**CHAPTER 7 FUTURES AND OPTIONS ON FOREIGN EXCHANGE**

**ANSWERS & SOLUTIONS TO END-OF-CHAPTER QUESTIONS AND PROBLEMS**

QUESTIONS

1. Explain the basic differences between the operation of a currency forward market and a futures market.

Answer: The forward market is an OTC market where the forward contract for purchase or sale of foreign currency is tailor-made between the client and its international bank. No money changes hands until the maturity date of the contract when delivery and receipt are typically made. A futures contract is an exchange-traded instrument with standardized features specifying contract size and delivery date. Futures contracts are marked-to-market daily to reflect changes in the settlement price. Delivery is seldom made in a futures market. Rather a reversing trade is made to close out a long or short position.

2. In order for a derivatives market to function most efficiently, two types of economic agents are needed: hedgers and speculators. Explain.

Answer: Two types of market participants are necessary for the efficient operation of a derivatives market: **speculators** and **hedgers**. A speculator attempts to profit from a change in the futures price. To do this, the speculator will take a long or short position in a futures contract depending upon his expectations of future price movement. A hedger, on-the-other-hand, desires to avoid price variation by locking in a purchase price of the underlying asset through a long position in a futures contract or a sales price through a short position. In effect, the hedger passes off the risk of price variation to the speculator who is better able, or at least more willing, to bear this risk.

3. Why are most futures positions closed out through a reversing trade rather than held to delivery?

Answer: In forward markets, approximately 90 percent of all contracts that are initially established result in the short making delivery to the long of the asset underlying the contract. This is natural because the terms of forward contracts are tailor-made between the long and short. By contrast, only about one percent of currency futures contracts result in delivery. While futures contracts are useful for speculation and hedging, their standardized delivery dates make them unlikely to correspond to the actual future dates when foreign exchange transactions will occur. Thus, they are generally closed out in a reversing trade. In fact, the commission that buyers and sellers pay to transact in the futures market is a single amount that covers the round-trip transactions of initiating and closing out the position.

4. How can the FX futures market be used for price discovery?

Answer: To the extent that FX forward prices are an unbiased predictor of future spot exchange rates, the market anticipates whether one currency will appreciate or depreciate versus another. Because FX futures contracts trade in an expiration cycle, different contracts expire at different periodic dates into the future. The pattern of the prices of these contracts provides information as to the market’s current belief about the relative future value of one currency versus another at the scheduled expiration dates of the contracts. One will generally see a steadily appreciating or depreciating pattern; however, it may be mixed at times. Thus, the futures market is useful for *price discovery*, i.e., obtaining the market’s forecast of the spot exchange rate at different future dates.

5. What is the major difference in the obligation of one with a long position in a futures (or forward) contract in comparison to an options contract?

Answer: A futures (or forward) contract is a vehicle for buying or selling a stated amount of foreign exchange at a stated price per unit at a specified time in the future. If the long holds the contract to the delivery date, he pays the effective contractual futures (or forward) price, regardless of whether it is an advantageous price in comparison to the spot price at the delivery date. By contrast, an option is a contract giving the long the right to buy or sell a given quantity of an asset at a specified price at some time in the future, but not enforcing any obligation on him if the spot price is more favorable than the exercise price. Because the option owner does not have to exercise the option if it is to his disadvantage, the option has a price, or premium, whereas no price is paid at inception to enter into a futures (or forward) contract.

6. What is meant by the terminology that an option is in-, at-, or out-of-the-money?

Answer: A call (put) option with St > E (E > S*t*) is referred to as trading in-the-money. If St ≅ E the option is trading at-the-money. If S*t* < E (E < *St*) the call (put) option is trading *out-of-the-money*.

7. List the arguments (variables) of which an FX call or put option model price is a function. How does the call and put premium change with respect to a change in the arguments?

Answer: Both call and put options are functions of only six variables: *St, E, if, i$, T* and *σ.* When all else remains the same, the price of a European FX call (put) option will increase:

1. the larger (smaller) is *S*,

2. the smaller (larger) is *E*,

3. the smaller (larger) is *if*,

4. the larger (smaller) is *i$*,

5. the larger (smaller) *i$* is relative to *if*, and

6. the greater is *σ*.

When *i$* and *if* are not too much different in size, a European FX call and put will increase in price when the option term-to-maturity increases. However, when *i$* is very much larger than *if*, a European FX call will increase in price, but the put premium will decrease, when the option term-to-maturity increases. The opposite is true when *if* is very much greater than *i$*. For American FX options the analysis is less complicated. Since a longer term American option can be exercised on any date that a shorter term option can be exercised, or a some later date, it follows that the all else remaining the same, the longer term American option will sell at a price at least as large as the shorter term option.

PROBLEMS

1. Assume today’s settlement price on a CME EUR futures contract is $1.3140/EUR. You have a short position in one contract. Your performance bond account currently has a balance of $1,700. The next three days’ settlement prices are $1.3126, $1.3133, and $1.3049. Calculate the changes in the performance bond account from daily marking-to-market and the balance of the performance bond account after the third day.

Solution: $1,700 + [($1.3140 - $1.3126) + ($1.3126 - $1.3133)

+ ($1.3133 - $1.3049)] x EUR125,000 = $2,837.50, where EUR125,000 is the contract size of one EUR contract.

2. Do problem 1 again assuming you have a long position in the futures contract.

Solution: $1,700 + [($1.3126 - $1.3140) + ($1.3133 - $1.3126) + ($1.3049 - $1.3133)] x EUR125,000 = $562.50, where EUR125,000 is the contract size of one EUR contract.

With only $562.50 in your performance bond account, you would experience a margin call requesting that additional funds be added to your performance bond account to bring the balance back up to the initial performance bond level.

3. Using the quotations in Exhibit 7.3, calculate the face value of the open interest in the September 2019 Swiss franc futures contract.

Solution: 42 contracts x SF125,000 = SF5,500,000, where SF125,000 is the contract size of one SF contract. Note: By comparison the face value of the open interest in the 73,541 June 2019 contracts is SF9,192,625,000.

4. Using the quotations in Exhibit 7.3, note that the June 2019 Mexican peso futures contract has a price of $0.05143 per MXN. You believe the spot price in June will be $0.05795 per MXN. What speculative position would you enter into to attempt to profit from your beliefs? Calculate your anticipated profits, assuming you take a position in three contracts. What is the size of your profit (loss) if the futures price is indeed an unbiased predictor of the future spot price and this price materializes?

Solution: If you expect the Mexican peso to appreciate from $0.05143 to $0.05795 per MXN, you would take a long position in futures since the futures price of $0.05143 is less than your expected spot price.

Your anticipated profit from a long position in three contracts is: 3 x ($0.05795 - $0.05143) x MXN500,000 = $9,780 where MXN500,000 is the contract size of one MXN contract.

If the futures price is an unbiased predictor of the expected spot price, the expected spot price is the futures price of $0.05143 per MXN. If this spot price materializes, you will not have any profits or losses from your short position in three futures contracts: 3 x ($0.05143 - $0.05143) x MXN500,000 = 0.

5. Do problem 4 again assuming you believe the June 2019 spot price will be $0.04491 per MXN.

Solution: If you expect the Mexican peso to depreciate from $0.05143 to $0.04491 per MXN, you would take a short position in futures since the futures price of $0.05143 is greater than your expected spot price.

Your anticipated profit from a short position in three contracts is: 3 x ($0.05143 - $0.04491) x MXN500,000 = $9,780, where MXN500,000 is the contract size of one MXN contract.

If the futures price is an unbiased predictor of the future spot price and this price materializes, you will not profit or lose from your long futures position.

6. Using the market data in Exhibit 7.6, show the net terminal value of a long position in one 110 Sep Japanese yen European call contract at the following terminal spot prices (stated in U.S. cents per 100 yen): 101, 105, 110, 115, and 119. Ignore any time value of money effect.

Solution: The net terminal value of one call contract is:

[*Max[ST – E, 0*] *– Ce*] x JPY1,000,000/100 ÷ 100¢, where JPY1,000,000 is the contract size of one JPY contract.

At 101: [*Max*[101 – 110, 0] – 1.40] x JPY1,000,000/100 ÷ 100¢ = -$140

At 105: [*Max*[105 – 110, 0] – 1.40] x JPY1,000,000/100 ÷ 100¢ = -$140

At 110: [*Max*[110 – 110, 0] – 1.40] x JPY1,000,000/100 ÷ 100¢ = -$140

At 115: [*Max*[115 – 110, 0] – 1.40] x JPY1,000,000/100 ÷ 100¢ = $360

At 119: [*Max* [119 – 110, 0] – 1.40] x JPY1,000,000/100 ÷ 100¢ = $760

7. Using the market data in Exhibit 7.6, show the net terminal value of a long position in one 110 Sep Japanese yen European put contract at the following terminal spot prices (stated in U.S. cents per 100 yen): 101, 105, 110, 115, and 119. Ignore any time value of money effect.

Solution: The net terminal value of one put contract is:

[*Max*[*E –ST*, 0] – *Pe* x JPY1,000,000/100 ÷ 100¢, where JPY1,000,000 is the contract size of one JPY contract.

At 101: [*Max*[110 – 101, 0] – 2.89] x JPY1,000,000/100 ÷ 100¢ = $611

At 105: [*Max*[110 – 105, 0] – 2.89] x JPY1,000,000/100 ÷ 100¢ = $211

At 110: [*Max*[110 – 110, 0] – 2.89] x JPY1,000,000/100 ÷ 100¢ = -$289

At 115: [*Max*[110 – 115, 0] – 2.89] x JPY1,000,000/100 ÷ 100¢ = -$289

At 119: [*Max*[110 – 119, 0] – 2.89] x JPY1,000,000/100 ÷ 100¢ = -$289

8. Assume that the Japanese yen is trading at a spot price of 92.04 cents per 100 yen. Further assume that the premium of an American call (put) option with a striking price of 93 is 2.10 (2.20) cents. Calculate the intrinsic value and the time value of the call and put options.

Solution: Premium - Intrinsic Value = Time Value

Call: 2.10 - *Max*[92.04 – 93.00 = - .96, 0] = 2.10 cents per 100 yen

Put: 2.20 - *Max*[93.00 – 92.04 = .96, 0] = 1.24 cents per 100 yen

9. Assume spot Swiss franc is $0.7000 and the six-month forward rate is $0.6950. What is the minimum price that a six-month American call option with a striking price of $0.6800 should sell for in a rational market? Assume the annualized six-month Eurodollar rate is 3 ½ percent.

Solution:

Note to Instructor: A complete solution to this problem relies on the boundary expressions presented in footnote 3 of the text of Chapter 7.

*Ca* ≥ *Max*[(70 - 68), (69.50 - 68)/(1.0175), 0]

≥ *Max*[ 2, 1.47, 0] = 2 cents

10. Do problem 9 again assuming an American put option instead of a call option.

Solution: *Pa* ≥ *Max*[(68 - 70), (68 - 69.50)/(1.0175), 0]

≥ *Max*[ -2, -1.47, 0] = 0 cents

11. Use the European option-pricing models developed in the chapter to value the call of problem 9 and the put of problem 10. Assume the annualized volatility of the Swiss franc is 14.2 percent. This problem can be solved using the FXOPM.xls spreadsheet.

Solution:

*d1* = [*ln*(69.50/68) + .5(.142)2(.50)]/(.142)*√*.50 = .2675

*d2* = *d1* - .142*√*.50 = .2765 - .1004 = .1671

*N(d1)* = .6055

*N(d2)* = .5664

*N(-d1)* = .3945

*N(-d2)* = .4336

*Ce* = [69.50(.6055) - 68(.5664)]*e*-(.035)(.50) = 3.51 cents

*Pe* = [68(.4336) - 69.50(.3945)]*e*-(.035)(.50) = 2.03 cents

12. Use the binomial option-pricing model developed in the chapter to value the call of problem 9.

The volatility of the Swiss franc is 14.2 percent.

Solution: The spot rate at *T* will be either 77.39¢ = 70.00¢(1.1056) or 63.32¢ = 70.00¢(.9045), where *u = e*.142√.50 = 1.1056 and *d = 1/u* = .9045. At the exercise price of *E* = 68, the option will only be exercised at time *T* if the Swiss franc appreciates; its exercise value would be *CuT* = 9.39¢ = 77.39¢ - 68. If the Swiss franc depreciates it would not be rational to exercise the option; its value would be *CdT* = 0.

The hedge ratio is *h* = (9.39 – 0)/(77.39 – 63.32) = .6674.

Thus, the call premium is:

*C0* = *Max*{[69.50(.6674) – 68((77.39/68)(.6674 – 1) +1)]/(1.0175), 70 – 68}

= *Max*[4.05, 2] = 4.05 cents per SF.

