**Solutions for End-of-Chapter Questions and Problems: Chapter Seven**

1. What is the process of *asset transformation* performed by a financial institution? Why does this process often lead to the creation of *interest rate risk*? What is interest rate risk?

Asset transformation by an FI involves purchasing primary assets and issuing secondary assets as a source of funds. The primary securities purchased by the FI often have maturity and liquidity characteristics that are different from the secondary securities issued by the FI. For example, a bank buys medium- to long-term bonds and makes medium-term loans with funds raised by issuing short-term deposits.

Interest rate risk occurs because the prices and reinvestment income characteristics of long-term assets react differently to changes in market interest rates than the prices and interest expense characteristics of short-term deposits. Interest rate risk is the risk incurred by an FI when the maturities of its assets and liabilities are mismatched.

1. What is*refinancing risk*? How is refinancing risk part of interest rate risk? If an FI funds long-term fixed-rate assets with short-term liabilities, what will be the impact on earnings of an increase in the rate of interest? A decrease in the rate of interest?

Refinancing risk is the risk that the cost of rolling over or reborrowing funds will rise above the returns being earned on asset investments. This risk occurs when an FI is holding assets with maturities greater than the maturities of its liabilities. For example, if a bank has a ten-year fixed-rate loan funded by a 2-year time deposit, the bank faces a risk in that new deposits may only be obtained, and the loans refinanced, at a higher rate in two years. These interest rate increases would reduce net interest income. The bank would benefit if interest rates fall as the cost of renewing the deposits would decrease, while the interest rate earned on the loan would not change. In this case, net interest income would increase.

1. What is *reinvestment risk*? How is reinvestment risk part of interest rate risk? If an FI funds short-term assets with long-term liabilities, what will be the impact on earnings of a decrease in the rate of interest? An increase in the rate of interest?

Reinvestment risk is the risk that the return on funds to be reinvested will fall below the cost of funds. This risk occurs when an FI holds assets with maturities that are shorter than the maturities of its liabilities. For example, if a bank has a two-year loan funded by a ten-year fixed-rate time deposit, the bank faces the risk that it might be forced to lend or reinvest the money at lower rates after two years, perhaps even below the deposit rates. Also, if the bank receives periodic cash flows, such as coupon payments from a bond or monthly payments on a loan, these periodic cash flows will also be reinvested at the new lower (or higher) interest rates. Besides the effect on the income statement, reinvestment risk may cause realized yields on assets to differ from the a priori expected yields.

4. The sales literature of a mutual fund claims that the fund has no risk exposure since it invests exclusively in federal government securities which are free of default risk. Is this claim true? Explain why or why not.

Although the fund's asset portfolio is comprised of securities with no default risk, the securities are exposed to interest rate risk. For example, if interest rates increase, the market value of the fund's Treasury security portfolio will decrease. Further, if interest rates decrease, the realized yield on these securities will be less than the expected rate of return because of reinvestment risk. In either case, investors who liquidate their positions in the fund may sell at a Net Asset Value (NAV) that is lower than the purchase price.

5. How can interest rate risk adversely affect the economic or market value of an FI?

When interest rates increase (or decrease), the values of fixed-rate assets decrease (or increase) because of the discounted present value of the cash flows. To the extent that the change in market value of the assets differs from the change in market value of the liabilities, the difference is realized in the economic or market value of the equity of the FI. For example, for most depository institutions, an increase in interest rates will cause asset values to decrease more than liability values. The difference will cause the market value, or share price, of equity to decrease.

6. Consider an FI that issues $100 million of liabilities with one year to maturity to finance the purchase of $100 million of assets with a two year maturity. Suppose that the cost of funds (liabilities) for the FI is 5 percent per year and the interest return on the assets is 8 percent per year.

a. Calculate the FI’s profit spread and dollar value of profit in year 1.

Over the first year, the FI can lock in a profit spread of 3 percent (8 percent - 5 percent) by borrowing short term (for one year) and lending long term (for two years). Thus, its profit is $3 million (0.03 x $100m.). Its profit for the second year, however, is uncertain. The risk always exists, however, that interest rates will change between years 1 and 2.

b. Calculate the profit spread and dollar value of profit in year 2, if the FI can refinance its liabilities at 5 percent.

If the level of interest rates does not change, the FI will, receive a profit spread of 3 percent or $3 million profit for the second year as well.

c. If interest rates rise and the FI can borrow new one-year liabilities at 9 percent in the second year, calculate the FI’s profit spread and dollar value of profit in year 2.

