**Solutions for End-of-Chapter Questions and Problems: Chapter Twenty-Four**

1. Explain the similarity between a swap and a forward contract.

A forward contract requires delivery or taking delivery of some commodity or financial security at a specified time in the future at a price specified at the time of origination. In a swap, each party promises to deliver and/or receive a pre-specified series of payments at specific intervals over a specified time horizon. In this way, a swap can be considered to be the same as a series of forward contracts.

2. Forward, futures, and option contracts had been used by FIs to hedge risk for many years before swaps were invented. If FIs already had these hedging instruments, why did they need swaps?

Although similar in many ways, the following distinguishing characteristics cause the instruments to be differentiated:

(a) A swap can be viewed as a portfolio of forward contracts with different maturity dates. Since cash flows on forward contracts are symmetric, the same can be said of swaps. This is in contrast to options, whose cash flows are asymmetric (truncated either on the positive or negative side depending upon the position).

(b) Options are marked to market continuously, swaps are marked to market at coupon payment dates, and forward contracts are settled only upon delivery (at maturity). Therefore, the credit risk exposure is greatest under a forward contract, where no third party guarantor exists as in options (the options clearing corporation for exchange-traded options) and swaps (the swap intermediary).

(c) The transactions cost is highest for the option (the nonrefundable option premium), next for the swap (the swap intermediary's fee), and finally for the forward (which has no up-front payment).

(d) Swaps also have a longer maturity than any other instrument and provide an additional opportunity for FIs to hedge longer term positions at lower cost. Moreover, since the package of forward contracts mirrors debt instruments, the swap provided FIs with a hedge instrument that is attractive and less costly than separate forward contracts.

(e) Finally, the introduction of a swap intermediary reduces the credit risk exposure and the information and monitoring costs that are associated with a portfolio of individual forward contracts.

3. Distinguish between a swap buyer and a swap seller. In which markets does each have the comparative advantage?

The swap buyer makes the fixed-rate payments in an interest rate swap and the swap seller makes the variable-rate payments. This distinction occurs by convention. The notation in this text refers to the comparative advantage party as that which makes the specific swap payment. Thus, the buyer is said to have the comparative advantage in fixed-rate payments.

4. An insurance company owns $50 million of floating-rate bonds yielding LIBOR plus 1 percent. These loans are financed with $50 million of fixed-rate guaranteed investment contracts (GICs) costing 10 percent. A bank has $50 million of auto loans with a fixed rate of 14 percent. The loans are financed with $50 million of CDs at a variable rate of LIBOR plus 4 percent.

a. What is the risk exposure of the insurance company?

The insurance company (IC) is exposed to falling interest rates on the asset side of the balance sheet.

b. What is the risk exposure of the bank?

The bank is exposed to rising interest rates on the liability side of the balance sheet.

c. What would be the cash flow goals of each company if they were to enter into a swap arrangement?

The IC wishes to convert the fixed-rate liabilities into variable-rate liabilities by swapping the fixed-rate payments for variable-rate payments. The bank wishes to convert variable-rate liabilities into fixed-rate liabilities by swapping the variable-rate payments for fixed-rate payments.

d. Which FI would be the buyer and which FI would be the seller in the swap?

The bank will make fixed-rate payments and therefore is the buyer in the swap. The IC will make variable-rate payments and therefore is the seller in the swap.

e. Diagram the direction of the relevant cash flows for the swap arrangement.

Please see the diagram at the top of the next page. Note that the fixed-rate swap payments from the bank to the insurance company will offset the payments on the fixed-rate liabilities that the insurance company has incurred. The reverse situation occurs regarding the variable-rate swap payments from the insurance company to the bank. Depending on the rates negotiated and the maturities of the assets and liabilities, both FIs now have durations much closer to zero on this portion of their respective balance sheets.



f. What are reasonable cash flow amounts, or relative interest rates, for each of the payment streams?

Determining a set of reasonable interest rates involves an analysis of the benefits to each FI. That is, does each FI pay lower interest rates with the swap than contractually obligated without the swap? Clearly, the direction of the cash flows will help reduce interest rate risk.

One feasible swap is for the IC to pay the bank LIBOR + 2.5 percent, and for the bank to pay the IC 12 percent. The net financing cost for each firm is given below.

Insurance

Bank Company

Cash market liability rate LIBOR + 4% 10.0%

Minus swap rate -(LIBOR + 2.5%) -12.0%

Plus swap rate + 12% +(LIBOR + 2.5%)

Net financing cost (rate) 13.5% LIBOR + 0.5%

Whether the two firms would negotiate these rates depends on the relative negotiating power of each firm, and the alternative rates for each firm in the alternate markets. That is, the fixed-rate liability market for the bank and the variable-rate liability market for the insurance company.

5. In a swap arrangement, the variable-rate swap cash flow streams often do not fully hedge the variable-rate cash flow streams from the balance sheet due to basis risk.

a. What are the possible sources of basis risk in an interest rate swap?

First, the variable-rate index on the liabilities in the cash market may not match perfectly the variable-rate index negotiated into the swap agreement. This source of basis risk is similar to the cross-hedge risk in the use of futures contracts. Second, the premium over the index in the cash-market variable-rate liability may change over time as credit (default) risk conditions change.

b. How could the failure to achieve a perfect hedge be realized by the swap buyer?

Swap pricing normally is based on a fixed notional amount over the life of the swap. If the dollar value of the fixed-rate asset portfolio of the buyer decreases over time, a fixed-notional amount swap agreement may not accurately reflect the desired interest-rate risk goals of the buyer over the life of the swap. This situation could occur as loans are amortized (repaid in the normal context) or as prepayment rates change on either loans or bonds as macroeconomic conditions change.

c. How could the failure to achieve a perfect hedge be realized by the swap seller?

The swap seller is subject to basis risk as discussed in part (a) above.

6. A commercial bank has $200 million of four-year maturity floating-rate loans yielding the T-bill rate plus 2 percent. These loans are financed with $200 million of four-year maturity fixed-rate deposits costing 9 percent. The commercial bank can issue four-year variable-rate deposits at the T-bill rate plus 1.5 percent. A savings bank has $200 million of four-year maturity mortgages with a fixed rate of 13 percent. They are financed with $200 million of four-year maturity CDs with a variable rate of the T-bill rate plus 3 percent. The savings bank can issue four-year long-term debt at 12.5 percent.

a. Discuss the type of interest rate risk each FI faces.

The commercial bank is exposed to a decrease in rates that would lower interest income, while the savings bank is exposed to an increase in rates that would increase interest expense. In either case, profit performance would suffer.

b. Propose a swap that would result in each FI having the same type of asset and liability cash flows.