MINI CASE: THE OPTIONS SPECULATOR

A speculator is considering the purchase of five three-month Japanese yen call options with a striking price of 96 cents per 100 yen. The premium is 1.35 cents per 100 yen. The spot price is 95.28 cents per 100 yen and the 90-day forward rate is 95.71 cents. The speculator believes the yen will appreciate to $1.00 per 100 yen over the next three months. As the speculator’s assistant, you have been asked to prepare the following:

1. Graph the call option cash flow schedule.

2. Determine the speculator’s profit if the yen appreciates to $1.00/100 yen.

3. Determine the speculator’s profit if the yen only appreciates to the forward rate.

4. Determine the future spot price at which the speculator will only break even.

Suggested Solution to the Options Speculator:

1. **+**



**-**

2. (5 x ¥1,000,000) x [(100 - 96) - 1.35]/10000 = $1,325.00.

3. Since the option expires out-of-the-money, the speculator will let the option expire worthless. He will only lose the option premium.

4. *ST = E + C* = 96 + 1.35 = 97.35 cents per 100 yen.

**CHAPTER 14 INTEREST RATE AND CURRENCY SWAPS**

**ANSWERS & SOLUTIONS TO END-OF-CHAPTER QUESTIONS AND PROBLEMS**

QUESTIONS

1. Describe the difference between a swap broker and a swap dealer.

Answer: A swap broker arranges a swap between two counterparties for a fee without taking a risk position in the swap. A swap dealer is a market maker of swaps and assumes a risk position in matching opposite sides of a swap and in assuring that each counterparty fulfills its contractual obligation to the other.

2. What is the necessary condition for a fixed-for-floating interest rate swap to be possible?

Answer: For a fixed-for-floating interest rate swap to be possible it is necessary for a quality spread differential to exist. In general, the default-risk premium of the fixed-rate debt will be larger than the default-risk premium of the floating-rate debt.

3. Discuss the basic motivations for a counterparty to enter into a currency swap.

Answer: One basic reason for a counterparty to enter into a currency swap is to exploit the comparative advantage of the other in obtaining debt financing at a lower interest rate than could be obtained on its own. A second basic reason is to lock in long-term exchange rates in the repayment of debt service obligations denominated in a foreign currency.

4. How does the theory of comparative advantage relate to the currency swap market?

Answer: Name recognition is extremely important in the international bond market. Without it, even a creditworthy corporation will find itself paying a higher interest rate for foreign denominated funds than a local borrower of equivalent creditworthiness. Consequently, two firms of equivalent creditworthiness can each exploit their, respective, name recognition by borrowing in their local capital market at a favorable rate and then re-lending at the same rate to the other.

5. Discuss the risks confronting an interest rate and currency swap dealer.

Answer: An interest rate and currency swap dealer confronts many different types of risk. *Interest rate risk* refers to the risk of interest rates changing unfavorably before the swap dealer can lay off on an opposing counterparty the unplaced side of a swap with another counterparty. *Basis risk* refers to the floating rates of two counterparties being pegged to two different indices. In this situation, since the indexes are not perfectly positively correlated, the swap bank may not always receive enough floating rate funds from one counterparty to pass through to satisfy the other side, while still covering its desired spread, or avoiding a loss. *Exchange-rate risk* refers to the risk the swap bank faces from fluctuating exchange rates during the time it takes the bank to lay off a swap it undertakes on an opposing counterparty before exchange rates change. Additionally, the dealer confronts *credit risk* from one counterparty defaulting and its having to fulfill the defaulting party’s obligation to the other counterparty. *Mismatch risk* refers to the difficulty of the dealer finding an exact opposite match for a swap it has agreed to take. *Sovereign risk* refers to a country imposing exchange restrictions on a currency involved in a swap making it costly, or impossible, for a counterparty to honor its swap obligations to the dealer. In this event, provisions exist for the early termination of a swap, which means a loss of revenue to the swap bank.

6. Briefly discuss some variants of the basic interest rate and currency swaps diagramed in the chapter.

Answer: Instead of the basic fixed-for-floating interest rate swap, there are also zero-coupon-for-floating rate swaps where the fixed rate payer makes only one zero-coupon payment at maturity on the notional value. There are also floating-for-floating rate swaps where each side is tied to a different floating rate index or a different frequency of the same index. Currency swaps need not be fixed-for-fixed; fixed-for-floating and floating-for-floating rate currency swaps are frequently arranged. Moreover, both currency and interest rate swaps can be amortizing as well as non-amortizing.

7. If the cost advantage of interest rate swaps would likely be arbitraged away in competitive markets, what other explanations exist to explain the rapid development of the interest rate swap market?

Answer: All types of debt instruments are not always available to all borrowers. Interest rate swaps can assist in market completeness. That is, a borrower may use a swap to get out of one type of financing and to obtain a more desirable type of credit that is more suitable for its asset maturity structure.

8. Suppose Morgan Guaranty, Ltd. is quoting swap rates as follows: 7.75 - 8.10 percent annually against six-month dollar LIBOR for dollars and 11.25 - 11.65 percent annually against six-month dollar LIBOR for British pound sterling. At what rates will Morgan Guaranty enter into a $/£ currency swap?

Answer: Morgan Guaranty will pay annual fixed-rate dollar payments of 7.75 percent against receiving six-month dollar LIBOR flat, or it will receive fixed-rate annual dollar payments at 8.10 percent against paying six-month dollar LIBOR flat. Morgan Guaranty will make annual fixed-rate £ payments at 11.25 percent against receiving six-month dollar LIBOR flat, or it will receive annual fixed-rate £ payments at 11.65 percent against paying six-month dollar LIBOR flat. Thus, Morgan Guaranty will enter into a currency swap in which it would pay annual fixed-rate dollar payments of 7.75 percent in return for receiving semi-annual fixed-rate £ payments at 11.65 percent, or it will receive annual fixed-rate dollar payments at 8.10 percent against paying annual fixed-rate £ payments at 11.25 percent.

9. A U.S. company needs to raise €50,000,000. It plans to raise this money by issuing dollar-denominated bonds and using a currency swap to convert the dollars to euros. The company expects interest rates in both the United States and the euro zone to fall.

a. Should the swap be structured with interest paid at a fixed or a floating rate?

b. Should the swap be structured with interest received at a fixed or a floating rate?

CFA Guideline Answer:

a. The U.S. company would pay the interest rate in euros. Because it expects that the interest rate in the euro zone will fall in the future, it should choose a swap with a floating rate on the interest paid in euros to let the interest rate on its debt float down.

b. The U.S. company would receive the interest rate in dollars. Because it expects that the interest rate in the United States will fall in the future, it should choose a swap with a fixed rate on the interest received in dollars to prevent the interest rate it receives from going down.

\*10. Assume a currency swap in which two counterparties of comparable credit risk each borrow at the best rate available, yet the nominal rate of one counterparty is higher than the other. After the initial principal exchange, is the counterparty that is required to make interest payments at the higher nominal rate at a financial disadvantage to the other in the swap agreement? Explain your thinking.

Answer: Superficially, it may appear that the counterparty paying the higher nominal rate is at a disadvantage since it has borrowed at a lower rate. However, if the forward rate is an unbiased predictor of the expected spot rate and if IRP holds, then the currency with the higher nominal rate is expected to depreciate versus the other. In this case, the counterparty making the interest payments at the higher nominal rate is in effect making interest payments at the lower interest rate because the payment currency is depreciating in value versus the borrowing currency.

PROBLEMS

1. Alpha and Beta Companies can borrow for a five-year term at the following rates:

Alpha Beta

Moody’s credit rating Aa Baa

Fixed-rate borrowing cost 10.5% 12.0%

Floating-rate borrowing cost LIBOR LIBOR + 1%

a. Calculate the quality spread differential (QSD).

b. Develop an interest rate swap in which both Alpha and Beta have an equal cost savings in their borrowing costs. Assume Alpha desires floating-rate debt and Beta desires fixed-rate debt. No swap bank is involved in this transaction.

Solution:

a. The QSD = (12.0% - 10.5%) minus (LIBOR + 1% - LIBOR) = .5%.

b. Alpha needs to issue fixed-rate debt at 10.5% and Beta needs to issue floating rate-debt at LIBOR + 1%. Alpha needs to pay LIBOR to Beta. Beta needs to pay 10.75% to Alpha. If this is done, Alpha’s floating-rate all-in-cost is: 10.5% + LIBOR - 10.75% = LIBOR - .25%, a .25% savings over issuing floating-rate debt on its own. Beta’s fixed-rate all-in-cost is: LIBOR+ 1% + 10.75% - LIBOR = 11.75%, a .25% savings over issuing fixed-rate debt.

2. Do problem 1 over again, this time assuming more realistically that a swap bank is involved as an intermediary. Assume the swap bank is quoting five-year dollar interest rate swaps at 10.7% - 10.8% against LIBOR flat.

Solution: Alpha will issue fixed-rate debt at 10.5% and Beta will issue floating rate-debt at LIBOR + 1%. Alpha will receive 10.7% from the swap bank and pay it LIBOR. Beta will pay 10.8% to the swap bank and receive from it LIBOR. If this is done, Alpha’s floating-rate all-in-cost is: 10.5% + LIBOR - 10.7% = LIBOR - .20%, a .20% savings over issuing floating-rate debt on its own. Beta’s fixed-rate all-in-cost is: LIBOR+ 1% + 10.8% - LIBOR = 11.8%, a .20% savings over issuing fixed-rate debt.

3. Company A is a AAA-rated firm desiring to issue five-year FRNs. It finds that it can issue FRNs at six-month LIBOR + .125 percent or at three-month LIBOR + .125 percent. Given its asset structure, three-month LIBOR is the preferred index. Company B is an A-rated firm that also desires to issue five-year FRNs. It finds it can issue at six-month LIBOR + 1.0 percent or at three-month LIBOR + .625 percent. Given its asset structure, six-month LIBOR is the preferred index. Assume a notional principal of $15,000,000. Determine the QSD and set up a floating-for-floating rate swap where the swap bank receives .125 percent and the two counterparties share the remaining savings equally.

Solution: The quality spread differential is [(Six-month LIBOR + 1.0 percent) minus (Six-month LIBOR + .125 percent) =] .875 percent minus [(Three-month LIBOR + .625 percent) minus (Three-month LIBOR + .125 percent) =] .50 percent, which equals .375 percent. If the swap bank receives .125 percent, each counterparty is to save .125 percent. To affect the swap, Company A would issue FRNs indexed to six-month LIBOR and Company B would issue FRNs indexed three-month LIBOR. Company B might make semi-annual payments of six-month LIBOR + .125 percent to the swap bank, which would pass all of it through to Company A. Company A, in turn, might make quarterly payments of three-month LIBOR to the swap bank, which would pass through three-month LIBOR - .125 percent to Company B. On an annualized basis, Company B will remit to the swap bank six-month LIBOR + .125 percent and pay three-month LIBOR + .625 percent on its FRNs. It will receive three-month LIBOR - .125 percent from the swap bank. This arrangement results in an all-in cost of six-month LIBOR + .825 percent, which is a rate .125 percent below the FRNs indexed to six-month LIBOR + 1.0 percent Company B could issue on its own. Company A will remit three-month LIBOR to the swap bank and pay six-month LIBOR + .125 percent on its FRNs. It will receive six-month LIBOR + .125 percent from the swap bank. This arrangement results in an all-in cost of three-month LIBOR for Company A, which is .125 percent less than the FRNs indexed to three-month LIBOR + .125 percent it could issue on its own. The arrangements with the two counterparties net the swap bank .125 percent per annum, received quarterly.

\*4. A corporation enters into a five-year interest rate swap with a swap bank in which it agrees to pay the swap bank a fixed rate of 9.75 percent annually on a notional amount of €15,000,000 and receive LIBOR. As of the second reset date, determine the price of the swap from the corporation’s viewpoint assuming that the fixed-rate side of the swap has increased to 10.25 percent.

Solution: On the reset date, the present value of the future floating-rate payments the corporation will receive from the swap bank based on the notional value will be €15,000,000. The present value of a hypothetical bond issue of €15,000,000 with three remaining 9.75 percent coupon payments at the new fixed-rate of 10.25 percent is €14,814,304. This sum represents the present value of the remaining payments the swap bank will receive from the corporation. Thus, the swap bank should be willing to buy and the corporation should be willing to sell the swap for €15,000,000 - €14,814,304 = €185,696.

5. DVR, Inc. can borrow dollars for five years at a coupon rate of 2.75 percent. Alternatively, it can borrow yen for five years at a rate of .85 percent. The five-year yen swap rates are .64--.70 percent and the dollar swap rates are 2.41--2.44 percent. The current ¥/$ exchange rate is 87.575. Determine the dollar AIC and the dollar cash flow that DVR would have to pay under a currency swap where it borrows ¥1,750,000,000 and swaps the debt service into dollars. This problem can be solved using the excel spreadsheet CURSWAP.xls.