In this case the FI’s profit spread in the second year is negative: 8 percent -9 percent = -1 percent, or the FI loses $1 million(-0.01 x 100m.). The positive spread earned in the first year by the FI from holding assets with a longer maturity than its liabilities is offset by a negative spread in the second year. As a result, when an FI holds longer-term assets relative to liabilities, it potentially exposes itself to the interest rate risk that the cost of refinancing can be more than the return earned on asset investments.

d. If interest rates fall and the FI can borrow new one-year liabilities at 3 percent in the second year, calculate the FI’s profit spread and dollar value of profit in year 2.

If interest rates rise and the FI can borrow new one-year liabilities at 3 percent in the second year, its profit spread in the second year is positive: 8 percent - 3 percent = 5 percent, or the FI gains $5 million(0.05 x 100m.). The positive spread earned in the first year by the FI from holding assets with a longer maturity than its liabilities is even greater in the second year.

7. Consider an FI that issues $200 million of liabilities with two years to maturity to finance the purchase of $200 million of assets with a one year maturity. Suppose that the cost of funds (liabilities) for the FI is 5 percent per year and the interest return on the assets is 9 percent per year.

a. Calculate the FI’s profit spread and dollar value of profit in year 1.

Over the first year, the FI can lock in a profit spread of 4 percent (9 percent - 5 percent) by borrowing long term (for two years) and lending short term (for one year). Thus, its profit is $8 million (0.04 x $200m.). In this case, the FI is also exposed to an interest rate risk; by holding shorter term assets relative to liabilities, it faces uncertainty about the interest rate at which it canreinvest funds in the second period.

b. Calculate the profit spread and dollar value of profit in year 2, if the FI can reinvest its assets at 9 percent.

If the level of interest rates does not change, the FI will receive a profit spread of 4 percent or $8 million profit for the second year as well.

c. If interest rates fall and the FI can invest in one-year assets at 6 percent in the second year, calculate the FI’s profit spread and dollar value of profit in year 2.

If in the second year interest rates on $200 million invested in new one-year assets decreases to 6 percent, the FI’s profit spread falls to 1 percent (6 percent - 5 percent), or the FI profit falls to $2 million (0.01 x $200m.). As a result, when an FI holds longer term liabilities relative to assets, it potentially exposes itself to the interest rate risk that borrowed funds can only be reinvested at a rate lower than their cost.

d. If interest rates rise and the FI can invest in one-year assets at 11 percent in the second year, calculate the FI’s profit spread and dollar value of profit in year 2.

If in the second year interest rates on $200 million invested in new one-year assets increases to 11 percent, the FI’s profit spread rises to 6 percent (11 percent - 5 percent), or the FI profit increases to $12 million (0.06 x $200m.).

8. A financial institution has the following market value balance sheet structure:

Assets Liabilities and Equity

Cash $1,000 Certificate of deposit $10,000

Bond $10,000 Equity $1,000

Total assets $11,000 Total liabilities and equity $11,000

a. The bond has a 10-year maturity, a fixed-rate coupon of 10 percent paid at the end of each year, and a par value of $10,000. The certificate of deposit has a 1-year maturity and a 6 percent fixed rate of interest. The FI expects no additional asset growth. What will be the net interest income (NII) at the end of the first year? *Note*: Net interest income equals interest income minus interest expense.

Interest income $1,000 $10,000 x 0.10

Interest expense 600 $10,000 x 0.06

Net interest income (NII) $400

b. If at the end of year 1 market interest rates have increased 100 basis points (1 percent), what will be the net interest income for the second year? Is the change in NII caused by reinvestment risk or refinancing risk?

Interest income $1,000 $10,000 x 0.10

Interest expense 700 $10,000 x 0.07

Net interest income (NII) $300

The decrease in net interest income is caused by the increase in financing cost without a corresponding increase in the earnings rate. Thus, the change in NII is caused by refinancing risk. The increase in market interest rates does not affect the interest income because the bond has a fixed-rate coupon for ten years. Note: this answer makes no assumption about reinvesting the first year’s interest income at the new higher rate.

c. Assuming that market interest rates increase 1 percent, the bond will have a value of $9,446 at the end of year 1. What will be the market value of the equity for the FI? Assume that all of the NII in part (a) is used to cover operating expenses or is distributed as dividends.