One feasible swap would be for the commercial bank to send variable-rate payments of the T-bill rate + 1 percent (T-bill + 1%) to the savings bank and to receive fixed-rate payments of 9 percent from the savings bank.

c. Show that this swap would be acceptable to both parties.

The swap flows are shown below.



Given these patterns of cash flows associated with the swap, the commercial bank and savings bank will realize the following financing costs.

Savings Bank Commercial Bank

Cash market liability rate T-bill + 3% 9%

Minus swap rate -(T-bill + 1%) -9%

Plus swap rate + 9% +(T-bill + 1%)

Net financing cost rate 11% T-bill + 1%

Rate available on:

Variable-rate debt 12.5%

Fixed-rate debt T-bill + 1.5%

As a result of the swap, the bank has transformed its four-year, fixed-rate interest payments into variable-rate payments, matching the variability of returns on its assets. Further, through the interest rate swap, the bank effectively pays T-bill plus 1 percent for its financing. Had it gone to the debt market, the bank would pay T-bill plus 1.5 percent. Thus, the swap allows the bank to manage its interest rate risk at an overall savings of 0.5 percent better than market rates. The savings bank has transformed its variable-rate interest payments into fixed-rate payments, matching the fixed rate of return on its assets. Further, through the interest rate swap, the savings bank effectively pays 11 percent for its financing. Had it gone to the debt market, the bank would pay 12.5 percent. Thus, the swap allows the savings bank to manage its interest rate risk at an overall savings of 1.5 percent better than market rates.

d. The realized T-bill rates over the four-year contract period are as follows:

End of Year T-bill Rate

1 1.75%

2 2.00

3 2.25

4 2.50

Calculate the realized cash flows on the swap and the net interest yield for the savings bank and the commercial bank over the contract period.

The realized cash flows on the swap agreement are as follows:

Cash Cash Net payment

Payment payment by made by

End of Year T-bill rate T-bill rate + 1% by bank savings bank savings bank

1 1.75% 2.75% $5.5m $22m $16.5m

2 2.00 4.00 8.0m 22m 14.0m

3 2.25 4.25 8.5m 22m 13.5m

4 2.50 3.50 7.0m 22m 15.0m

The net interest yield on the assets minus the cost of liabilities plus the swap for the commercial bank is locked at 1 percent [(T-bill + 2%) – (T-bill + 1%)] for the four-year swap contract period. The net interest yield on the assets minus the cost of liabilities plus the swap for the savings bank is locked at on is 2 percent (13% - 11%) for the four-year swap contract period.

An adjustment to make the net interest yield equal at 1.5 percent would be to have the savings bank pay a fixed rate of 9.5 percent or receive a variable rate of T-bill + 0.5 percent. Obviously, many rate combinations could be negotiated to achieve acceptable rate spreads and to achieve the desired interest rate risk management goals.

e. What are some of the practical difficulties in arranging this swap?

The floating rate assets may not be tied to the same rate as the floating rate liabilities. This would result in basis risk. Also, if the mortgages are amortizing, the interest payments would not match those on the notional amount of the swap.

7. Bank 1 can issue five-year CDs at an annual rate of 11 percent fixed or at a variable rate of LIBOR plus 2 percent. Bank 2 can issue five-year CDs at an annual rate of 13 percent fixed or at a variable rate of LIBOR plus 3 percent.

a. Is a mutually beneficial swap possible between the two banks?

A mutually beneficial swap exists because comparative advantage exists.

b. Where is the comparative advantage of the two banks?

Bank 1 has a comparative advantage in the fixed-rate market because the difference in fixed rates is 2 percent in favor of Bank 1. Bank 2 has the comparative advantage in the variable-rate market because the difference in variable rates is only –1 percent against Bank 1. One way to compare the rate alternatives is to utilize the following matrix.

Fixed Variable

Rate Rate

Bank 1 11% LIBOR + 2%

Bank 2 13% LIBOR + 3%

Difference -2% -1%

c. What is an example of a feasible swap?

Many rate combinations are possible to achieve a reduced interest charge. The following is a framework to achieve the outside boundaries of acceptable interest rates using the matrix of possible rates shown in part (b).

Using the rates shown for Bank 1 as the negotiated swap rates will give the entire interest rate advantage to Bank 2. The diagram and payoff matrix below verifies this case.



The relative payoffs are given below:

Bank 2 Bank 1

Cash market liability rate LIBOR+3% 11%

Minus swap rate -(LIBOR+2%) -11%

Plus swap rate + 11% +(LIBOR+2%)

Net financing cost (rate) 12.0% LIBOR+2%

Bank 1 is paying the rate it could achieve in the variable rate market. Thus, Bank 1 receives no benefit to these swap rates. Now consider the rates shown for Bank 2 in the matrix of rates in part (b).



In this case, Bank 2 is receiving the exact rate it owes on the liabilities and it is paying the rate necessary if it was in the fixed-rate market. Bank 1 receives the entire 1 percent benefit as it is paying net 1 percent less than it would need to pay in the variable-rate market.

The relative payoffs are given below:

Bank 2 Bank 1

Cash market liability rate LIBOR+3% 11%

Minus swap rate -(LIBOR+1%) -11%

Plus swap rate + 11% +(LIBOR+1%)

Net financing cost rate 13% LIBOR+1%

Any swap rate combination between these two boundaries that yields a total saving in combined interest cost becomes a feasible set of negotiated swap rates. The exact set of rates will depend on negotiating position of each bank and the expected interest rates over the life of the swap. As an example, consider the average of the two fixed-rate payments and the average of the two variable-rate payments. The relative payoffs are given below:

Bank 2 Bank 1

Cash market liability rate LIBOR+3.0% 11.0%

Minus swap rate -(LIBOR+2.5%) -12.0%

Plus swap rate + 12.0% +(LIBOR+2.5%)

Net financing cost rate 12.5% LIBOR+1.5%

In each case, the banks are paying 0.5 percent less than they would in the relative desired cash markets.

1. First Bank can issue one-year, floating-rate CDs at prime plus 1 percent or fixed-rate CDs at 12.5 percent. Second Bank can issue one-year, floating-rate CDs at prime plus 0.5 percent or fixed-rate at 11.0 percent.
2. What is a feasible swap with all of the benefits going to First Bank?

The possible interest rate alternatives faced by each firm are given below:

Fixed Variable

Rate Rate

First Bank 12.5% Prime+1.0%

Second Bank 11.0% Prime+0.5%

Difference 1.5% 0.5%

The interest rate difference is 1.5 – 0.5 = 1.0 percent. Second Bank has the comparative advantage in the fixed-rate market and First Bank has the comparative advantage in the variable-rate market. A set of swap rates within the feasible boundaries that will give all the benefits to First Bank is 11 percent fixed rate and Prime + 0.5 percent variable rate.

