 1 = 6.22\%$$

$${}_1R_3 = [(1 + .0565)(1 + .0675 + .0005)(1 + .0685 + .001)]^{1/3} - 1 = 6.47\%$$

$${}_1R_4 = [(1 + .0565)(1 + .0675 + .0005)(1 + .0685 + .001)(1 + .0715 + .0012)]^{1/4} - 1 = 6.67\%$$

and the current yield curve will be upward sloping as shown:

Yield to Maturity

6.67%

6.47%

6.22%

5.65%

0 1 2 3 4 Term to Maturity
(in years)

39. *The Wall Street Journal* reports that the rate on three-year Treasury securities is 5.25 percent and the rate on four-year Treasury securities is 5.50 percent. The one-year interest rate expected in year four is $E({}_4r_1)$, 6.10 percent. According to the liquidity premium hypothesis, what is the liquidity premium on the four-year Treasury security, L_4 ?

$${}_1R_4 = [(1+{}_1R_1)(1+E({}_2r_1)+L_2)(1+E({}_3r_1)+L_3)(1+E({}_4r_1)+L_4)]^{1/4} - 1$$

Thus, $0.055 = [(1+.0525)^3(1+E({}_4r_1)+L_4)]^{1/4} - 1$

and $0.061 + L_4 = [(1+.055)^4/(1+.0525)^3] - 1 \Rightarrow L_4 = .00154 = 0.154\%$

40. You note the following yield curve in *The Wall Street Journal*. According to the unbiased expectations hypothesis, what is the one-year forward rate for the period beginning two years from today, ${}_2f_1$?

Maturity	Yield
One day	2.00%
One year	5.50
Two years	6.50
Three years	9.00

$${}_2f_1 = [(1 + {}_1R_2)^2 / (1 + {}_1R_1)] - 1$$

$${}_2f_1 = [(1.065)^2 / (1.055)] - 1 = 7.51\%$$

Integrated Mini Case: Calculating and Using the Repricing GAP

State Bank's balance sheet is listed below. Market yields are in parenthesis, and amounts are in millions.

<u>Assets</u>		<u>Liabilities and Equity</u>	
Cash	\$20	Demand deposits	\$250
Fed funds (5.05%)	150	Savings accounts (1.5%)	20
3-month T-bills (5.25%)	150	MMDAs (4.5%)	
2-year T-notes (6.50%)	100	(no minimum balance requirement)	340
8-year T-notes (7.50%)	200	3-month CDs (4.2%)	120
5-year munis (floating rate)		6-month CDs (4.3%)	220
(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 car loans (7%)	350	5-year CDs (6%)	350
7-month C&I loans (5.8%)	200	Fed funds (5%)	225
2-year C&I loans (floating rate)		Overnight repos (5%)	290
(5.15%, repriced @ 6-months)	275	6-month commercial paper (5.05%)	300
15-year variable rate mortgages		Subordinate notes:	
(5.8%, repriced @ 6-months)	200	3-year fixed rate (6.55%)	200

15-year variable rate mortgages (6.1%, repriced @ year)	400	Subordinated debt: 7-year fixed rate (7.25%)	<u>100</u>
15-year fixed-rate mortgages (7.85%)	300	Total liabilities	\$3,545
30-year variable rate mortgages (6.3%, repriced @ quarter)	225		
30-year variable rate mortgages (6.4%, repriced @ month)	355		
30-year fixed-rate mortgages (8.2%)	400		
Premises and equipment	<u>20</u>	Equity	<u>400</u>
Total assets	<u>\$3,945</u>	Total liabilities and equity	<u>\$3,945</u>