Cash $1,000 Certificate of deposit $10,000

Bond $9,446 Equity $ 446

Total assets $10,446 Total liabilities and equity $10,446

d. If market interest rates had decreased 100 basis points by the end of year 1, would the market value of equity be higher or lower than $1,000? Why?

The market value of the equity would be higher ($1,600) because the value of the bond would be higher ($10,600) and the value of the CD would remain unchanged.

e. What factors have caused the changes in operating performance and market value for this firm?

The operating performance has been affected by changes in market interest rates that have caused corresponding changes in interest income, interest expense, and net interest income. These specific changes have occurred because of the unique maturities of the fixed-rate assets and variable-rate liabilities. Similarly, the economic or market value of the firm has changed because of the effect of the changing rates on the market value of the bond.

9. How does a policy of matching the maturities of assets and liabilities work (a) to minimize interest rate risk and (b) against the asset-transformation function of FIs?

A policy of maturity matching will allow changes in market interest rates to have approximately the same effect on both interest income and interest expense. An increase in rates will tend to increase both income and expense, and a decrease in rates will tend to decrease both income and expense. The changes in income and expense may not be equal because of different cash flow characteristics of the assets and liabilities. The asset-transformation function of an FI involves investing short-term liabilities in long-term assets. Maturity matching clearly works against successful implementation of this process.

10. Corporate bonds usually pay interest semiannually. If a company decided to change from semiannual to annual interest payments, how would this affect the bond’s interest rate risk?

The interest rate risk would increase as the bonds are being paid back more slowly and therefore the cash flows would be exposed to interest rate changes for a longer period of time. Thus, any change in interest rates would cause a larger inverse change in the value of the bonds.

11. Two 10-year bonds are being considered for an investment that may have to be liquidated before the maturity of the bonds. The first bond is a 10-year premium bond with a coupon rate higher than its required rate of return, and the second bond is a zero-coupon bond that pays only a lump-sum payment after 10 years with no interest over its life. Which bond would have more interest rate risk? That is, which bond’s price would change by a larger amount for a given change in interest rates? Explain your answer.

The zero-coupon bond would have more interest rate risk. Because the entire cash flow is not received until the bond matures, the entire cash flow is exposed to interest rate changes over the entire life of the bond. The cash flows of the coupon-paying bond are returned with periodic regularity, thus allowing less exposure to interest rate changes. In effect, some of the cash flows may be received before interest rates change.

12. Consider again the two bonds in problem 11. If the investment goal is to leave the assets untouched until maturity, such as for a child’s education or for one’s retirement, which of the two bonds has more interest rate risk? What is the source of this risk?

In this case the coupon-paying bond has more interest rate risk. The zero-coupon bond will generate exactly the expected return at the time of purchase because no interim cash flows will be realized. Thus, the zero-coupon bond has no reinvestment risk. The coupon-paying bond faces reinvestment risk each time a coupon payment is received. The results of reinvestment will be beneficial if interest rates rise, but decreases in interest rate will cause the realized return to be less than the expected return.

13. A money market mutual fund bought $1 million of two-year Treasury notes six months ago. During this time, the value of the securities has increased, but for tax reasons the mutual fund wants to postpone any sale for two more months. What type of risk does the mutual fund face for the next two months?

The mutual fund faces the risk of interest rates rising and the value of the securities falling.

14. A bank invested $50 million in a two-year asset paying 10 percent interest per year and simultaneously issued a $50 million, one-year liability paying 8 percent interest per year. The liability will be rolled over after one year at the current market rate. What will be the bank’s net interest income if at the end of the first year all interest rates have increased by 1 percent (100 basis points)?

Net interest income is not affected in the first year, but NII will decrease in the second year.

Year 1 Year 2

Interest income $5,000,000 $5,000,000

Interest expense $4,000,000 $4,500,000

Net interest income $1,000,000 $500,000

The bank’s net interest income decreases in year 2 by $500,000 as the result of refinancing risk.

15. What is *credit risk*? Which types of FIs are more susceptible to this type of risk? Why?

Credit risk is the risk that promised cash flows from loans and securities held by FIs may not be paid in full. FIs that lend money for long periods of time, whether as loans or by buying bonds, are more susceptible to this risk than those FIs that have short investment horizons. For example, life insurance companies and depository institutions generally must wait a longer time for returns to be realized than money market mutual funds and property-casualty insurance companies.