1. What is a feasible swap with all of the benefits going to Second Bank?

A set of rates within the feasible boundaries that will give all the benefits to Second Bank is 12.5 percent fixed rate and Prime + 1.0 percent variable rate.

1. Diagram each situation.

Diagram of all the benefits going to First Bank.



The payoff matrix that demonstrates that all of the benefits go to First Bank follows.

First Bank Second Bank

Cash market liability rate Prime+1% 11.0%

Minus swap rate -(Prime+0.5%) -11.0%

Plus swap rate + 11% +(Prime+0.5%)

Net financing cost rate 11.5% Prime+0.5%

The net cost for First Bank is 11.5 percent, or 1 percent less than it would pay in the fixed-rate cash market. The net cost for Second Bank is exactly the same as it would pay in the variable-rate cash market.

Diagram of all the benefits going to Second Bank.



The net cost for First Bank is 12.5 percent, which is exactly what it would pay in the fixed-rate cash market. The net cost for Second Bank is Prime - 0.5 percent, or 1 percent less than it would pay in the variable-rate cash market. The payoff matrix that illustrates that all of the benefits go to Second Bank follows.

First Bank Second Bank

Cash market liability rate Prime+1% 11.0%

Minus swap rate -(Prime+1%) -12.5%

Plus swap rate + 12.5% +(Prime+1%)

Net financing cost rate 12.5% Prime-0.5%

1. What factors will determine the final swap arrangement?

The primary factor that will determine the final distribution of the swap rates is the present value of the cash flows for the two parties. The most important no-arbitrage condition is that the present value of the expected cash flows made by the buyer should equal the present value of the expected cash flows made by the seller. Secondary factors include the negotiating strengths of either party to the transaction.

1. Two multinational FIs enter their respective debt markets to issue $100 million of two-year notes. FI A can borrow at a fixed annual rate of 11 percent or a floating rate of LIBOR plus 50 basis points, repriced at the end of the year. FI B can borrow at a fixed annual rate of 10 percent or a floating rate of LIBOR, repriced at the end of the year.
2. If FI A is a positive duration gap insurance company and FI B is a money market mutual fund, in what market(s) should each firm borrow so as to reduce its interest rate risk exposure?

FI A will prefer to borrow in the fixed-rate debt market in order to generate positive cash flows when interest rates increase. This will offset the impact of an increase in interest rates, which would cause the market value of the insurance company's equity to decline. FI B will prefer to borrow in the floating rate debt market so as to better match the duration of its short-term assets.

1. In which debt market does FI A have a comparative advantage over FI B?

The matrix of possible interest rates is given below.

Fixed Variable

rate rate

FI A 11.0% LIBOR+0.5%

FI B 10.0% LIBOR %

Difference 1.0% 0.5%

FI A has a comparative advantage in the floating-rate market and FI B has a comparative advantage in the fixed-rate market. This is because the default risk premium of FI A over FI B is 50 basis points in the floating-rate market and 100 basis points in the fixed-rate market.

1. Although FI A is riskier than FI B and therefore must pay a higher rate in both the fixed-rate and floating-rate markets, there are possible gains to trade. Set up a swap to exploit FI A's comparative advantage over FI B. What are the total gains from the swap? Assume a swap intermediary fee of 10 basis points.

The total gains to the swap are 50 basis points (the price differential on FI A's default risk premium over FI B) less 10 basis points (the swap intermediary fee). Both FI A and B can exploit this price differential by issuing debt in the debt market in which they have comparative advantage and then swapping the interest payments. The 40 basis points can be allocated to either FI A and/or FI B according to the terms of the swap. A possible set of feasible swap rates that give all of the gains to FI A (see part (d) below) is illustrated here.



Evidence that FI A receives all of the benefits is given in the payoff matrix below.

FI A FI B

Cash market liability rate LIBOR+0.5% 10.0%

Minus swap rate -(LIBOR %) -10.0%

Plus swap rate + 10.0% +(LIBOR %)

Net financing cost rate 10.5% LIBOR %

Less intermediary fee 0.1%

Financing cost rate net of fee 10.6%

FI A is paying the intermediary fee, since FI B is receiving no benefits from this swap transaction. The 40 basis point net differential could be shared in a number of other combinations where FI A received most (exploited) of the benefit.

1. The gains from the swap can be apportioned between FI A and FI B through negotiation. What terms of swap would give all the gains to FI A? What terms of swap would give all the gains to FI B?

All the gains go to FI A if FI B pays LIBOR for FI A's floating rate debt. Then FI A must pay 10 percent for FI B's fixed-rate debt plus 50 basis points on FI A's floating rate debt plus 10 basis points for the swap intermediary's fee. The total fixed annual interest cost to FI A is 10.6 percent, a savings of 40 basis points over the cash-market fixed rate of 11 percent. This swap rate apportionment is illustrated in part (c) above.

All the gains go to FI B if FI A pays 11 percent for FI B’s fixed-rate, 10 percent debt. Then FI B pays LIBOR plus 50 basis points on FI A's floating rate debt for a net savings of 50 basis points. The savings occurs because FI B receives an excess 1 percent from FI A, but must pay 50 basis points more to FI A than it would pay in the cash floating-rate market. FI A must pay 11 percent against FI B's fixed-rate debt, but receives its exact liability payment from FI B. A diagram of this allocation is given below.

In this example, FI B would pay the swap intermediary fee of 10 basis points, and thus would realize a net, after-fee savings of 40 basis points. The payoff matrix is given below.



FI A FI B

Cash market liability rate LIBOR+0.5% 10.0%

Minus swap rate -(LIBOR+0.5 %) -11.0%

Plus swap rate + 11.0% +(LIBOR+0.5 %)

Net financing cost rate 11.0% LIBOR-0.5%

Less intermediary fee 0.1%

Financing cost rate net of fee LIBOR-0.4%

1. Assume swap pricing that allocates all gains from the swap to FI A. If FI A buys the swap from FI B and pays the swap intermediary's fee, what are the realized net cash flows if LIBOR is 8.25 percent?