Solution: Since the dollar AIC is 2.66% and the DVR’s dollar borrowing rate is 2.75%, it should borrow yen and swap into dollars. The swap locks-in the dollar cashflows DVR needs to cover the yen debt service. The output from using the excel spreadsheet CURSWAP.xls is:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **Cross-Currency Swap Analyzer** | | |  |
|  |  |  |  |  |  |
|  | **FC Bond** | **FC** | **$** | **Actual** |  |
| **Year** | **Cashflow** | **Received** | **Paid** | **$ Cashflow** |  |
|  |  |  |  |  |  |
| 0 | 1,750,000,000 | -1,768,027,402 | 20,188,723 | 19,982,872 |  |
| 1 | -14,875,000 | 14,875,000 | -492,605 | -492,605 |  |
| 2 | -14,875,000 | 14,875,000 | -492,605 | -492,605 |  |
| 3 | -14,875,000 | 14,875,000 | -492,605 | -492,605 |  |
| 4 | -14,875,000 | 14,875,000 | -492,605 | -492,605 |  |
| 5 | -1,764,875,000 | 1,764,875,000 | -20,681,328 | -20,681,328 |  |
|  |  |  |  |  |  |
| **AIC** | 0.85% | 0.64% | 2.44% | 2.66% |  |
|  |  |  |  |  |  |
| Face Value: | 1,750,000,000 |  |  | Bid | Ask |
|  |  |  |  |  |  |
| Coupon Rate: | 0.850% |  | Spot FX Rate: | 87.57500 | 87.57500 |
|  |  |  |  |  |  |
| OP as % of Par: | 100.000% |  | FC Swap Rate: | 0.64% | 0.70% |
|  |  |  |  |  |  |
| Underwriting Fee: | 0.000% |  | $ Swap Rate: | 2.41% | 2.44% |

6. Karla Ferris, a fixed income manager at Mangus Capital Management, expects the current positively sloped U.S. Treasury yield curve to shift parallel upward.

Ferris owns two $1,000,000 corporate bonds maturing on June 15, 2020, one with a variable rate based on 6-month U.S. dollar LIBOR and one with a fixed rate. Both yield 50 basis points over comparable U.S. Treasury market rates, have very similar credit quality, and pay interest semi-annually.

Ferris wished to execute a swap to take advantage of her expectation of a yield curve shift and believes that any difference in credit spread between LIBOR and U.S. Treasury market rates will remain constant.

a. Describe a six-month U.S. dollar LIBOR-based swap that would allow Ferris to take advantage of her expectation. Discuss, assuming Ferris’ expectation is correct, the change in the swap’s value and how that change would affect the value of her portfolio. [No calculations required to answer part a.]

Instead of the swap described in part a, Ferris would use the following alternative derivative strategy to achieve the same result.

b. Explain, assuming Ferris’ expectation is correct, how the following *strategy* achieves the same result in response to the yield curve shift. [No calculations required to answer part b.]

Settlement Date Nominal Eurodollar Futures Contract Value

12-15-18 $1,000,000

03-15-19 1,000,000

06-15-19 1,000,000

09-15-19 1,000,000

12-15-19 1,000,000

03-15-20 1,000,000

c. Discuss *one* reason these two derivative strategies provide the same result.

# CFA Guideline Answer

1. The Swap Value and its Effect on Ferris’ Portfolio

Because Karla Ferris believes interest rates will rise, she will want to swap her $1,000,000 fixed-rate corporate bond interest to receive six-month U.S. dollar LIBOR. She will continue to hold her variable-rate six-month U.S. dollar LIBOR rate bond because its payments will increase as interest rates rise. Because the credit risk between the U.S. dollar LIBOR and the U.S. Treasury market is expected to remain constant, Ferris can use the U.S. dollar LIBOR market to take advantage of her interest rate expectation without affecting her credit risk exposure.

To execute this swap, she would enter into a two-year term, semi-annual settle, $1,000,000 nominal principal, pay fixed-receive floating U.S. dollar LIBOR swap. If rates rise, the swap’s *mark-to-market* value will *increase* because the U.S. dollar LIBOR Ferris receives will be *higher* than the LIBOR rates from which the swap was priced. If Ferris were to enter into the same swap after interest rates rise, she would pay a higher fixed rate to receive LIBOR rates. This higher fixed rate would be calculated as the present value of now higher forward LIBOR rates. Because Ferris would be paying a stated fixed rate that is lower than this new higher-present-value fixed rate, she could sell her swap at a premium. This premium is called the “replacement cost” value of the swap.

b. Eurodollar Futures Strategy

The appropriate futures hedge is to *short* a combination of Eurodollar futures contracts with different settlement dates to match the coupon payments and principal. This futures hedge accomplishes the same objective as the pay fixed-receive floating swap described in Part a. By discussing how the yield-curve shift affects the value of the futures hedge, the candidate can show an understanding of how Eurodollar futures contracts can be used instead of a pay fixed-receive floating swap.

If rates rise, the mark-to-market values of the Eurodollar contracts decrease; their yields must increase to equal the new higher forward and spot LIBOR rates. Because Ferris must *short or sell* the Eurodollar contracts to duplicate the pay fixed-receive variable swap in Part a, she gains as the Eurodollar futures contracts decline in value and the *futures hedge* increases in value. As the contracts expire, or if Ferris sells the remaining contracts prior to maturity, she will recognize a gain that increases her return. With higher interest rates, the value of the fixed-rate bond will decrease. If the hedge ratios are appropriate, the value of the portfolio, however, will remain unchanged because of the increased value of the hedge, which offsets the fixed-rate bond’s decrease.

Why the Derivative Strategies Achieve the Same Result

Arbitrage market forces make these two strategies provide the same result to Ferris. The two strategies are different mechanisms for different market participants to hedge against increasing rates. Some money managers prefer swaps; others, Eurodollar futures contracts. Each institutional market participant has different preferences and choices in hedging interest rate risk. The key is that market makers moving into and out of these two markets ensure that the markets are similarly priced and provide similar returns. As an example of such an arbitrage, consider what would happen if forward market LIBOR rates were lower than swap market LIBOR rates. An arbitrageur would, under such circumstances, sell the futures/forwards contracts and enter into a received fixed-pay variable swap. This arbitrageur could now receive the higher fixed rate of the swap market and pay the lower fixed rate of the futures market. He or she would pocket the differences between the two rates (without risk and without having to make any [net] investment.) This arbitrage could not last.

As more and more market makers sold Eurodollar futures contracts, the selling pressure would cause their prices to fall and yields to rise, which would cause the present value cost of selling the Eurodollar contracts also to increase. Similarly, as more and more market makers offer to receive fixed rates in the swap market, market makers would have to lower their fixed rates to attract customers so they could lock in the lower hedge cost in the Eurodollar futures market. Thus, Eurodollar forward contract yields would rise and/or swap market receive-fixed rates would fall until the two rates converge. At this point, the arbitrage opportunity would no longer exist and the swap and forwards/futures markets would be in equilibrium.

7. Rone Company asks Paula Scott, a treasury analyst, to recommend a flexible way to manage the company’s financial risks.

Two years ago, Rone issued a $25 million (U.S.$), five-year floating rate note (FRN). The FRN pays an annual coupon equal to one-year LIBOR plus 75 basis points. The FRN is non-callable and will be repaid at par at maturity.

Scott expects interest rates to increase and she recognizes that Rone could protect itself against the increase by using a pay-fixed swap. However, Rone’s Board of Directors prohibits both short sales of securities and swap transactions. Scott decides to replicate a pay-fixed swap using a combination of capital market instruments.

a. Identify the instruments needed by Scott to replicate a pay-fixed swap and describe the required transactions.

b. Explain how the transactions in Part a are equivalent to using a pay-fixed swap.

CFA Guideline Answer

a. The instruments needed by Scott are a fixed-coupon bond and a floating rate note (FRN).

The transactions required are to:

∙ issue a fixed-coupon bond with a maturity of three years and a notional amount of $25 million, and

∙ buy a $25 million FRN of the same maturity that pays one-year LIBOR plus 75 bps.

b. At the outset, Rone will issue the bond and buy the FRN, resulting in a zero net cash flow at initiation. At the end of the third year, Rone will repay the fixed-coupon bond and will be repaid the FRN, resulting in a zero net cash flow at maturity. The net cash flow associated with each of the three annual coupon payments will be the difference between the inflow (to Rone) on the FRN and the outflow (to Rone) on the bond. Movements in interest rates during the three-year period will determine whether the net cash flow associated with the coupons is positive or negative to Rone. Thus, the bond transactions are financially equivalent to a plain vanilla pay-fixed interest rate swap.

# 8. A company based in the United Kingdom has an Italian subsidiary. The subsidiary generates €25,000,000 a year, received in equivalent semiannual installments of €12,500,000. The British company wishes to convert the euro cash flows to pounds twice a year. It plans to engage in a currency swap in order to lock in the exchange rate at which it can convert the euros to pounds. The current exchange rate is €1.5/£. The fixed rate on a plain vanilla currency swap in pounds is 7.5 percent per year, and the fixed rate on a plain vanilla currency swap in euros is 6.5 percent per year.

# a. Determine the notional principals in euros and pounds for a swap with semiannual payments that will help achieve the objective.

b. Determine the semiannual cash flows from this swap.

# CFA Guideline Answer

a. The semiannual cash flow must be converted into pounds is €25,000,000/2 = €12,500,000. In order to create a swap to convert €12,500,000, the equivalent notional principals are

∙ Euro notional principal = €12,500,000/(0.065/2) = €384,615,385

∙ Pound notional principal = €384,615,385/€1.5/£ = £256,410,257

b. The cash flows from the swap will now be

∙ Company makes swap payment = €384,615,385(0.065/2) = €12,500,000

∙ Company receives swap payment = £256,410,257(0.075/2) = £9,615,385

The company has effectively converted euro cash receipts to pounds.

9. Ashton Bishop is the debt manager for World Telephone, which needs €3.33 billion Euro financing for its operations. Bishop is considering the choice between issuance of debt denominated in:

• Euros (€), or

• U.S. dollars, accompanied by a combined interest rate and currency swap.

a. Explain *one* risk World would assume by entering into the combined interest rate and currency swap.

Bishop believes that issuing the U.S.-dollar debt and entering into the swap can lower World’s cost of debt by 45 basis points. Immediately after selling the debt issue, World would swap the U.S. dollar payments for Euro payments throughout the maturity of the debt. She assumes a constant currency exchange rate throughout the tenor of the swap.

Exhibit 1 gives details for the two alternative debt issues. Exhibit 2 provides current information about spot currency exchange rates and the three-year tenor euro/U.S. dollar currency and interest rate swap.

## Exhibit 1

## World Telephone Debt Details

|  |  |  |
| --- | --- | --- |
| Characteristic | Euro Currency Debt | U.S. Dollar Currency Debt |
| Par value | €3.33 billion | $3 billion |
| Term to maturity | 3 years | 3 years |
| Fixed interest rate | 6.25% | 7.75% |
| Interest payment | Annual | Annual |

Exhibit 2

Currency Exchange Rate and Swap Information

|  |  |
| --- | --- |
| Spot currency exchange rate | $0.90 per euro ($0.90/€1.00) |
| 3-year tenor euro/U.S. dollar  fixed interest rates | 5.80% euro/7.30% U.S. Dollar |

b**.** Show the notional principal and interest payment cash flows of the combined interest rate and currency swap.

Note: Your response should show both the correct currency ($ or €) and amount for *each* cash flow.

Answer problem b in the template provided below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Cash Flows **of the Swap** | Year 0 | Year 1 | **Year 2** | **Year 3** |
| World pays |  |  |  |  |
| Notional principal |  |  |  |  |
| Interest payment |  |  |  |  |
| World receives |  |  |  |  |
| Notional principal |  |  |  |  |
| Interest payment |  |  |  |  |

c. State whether or not World would reduce its borrowing cost by issuing the debt denominated in U.S. dollars, accompanied by the combined interest rate and currency swap. Justify your response with *one* reason.

CFA Guideline Answer

a. World would assume both counterparty risk and currency risk. Counterparty risk is the risk that Bishop’s counterparty will default on payment of principal or interest cash flows in the swap. Currency risk is the currency exposure risk associated with all cash flows. If the US$ appreciates (Euro depreciates), there would be a loss on funding of the coupon payments; however, if the US$ depreciates, then the dollars will be worth less at the swap’s maturity.

b.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Year 0 | Year 1 | Year 2 | Year 3 |
| World pays |  | | | |
| Notional  Principal | $3 billion |  |  | €3.33 billion |
| Interest payment |  | €193.14 million1 | €193.14 million | €193.14 million |
| World receives |  | | | |
| Notional  Principal | $3.33 billion |  |  | €3 billion |
| Interest payment |  | $219 million2 | $219 million | $219 million |

1 € 193.14 million = € 3.33 billion x 5.8%

2 $219 million = $ 3 billion x 7.3%

c. World would not reduce its borrowing cost, because what Bishop saves in the Euro market, she loses in the dollar market. The interest rate on the Euro pay side of her swap is 5.80 percent, lower than the 6.25 percent she would pay on her Euro debt issue, an interest savings of 45 bps. But Bishop is only receiving 7.30 percent in U.S. dollars to pay on her 7.75 percent U.S. debt interest payment, an interest shortfall of 45 bps. Given a constant currency exchange rate, this 45 bps shortfall exactly offsets the savings from paying 5.80 percent versus the 6.25 percent. Thus there is no interest cost savings by selling the U.S. dollar debt issue and entering into the swap arrangement.