16. What is the difference between *firm-specific credit risk* and *systematic credit risk*? How can an FI alleviate firm-specific credit risk?

Firm-specific credit risk refers to the likelihood that a single asset may deteriorate in quality, while systematic credit risk involves macroeconomic factors that may increase the default risk of all firms in the economy. Thus, if S&P lowers its rating on IBM stock and if an investor is holding only this particular stock, he may face significant losses as a result of this downgrading. However, portfolio theory in finance has shown that firm-specific credit risk can be diversified away if a portfolio of well-diversified stocks is held. Similarly, if an FI holds a well-diversified portfolio of assets, the FI will face only systematic credit risk that will be affected by the general condition of the economy. The risks specific to any one customer will not be a significant portion of the FIs overall credit risk.

17. Many banks and savings institutions that failed in the 1980s had made loans to oil companies in Louisiana, Texas, and Oklahoma. When oil prices fell, these companies, the regional economy, and the banks and savings institutions all experienced financial problems. What types of risk were inherent in the loans that were made by these banks and savings institutions?

The loans in question involved credit risk. Although the geographic area covered a large region of the United States, the risk more closely characterized firm-specific risk than systematic risk. More extensive diversification by the FIs to other types of industries would have decreased the amount of financial hardship these institutions had to endure.

18. What is *liquidity risk*? What routine operating factors allow FIs to deal with this risk in times of normal economic activity? What market reality can create severe financial difficulty for an FI in times of extreme liquidity crises?

Liquidity risk is the risk that a sudden surge in liability withdrawals may require an FI to liquidate assets in a very short period of time and at less than fair market prices. In times of normal economic activity, depository institutions meet cash withdrawals by accepting new deposits and borrowing funds in the short-term money markets. However, in times of harsh liquidity crises, the FI may need to sell assets at significant losses in order to generate cash quickly.

19. Consider the simple FI balance sheet below (in millions of dollars).

**Before the Withdrawal**

**Assets Liabilities/Equity**

Cash assets $ 20 Deposit $150

Nonliquid

assets 155 Equity 25

$175 $175

Suppose that depositors unexpectedly withdraw $50 million in deposits and the FI receives no new deposits to replace them. Assume that the FI cannot borrow any more funds in the short-term money markets, and because it cannot wait to get better prices for its assets in the future (as it needs the cash now to meet immediate depositor withdrawals), the FI has to sell any nonliquid assets at 75 cents on the dollar. Show the FI’s balance sheet after adjustments are made for the $50 million of deposit withdrawals.

.  **Before the Withdrawal After the Withdrawal**

**Assets Liabilities/Equity Assets Liabilities/Equity**

Cash assets $ 20 Deposit $150 Cash assets $ 0 Deposits $100

Nonliquid Nonliquid

assets 155 Equity 25 assets 115 Equity 15

$175 $175 $115 $115

To meet these deposit withdrawals, the FI first uses the $20 million it has in cash assets and then seeks to sell some of its nonliquid assets to raise an additional $30 million in cash. To cover the remaining $30 million in deposit withdrawals, the FI must sell $40 million in nonliquid assets, incurring a loss of $10million from the face value of those assets. The FI must then write off any such losses against its capital or equity funds. Since its capital was only $10 million before the deposit withdrawal, the loss on the fire-sale of assets of $5 million leaves the FI with $5 million.

20. What two factors provide potential benefits to FIs that expand their asset holdings and liability funding sources beyond their domestic borders?

FIs can realize operational and financial benefits from direct foreign investment and foreign portfolio investments in two ways. First, the technologies and firms across various economies differ from each other in terms of growth rates, extent of development, etc. Second, exchange rate changes may not be perfectly correlated across various economies.

21. What is *foreign exchange risk*? What does it mean for an FI to be *net long* in foreign assets? What does it mean for an FI to be *net short* in foreign assets? In each case, what must happen to the foreign exchange rate to cause the FI to suffer losses?

Foreign exchange risk is the risk that exchange rate changes can affect the value of an FI’s assets and liabilities denominated in non-domestic currencies. An FI is net long in foreign assets when the foreign currency-denominated assets exceed the foreign currency-denominated liabilities. In this case, an FI will suffer potential losses if the domestic currency strengthens relative to the foreign currency when repayment of the assets will occur in the foreign currency. An FI is net short in foreign assets when the foreign currency-denominated liabilities exceed the foreign currency-denominated assets. In this case, an FI will suffer potential losses if the domestic currency weakens relative to the foreign currency when repayment of the liabilities will occur in the domestic currency.