FI A (in millions of dollars) FI B

Pays out fixed rate ($10.00) Pays out LIBOR ($8.25)

Receives LIBOR from B $8.25 Receives fixed rate from A $10.00

Pays floating-rate Pays fixed-rate to creditors ($10.00)

to creditors (LIBOR+0.5%) ($8.75)

Pays intermediary fee ($0.10)

Net cash inflow ($10.60) Net cash inflow ($8.25)

This solution is an extension of the diagram in part (c) and the explanation at the beginning of part (d) above where LIBOR is 8.25 percent. The summary shows the effective cost rate converted to dollars for the total cash flows of each FI. However, the cash flows in a swap arrangement include only the differential cash flows between the two parties. Thus, at the end of the year, FI A would pay $1.75m ($10.00m - $8.25m) to FI B and $0.10m to the intermediary for a total cash flow on the swap arrangement of $1.85m. FI B receives $1.75m from FI A.

f. If FI A buys the swap in part (e) from FI B and pays the swap intermediary's fee, what are the realized net cash flows if LIBOR is 11 percent? Be sure to net swap payments against cash market payments for both FIs.

FI A (in millions of dollars) FI B

Pays out fixed rate ($10.00) Pays out LIBOR ($11.00)

Receives LIBOR from B $11.00 Receives fixed rate from A $10.00

Pays floating-rate Pays fixed-rate to creditors ($10.00)

to creditors (LIBOR+0.5%) ($11.50)

Pays intermediary fee ($0.10)

Net cash inflow ($10.60) Net cash inflow ($11.00)

Even though LIBOR has increased to 11 percent, FI A’s total effective cost rate has not changed. The rate remains at 10.60 percent, or a total of $10.60 million. However, the cost rate for FI B has increased because LIBOR has increased. Thus, the actual cash flows in the swap transaction now are such that FI B pays $1.00m ($11m - $10m) to FI A, and that FI A receives $1.00m and pays out $0.10m to the intermediary. Each FI, of course, must pay the cash market liability rates.

g. If all barriers to entry and pricing inefficiencies between FI A's debt markets and FI B's debt markets were eliminated, how would that affect the swap transaction?

If relative prices are the same in the markets of both FI A and FI B, then there are no potential gains to trade and therefore no swap transaction can take place. Each FI will issue debt in their respective debt markets.

10. What are off-market swap arrangements? How are these arrangements negotiated?

An off-market swap is a customized swap arrangement where one party pays to the other party a fee to relax certain terms of the swap agreement. Terms that are relaxed often include interest rates, the use of special indexes, and changes in the notional values as the swap matures.

11. Describe how an inverse floater works to the advantage of an investor who receives coupon payments of 10 percent minus LIBOR if LIBOR is currently at 4 percent. When is it a disadvantage to the investor? Does the issuing party bear any risk?

An inverse floater pays coupon interest of 10% - 4% to the investor at current rates. Thus, an investor who purchases this instrument at LIBOR will receive a return of 6%. If LIBOR decreases below 4 percent, the investor receives a higher return. However, the danger occurs if LIBOR rises above 10 percent, in which case the investor receives nothing and may be stuck with this investment. The losses will depend on the opportunity costs associated with these funds. The issuing party only pays the LIBOR rate less the 4 percent (unless it has been swapped) and is subject to the risk that the LIBOR rates will decline.

12. An FI has $500 million of assets with a duration of nine years and $450 million of liabilities with a duration of three years. The FI wants to hedge its duration gap with a swap that has fixed-rate payments with a duration of six years and floating-rate payments with a duration of two years. What is the optimal amount of the swap to effectively macrohedge against the adverse effect of a change in interest rates on the value of the FI’s equity?

Using the formula,

NS = [(DA - kDL)A]/(DFixed – DFloating) = [(9 – 0.9x3)$500 million]/(6 – 2) = $787.5 million.

13. A U.S. thrift has most of its assets in the form of Swiss franc-denominated floating-rate loans. Its liabilities consist mostly of fixed-rate dollar-denominated CDs. What type of currency risk and interest rate risk does this FI face? How might it use a swap to eliminate some of these risks?

The thrift is exposed to a drop in interest rates and a devaluation of the Swiss franc. It might want to change its assets to fixed-rate dollar-denominated assets. Alternatively, if it could find a counterparty willing to receive floating-rate francs while paying fixed-rate dollars, the thrift could reduce its interest rate risk and its exchange rate risk.

14. A Swiss bank issues a $100 million, three-year Eurodollar CD at a fixed annual rate of 7 percent. The proceeds of the CD are lent to a Swiss company for three years at a fixed rate of 9 percent. The spot exchange rate is SF1.50/$.

a. Is this expected to be a profitable transaction?

This transaction is expected to be profitable since the spread is 2 percent.

b. What are the cash flows if exchange rates are unchanged over the next three years?

The 2 percent spread on $100 million (SF150 million) is $2 million. Converting into Swiss francs at the spot exchange rate yields an annual expected cash flow of SF3 million. The cash flows are as follows:

Eurodollar CD Swiss loan

t Cash Outflow (US$) (SF) cash inflow (SF) Spread (SF)

1 7m 10.5m 13.5m 3m

2 7m 10.5m 13.5m 3m

3 107m 160.5m 163.5m 3m

c. What is the risk exposure of the bank's underlying cash position?

This spread will be reduced or eliminated if the SF depreciates relative to the U.S. dollar. That is, if it takes more SFs to purchase U.S. dollars, it will be more costly for the bank to repay the Eurodollar CD using SF loan proceeds.

d. How can the Swiss bank reduce that risk exposure?

The Swiss bank can undertake a short currency hedge if it wants to protect itself against exchange rate risk exposure.

e. If the US dollar is expected to appreciate against the SF to SF1.65/$, SF1.815/$, and SF2.00/$ over the next three years, respectively, what will be the cash flows on this transaction?

Eurodollar CD Swiss loan

t Cash Outflow (US$) (SF) cash inflow (SF) Spread (SF)

1 7m 11.550m 13.5m 1.950m

2 7m 12.705m 13.5m 0.795m

3 107m 214.000m 163.5m (50.500m)

f. If the Swiss bank swaps US$ payments for SF payments at the current spot exchange rate, what are the cash flows on the swap? What are the cash flows on the entire hedged position? Assume that the U.S. dollar appreciates at the rates in part (e).