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

<u>Assets</u>		<u>Repricing period</u>
Cash	\$20	Not rate sensitive
Fed funds (5.05%)	150	30-days
3-month T-bills (5.25%)	150	6-months
2-year T-notes (6.50%)	100	2-years
8-year T-notes (7.50%)	200	Not rate sensitive
5-year munis (floating rate) (8.20%, repriced @ 6 months)	50	6-months
6-month consumer loans (6%)	250	6-months
1-year consumer loans (5.8%)	300	1-year
5-year car loans (7%)	350	5-years
7-month C&I loans (5.8%)	200	1-year
2-year C&I loans (floating rate) (5.15%, repriced @ 6-months)	275	6-months
15-year variable rate mortgages (5.8%, repriced @ 6-months)	200	6-months
15-year variable rate mortgages (6.1%, repriced @ year)	400	1-year
15-year fixed-rate mortgages (7.85%)	300	Not rate sensitive
30-year variable rate mortgages (6.3%, repriced @ quarter)	225	6-months
30-year variable rate mortgages (6.4%, repriced @ month)	355	30-days
30-year fixed-rate mortgages (8.2%)	400	Not rate sensitive
Premises and equipment	<u>20</u>	Not rate sensitive
<u>Liabilities and Equity</u>		<u>Repricing Period</u>
Demand deposits	\$250	Not rate sensitive
Savings accounts (1.5%)	20	30-days

MMDAs (4.5%)		
(no minimum balance requirement)	340	30-days
3-month CDs (4.2%)	120	6-months
6-month CDs (4.3%)	220	6-months
1-year CDs (4.5%)	375	1-year
2-year CDs (5%)	425	2-years
4-year CDs (5.5%)	330	5-years
5-year CDs (6%)	350	5-years
Fed funds (5%)	225	30-months
Overnight repos (5%)	290	30-months
6-month commercial paper (5.05%)	300	6-months
Subordinate notes		
3-year fixed rate (6.55%)	200	5-years
Subordinated debt		
7-year fixed rate (7.25%)	100	Not rate sensitive
Equity	400	Not rate sensitive

30-day repricing gap: RSAs = \$150m. + \$355m. = \$505m.
RSLs = \$20m. + \$340m. + \$225m. + \$290m. = \$875m.
CGAP = \$505m. - \$875m. = -\$370m.

6-month repricing gap: RSAs = \$505m. + \$150m. + \$50m. + \$250m. + \$275m. + \$200m.
+ \$225m. = \$1655m.
RSLs = \$875m. + \$120m. + \$220m. + \$300m. = \$1515m.
CGAP = \$1655m. - \$1515m. = \$140m.

1-year repricing gap: RSAs = \$1655m. + \$300m. + \$200m. + \$400m. = \$2555m.
RSLs = \$1515m. + \$375m. = \$1890m.
CGAP = \$2555m. - \$1890m. = \$665m.

2-year repricing gap: RSAs = \$2555m. + \$100m. = \$2655m.
RSLs = \$1890m. + \$425m. = \$2315m.
CGAP = \$2655m. - \$2315m. = \$340m.

5-year repricing gap: RSAs = \$2655m. + \$350m. = \$3005m.
RSLs = \$2315m. + \$330m. + \$350m. + \$200m. = \$3195m.
CGAP = \$3005m. - \$3195m. = -\$190m.

b. What is the impact over the next six months on net interest income if interest rates on RSAs increase 60 basis points and on RSLs increase 40 basis points?

$$\begin{aligned}\Delta \text{NII (6-months)} &= \Delta \text{II (6-months)} - \Delta \text{IE (6-months)} \\ &= \$1655\text{m.}(.0060) - \$1515\text{m.}(.0040) = \$3.87\text{m.}\end{aligned}$$

c. What is the impact over the next year on net interest income if interest rates on RSAs increase 60 basis points and on RSLs increase 40 basis points?

$$\begin{aligned}\Delta \text{NII (1-year)} &= \Delta \text{II (1-year)} - \Delta \text{IE (1-year)} \\ &= \$2555\text{m.}(.0060) - \$1890\text{m.}(.0040) = \$7.77\text{m.}\end{aligned}$$