22. If the Swiss franc is expected to depreciate in the near future, would a U.S.-based FI in Bern City prefer to be net long or net short in its asset positions? Discuss.

The U.S. FI would prefer to be net short (liabilities greater than assets) in its asset position. The depreciation of the Swiss franc relative to the dollar means that the U.S. FI would pay back the net liability position with fewer dollars. In other words, the decrease in the foreign assets in dollar value after conversion will be less than the decrease in the value of the foreign liabilities in dollar value after conversion.

23. If international capital markets are well integrated and operate efficiently, will FIs be exposed to foreign exchange risk? What are the sources of foreign exchange risk for FIs?

If there are no real or financial barriers to international capital and goods flows, FIs can eliminate all foreign exchange rate risk exposure. Sources of foreign exchange risk exposure include international differentials in real prices, cross-country differences in the real rate of interest (perhaps, as a result of differential rates of time preference), regulatory and government intervention, and restrictions on capital movements, trade barriers, and tariffs.

24. If an FI has the same amount of foreign assets and foreign liabilities in the same currency, has that FI necessarily reduced the risk involved in these international transactions to zero? Explain.

Matching the size of the foreign currency book will not eliminate the risk of the international transactions if the maturities of the assets and liabilities are mismatched. To the extent that the assets and liabilities are mismatched in terms of maturities, or more importantly durations, the FI will be exposed to foreign interest rate risk.

25. A U.S. insurance company invests $1,000,000 in a private placement of British bonds. Each bond pays £300 in interest per year for 20 years. If the current exchange rate is £1.564/$, what is the nature of the insurance company’s exchange rate risk? Specifically, what type of exchange rate movement concerns this insurance company?

In this case, the insurance company is worried about the value of the £ falling. If this happens, the insurance company would be able to buy fewer dollars with the £s received. This would happen if the exchange rate rose to say £1.68/$ since now it would take more £s to buy one dollar, but the bond contract is paying a fixed amount of interest and principal.

26. Assume that a bank has assets located in London worth £150 million on which it earns an average of 8 percent per year. The bank has £100 million in liabilities on which it pays an average of 6 percent per year. The current spot exchange rate is £1.50/$.

a. If the exchange rate at the end of the year is £2.00/$, will the dollar have appreciated or devalued against the mark?

The dollar will have appreciated, or conversely, the £ will have depreciated.

b. Given the change in the exchange rate, what is the effect in dollars on the net interest income from the foreign assets and liabilities? *Note*: The net interest income is interest income minus interest expense.

Measurement in £

Interest received = £12 million

Interest paid = £6 million

Net interest income = £6 million

Measurement in $ before £ devaluation

Interest received in dollars = $8 million

Interest paid in dollars = $4 million

Net interest income = $4 million

Measurement in $ after £ devaluation

Interest received in dollars = $6 million

Interest paid in dollars = $3 million

Net interest income = $3 million

Thus, net interest income decreases by $1 million as a result of foreign exchange risk.

c. What is the effect of the exchange rate change on the value of assets and liabilities in dollars?

The assets were worth $100 million (£150m/1.50) before depreciation, but after devaluation they are worth only $75 million. The liabilities were worth $66.67 million before depreciation, but they are worth only $50 million after devaluation. Since assets decline by $25 million and liabilities by $16.67 million, net worth decreases by $8.33 million using spot rates at the end of the year.

27. Six months ago, Qualitybank, issued a $100 million, one-year maturity CD denominated in euros. On the same date, $60 million was invested in a €-denominated loan and $40 million was invested in a U.S. Treasury bill. The exchange rate on this date was €1.5675/$. Assume no repayment of principal and an exchange rate today of €1.2540/$.

a. What is the current value of the CD principal (in euros and dollars)?

The current principal value on the CD is €156.75m and $125m (€156.75m/1.2540).

b. What is the current value of the euro-denominated loan principal (in euros and

dollars)?

The current principal value on the loan is €94.050m and $75m (€94.050m/1.2540).

c. What is the current value of the U.S. Treasury bill (in euros and dollars)?

The current principal value on the U.S. Treasury bill is $40m and €50.16m ($40m x 1.2540). For a U.S. bank this does not change in value.