MINI CASE: THE CENTRALIA CORPORATION’S CURRENCY SWAP

The Centralia Corporation is a U.S. manufacturer of small kitchen electrical appliances. It has decided to construct a wholly owned manufacturing facility in Zaragoza, Spain, to manufacture microwave ovens for sale in the European Union. The plant is expected to cost €5,500,000, and to take about one year to complete. The plant is to be financed over its economic life of eight years. The borrowing capacity created by this capital expenditure is $2,900,000; the remainder of the plant will be equity financed. Centralia is not well known in the Spanish or international bond market; consequently, it would have to pay 7 percent per annum to borrow euros, whereas the normal borrowing rate in the euro zone for well-known firms of equivalent risk is 6 percent. Alternatively, Centralia can borrow dollars in the U.S. at a rate of 8 percent.

Study Questions

1. Suppose a Spanish MNC has a mirror-image situation and needs $2,900,000 to finance a capital expenditure of one of its U.S. subsidiaries. It finds that it must pay a 9 percent fixed rate in the United States for dollars, whereas it can borrow euros at 6 percent. The exchange rate has been forecast to be $1.33/€1.00 in one year. Set up a currency swap that will benefit each counterparty.

\*2. Suppose that one year after the inception of the currency swap between Centralia and the Spanish MNC, the U.S. dollar fixed-rate has fallen from 8 to 6 percent and the euro zone fixed-rate for euros has fallen from 6 to 5.50 percent. In both dollars and euros, determine the market value of the swap if the exchange rate is $1.3343/€1.00.

Suggested Solution to The Centralia Corporation’s Currency Swap

1. The Spanish MNC should issue €2,180,500 of 6 percent fixed-rate debt and Centralia should issue $2,900,000 of fixed-rate 8 percent debt, since each counterparty has a relative comparative advantage in their home market. They will exchange principal sums in one year. The contractual exchange rate for the initial exchange is $2,900,000/€2,180,500, or $1.33/€1.00. Annually the counterparties will swap debt service: the Spanish MNC will pay Centralia $232,000 (= $2,900,000 x .08) and Centralia will pay the Spanish MNC €130,830 (= €2,180,500 x .06). The contractual exchange rate of the first seven annual debt service exchanges is $232,000/€130,830, or $1.7733/€1.00. At maturity, Centralia and the Spanish MNC will re-exchange the principal sums and the final debt service payments. The contractual exchange rate of the final currency exchange is $3,132,000/€2,311,330 = ($2,900,000 + $232,000)/(€2,180,500 + €130,830), or $1.3551/€1.00.

\*2. The market value of the dollar debt is the present value of a seven-year annuity of $232,000 and a lump sum of $2,900,000 discounted at 6 percent. This present value is $3,223,778. Similarly, the market value of the euro debt is the present value of a seven-year annuity of €130,830 and a lump sum of €2,180,500 discounted at 5.50 percent. This present value is €2,242,459. The dollar value of the swap is $3,223,778 - €2,242,459 x 1.3343 = $231,665. The euro value of the swap is €2,242,459 - $3,223,778/1.3343 = -€173,623.

**CHAPTER 8 MANAGEMENT OF TRANSACTION EXPOSURE**

**ANSWERS & SOLUTIONS TO END-OF-CHAPTER QUESTIONS AND PROBLEMS**

QUESTIONS

1. How would you define transaction exposure? How is it different from economic exposure?

Answer: Transaction exposure is the sensitivity of realized domestic currency values of the firm’s contractual cash flows denominated in foreign currencies to unexpected changes in exchange rates. Unlike economic exposure, transaction exposure is well-defined and short-term.

2. Discuss and compare hedging transaction exposure using the forward contract vs. money market instruments. When do the alternative hedging approaches produce the same result?

Answer: Hedging transaction exposure by a forward contract is achieved by selling or buying foreign currency receivables or payables forward. On the other hand, money market hedge is achieved by borrowing or lending the present value of foreign currency receivables or payables, thereby creating offsetting foreign currency positions. If the interest rate parity is holding, the two hedging methods are equivalent.

3. Discuss and compare the costs of hedging via the forward contract and the options contract.

Answer: There is no up-front cost of hedging by forward contracts. In the case of options hedging, however, hedgers should pay the premiums for the contracts up-front. The cost of forward hedging, however, may be realized ex post when the hedger regrets his/her hedging decision.

4. What are the advantages of a currency options contract as a hedging tool compared with the forward contract?

Answer: The main advantage of using options contracts for hedging is that the hedger can decide whether to exercise options upon observing the realized future exchange rate. Options thus provide a hedge against ex post regret that forward hedger might have to suffer. Hedgers can only eliminate the downside risk while retaining the upside potential.

5. Suppose your company has purchased a put option on the euro to manage exchange exposure associated with an account receivable denominated in that currency. In this case, your company can be said to have an ‘insurance’ policy on its receivable. Explain in what sense this is so.

Answer: Your company in this case knows in advance that it will receive a certain minimum dollar amount no matter what might happen to the $/€ exchange rate. Furthermore, if the euro appreciates, your company will benefit from the rising euro.

6. Recent surveys of corporate exchange risk management practices indicate that many U.S. firms simply do not hedge. How would you explain this result?

Answer: There can be many possible reasons for this. First, many firms may feel that they are not really exposed to exchange risk due to product diversification, diversified markets for their products, etc. Second, firms may be using self-insurance against exchange risk. Third, firms may feel that shareholders can diversify exchange risk themselves, rendering corporate risk management unnecessary.

7. Should a firm hedge? Why or why not?

Answer: In a perfect capital market, firms may not need to hedge exchange risk. But firms can add to their value by hedging if markets are imperfect. First, if management knows about the firm’s exposure better than shareholders, the firm, not its shareholders, should hedge. Second, firms may be able to hedge at a lower cost. Third, if default costs are significant, corporate hedging can be justifiable because it reduces the probability of default. Fourth, if the firm faces progressive taxes, it can reduce tax obligations by hedging which stabilizes corporate earnings.

8. Using an example, discuss the possible effect of hedging on a firm’s tax obligations.

Answer: One can use an example similar to the one presented in the chapter.

9. Explain contingent exposure and discuss the advantages of using currency options to manage this type of currency exposure.

Answer: Companies may encounter a situation where they may or may not face currency exposure. In this situation, companies need options, not obligations, to buy or sell a given amount of foreign exchange they may or may not receive or have to pay. If companies either hedge using forward contracts or do not hedge at all, they may face definite currency exposure.

10. Explain cross-hedging and discuss the factors determining its effectiveness.

Answer: Cross-hedging involves hedging a position in one asset by taking a position in another asset. The effectiveness of cross-hedging would depend on the strength and stability of the relationship between the two assets.

PROBLEMS

1. Cray Research sold a super computer to the Max Planck Institute in Germany on credit and invoiced €10 million payable in six months. Currently, the six-month forward exchange rate is $1.10/€ and the foreign exchange advisor for Cray Research predicts that the spot rate is likely to be $1.05/€ in six months.

(a) What is the expected gain/loss from the forward hedging?

(b) If you were the financial manager of Cray Research, would you recommend hedging this euro receivable? Why or why not?

(c) Suppose the foreign exchange advisor predicts that the future spot rate will be the same as the forward exchange rate quoted today. Would you recommend hedging in this case? Why or why not?

(d) Suppose now that the future spot exchange rate is forecast to be $1.17/€. Would you recommend hedging? Why or why not?

Solution:

(a) Expected gain($) = 10,000,000(1.10 – 1.05)

= 10,000,000(.05)

= $500,000.

Note that for each euro sold forward, Cray Research will receive $1.10 for sure and has to deliver one euro that is expected to cost $1.05.

(b) I would recommend hedging because Cray Research can increase the expected dollar receipt by $500,000 and also eliminate the exchange risk.

(c) Since Cray Research can eliminate risk without sacrificing dollar receipt, I still would recommend hedging.

(d) Now, hedging via forward contract involves an expected loss: -$700,000 = 10,000,000 (1.10 -1.17). Hedging thus becomes much less attractive. But if Cray Research is highly risk averse, it may still decide to hedge. The decision to hedge then critically depends on the firm’s degree of risk aversion.

2. IBM purchased computer chips from NEC, a Japanese electronics concern, and was billed ¥250 million payable in three months. Currently, the spot exchange rate is ¥105/$ and the three-month forward rate is ¥100/$. The three-month money market interest rate is 8 percent per annum in the U.S. and 7 percent per annum in Japan. The management of IBM decided to use the money market hedge to deal with this yen account payable.

(a) Explain the process of a money market hedge and compute the dollar cost of meeting the yen obligation.

(b) Conduct the cash flow analysis of the money market hedge.

Solution:

(a). Let’s first compute the PV of ¥250 million, i.e.,

250m/1.0175 = ¥245,700,245.70

So if the above yen amount is invested today at the Japanese interest rate for three months, the maturity value will be exactly equal to ¥25 million which is the amount of payable.

To buy the above yen amount today, it will cost:

$2,340,002.34 = ¥245,700,245.70/105.

The dollar cost of meeting this yen obligation is $2,340,002.34 as of today.

(b)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Transaction CF0  CF1

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Buy yens spot -$2,340,002.34

with dollars ¥245,700,245.70

2. Invest in Japan - ¥245,700,245.70 ¥250,000,000

3. Pay yens - ¥250,000,000

Net cash flow - $2,340,002.34

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. You plan to visit Geneva, Switzerland in three months to attend an international business conference. You expect to incur the total cost of SF 5,000 for lodging, meals and transportation during your stay. As of today, the spot exchange rate is $0.60/SF and the three-month forward rate is $0.63/SF. You can buy the three-month call option on SF with the exercise rate of $0.64/SF for the premium of $0.05 per SF. Assume that your expected future spot exchange rate is the same as the forward rate. The three-month interest rate is 6 percent per annum in the United States and 4 percent per annum in Switzerland.

(a) Calculate your expected dollar cost of buying SF5,000 if you choose to hedge via call option on SF.

(b) Calculate the future dollar cost of meeting this SF obligation if you decide to hedge using a forward contract.

(c) At what future spot exchange rate will you be indifferent between the forward and option market hedges?

(d) Illustrate the future dollar costs of meeting the SF payable against the future spot exchange rate under both the options and forward market hedges.

Solution:

(a) Total option premium = (.05)(5000) = $250. In three months, $250 is worth $253.75 = $250(1.015). At the expected future spot rate of $0.63/SF, which is less than the exercise price, you don’t expect to exercise options. Rather, you expect to buy Swiss franc at $0.63/SF. Since you are going to buy SF5,000, you expect to spend $3,150 (=.63x5,000). Thus, the total expected cost of buying SF5,000 will be the sum of $3,150 and $253.75, i.e., $3,403.75.

(b) $3,150 = (.63)(5,000).

(c) $3,150 = 5,000x + 253.75, where x represents the break-even future spot rate. Solving for x, we obtain x = $0.57925/SF. Note that at the break-even future spot rate, options will not be exercised.

(d) If the Swiss franc appreciates beyond $0.64/SF, which is the exercise price of call option, you will exercise the option and buy SF5,000 for $3,200. The total cost of buying SF5,000 will be $3,453.75 = $3,200 + $253.75. This is the maximum you will pay for SF5,000.

$ Cost

Options hedge

Forward hedge

$3,453.75

$3,150

0

0.579

0.64

(strike price)

$/SF

$253.75

4. Boeing just signed a contract to sell a Boeing 737 aircraft to Air France. Air France will be billed €20 million which is payable in one year. The current spot exchange rate is $1.05/€ and the one-year forward rate is $1.10/€. The annual interest rate is 6.0% in the U.S. and 5.0% in France. Boeing is concerned with the volatile exchange rate between the dollar and the euro and would like to hedge exchange exposure.

(a) It is considering two hedging alternatives: sell the euro proceeds from the sale forward or borrow euros from Credit Lyonnaise against the euro receivable. Which alternative would you recommend? Why?

(b) Other things being equal, at what forward exchange rate would Boeing be indifferent between the two hedging methods?

Solution:

(a) In the case of forward hedge, the future dollar proceeds will be (20,000,000)(1.10) = $22,000,000. In the case of money market hedge (MMH), the firm has to first borrow the PV of its euro receivable, i.e., 20,000,000/1.05 =€19,047,619. Then the firm should exchange this euro amount into dollars at the current spot rate to receive: (€19,047,619)($1.05/€) = $20,000,000, which can be invested at the dollar interest rate for one year to yield: $20,000,000(1.06) = $21,200,000. Clearly, the firm can receive $800,000 more by using forward hedging.