Net swap

t Cash flow (SF) Swap payments(SF) cash flow (SF) Total cash flow

1 11.55m 10.5m 1.05m 3m

2 12.705m 10.5m 2.205m 3m

3 214.00m 160.5m 53.5m 3m

The cash flows of the underlying cash position from part (e) are added to the net cash flows from the swap hedge (column four) to give the total cash flows in column five. That is, at the end of the first year, the spread on the loan CD is SF1.95m. The swap generates a net cash flow of SF1.05m for a total end of year 1 spread of SF3 million. At the end of year 2, the SF0.795m loan CD spread plus the SF2.205m net swap cash flow equals SF3m. At the end of year 3, the SF50.5m loss on the loan CD position is offset by the SF53.5m gain on the swap for a total cash flow of SF3m. Therefore, the hedged position locks in the annual 2 percent spread.

g. What are the cash flows on the swap and the hedged position if actual spot exchange rates are as follows:

End of year 1: SF1.55/US$

End of year 2: SF1.47/US$

End of year 3: SF1.48/US$

CD Net swap

t cash flow (SF) Swap payments(SF) cash flow (SF) Total cash flow

1 10.85m 10.5m 0.35m 3m

2 10.29m 10.5m (0.21m) 3m

3 158.36m 160.5m (2.14m) 3m

Total end of year 1 cash flows are net swap cash flows of SF0.35m plus the loan ‑ CD spread of SF2.65m (SF13.5m ‑ SF10.85m). Total end of year 2 cash flows are -SF0.21m on the swap plus SF3.21m (SF13.5m ‑ SF10.29m). End of year 3 cash flows are -SF2.14m on the swap plus SF5.14m on the loan ‑ CD spread (SF163.5m ‑ SF158.36m). The loan cash flows in SF are given in column four of part (e).

h. What would be the bank's risk exposure if the fixed-rate Swiss loan was financed with a floating rate U.S. $100 million, three-year Eurodollar CD?

The Swiss bank is now exposed to both exchange rate risk and interest rate risk. If the Sf depreciates against the U.S. dollar and/or the Eurodollar CD floating rate increases, the spread on the unhedged position will be reduced.

i. What type(s) of hedge is appropriate if the Swiss bank in part (h) wants to reduce its risk exposure?

If the bank wants to hedge its risk exposure, it should enter a short currency hedge and a short interest rate hedge.

j. If the annual Eurodollar CD rate is set at LIBOR and LIBOR at the end of years 1, 2, and 3 is expected to be 7 percent, 8 percent, and 9 percent, respectively, what will be the cash flows on the bank's unhedged cash position? Assume no change in exchange rates.

Eurodollar CD Swiss loan

t cash outflow (US$) (SF) cash inflow (SF) Spread (SF)

1 7m 10.5m 13.5m 3m

2 8m 12.0m 13.5m 1.5m

3 109m 163.5m 163.5m 0m

The spread on the underlying cash position is reduced when rates increase even if exchange rates are held constant.

k. What are the cash flows on the bank's unhedged cash position if exchange rates are as follows:

End of year 1: SF1.55/US$

End of year 2: SF1.47/US$

End of year 3: SF1.48/US$

Eurodollar CD Swiss loan

t cash outflow (US$) (SF) cash inflow (SF) Spread (SF)

1 7m 10.85m 13.5m 2.65m

2 8m 11.76m 13.5m 1.74m

3 109m 161.32m 163.5m 2.18m

Without the swap, the cost to the bank of meeting the Eurodollar CD payments at the end of year 1 would be SF10.85m (US$7m x 1.55). At the end of year 2 the cost would be SF11.76m (US$8m x 1.47). At the end of year 3, the cost would be SF161.32m (US$109m x 1.48).

l. What are both the swap and total hedged position cash flows if the bank swaps out its floating rate US$ CD payments in exchange for 7.75 percent fixed-rate SF payments at the current spot exchange rate of SF1.50/$?

Net swap

t Cash flow (SF) Swap payments(SF) cash flow (SF) Total cash flow

1 10.85m $7.75mx1.5=11.625m (0.775m) 1.875m

2 11.76m $7.75mx1.5=11.625m 0.135m 1.875m

3 161.32m $107.75mx1.5=161.625m (0.305m) 1.875m

The total cash flows are:

End of year 1 = swap loss of SF0.775m plus spread of SF2.65m.

End of year 2 = swap gain of SF0.135m plus spread of SF1.74m.

End of year 3 = swap loss of SF0.305m plus spread of SF2.18m.

The swap hedge locks in both an interest spread of 1.25 percent (9% ‑ 7.75%) and an exchange rate of SF1.5. Based on a face value of $100m (SF150m), this yields a profit of $1.25m or SF1.875 million each year.

m. If forecasted interest rates are 7 percent, 10.14 percent, and 10.83 percent over the next three years, respectively, and exchange rates over the next years are those in part (k), calculate the cash flows on an 8.75 percent fixed-floating-rate swap of U.S. dollars to Swiss francs at SF1.50/$.

Net swap

t Cash flow (SF) Swap payments(SF) cash flow (SF) Total cash flow

1 10.85m 13.125m (2.275m) 0.375m

2 14.906m 13.125m 1.781m 0.375m

3 164.028m 163.125m 0.903m 0.375m

The second year annual interest on the floating rate CD would have been US$10.14m or SF10.85m (at the prevailing exchange rate of SF1.47/$). The third year annual interest on the floating rate CD would have been US$110.83m or SF164.028m (at the prevailing exchange rate of SF1.48/$). The fixed swap interest payment was SF13.125 ($8.75m x 1.50) in each year. The swap hedge locks in a spread of 0.25 percent at SF1.50 for an annual cash flow of SF0.375million. Year 1 cash flows = SF13.5m – SF10.85m – SF2.275m. Year 2 cash flows = SF13.5m – SF14.906m + SF1.781m. Year 3 cash flows = SF163.5m – SF164.028m + SF0.903m.

15. Bank A has the following balance sheet information (in millions):

**Assets Liabilities and Equity** Rate-sensitive assets $50 Rates-sensitive liabilities $75 Fixed-rate assets 150 Fixed-rate liabilities 100 Net worth 25 Total assets $200 Total liabilities and equity $200

Rate-sensitive assets are repriced quarterly at the 91-day Treasury bill rate plus 150 basis points. Fixed-rate assets have five years until maturity and are paying 9 percent annually. Rate-sensitive liabilities are repriced quarterly at the 91-day Treasury bill rate plus 100 basis points. Fixed-rate liabilities have two years until maturity and are paying 7 percent annually. Currently, the 91-day Treasury bill rate is 6.25 percent.

a. What is the bank's current net interest income? If Treasury bill rates increase 150 basis points, what will be the change in the bank's net interest income?

Interest income = 50(0.0625 + 0.015) + 150(0.09) = $17.375 million, and interest expense = 75(0.0625 + 0.01) + 100(0.07) = $12.4375 million. Thus, net interest income = $4.9375 million.

After the interest rate increase, interest income = 50(0.0775 + 0.015) + 150(0.09) = $18.125 million, interest expense = 75(0.0775 + 0.01) + 100(0.07) = $13.5625 million, and net interest income = $4.5625 million for a decline of $375,000.

b. What is the bank's repricing or funding gap? Use the repricing model to calculate the change in the bank's net interest income if interest rates increase 150 basis points.