1. What is Qualitybank’s profit/loss from this transaction (in euros and dollars)?

Qualitybank's loss is €12.540m (($40m x 1.5675) - €50.16m) or $10m (($125m - $100m) – ($75m - $60m)).

Solution matrix for problem 27:

**At Issue Date:**

Dollar Transaction Values (in millions) Euro Transaction Values (in millions)

Euro Euro Euro Euro

Loan $60 CD $100 Loan €94.050 CD €156.75

U.S T-bill $40 U.S. T-bill €62.700

$100 $100 €156.750 €156.75

**Today:**

Dollar Transaction Values (in millions) €Transaction Values (in millions)

Euro Euro Euro Euro

Loan $75 CD $125 Loan €94.050 CD €156.75

U.S. T-bill $40 U.S. T-bill €50.160

$115 $125 €144.210 €156.75

Loss -$ 10 Loss -€12.540

28. Suppose you purchase a 10-year, AAA-rated Swiss bond for par that is paying an annual coupon of 6 percent. The bond has a face value of 1,000 Swiss francs (SF). The spot rate at the time of purchase is SF1.15/$. At the end of the year, the bond is downgraded to AA and the yield increases to 8 percent. In addition, the SF appreciates to SF1.05/$.

a. What is the loss or gain to a Swiss investor who holds this bond for a year? What portion of this loss or gain is due to foreign exchange risk? What portion is due to interest rate risk?

Beginning of the Year



End of the Year



The loss to the Swiss investor (SF875.06 + SF60 - SF1,000)/SF1,000 = -6.49 percent. The entire amount of the loss is due to interest rate risk.

b. What is the loss or gain to a U.S. investor who holds this bond for a year? What portion of this loss or gain is due to foreign exchange risk? What portion is due to interest rate risk?

Price at beginning of year = SF1,000/SF1.15 = $869.565

Price at end of year = SF875.06/SF1.05 = $833.393

Interest received at end of year = SF60/SF1.05 = $57.143

Gain to U.S. investor = ($833.393 + $57.143 - $869.565)/$869.565 = +2.41%.

The U.S. investor had an equivalent loss of 6.49 percent ([((SF875.06 + SF60)/SF1.15) - $869.565]/$869.565) from interest rate risk, but had a gain of 8.90 percent (2.41% - (-6.49%)) from foreign exchange risk.

29. What is *country or sovereign risk*? What remedy does an FI realistically have in the event of a collapsing country or currency?

Country risk is the risk that repayments to foreign lenders or investors may be interrupted because of restrictions, intervention, or interference from foreign governments. A lender FI has very little recourse in this situation unless the FI is able to restructure the debt or demonstrate influence over the future supply of funds to the country in question. This influence likely would involve significant working relationships with the IMF and the World Bank.

30. What is *market risk*? How does this risk affect the operating performance of financial institutions? What actions can be taken by an FI’s management to minimize the effects of this risk?

Market risk is the risk incurred from assets and liabilities in an FI’s trading book due to changes in interest rates, exchange rates, and other prices. Market risk affects any firm that trades assets and liabilities. The risk can surface because of changes in interest rates, exchange rates, or any other prices of financial assets that are traded rather than held on the balance sheet. Market risk can be minimized by using appropriate hedging techniques such as futures, options, and swaps, and by implementing controls that limit the amount of exposure taken by market makers.

31. What is the nature of an off-balance-sheet activity? How does an FI benefit from such activities? Identify the various risks that these activities generate for an FI, and explain how these risks can create varying degrees of financial stress for the FI at a later time.

Off-balance-sheet activities are contingent commitments to undertake **future** on-balance-sheet investments. The usual benefit of committing to a future activity is the generation of immediate fee income without the normal recognition of the activity on the balance sheet. As such, these contingent investments may be exposed to credit risk (if there is some default risk probability), interest rate risk (if there is some price and/or interest rate sensitivity), and foreign exchange rate risk (if there is a cross currency commitment).

32. What is *technology risk*? What is the difference between *economies of scale* and *economies of scope*? How can these economies create benefits for an FI? How can these economies prove harmful to an FI?