(b) According to IRP, F = S(1+i$)/(1+iF). Thus the “indifferent” forward rate will be:

F = 1.05(1.06)/1.05 = $1.06/€.

5. Suppose that Baltimore Machinery sold a drilling machine to a Swiss firm and gave the Swiss client a choice of paying either $10,000 or SF 15,000 in three months.

(a) In the above example, Baltimore Machinery effectively gave the Swiss client a free option to buy up to $10,000 dollars using Swiss franc. What is the ‘implied’ exercise exchange rate?

(b) If the spot exchange rate turns out to be $0.62/SF, which currency do you think the Swiss client will choose to use for payment? What is the value of this free option for the Swiss client?

(c) What is the best way for Baltimore Machinery to deal with the exchange exposure?

Solution:

(a) The implied exercise (price) rate is: 10,000/15,000 = $0.6667/SF.

(b) If the Swiss client chooses to pay $10,000, it will cost SF16,129 (=10,000/.62). Since the Swiss client has an option to pay SF15,000, it will choose to do so. The value of this option is obviously SF1,129 (=SF16,129-SF15,000).

(c) Baltimore Machinery faces a contingent exposure in the sense that it may or may not receive SF15,000 in the future. The firm thus can hedge this exposure by buying a put option on SF15,000.

6. Princess Cruise Company (PCC) purchased a ship from Mitsubishi Heavy Industry. PCC owes Mitsubishi Heavy Industry 500 million yen in one year. The current spot rate is 124 yen per dollar and the one-year forward rate is 110 yen per dollar. The annual interest rate is 5% in Japan and 8% in the U.S. PCC can also buy a one-year call option on yen at the strike price of $.0081 per yen for a premium of .014 cents per yen.

(a) Compute the future dollar costs of meeting this obligation using the money market hedge and the forward hedges.

(b) Assuming that the forward exchange rate is the best predictor of the future spot rate, compute the expected future dollar cost of meeting this obligation when the option hedge is used.

(c) At what future spot rate do you think PCC may be indifferent between the option and forward hedge?

Solution:

(a) In the case of forward hedge, the dollar cost will be 500,000,000/110 = $4,545,455. In the case of money market hedge, the future dollar cost will be: 500,000,000(1.08)/(1.05)(124)

= $4,147,465.

(b) The option premium is: (.014/100)(500,000,000) = $70,000. Its future value will be $70,000(1.08) = $75,600.

At the expected future spot rate of $.0091(=1/110), which is higher than the exercise of $.0081, PCC will exercise its call option and buy ¥500,000,000 for $4,050,000 (=500,000,000x.0081).

The total expected cost will thus be $4,125,600, which is the sum of $75,600 and $4,050,000.

(c) When the option hedge is used, PCC will spend “at most” $4,125,000. On the other hand, when the forward hedging is used, PCC will have to spend $4,545,455 regardless of the future spot rate. This means that the options hedge dominates the forward hedge. At no future spot rate, PCC will be indifferent between forward and options hedges.

7. Consider a U.S.-based company that exports goods to Switzerland. The U.S. Company expects to receive payment on a shipment of goods in three months. Because the payment will be in Swiss francs, the U.S. Company wants to hedge against a decline in the value of the Swiss franc over the next three months. The U.S. risk-free rate is 2 percent, and the Swiss risk-free rate is 5 percent. Assume that interest rates are expected to remain fixed over the next six months. The current spot rate is $0.5974

1. Indicate whether the U.S. Company should use a long or short forward contract to hedge currency risk.
2. Calculate the no-arbitrage price at which the U.S. Company could enter into a forward contract that expires in three months.
3. It is now 30 days since the U.S. Company entered into the forward contract. The spot rate is $0.55. Interest rates are the same as before. Calculate the value of the U.S. Company’s forward position.

Solution:

1. The risk to the U.S. company is that the value of the Swiss franc will decline and it will receive fewer U.S. dollars on conversion. To hedge this risk, the company should enter into a contract to sell Swiss francs forward.
2. S0 = $0.5974

T = 90/365

r = 0.02

rf = 0.05



1. St = $0.55

T = 90/365

t = 30/365

T – t = 60/365

r = 0.02

rf = 0.05



This represents a gain to the short position of $0.0456 per Swiss franc. In this problem, the U.S. company holds the short forward position.

8. Suppose that you are a U.S.-based importer of goods from the United Kingdom. You expect the value of the pound to increase against the U.S. dollar over the next 30 days. You will be making payment on a shipment of imported goods in 30 days and want to hedge your currency exposure. The U.S. risk-free rate is 5.5 percent, and the U.K. risk-free rate is 4.5 percent. These rates are expected to remain unchanged over the next month. The current spot rate is $1.50.

1. Indicate whether you should use a long or short forward contract to hedge currency risk.
2. Calculate the no-arbitrage price at which you could enter into a forward contract that expires in three months.
3. Move forward 10 days. The spot rate is $1.53. Interest rates are unchanged. Calculate the value of your forward position.
4. Using the text software spreadsheet TRANSEXP, replicate the analysis in Exhibit 8.8.

Solution:

1. The risk to you is that the value of the British pound will rise over the next 30 days and it will require more U.S. dollars to buy the necessary pounds to make payment. To hedge this risk, you should enter a forward contract to buy British pounds.
2. S0 = $1.50

T = 30/365

r = 0.055

rf = 0.045



c. St = $1.53

T = 30/365

t = 10/365

T – t = 20/365

r = 0.055

rf = 0.045



Because you are long, this is a gain of $0.0295 per British pound.

d. The answer is provided in Exhibit 8.8 of the textbook.

MINICASE: AIRBUS’ DOLLAR EXPOSURE

Airbus sold an aircraft, A400, to Delta Airlines, a U.S. company, and billed $30 million payable in six months. Airbus is concerned with the euro proceeds from international sales and would like to control exchange risk. The current spot exchange rate is $1.05/€ and six-month forward exchange rate is $1.10/€ at the moment. Airbus can buy a six-month put option on U.S. dollars with a strike price of €0.95/$ for a premium of €0.02 per U.S. dollar. Currently, six-month interest rate is 2.5% in the euro zone and 3.0% in the U.S.

a. Compute the guaranteed euro proceeds from the American sale if Airbus decides to hedge using a forward contract.

b. If Airbus decides to hedge using money market instruments, what action does Airbus need to take? What would be the guaranteed euro proceeds from the American sale in this case?

c. If Airbus decides to hedge using put options on U.S. dollars, what would be the ‘expected’ euro proceeds from the American sale? Assume that Airbus regards the current forward exchange rate as an unbiased predictor of the future spot exchange rate.

d. At what future spot exchange rate do you think Airbus will be indifferent between the option and money market hedge?

Solution:

a. Airbus will sell $30 million forward for €27,272,727 = ($30,000,000) / ($1.10/€).

b. Airbus will borrow the present value of the dollar receivable, i.e., $29,126,214 = $30,000,000/1.03, and then sell the dollar proceeds spot for euros: €27,739,251 (=$29,126,214/$1.05/€). This is the euro amount that Airbus is going to keep.

c. Since the expected future spot rate is less than the strike price of the put option, i.e., €0.9091< €0.95, Airbus expects to exercise the put option on $ and receive €28,500,000 = ($30,000,000)(€0.95/$). This is gross proceeds. Airbus spent €600,000 (=0.02x30,000,000) upfront for the option and its future cost is equal to €615,000 = €600,000 x 1.025. Thus the net euro proceeds from the American sale is €27,885,000, which is the difference between the gross proceeds and the option costs.

d. At the indifferent future spot rate, the following will hold:

€28,432,732 = ST (30,000,000) - €615,000.

Solving for ST , we obtain the “indifference” future spot exchange rate, i.e., €0.9683/$, or $1.0327/€. Note that €28,432,732 is the future value of the proceeds under money market hedging: €28,432,732 = (€27,739,251) (1.025).

Case Application: Richard May’s Options

It is Tuesday afternoon, February 14, 2012. Richard May, Assistant Treasurer at American Digital Graphics (ADG), sits in his office on the thirty-fourth floor of the building that dominates Rockefeller Plaza’s west perimeter. Its Valentine’s Day and Richard and his wife have dinner reservations with another couple at Balthazar at 7:30. “I must get this hedging memo done,” thinks May, “and get out of here. Foreign exchange options? I had better get the story straight before someone in the Finance Committee starts asking questions. Let’s see, there are two ways in which I can envisage us using options now. One is to hedge a dividend due on September 15th from ADG Germany. The other is to hedge our upcoming payment to Matsumerda for their spring RAM chip statement. With the yen at 78 and increasing I’m glad we haven’t covered the payment so far, but now I’m getting nervous and I would like to protect my posterior. An option to buy yen on June 10 might be just the thing.

Before we delve any further into Richard May’s musings, let us learn a bit about ADG, and about foreign exchange options. American Digital Graphics is a $12 billion sales company engaged in, among other things, the development, manufacture, and marketing of microprocessor-based equipment. Although 30 percent of the firm’s sales are currently abroad, the firm has full-fledged manufacturing facilities in only three foreign countries, Germany, Canada, and Brazil. An assembly plant in Singapore exists primarily to solder Japanese semiconductor chips onto circuit boards and to screw these into Brazilian-made boxes for shipment to the United States, Canada, and Germany. The German subsidiary has developed half of its sales to France, the Netherlands, and the United Kingdom, billing in euros. ADG Germany has accumulated a cash reserve of €900,000, worth $1,178,100 at today’s exchange rate. While the Hamburg office has automatic permission to repatriate €3 million, they have been urged to seek authorization to convert another €1 million by September 15th. The firm has an agreement to buy three hundred thousand RAM chips at ¥8000 each semi-annually, and it is this payment that will fall due on June 10th.

The conventional means of hedging exchange risk are forward or future contracts. These, however, are fixed and inviolable agreements. In many practical instances the hedger is uncertain whether foreign currency cash inflow or outflow will materialize. In such cases, what is needed is the right, but not the obligation, to buy or sell a designated quantity of a foreign currency at a specified price (exchange rate). This is precisely what a foreign exchange option provides.

A foreign exchange option gives the holder *the right to buy or sell a designated quantity of a foreign currency* at a specified exchange rate up to or at a stipulated date.

The terminal date of the contract is called the expiration date (or maturity date). If the option may be exercised before the expiration date, it is called an American option; if only at the expiration date, a European option.

The party retaining the option is the option buyer; the party giving the option is the option seller (or writer). The exchange rate at which the option can be exercised is called the exercise price or strike price. The buyer of the option must pay the seller some amount, called the option price or the premium, for the rights involved.

The important feature of a foreign exchange option is that the holder of the option has the right, but not the obligation, to exercise it. He will only exercise it if the currency moves in a favorable direction. Thus, once you have paid for an option you cannot lose, unlike a forward contract, where you are obliged to exchange the currencies and therefore will lose if the movement is unfavorable.

The disadvantage of an option contract, compared to a forward or futures contract is that you have to pay a price for the option, and this price or premium tends to be quite high for certain options. In general, the option’s price will be higher the greater the risk to the seller (and the greater the value to the buyer because this is a zero-sum game). The risk of a call option will be greater, and the premium higher, the higher the forward rate relative to the exercise price; after all, one can always lock in a profit by buying at the exercise price and selling at the forward rate. The chance that the option will be exercised profitably is also higher, the more volatile is the currency, and the longer the option has to run before it expires.

Returning to Richard May in his Rockefeller Center office, we find that he has been printing spot, forward and currency options and futures quotations from the company’s Bloomberg terminal.

The option prices are quoted in U.S. cents per euro. Yen are quoted in hundredths of a cent. Looking at these prices, Richard realizes that he can work out how much the euro or yen would have to change to make the option worthwhile. Richard makes a mental note that ADG can typically borrow in the Eurocurrency market at LIBOR + 1% and lend at LIBID.

“I’ll attach these numbers to my memo,” mutters May, but the truth is he has yet to come to grips with the real question, which is when, if ever, are currency options a better means of hedging exchange risk for an international firm than traditional forward exchange contracts or future’s contracts. Please assist Mr. May in his analysis of currency hedging for his report to ADG’s Finance Committee. In doing so, you may consult the highlighted market quotes in the following attachments.

Solution

ADG’s euro receivable

ADG has a €3,000,000 receivable in 214 days on September 15th. To assess alternative

ways of hedging, the following data are relevant: The current spot exchange rate

(S)=$1.3088/€, 7-month forward exchange rate (F)=$1.3090, the dollar interest rate

(bid)=0.78% and euro interest rate (ask)=1.40%. The put option on the euro with the

strike (exercise) price of $1.31 selling for a premium of 5.09 cents per euro. Here we

consider and compare three alternative hedging methods as in our discussions in the

textbook: Forward, money market, and option hedges. Hedging with futures is often

inconvenient due to the standardized maturities and contract size and also possibly thin

trading.