Funding gap = Rate sensitive assets ‑ Rate sensitive liabilities = 50 ‑ 75 = ‑ $25 million. The repricing model states that NII = GAP( R) = ‑25(0.015) = ‑ $0.375 million. The bank is exposed to interest rate increases since interest expense increases more than interest income.

c. How can swaps be used as an interest rate hedge in this example?

A short hedge can be used to hedge the bank's interest rate risk exposure. The short hedge can be implemented by selling futures or forward contracts, buying put options, or buying a swap of liabilities. Swapping liabilities allows the institution to make fixed-rate liability payments in exchange for a counter-party making the floating rate payments. Similarly, the FI could also swap assets. The short hedge can be accomplished by swapping out fixed-rate asset payments in exchange for floating-rate asset payments.

16. Use the following information to construct a swap of asset cash flows for the bank in problem 15. The bank is a price taker in both the fixed-rate market at 9 percent and the rate-sensitive market at the T-bill rate plus 1.5 percent. A securities dealer has a large portfolio of rate sensitive assets funded with fixed-rate liabilities. The dealer is a price taker in a fixed-rate asset market paying 8.5 percent and a floating-rate asset market paying the 91-day T‑bill rate plus 1.25 percent. All interest is paid annually.

a. What is the interest rate risk exposure to the securities dealer?

The securities dealer is exposed to interest rate declines.

b. How can the bank and the securities dealer use a swap to hedge their respective interest rate risk exposures?

The two counterparties can use a swap of asset cash flows to hedge their respective interest rate risk exposures. The bank would swap out fixed-rate asset payments in exchange for floating-rate asset payments to yield positive cash flows when interest rates increase. The securities dealer would swap out floating-rate asset payments in exchange for fixed-rate asset payments to yield positive cash flows when interest rates decrease.

c. What are the total potential gains to the swap?

The total gains to the swap trade are 25 basis points. This is because the bank earns a 25 basis point premium in the floating-rate market and a 50 basis point premium in the fixed-rate market.

d. Consider the following two-year swap of asset cash flows: An annual fixed-rate asset cash flow of 8.6 percent in exchange for a floating-rate asset cash flow of T‑bill plus 125 basis points. The swap intermediary fee is 5 basis points. How are the swap gains apportioned between the bank and the securities dealer if they each hedge their interest rate risk exposures using this swap?



Bank Securities Dealer

Cash market asset rate 9.00% T-bill+1.25%

Minus swap rate -8.60% -(T-bill+1.25%)

Plus swap rate T-bill+1.25% 8.60%

Net financing cost rate T-bill+1.65% 8.60%

Minus swap intermediary fee -0.05%

T-bill+1.60%

Minus cash market rate T-bill+1.50% 8.50%

Net gain from swap 0.10% 0.10%

The securities dealer gains 10 basis points because it obtains fixed-rate cash inflows at 8.6 percent instead of the 8.5 percent available in its cash market. The bank gains 10 basis points because it obtains floating rate cash inflows at T‑bill + 1.60 percent instead of the T‑bill + 1.50 percent available in its cash market. The remaining 5 basis points goes to the swap intermediary.

e. What are the realized cash flows if T‑bill rates at the end of the first year are 7.75 percent and at the end of the second year are 5.5 percent? Assume that the notional value is $107.14 million.

At the end of the first year (in millions of dollars):

**Bank Cash Flows** **Securities Dealer Cash Flows**

Swap cash inflows

107.14(0.0775 + 0.016) = $10.0176 107.14(0.086) = $9.214

Cash market cash flows

107.14(0.09) = $9.6426 107.14(0.0775 + 0.0125) = $9.6426

Net swap gain (loss) $0.375 ($0.4286)

The dealer pays the bank $375,000 to offset the decline in net interest income when interest rates increase (see part a) and pays the swap intermediary $53,600 (5 basis points), for a total cost of $428,600 when interest rates increase 150 basis points.

At the end of the second year, interest rates decline to 5.5%.

**Bank Cash Flows** **Dealer Cash Flows**

Swap cash inflows

107.14(0.0550 + 0.016) = $7.607 107.14(0.086) = $9.214

Cash market cash flows

107.14(0.09) = $9.6426 107.14(0.055 + 0.0125) = $7.232

Net swap gain (loss) ($2.036) $1.982

The bank pays the dealer $1.982 million and pays the swap intermediary $53,600 (5 basis points), for a total cost of $2.036 million when interest rates decrease 75 basis points.

f. What are the sources of the swap gains to trade?

The gains to the swap trade emanate from the pricing discrepancy in the two cash markets. That is, the bank earns a 50 basis point premium in the fixed-rate asset market, while only a 25 basis point premium in the floating rate asset market. The swap allows both the bank and the securities dealer to exploit their own comparative advantage in their respective cash market.

g. What are the implications for the efficiency of cash markets?

There must be some barrier that prevents the two firms from directly transacting in the other's cash market (or equivalently raises the costs of these cross-market transactions). This barrier may consist of regulatory restrictions or tax considerations. If, however, the barrier results from information asymmetries, these potential gains to trade can be expected to disappear as the swap market develops.

17. Consider the following currency swap of coupon interest on the following assets:

5 percent (annual coupon) fixed-rate U.S. $1 million bond

5 percent (annual coupon) fixed-rate bond denominated in Swiss francs (SF)

Spot exchange rate: SF1.5/$

a. What is the face value of the SF bond if the investments are equivalent at spot rates?

U.S. $1 million is equivalent to SF1.5 million face value.

b. What are the realized cash flows, assuming no change in spot exchange rates? What are the net cash flows on the swap?

Interest payments on the U.S. bond are 0.05(U.S.$1 million) = $50,000. In Swiss francs, interest payments are 0.05(SF1.5 million) = SF75,000. At spot exchange rates, these two cash flows are identical. There are no net swap cash flows.

c. What are the cash flows if the spot exchange rate falls to SF0.50/$? What are the net cash flows on the swap?

Coupon payments on the U.S. bond are $50,000, which is equivalent to SF25,000. Coupon payments on the Swiss franc bond are SF75,000, which is equivalent to $150,000. The net cash flows on the swap are $100,000, or SF50,000. The counterparty that swaps in Swiss franc bond payments receives the cash flows. The counterparty that swaps in the U.S. dollar payments makes the payments.

d. What are the cash flows if the spot exchange rate rises to SF2.25/$? What are the net cash flows on the swap?

Coupon payments on the U.S. bond are $50,000, which is equivalent to SF112,500. Coupon payments on the Swiss franc bond are SF75,000, which is equivalent to $33,333. The net cash flows on the swap are $16,667, or SF37,500. The counterparty that swaps in U.S. dollar bond payments receives the cash flows. The counterparty that swaps in the Swiss franc payments makes the payments.

e. Describe the underlying cash position that would prompt the FI to hedge by swapping dollars in exchange for Swiss francs.