Technology risk occurs when investment in new technologies does not generate the cost savings expected in the production and expansion of financial services. Economies of scale occur when the average cost of production decreases with the production of or an expansion in the amount of financial services provided. Economies of scope occur when an FI is able to lower overall costs by producing new products with inputs similar to those used for other products. In financial service industries, the use of data from existing customer databases to assist in providing new service products is an example of economies of scope. Failure to produce the perceived synergies or costs savings can result in major losses in competitive efficiency of an FI and, ultimately, in an FI’s long-term failure.

33. What is the difference between technology risk and *operational risk*? How does internationalizing the payments system among banks increase operational risk?

Technology risk is the risk incurred by an FI when its technological investments do not produce

anticipated cost savings. For example, if an FI spends millions on upgrading its computer systems, but is not able to recapture its costs because its productivity has not increased commensurately or because the technology has already become obsolete, it has invested in a negative NPV investment in technology.

Operational risk refers to the risk that existing technology, auditing, monitoring, and other support systems may malfunction or break down. This includes the failure of the back-room support operations necessary to maintain the smooth functioning of the operation of FIs, including settlement, clearing, and other transaction-related activities. For example, computerized payment systems such as Fedwire, CHIPS, and SWIFT allow modern financial intermediaries to transfer funds, securities, and messages across the world in seconds of real time. This creates the opportunity to engage in global financial transactions over a short time in an extremely cost-efficient manner. However, the interdependence of such transactions also creates settlement risk. Typically, any given transaction leads to other transactions as funds and securities trade across the globe. If there is either a transmittal failure or high-tech fraud affecting any one of the intermediate transactions, this could cause an unraveling of all subsequent transactions.

34. Why can *insolvency risk* be classified as a consequence or outcome of any or all of the other types of risks?

Insolvency risk is the risk that an FI may not have enough capital to offset a sudden decline in the value of its assets. This risk involves the shortfall of capital in times when the operating performance of the institution generates accounting losses. These losses may be the result of one or more of interest rate, credit, liquidity, sovereign, foreign exchange, market, off-balance-sheet, and technological risks.

35. Discuss the interrelationships among the different sources of FI risk exposure. Why would the construction of an FI risk management model to measure and manage only one type of risk be incomplete?

Measuring each source of FI risk exposure individually creates the false impression that they are independent of each other. For example, the interest rate risk exposure of an FI could be reduced by requiring customers to take on more interest rate risk exposure through the use of floating-rate products. However, this reduction in FI risk may be obtained only at the possible expense of increased credit risk. That is, customers experiencing losses resulting from unanticipated interest rate changes may be forced into insolvency, thereby increasing the FI’s default risk. Similarly, off-balance-sheet risk encompasses several risks since off-balance-sheet contingent contracts typically have credit risk and interest rate risk as well as currency risk. Moreover, the failure of collection and payment systems may lead corporate customers into bankruptcy. Thus, technology risk may influence the credit risk of FIs. As a result of these interdependencies, FIs have focused on developing sophisticated models that attempt to measure all of the risks faced by the FI at any point in time.

36. Characterize the risk exposure(s) of the following FI transactions by choosing one or more of the risk types listed below:

a. Interest rate risk d. Technology risk

b. Credit risk e. Foreign exchange rate risk

c. Off-balance-sheet risk f. Country or sovereign risk

(1) A bank finances a $10 million, six-year fixed-rate commercial loan by selling one-year certificates of deposit. a, b

(2) An insurance company invests its policy premiums in a long-term municipal bond portfolio. a, b

(3) A French bank sells two-year fixed-rate notes to finance a two-year fixed-rate loan to a British entrepreneur. b, e, f

(4) A Japanese bank acquires an Austrian bank to facilitate clearing operations.

a, b, c, d, e, f

(5) A mutual fund completely hedges its interest rate risk exposure using forward contingent contracts. b, c

(6) A bond dealer uses his own equity to buy Mexican debt on the less-developed country (LDC) bond market. a, b, e, f

(7) A securities firm sells a package of mortgage loans as mortgage-backed securities.

a, b, c

37. Consider these four types of risks: credit, foreign exchange, market, and sovereign. These risks can be separated into two pairs of risk types in which each pair consists of two related risk types, with one being a subset of the other. How would you pair off the risk types, and which risk type could be considered a subset of the other type in the pair?

Credit risk and sovereign risk comprise one pair, while FX and market risk make up the other. Sovereign risk is a type of credit risk in that one reason why a loan may default is because of political upheaval in the country in which the borrower resides. FX risk is a type of market risk in that one reason why the market value of an outstanding loan or security may change is due to a change in exchange rates.