▪ Forward hedge

If ADG chooses to use forward contract, it just needs to sell its euro receivable at today’s

forward exchange. ADG then is assured of receiving a guaranteed dollar amount of

$3,927,000 on September 15th: (€3,000,000) ($1.3090/€) = $3,927,000.

▪ Money market hedge

If ADG decides to use money market hedging, it first needs to borrow the present value

(PV) of its euro receivable at 2.40% interest rate (=1.40%+1.0%):

PV = (€3,000,000) / (1+0.024(214/360)) = 3,000,000 / 1.01427 = €2,957,802.

It then would convert €2,957,802 at today’s spot exchange rate of $1.3088/€ into

$3,871,171. If ADG invests this dollar amount at the dollar interest rate till September

15th, the future value (FV) of the investment will be:

FV = ($3,871,171) (1+0.0078 (214/360) ) = $3,889,121.

▪ Option hedge

If ADG chooses to hedge its euro receivable using currency options, it can purchase put

options on three million euros with a $1.31 strike price at the premium of 5.09 cents per

euro. This means that the firm has to spend the option cost upfront. The option costs,

including the time value of money, would be: 153,408 = (€3,000,000) ($0.0509)

[1+0.0078 (214/360) ]. If the future spot exchange rate turns out to be less than the

strike price, i.e., if the euro becomes cheaper than the option strike price ($1.31), ADG

will simply exercise its put option and exchange its euro receivable at the strike price,

collect $3,776,592 (net of option costs), which is the guaranteed minimum net dollar

proceeds: (€3,000,000) ($1.31) - $153,408 = $3,776,592. If the euro becomes stronger

than the strike price, the firm will simply let its put option expire and convert its euro

receivable at the future spot exchange rate.

As can be seen from the following graph, forward hedging dominates money market

hedging. If the future spot rate exceeds the indifference rate, S\* = $1.36, option hedging

becomes preferable; otherwise, forward hedging is preferable.

ADG’s yen payable

ADG has a ¥2,400 million payable in 4 months. The relevant market data include: The

current spot exchange rate of $0.01274/¥, four-month forward exchange rate of

$0.01274/¥, four-month call option on yen with the strike price set at 127 cents for 100

yen that is selling for 3.11 cents per 100 yen. ADG’s borrowing interest rate in dollars is

0.62%, while lending interest rate in yen is 0.18%.

▪ Forward hedge

If ADG decides to use forward contract to hedge its yen payable, it just needs to purchase the yen payable amount forward at today forward exchange rate. The dollar cost of doing so will be $30,576,000 = (¥2,400,000,000) ($0.01274/¥).

▪ Money market hedge

Money market hedging would require borrowing the PV of the yen pable in dollars,

$30,558,123.50 = [(¥2,400,000,000)/(1+0.0018(117/360)] ($0.01274),

and converting the dollar amount borrowed into yen and invest for four months at the yen interest rate to receive,

¥2,400,000,000 = ($30,558,123.50/$0.01274/¥)(1+0.0018(117/360)).

When ADG receives the maturity value of the yen investment, it will use the yen amount to make payment to Matsumerda. Lastly, in four month, ADG will pay back the dollar loan:

$30,719,012 = ($30,558,123.50) (1+0.0162(117/360)).

▪ Option hedge

In the case of hedging with option, ADG will need to buy call option on its yen payable. If ADG decides to buy ontions with strike price set at $0.0127 per dollar trading for 3.11 cents per 100 yens, the option cost (including the time value of money) will be,

$747,783 = (¥2,400,000,000)($0.000311)[1+0.0057(117/360)]

= ($746,400)(1.0018525)

If the yen appreciates beyond the strike price of the call optopn, K=$0.0127/¥, ADG will simply exercise its option and the max dollar cost of securing the yen payable amount will be,

$31,227,783 = (¥2,400,000,000)($0.0127/¥) + $747,783.

As can be seen from the graph, forward hedge dominates money market hedge as the dollar cost will be always lower with forward hedge than with money market hedge. If the exchange rate becomes lower than the indifference rate, S\*=$0.0124, call option hedge would be preferable; otherwise, forward hedge would be preferrable. Thje indifference rate can be identified from solving the following equation for S\*: 30,576,000 = (2,400,000,000) S\* +747,783.

**CHAPTER 9 MANAGEMENT OF ECONOMIC EXPOSURE**

**ANSWERS & SOLUTIONS TO END OF CHAPTER QUESTIONS AND PROBLEMS**

QUESTIONS

1. How would you define economic exposure to exchange risk?

Answer: Economic exposure can be defined as the possibility that the firm’s cash flows and thus its market value may be affected by the unexpected exchange rate changes.

2. Explain the following statement: “Exposure is the regression coefficient.”

Answer: Exposure to currency risk can be appropriately measured by the sensitivity of the firm’s future cash flows and the market value to random changes in exchange rates. Statistically, this sensitivity can be estimated by the regression coefficient. Thus, exposure can be said to be the regression coefficient.

3. Suppose that your company has an equity position in a French firm. Discuss the condition under which the dollar/euro exchange rate uncertainty does not constitute exchange exposure for your company.

Answer: Mere changes in exchange rates do not necessarily constitute currency exposure. If the euro value of the equity moves in the opposite direction as much as the dollar value of the euro changes, then the dollar value of the equity position will be insensitive to exchange rate movements. As a result, your company will not be exposed to currency risk.

4. Explain the competitive and conversion effects of exchange rate changes on the firm’s operating cash flow.

Answer: The competitive effect: exchange rate changes may affect operating cash flows by altering the firm’s competitive position.

The conversion effect: A given operating cash flows in terms of a foreign currency will be converted into higher or lower dollar (home currency)amounts as the exchange rate changes.

5. Discuss the determinants of operating exposure.

Answer: The main determinants of a firm’s operating exposure are (i) the structure of the markets in which the firm sources its inputs, such as labor and materials, and sells its products, and (ii) the firm’s ability to mitigate the effect of exchange rate changes by adjusting its markets, product mix, and sourcing.

6. Discuss the implications of purchasing power parity for operating exposure.

Answer: If the exchange rate changes are matched by the inflation rate differential between countries, firms’ competitive positions will not be altered by exchange rate changes. Firms are not subject to operating exposure.

7. General Motors exports cars to Spain but the strong dollar against the euro hurts sales of GM cars in Spain. In the Spanish market, GM faces competition from the Italian and French car makers, such as Fiat and Renault, whose operating currencies are the euro. What kind of measures would you recommend so that GM can maintain its market share in Spain.

Answer: Possible measures that GM can take include: (1) diversify the market; try to market the cars not just in Spain and other European countries but also in, say, Asia; (2) locate production facilities in Spain and source inputs locally; (3) locate production facilities, say, in Morocco where production costs are low and export to Spain from Morocco.

8. What are the advantages and disadvantages of financial hedging of the firm’s operating exposure vis-à-vis operational hedges (such as relocating manufacturing site)?

Answer: Financial hedging can be implemented quickly with relatively low costs, but it is difficult to hedge against long-term, real exposure with financial contracts. On the other hand, operational hedges are costly, time-consuming, and not easily reversible.

9. Discuss the advantages and disadvantages of maintaining multiple manufacturing sites as a hedge against exchange rate exposure.

Answer: To establish multiple manufacturing sites can be effective in managing exchange risk exposure, but it can be costly because the firm may not be able to take advantage of the economy of scale.

10. Evaluate the following statement: “A firm can reduce its currency exposure by diversifying across different business lines.”

Answer: Conglomerate expansion may be too costly as a means of hedging exchange risk exposure. Investment in a different line of business must be made based on its own merit.

11. The exchange rate uncertainty may not necessarily mean that firms face exchange risk exposure. Explain why this may be the case.

Answer: A firm can have a natural hedging position due to, for example, diversified markets, flexible sourcing capabilities, etc. In addition, to the extent that the PPP holds, nominal exchange rate changes do not influence firms’ competitive positions. Under these circumstances, firms do not need to worry about exchange risk exposure.

PROBLEMS

1. Suppose that you hold a piece of land in the City of London that you may want to sell in one year. As a U.S. resident, you are concerned with the dollar value of the land. Assume that, if the British economy booms in the future, the land will be worth £2,000 and one British pound will be worth $1.40. If the British economy slows down, on the other hand, the land will be worth less, i.e., £1,500, but the pound will be stronger, i.e., $1.50/£. You feel that the British economy will experience a boom with a 60% probability and a slow-down with a 40% probability.

(a) Estimate your exposure b to the exchange risk.

(b) Compute the variance of the dollar value of your property that is attributable to the exchange rate uncertainty.

(c) Discuss how you can hedge your exchange risk exposure and also examine the consequences of hedging.

Solution: (a) Let us compute the necessary parameter values:

E(P) = (.6)($2800)+(.4)($2250) = $1680+$900 = $2,580

E(S) = (.6)(1.40)+(.4)(1.5) = 0.84+0.60 = $1.44

Var(S) = (.6)(1.40-1.44)2 + (.4)(1.50-1.44)2

= .00096+.00144 = .0024.

Cov(P,S) = (.6)(2800-2580)(1.4-1.44)+(.4)(2250-2580)(1.5-1.44)

= -5.28-7.92 = -13.20

b = Cov(P,S)/Var(S) = -13.20/.0024 = -£5,500.

You have a negative exposure! As the pound gets stronger (weaker) against the dollar, the dollar value of your British holding goes down (up).

(b) b2Var(S) = (-5500)2(.0024) =72,600($)2

(c) Buy £5,500 forward. By doing so, you can eliminate the volatility of the dollar value of your British asset that is due to the exchange rate volatility.

2. A U.S. firm holds an asset in France and faces the following scenario:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | State 1 | State 2 | State 3 | State 4 |
| Probability | 25% | 25% | 25% | 25% |
| Spot rate | $1.20/€ | $1.10/€ | $1.00/€ | $0.90/€ |
| P\* | €1500 | €1400 | €1300 | €1200 |
| P | $1,800 | $1,540 | $1,300 | $1,080 |

In the above table, P\* is the euro price of the asset held by the U.S. firm and P is the dollar price of the asset.

(a) Compute the exchange exposure faced by the U.S. firm.

(b) What is the variance of the dollar price of this asset if the U.S. firm remains unhedged against this exposure?

1. If the U.S. firm hedges against this exposure using the forward contract, what is the variance of the dollar value of the hedged position?

Solution: (a)

E(S) = .25(1.20 +1.10+1.00+0.90) = $1.05/€

E(P) = .25(1,800+1,540+1,300 +1,080) = $1,430

Var(S) = .25[(1.20-1.05)2 +(1.10-1.05)2+(1.00-1.05)2+(0.90-1.05)2]

= .0125

Cov(P,S) = .25[(1,800-1,430)(1.20-1.05) + (1,540-1,430)(1.10-1.05)

(1,300-1,430)(1.00-1.05) + (1,080-1,430)(0.90-1.05)]

= 30

b = Cov(P,S)/Var(S) = 30/0.0125 = €2,400.

(b) Var(P) = .25[(1,800-1,430)2+(1,540-1,430)2+(1,300-1,430)2+(1,080-1,430)2]

= 72,100($)2.

(c) Var(P) - b2Var(S) = 72,100 - (2,400)2(0.0125) = 100($)2.

This means that most of the volatility of the dollar value of the French asset can be removed by hedging exchange risk. The hedging can be achieved by selling €2,400 forward.

3. Suppose you are a British venture capitalist holding a major stake in an e-commerce start-up in Silicon Valley. As a British resident, you are concerned with the pound value of your U.S. equity position. Assume that if the American economy booms in the future, your equity stake will be worth $1,000,000, and the exchange rate will be $1.40/£. If the American economy experiences a recession, on the other hand, your American equity stake will be worth $500,000, and the exchange rate will be $1.60/£. You assess that the American economy will experience a boom with a 70 percent probability and a recession with a 30 percent probability.

(a) Estimate your exposure to the exchange risk.

(b) Compute the variance of the pound value of your American equity position that is attributable to the exchange rate uncertainty.

(c) How would you hedge this exposure? If you hedge, what is the variance of the pound value of the hedged position?

Solution:

Prob = 0.70 P\* = $1,000,000 S = $1.40 P = £714,300

Prob = 0.30 P\* = $500,000 S = $1.60 P = £312,500

E(S) = (0.70)/(1.40) + (0.30)/(1.60) = £0.688/$

E(P) = (0.70)\*(714,300) + (0.30)\*(312,500) = £593,760/$

Var(S) = 0.00167

Cov(P,S) = 7,535

(a) b = Cov(P,S)/Var(S) = 7,535/0.00167 = 4,511,976 ($)

(b) b2Var(S) = (4,511,976)2\*(0.00167) = 33,997,738,800

(c) Var(e) = Var(P) - b2Var(S) = 33,903,080,400 - 33,997,738,800 ≈ 0

You can hedge this exposure by selling $4,511,976 forward.