The FI is swapping dollar cash flows in exchange for Swiss francs so as to balance a U.S. dollar-denominated liability.

18. Consider the following fixed-floating-rate currency swap of assets: 5 percent (annual coupon) fixed-rate U.S. $1 million bond and floating-rate SF1.5 million bond set at LIBOR annually. Currently LIBOR is 4 percent. The face value of the swap is SF1.5 million. The spot exchange rate is SF1.5/$.

a. What are the realized cash flows on the swap at the spot exchange rate?

Coupon payments on the U.S. bond are $50,000, which is equivalent to SF75,000. Coupon payments on the Swiss franc bond are SF60,000 at the spot rate of LIBOR of 4%, which is equivalent to $40,000. The net cash flows on the swap are $10,000, or SF15,000. The counterparty that swaps in U.S. dollar bond payments receives the cash flows. The counterparty that swaps in the Swiss franc payments makes the payments.

b. If the 1-year forward rate is SF1.538 per US$, what are the realized net cash flows on the swap? Assume LIBOR is unchanged.

Coupon payments on the U.S. bond are $50,000, which at forward rates, is equivalent to SF76,900. Coupon payments on the Swiss franc bond are SF60,000, which is equivalent to $39,012. The net cash flows on the swap are $10,988, or SF16,900. The counterparty that swaps in U.S. dollar bond payments receives the cash flows. The counterparty that swaps in the Swiss franc payments makes the payments.

c. If LIBOR increases to 6 percent, what are the realized cash flows on the swap? Evaluate at the forward rate.

Coupon payments on the U.S. bond are $50,000, which at forward rates, is equivalent to SF76,900. Coupon payments on the Swiss franc bond are SF90,000 at the spot rate of LIBOR of 6 percent, which is equivalent to $58,518. The net cash flows on the swap are U.S. $8,518, or SF13,100. The counterparty that swaps in Swiss franc bond payments receives the cash flows. The counterparty that swaps in the U.S. dollar payments makes the payments.

19. Give two reasons why credit swaps have been the fastest-growing form of swaps in recent years?

First, FIs remain more likely to fail because of credit risk than either interest rate risk or FX risk. Second, credit swaps allow for the maintenance of long-term relationships without the FI bearing the full exposure to the credit risk of the customer.

20. What is a total return swap?

A total return swap involves swapping an obligation to pay interest at a specified fixed or floating rate for payments representing the total return on a loan or a bond of a specific amount. The swap can be designed to cover any change in value of the principal as well as just the interest. This type of swap often is used when there is exposure to a change in the credit risk of the counterparty.

21. How does a pure credit swap differ from a total return swap? How does it differ from a digital default option?

The total return swap includes an element of interest rate risk, while the pure credit swap has stripped this risk from the contract. In a pure credit swap, the lender makes a fixed fee or payment premium to the counterparty in exchange for the potential coverage of any loss due to a specific borrower defaulting on a loan. The swap is not tied to interest rate changes. The pure credit swap is similar in payoff to a digital default option with the exception that the premium is paid over the life of the swap rather than at the initiation of the risk coverage as with the option.

22. Why is the credit risk on a swap lower that the credit risk on a loan?

The credit risk on a swap is lower than that of a loan for the following reasons:

a) Swaps do not involve the exchange of principal payments. They only involve the swapping of interest payments, so the most a counterparty can lose is the difference in the interest payments.

b) In most cases, payments are made through netting by novation, which nets all payments with one counterparty, further reducing the possibility of default.

c) Swaps made by parties with poor credit ratings are usually backed by lines of credit, effectively making them collateralized loans, and further reducing their risks.

23. What is netting by novation?

Netting by novation involves the process of combining all contracts between two parties to determine the differential amount that must be forwarded from one party to another. Thus, all fixed-rate and variable-rate contracts are combined for a net payment. This reduces the potential for loss when some contracts are in-the-money and some contracts are out-of-the-money.

24. What role did the swap market play in the financial crisis of 2008-2009?

The financial crisis showed just how much risk the swap market can present to FIs and the global financial system. Specifically, as the subprime mortgage market began to fail in the summer of 2008, subprime mortgage pools that FIs bought were overrated and ended up falling precipitously in value as foreclosures rose on the underlying mortgage pools. Many of the credit default swaps were written on these subprime mortgage securities. Thus, as mortgage securities started to fail, buyers of the CDS contracts wanted to be paid for these losses. AIG was a major writer of these CDS securities. As of June 30, 2008, AIG had written $441 billion worth of swaps on corporate bonds and mortgage-backed securities.And when mortgage-backed securities started going bad, AIG had to make good on billions of dollars of credit default swaps. The problem was exacerbated by the fact that so many FIs were tied to one another through these deals. Lehman Brothers alone had made more than $700 billion worth of swaps, and many of them were backed by AIG. As the value of these insured-referenced entities fell, AIG had massive write-downs and additionally had to post more collateral. Soon it became clear that AIG was not going to be able to cover its losses. The result was massive write-downs at banks, investment banks, and insurance companies that had purchased the CDS contracts. Indeed, the reason the federal government stepped in and bailed out AIG was that the insurer was something of a last backstop in the CDS market. While banks and hedge funds were playing both sides of the CDS business—buying and trading them and thus offsetting whatever losses they took—AIG was simply providing the swaps and holding onto them. Had AIG been allowed to default, every FI that had bought a CDS contract from the company would have suffered huge losses in the value of the insurance contracts they had purchased, causing them their own credit problems.

Global funding market pressures were also evident in the virtual shut-down of the FX swap market during the financial crisis. This risk was driven by demand for dollar funding from global financial institutions, particularly European financial institutions. As many of these institutions increasingly struggled to obtain funding in the unsecured cash markets, they turned to the FX swap market as a primary channel for raising dollar funding. This extreme demand for dollar funding led a sizable shift in FX forward prices, with the implied dollar funding rate observed in FX swaps on many major currencies rising sharply above that suggested by the other relative interest measures such as the dollar OIS (overnight index swap) rate and the dollar Libor. Dealers reported that bid-ask spreads on FX swaps increased to as much as 10 times the levels that had prevailed before August 2007. During the quarter, the spread of the three month FX swap-implied dollar rate from euro and sterling—US dollar FX forward points—over the dollar Libor fixing rate widened to around 330 and 260 basis points, respectively, in early October after the Lehman failure.

The following problem refers to material in Appendix 24A.