MINI CASE: ECONOMIC EXPOSURE OF ALBION COMPUTERS PLC

Consider Case 3 of Albion Computers PLC discussed in the chapter. Now, assume that the pound is expected to depreciate to $1.50 from the current level of $1.60 per pound. This implies that the pound cost of the imported part, i.e., Intel’s microprocessors, is £341 (=$512/$1.50). Other variables, such as the unit sales volume and the U.K. inflation rate, remain the same as in Case 3.

(a) Compute the projected annual cash flow in dollars.

(b) Compute the projected operating gains/losses over the four-year horizon as the discounted present value of change in cash flows, which is due to the pound depreciation, from the benchmark case presented in Exhibit 12.4.

(c) What actions, if any, can Albion take to mitigate the projected operating losses due to the pound depreciation?

Suggested Solution to Economic Exposure of Albion Computers PLC

a) The projected annual cash flow can be computed as follows:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sales (40,000 units at £1,080/unit) £43,200,000

Variable costs (40,000 units at £697/unit) £27,880,000

Fixed overhead costs 4,000,000

Depreciation allowances 1,000,000

Net profit before tax £15,315,000

Income tax (50%) 7,657,500

Profit after tax 7,657,500

Add back depreciation 1,000,000

Operating cash flow in pounds £8,657,500

Operating cash flow in dollars $12,986,250

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Benchmark Current

Variables Case Case

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Exchange rate ($/£) 1.60 1.50

Unit variable cost (£) 650 697

Unit sales price (£) 1,000 1,080

Sales volume (units) 50,000 40,000

Annual cash flow (£) 7,250,000 8,657,500

Annual cash flow ($) 11,600,000 12,986,250

Four-year present value ($) 33,118,000 37,076,946

Operating gains/losses ($) 3,958,946

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c) In this case, Albion actually can expect to realize exchange gains, rather than losses. This is mainly due to the fact that while the selling price appreciates by 8% in the U.K. market, the variable cost of imported input increased by about 6.25%. Albion may choose not to do anything about the exposure.

**CHAPTER 11 INTERNATIONAL BANKING AND MONEY MARKET**

**ANSWERS & SOLUTIONS TO END-OF-CHAPTER QUESTIONS AND PROBLEMS**

QUESTIONS

1. Briefly discuss some of the services that international banks provide their customers and the market place.

Answer: International banks can be characterized by the types of services they provide that distinguish them from domestic banks. Foremost, international banks facilitate the imports and exports of their clients by arranging trade financing. Additionally, they serve their clients by arranging for foreign exchange necessary to conduct cross-border transactions and make foreign investments and by assisting in hedging exchange rate risk in foreign currency receivables and payables through forward and options contracts. Since international banks have established trading facilities, they generally trade foreign exchange products for their own account.

Two major features that distinguish international banks from domestic banks are the types of deposits they accept and the loans and investments they make. Large international banks both borrow and lend in the Eurocurrency market. Moreover, depending upon the regulations of the country in which it operates and its organizational type, an international bank may participate in the underwriting of Eurobonds and foreign bonds.

International banks frequently provide consulting services and advice to their clients in the areas of foreign exchange hedging strategies, interest rate and currency swap financing, and international cash management services. Not all international banks provide all services. Banks that do provide a majority of these services are known as *full service banks*.

2. Briefly discuss the various types of international banking offices.

Answer: The services and operations which an international bank undertakes is a function of the regulatory environment in which the bank operates and the type of banking facility established.

A *correspondent bank relationship* is established when two banks maintain a correspondent bank account with one another. The correspondent banking system provides a means for a bank’s MNC clients to conduct business worldwide through his local bank or its contacts.

A *representative office* is a small service facility staffed by parent bank personnel that is designed to assist MNC clients of the parent bank in its dealings with the bank’s correspondents. It is a way for the parent bank to provide its MNC clients with a level of service greater than that provided through merely a correspondent relationship.

A *foreign branch bank* operates like a local bank, but legally it is a part of the parent bank. As such, a branch bank is subject to the banking regulations of its home country and the country in which it operates. The primary reason a parent bank would establish a foreign branch is that it can provide a much fuller range of services for its MNC customers through a branch office than it can through a representative office.

A *subsidiary bank* is a locally incorporated bank that is either wholly owned or owned in major part by a foreign subsidiary. An *affiliate bank* is one that is only partially owned, but not controlled by its foreign parent. Both subsidiary and affiliate banks operate under the banking laws of the country in which they are incorporated. U.S. parent banks find subsidiary and affiliate banking structures desirable because they are allowed to engage in security underwriting.

*Edge Act banks* are federally chartered subsidiaries of U.S. banks which are physically located in the United States that are allowed to engage in a full range of international banking activities. A 1919 amendment to Section 25 of the Federal Reserve Act created Edge Act banks. The purpose of the amendment was to allow U.S. banks to be competitive with the services foreign banks could supply their customers. Federal Reserve Regulation K allows Edge Act banks to accept foreign deposits, extend trade credit, finance foreign projects abroad, trade foreign currencies, and engage in investment banking activities with U.S. citizens involving foreign securities. As such, Edge Act banks do not compete directly with the services provided by U.S. commercial banks. Edge Act banks are not prohibited from owning equity in business corporations as are domestic commercial banks. Thus, it is *through* the Edge Act that U.S. parent banks have historically owned foreign banking subsidiaries and held ownership positions in foreign banking affiliates. Since 1966, however, U.S. banks can invest directly in foreign banks, and since 1970, U.S. bank holding companies have been permitted to invest in foreign companies.

An *offshore banking center* is a country whose banking system is organized to permit external accounts beyond the normal economic activity of the country. Offshore banks operate as branches or subsidiaries of the parent bank. The primary activities of offshore banks are to seek deposits and grant loans in currencies other than the currency of the host government.

In 1981, the Federal Reserve authorized the establishment of *International Banking Facilities (IBF)*. An IBF is a separate set of asset and liability accounts that are segregated on the parent bank’s books; it is not a unique physical or legal entity. IBFs operate as foreign banks in the U.S. IBFs were established largely as a result of the success of offshore banking. The Federal Reserve desired to return a large share of the deposit and loan business of U.S. branches and subsidiaries to the U.S.

3. How does the deposit-loan rate spread in the Eurodollar market compare with the deposit-loan rate spread in the domestic U.S. banking system? Why?

Answer: Competition has driven the deposit-loan spread in the domestic U.S. banking system to about the same level as in the Eurodollar market. That is, in the Eurodollar market the deposit rate is about the same as the deposit rate for dollars in the U.S. banking system. Similarly the lending rates are about the same. In theory, the Eurodollar market can operate at a lower cost than the U.S. banking system because it is not subject to mandatory reserve requirements on deposits or deposit insurance on foreign currency deposits.

4. What is the difference between the Euronote market and the Eurocommercial paper market?

Answer: *Euronotes* are short-term notes underwritten by a group of international investment or commercial banks called a “facility.” A client-borrower makes an agreement with a facility to issue Euronotes in its own name for a period of time, generally three to 10 years. Euronotes are sold at a discount from face value, and pay back the full face value at maturity. Euronotes typically have maturities of from three to six months. *Eurocommercial paper* is an unsecured short-term promissory note issued by a corporation or a bank and placed directly with the investment public through a dealer. Like Euronotes, Eurocommercial paper is sold at a discount from face value. Maturities typically range from one to six months.

5. Briefly discuss the cause and the solution(s) to the international bank crisis involving less-developed countries.

Answer: The international debt crisis began on August 20, 1982 when Mexico asked more than 100 U.S. and foreign banks to forgive its $68 billion in loans. Soon Brazil, Argentina and more than 20 other developing countries announced similar problems in making the debt service on their bank loans. At the height of the crisis, Third World countries owed $1.2 *trillion!*

The international debt crisis had oil as its source. In the early 1970s, the Organization of Petroleum Exporting Countries (OPEC) became the dominant supplier of oil worldwide. Throughout this time period, OPEC raised oil prices dramatically and amassed a tremendous supply of U.S. dollars, which was the currency generally demanded as payment from the oil importing countries.

OPEC deposited billions in Eurodollar deposits; by 1976 the deposits amounted to nearly $100 billion. Eurobanks were faced with a huge problem of lending these funds in order to generate interest income to pay the interest on the deposits. Third World countries were only too eager to assist the equally eager Eurobankers in accepting Eurodollar loans that could be used for economic development *and* for payment of oil imports. The high oil prices were accompanied by high interest rates, high inflation, and high unemployment during the 1979-1981 period. Soon, thereafter, oil prices collapsed and the crisis was on.

U.S. Treasury Secretary Nicholas F. Brady of the first Bush Administration is largely credited with designing a strategy in the spring of 1989 to resolve the problem. Three important factors were necessary to move from the debt management stage, employed over the years 1982-1988 to keep the crisis in check, to debt resolution. First, banks had to realize that the face value of the debt would never be repaid on schedule. Second, it was necessary to extend the debt maturities and to use market instruments to collateralize the debt. Third, the LDCs needed to open their markets to private investment if economic development was to occur. Debt-for-equity swaps helped pave the way for an increase in private investment in the LDCs. However, monetary and fiscal reforms in the developing countries and the recent privatization trend of state owned industry were also important factors.

Treasury Secretary Brady’s solution was to offer creditor banks one of three alternatives: (1) convert their loans to marketable bonds with a face value equal to 65 percent of the original loan amount; (2) convert the loans into collateralized bonds with a reduced interest rate of 6.5 percent; or, (3) lend additional funds to allow the debtor nations to get on their feet. The second alternative called for an extension the debt maturities by 25 to 30 years and the purchase by the debtor nation of zero-coupon U.S. Treasury bonds with a corresponding maturity to guarantee the bonds and make them marketable. These bonds have come to be called *Brady bonds*.

6. What were the weaknesses Basel II that became apparent during the global financial crisis that began in mid-2007?

Answer: The crisis illustrated how quickly and severely liquidity risks can crystallize and certain sources of funding can evaporate, compounding concern related the valuation of assets and capital adequacy. Prior to the onset of the financial crisis, banks built up significant exposures to off-balance sheet market risks that were not adequately reflected in the capital requirements of Basel II. A number of banking organizations have experienced large losses, most of which were sustained in the banks’ trading accounts. These losses have not arisen from actual defaults, but rather from credit agency downgrades, widening credit spreads, and the loss of liquidity.

7. Discuss the regulatory and macroeconomic factors that contributed to the credit crunch of 2007-2008.

Answer: The origin of the credit crunch can be traced back to three key contributing factors: liberalization of banking and securities regulation, a global savings glut, and the low interest rate environment created by the Federal Reserve Bank in the early part of this decade.

The U.S. Glass-Steagall Act of 1933 mandated a separation of commercial banking from other financial services firms—such as securities, insurance, and real estate. The repeal of Glass-Steagall caused a blurring of the functioning of commercial banks, investment banks, insurance companies, and real estate mortgage banking firms. Since the repeal of Glass-Steagall, commercial banks began engaging in risky financial service activities that they previously would not have and which contributed to the credit crunch.

The Commodity Futures Trading Commission (CFTC) was created in 1974 to oversee futures trading to guard against price manipulation, prevent fraud among market participants, and to ensure the soundness of the exchanges. Credit default swaps (CDSs), a type of OTC credit derivative security, were not regulated by the CFTC. The CDS market grew from virtually nothing a half dozen years ago to a $58 trillion market that went largely unregulated and unknown. CDSs have played a prominent role in the credit crunch.

In the years leading up to the crisis, the world was awash in liquidity in recent years, much of it denominated in U.S. dollars, awaiting investment. As a result, the United States was able to maintain domestic investment at a rate that otherwise would have required higher domestic savings (or reduced consumption) and also found a ready market with central banks for U.S. Treasury and government agency securities, helping keep U.S. interest rates low.

The Fed Funds target rate fell from 6.5 percent set on May 16, 2000 to 1.0 percent on June 25, 2003, and stayed below 3.0 percent until May 3, 2005. The decrease in the Fed Funds rate was the Fed’s response to the financial turmoil created by the fall in stock market prices in 2000 as the high-tech, dot-com, boom came to an end. Low interest rates created the means for first-time homeowners to afford mortgage financing and also created the means for existing homeowners to trade up to more expensive homes. Low interest rate mortgages created an excess demand for homes, driving prices up substantially in most parts of the country, in particular in popular residential areas such as California and Florida.