25. The following information is available on a three-year swap contract. One-year maturity zero coupon discount yields are currently priced at par and pay a coupon rate of 5 percent. Two-year maturity zero-coupon discount yields are currently 5.51 percent. Three-year maturity zero-coupon discount yields are currently 5.775 percent. The terms of a three-year swap of $100 million notional value are 5.45 percent annual fixed-rate payments in exchange for floating-rate payments tied to the annual discount yield.

a. If an insurance company buys this swap, what can you conclude about the interest rate risk exposure of the company's underlying cash position?

Buying the swap is a short hedge position that is profitable when interest rates increase. Therefore, the insurance company's underlying cash position is exposed to interest rate increases, e.g., as in a positive duration gap and/or a negative repricing gap.

b. What are the realized cash flows expected over the three-year life of the swap?

If the year 1 discount yields are: d1 = 5 percent, d2 = 5.51 percent, and d3 = 5.775 percent, then the expected future spot rates can be calculated from the implied forward rates:

(1.0551)2 = (1.05)[1 + *E*(1*r*1)] => *E*(1*r*1)= 6.02 percent

(1.05775)3 = (1.0551)2[1 + *E*(2*r*1)] => *E*(2*r*1) = 6.31 percent

End of year-1 expected cash flows:

Cash outflow ‑$5.45 million + Cash inflow $5 million = ‑$0.45 million net cash outflow

End of year-2 expected cash flows:

Cash outflow ‑$5.45 million + Cash inflow $5.51 million = $0.06 million net cash inflow

End of year-3 expected cash flows:

Cash outflow ‑$5.45 million + Cash inflow $5.775 million = $0.325 million net cash inflow

c. What are the realized cash flows that occur over the three-year life of the swap if d2 = 4.95 percent and d3 = 6.1 percent?

If the year 1 discount yields are: d1 = 5 percent, d2 = 4.95 percent, and d3 = 6.1 percent, then the expected future spot rates can be calculated from the implied forward rates:

(1.0495)2 = (1.05)[1 + *E*(1*r*1)] => *E*(1*r*1)= 4.90 percent

(1.061)3 = (1.0495)2[1 + *E*(2*r*1)] => *E*(2*r*1) = 8.44 percent

End of year-1 expected cash flows:

Cash outflow -$5.45 million + Cash inflow $5 million = $045 million net cash outflow

End of year-2 expected cash flows:

Cash outflow -$5.45 million + Cash inflow $4.90 million = $0.55 million net cash outflow

End of year-3 expected cash flows:

Cash outflow -$5.45 million + Cash inflow $8.44 million = $2.99 million net cash inflow

**Integrated Mini Case: Hedging Interest Rate Risk with Futures versus Options versus Swaps**

On January 4, 2015, an FI has the following balance sheet (rates = 8 percent)

Assets Liabilities/Equity

A 450m DA = 8 years L 396m DL = 4 years

E 54m

DGAP = [8 – (396/450)4] = 4.48 years > 0

## The FI manager thinks rates will increase by 0.55 percent in the next three months. If this happens, the equity value will change by:



The FI manager will hedge this interest rate risk with either futures contracts, option contracts, or swap contracts.

If the FI uses futures, it will select June T-bonds to hedge. The duration on the T-bonds underlying the contract is 14.5 years, and the T-bond futures are selling at a price of $110.53125 per $100, or $110,531.25. T-bond futures rates, currently 5 percent, are expected to increase by 0.75 percent over the next three months.

If the FI uses options, it will buy puts on 15-year T-bonds futures with a June maturity, an exercise price of 109, and an option premium of  percent. The spot price on the T-bond underlying the option is $115.78125 per $100 of face value. The duration on the T-bonds underlying the options is 14.5 years, and the delta of the put options is -0.85. Managers expect these T-bond rates to increase by 0.7 percent from 5.25 percent in the next three months.

If the FI uses swaps, a swap agent offers a swap involving DFixed = 8 years (based on the 15-year Treasury bond rate) and DFloating = 1 year (based on Treasury bills).

If by April 4, 2015, balance sheet rates increase by 0.5 percent, futures rates by 0.7 percent, and T-bond rates underlying the option contracts by 0.66 percent, calculate the on and off-balance-sheet cash flows to the FI when using futures contracts, option contracts, and swap contracts as its hedge instrument.

For the hedge with futures contracts:

  contracts

On April 4, 2015, as the FI gets out of the futures hedge:

Loss on balance sheet Gain off balance sheet (futures)

 

 

The net gain is $9,582,222 - $9,333,333 = $248,889

For a hedge with option contracts:

,  contracts

On April 4, 2015, as the FI gets out of the option hedge:

Loss on balance sheet Gain off balance sheet (options)

 =  =

-$9,333,333 $9,680,000

The net gain is $9,333,333 - $9,680,000 = $346,667

For a hedge with swap contracts:

 buy swap

On April 4, 2015, as the FI gets out of the swap hedge:

Loss on balance sheet Gain off balance sheet (swaps)

 = ∆Swap value = (8 - 1) × $288,000,000 × 0.0005/1.08

-$9,333,333 $9,333,333

The net gain is $9,333,333 - $9,333,333 = $0

In this case, the FI would be better off hedging with option contracts rather than futures or swap contracts.

If by April 4, 2015, balance sheet rates actually fall by 0.25 percent, futures rates fall by 0.35 percent, and T-bond rates underlying the option contract fall by 0.34 percent, calculate the on and off-balance-sheet cash flows to the FI when using futures contracts, option contracts, and swap contracts as its hedge instrument.

On April 4, 2015, as the FI gets out of the futures hedge:

Loss on balance sheet Gain off balance sheet (futures)

 

 

The net gain is $4,666,667 - $4,791,111 = -$124,444

For a hedge with option contracts:

On April 4, 2015, as the FI gets out of the option hedge, the value of the T-bond underlying the put option has increased. The FI does not have to exercise these options if the loss on exercise is greater than the option premium. Thus:

Loss on balance sheet Gain off balance sheet (options)

 Exercise: =

= $4,666,667 -$4,986,667

No exercise: ΔO=1,081.7536×100,000×(-36/64%)

= -$608,486

The FI will not exercise the options, taking the loss. Rather, it will let the options expire unused. Thus, the net gain is $4,666,667 - $608,486 = $4,058,181

For a hedge with swap contracts:

On April 4, 2015, as the FI gets out of the swap hedge:

Loss on balance sheet Gain off balance sheet (swaps)

 = ∆Swap value = (8 - 1) × $288,000,000 × -0.0025/(1.08))

$4,666,667 -$4,666,667

The net gain is $4,666,667 - $4,666,667 = $0

In this case, the FI would again be better off hedging with option contracts rather than futures or swap contracts.