8. How did the credit crunch become a global financial Crisis?

Answer: As the credit crunch escalated, many CDOs found themselves stuck with various tranches of MBS debt, especially the highest risk tranches, which they had not yet placed or were unable to place as subprime foreclosure rates around the country escalated. Commercial and investment banks were forced to write down billions of subprime debt. As the U.S. economy slipped into recession, banks also started to set aside billions for credit-card debt and other consumer loans they feared would go bad. The credit rating firms—Moody’s, S&P, and Fitch—lowered their ratings on many CDOs after recognizing that the models they had used to evaluate the risk of the various tranches were mis-specified. Additionally, the credit rating firms downgraded many MBS, especially those containing subprime mortgages, as foreclosures around the country increased. An unsustainable problem arose for bond insurers who sold credit default swap (CDS) contracts and the banks that purchased this credit insurance. As the bond insurers got hit with claims from bank-sponsored SIVs as the MBS debt in their portfolios defaulted, the credit rating agencies required the insurers to put up more collateral with the counterparties who held the other side of the CDSs, which put stress on their capital base and prompted credit-rating downgrades, which in turn triggered more margin calls. If big bond insurers, such as American International Group (AIG) failed, the banks that relied on the insurance protection would be forced to write down even more mortgage-backed debt which would further erode their Tier I Core capital bases. By September 2008, a worldwide flight to quality investments—primarily short term U.S. Treasury Securities—ensued. The demand for safety was so great, at one point in November 2008, the one-month U.S. Treasury bill was yielding only one basis point. The modern day equivalent of a ‘bank run’ was operating in full force and many financial institutions could not survive.

9. What is a mortgage backed security?

Answer: A mortgage-backed security is a derivative security because its value is derived from the value of the underlying mortgages that secure it. Conceptually, mortgage-backed securities seem to make sense. Each MBS represents a portfolio of mortgages, thus diversifying the credit risk that the investor holds.

10. What is a structured investment vehicle and what effect did they have on the credit crunch?

Answer: A structured investment vehicle (SIV) is a virtual bank, frequently operated by a commercial bank or an investment bank, but which operates off balance sheet. Typically, an SIV raises short term funds in the commercial paper market to finance longer-term investment in mortgage-backed securities (MBSs). SIVs are frequently highly levered, with ratios of 10 to 15 times the amount equity raised. Structured investment vehicles have been one large investor in MBS. Since yield curves are typically upward sloping, the SIV might normally earn .25 percent by doing this. SIVs are subject to the interest rate risk of the yield curve inverting, that is, short-term rates rising above long-term rates, thus necessitating the SIV to refinance the MBS investment at short-term rates in excess of the rate being earned on the MBS. Default risk is another risk with which SIVs must contend. If the underlying mortgage borrowers default on their home loans, the SIV will lose investment value. Nevertheless, SIVs predominately invest only in high-grade Aaa/AAA MBS. By investing in a variety of MBS, an SIV further diversifies the credit risk of MBS investment. The SIV’s value obviously derives from the value of the portfolio of MBS it represents.

To cool the growth of the economy, the Fed steadily increased the Fed Funds target rate at meetings of the Federal Open Market Committee, from a low of 1.0 percent on June 25, 2003 to 5.25 percent on June 29, 2006. In turn, mortgage rates increased and home prices stopped increasing, thus stalling new housing starts and precluding mortgage refinancing to draw out paper capital gains. Many subprime borrowers found it difficult, if not impossible, to make mortgage payments in this economic environment, especially when their adjustable-rate mortgages were reset at higher rates. As matters unfolded, it was discovered that the amount of subprime MBS debt in structured investment vehicles was essentially unknown. While it was thought SIVs would spread MBS risk worldwide to investors best able to bear it, it turned out that many banks that did not hold mortgage debt directly, held it indirectly through MBS in SIVs they sponsored. To make matters worse, the diversification that investors in MBS and SIVs thought they had was only illusory. Diversification of credit risk only works when a portfolio is diversified over a broad set of asset classes. MBS and SIVs were diversified over a single asset class—poor quality residential mortgages! When subprime debtors began defaulting on their mortgages, commercial paper investors were unwilling to finance SIVs and trading in the interbank Eurocurrency market essentially ceased as traders became fearful of the counterparty risk of placing funds with even the strongest international banks. Liquidity worldwide essentially dried up, creating the credit crunch.

11. What is a collateralized debt obligation and what effect did they have on the credit crunch?

Answer: A collateralized debt obligation (CDO) is a corporate entity constructed to hold a portfolio of fixed-income assets as collateral. The portfolio of fixed-income assets is divided into different tranches, each representing a different risk class: AAA, AA-BB, or unrated. CDOs serve as an important funding source for fixed-income securities. An investor in a CDO is taking a position in the cash flows of a particular tranche, not in the fixed-income securities directly. The investment is dependent on the metrics used to define the risk and reward of the tranche.

To cool the growth of the economy, the Fed steadily increased the Fed Funds target rate at meetings of the Federal Open Market Committee, from a low of 1.0 percent on June 25, 2003 to 5.25 percent on June 29, 2006. In turn, mortgage rates increased and home prices stopped increasing, thus stalling new housing starts and precluding mortgage refinancing to draw out paper capital gains. Many subprime borrowers found it difficult, if not impossible, to make mortgage payments in this economic environment, especially when their adjustable-rate mortgages were reset at higher rates. As matters unfolded, it was discovered that the amount of subprime MBS debt in CDOs and SIVs, and who exactly owned it, were essentially unknown, or at least unappreciated. The diversification that investors in CDOs and SIVs thought they had was only illusory. Diversification of credit risk only works when a portfolio is diversified over a broad set of asset classes. MBS, SIVs and CDOs, however, were diversified over a single asset class—poor quality residential mortgages! When subprime debtors began defaulting on their mortgages, commercial paper investors were unwilling to finance SIVs and trading in the interbank Eurocurrency market essentially ceased as traders became fearful of the counterparty risk of placing funds with even the strongest international banks. Liquidity worldwide essentially dried up, creating the credit crunch.

PROBLEMS

1. Grecian Tile Manufacturing of Athens, Georgia, borrows $1,500,000 at LIBOR plus a lending margin of 1.25 percent per annum on a six-month rollover basis from a London bank. If six-month LIBOR is 4.50 percent over the first six-month interval and 5.375 percent over the second six-month interval, how much will Grecian Tile pay in interest over the first year of its Eurodollar loan?

Solution: $1,500,000 x (.045 + .0125)/2 + $1,500,000 x (.05375 + .0125)/2

= $43,125 + $49,687.50 = $92,812.50.

2. A bank sells a “three against six” $3,000,000 FRA for a three-month period beginning three months from today and ending six months from today. The purpose of the FRA is to cover the interest rate risk caused by the maturity mismatch from having made a three-month Eurodollar loan and having accepted a six-month Eurodollar deposit. The agreement rate with the buyer is 5.50 percent. There are actually 92 days in the three-month FRA period. Assume that three months from today the settlement rate is 4.875 percent. Determine how much the FRA is worth and who pays who--the buyer pays the seller or the seller pays the buyer.

Solution: Since the settlement rate is less than the agreement rate, the buyer pays the seller the absolute value of the FRA. The *absolute* value of the FRA is:

$3,000,000 x [(.04875-.055) x 92/360]/[1 + (.04875 x 92/360)]

= $3,000,000 x [-.001597/(1.012458)]

= $4,732.05.

3. Assume the settlement rate in problem 2 is 6.125 percent. What is the solution now?

Solution: Since the settlement rate is greater than the agreement rate, the seller pays the buyer the absolute value of the FRA. The absolute value of the FRA is:

$3,000,000 x [(.06125-.055) x 92/360]/[1 + (.06125 x 92/360)]

= $3,000,000 x [.001597/(1.015653)]

= $4,717.16.

4. A “three-against-nine” FRA has an agreement rate of 4.75 percent. You believe six-month LIBOR in three months will be 5.125 percent. You decide to take a speculative position in a FRA with a $1,000,000 notional value. There are 183 days in the FRA period. Determine whether you should buy or sell the FRA and what your expected profit will be if your forecast is correct about the six-month LIBOR rate.

Solution: Since the agreement rate is less than your forecast, you should buy a FRA. If your forecast is correct your expected profit will be:

$1,000,000 x [(.05125-.0475) x 183/360]/[1 + (.05125 x 183/360)]

= $1,000,000 x [.001906/(1.026052)]

= $1,857.61.

5. Recall the FRA problem presented as Example 11.2. Show how the bank can alternatively use a position in Eurodollar futures contracts (Chapter 7) to hedge the interest rate risk created by the maturity mismatch it has with the $3,000,000 six-month Eurodollar deposit and rollover Eurocredit position indexed to three-month LIBOR. Assume that the bank can take a position in Eurodollar futures contracts that mature in three months and have a futures price of 94.00.

Solution: To hedge the interest rate risk created by the maturity mismatch, the bank would need to buy (go long) three Eurodollar futures contracts. If on the last day of trading, three-month LIBOR is 5.125 percent, the bank will earn a profit of $6,562.50 from its futures position. This is calculated as:

[94.875 - 94.00] x 100 bp x 2 x $12.50 x 3 contracts = $6,562.50.

Note that this sum differs slightly from the $6,550.59 profit that the bank will earn from the FRA for two reasons. First, the Eurodollar futures contract assumes an arbitrary 90 days in a three-month period, whereas the FRA recognizes that the actual number of days in the specific three-month period is 91 days. Second, the Eurodollar futures contract pays off in future value terms, or as of the end of the three-month period, whereas the FRA pays off in present value terms, or as of the beginning of the three-month period.

6. The Fisher effect (Chapter 6) suggests that nominal interest rates differ between countries because of differences in the respective rates of inflation. According to the Fisher effect and your examination of the one-year Eurocurrency interest rates presented in Exhibit 11.3, order the currencies from the eight countries from highest to lowest in terms of the size of the inflation premium embedded in the nominal ask interest rates for April 3, 2019.

Solution: According to the Fisher effect, the one-year Eurocurrency interest rates suggest that the inflation premiums for the countries representing the eight currencies ordered from highest to lowest are: U.S. dollar, Canadian dollar, Singapore dollar, British pound, Japanese yen, euro, Swiss franc, and Danish krone.

7. George Johnson is considering a possible six-month $100 million LIBOR-based, floating-rate bank loan to fund a project at terms shown in the table below. Johnson fears a possible rise in the LIBOR rate by December and wants to use the December Eurodollar futures contract to hedge this risk. The contract expires December 20, 2009, has a US$ 1 million contract size, and a discount yield of 7.3 percent.

Johnson will ignore the cash flow implications of marking to market, initial margin requirements, and any timing mismatch between exchange-traded futures contract cash flows and the interest payments due in March.

**Loan Terms**

## September 20, 2009 December 20, 2009 March 20, 2010

• Borrow $100 million at • Pay interest for first three • Pay back principal

September 20 LIBOR + 200 months plus interest

basis points (bps) • Roll loan over at

• September 20 LIBOR = 7% December 20 LIBOR +

200 bps

Loan First loan payment (9%) Second payment

initiated and futures contract expires and principal

**↓** **↓** **↓**

• • •

9/20/09 12/20/09 3/20/10

a. Formulate Johnson’s September 20 floating-to-fixed-rate strategy using the Eurodollar future contracts discussed in the text above. Show that this strategy would result in a fixed-rate loan, assuming an increase in the LIBOR rate to 7.8 percent by December 20, which remains at 7.8 percent through March 20. Show all calculations.

Johnson is considering a 12-month loan as an alternative. This approach will result in two additional uncertain cash flows, as follows:

Loan First Second Third Fourth initiated payment (9%) payment payment payment

and principal

**↓ ↓ ↓ ↓ ↓**

• • • • •

9/20/09 12/20/09 3/20/10 6/20/10 9/20/10

b. Describe the strip hedge that Johnson could use and explain how it hedges the 12-month loan (specify number of contracts). No calculations are needed.

CFA Guideline Answer

a. The basis point value (BPV) of a Eurodollar futures contract can be found by substituting the contract specifications into the following money market relationship:

BPV FUT = Change in Value = (face value) x (days to maturity / 360) x (change in yield)

= ($1 million) x (90 / 360) x (.0001)

= $25

The number of contract, N, can be found by:

N = (BPV spot) / (BPV futures)

= ($2,500) / ($25)

= 100

OR

N = (value of spot position) / (face value of each futures contract)

= ($100 million) / ($1 million)

= 100

OR

N = (value of spot position) / (value of futures position)

= ($100,000,000) / ($981,750)

where value of futures position = $1,000,000 x [1 – (0.073 / 4)]

≈ 102 contracts

Therefore on September 20, Johnson would sell 100 (or 102) December Eurodollar futures contracts at the 7.3 percent yield. The implied LIBOR rate in December is 7.3 percent as indicated by the December Eurofutures discount yield of 7.3 percent. Thus a borrowing rate of 9.3 percent (7.3 percent + 200 basis points) can be locked in if the hedge is correctly implemented.

A rise in the rate to 7.8 percent represents a 50 basis point (bp) increase over the implied LIBOR rate. For a 50 basis point increase in LIBOR, the cash flow on the short futures position is:

= ($25 per basis point per contract) x 50 bp x 100 contracts

= $125,000.

However, the cash flow on the floating rate liability is:

= -0.098 x ($100,000,000 / 4)

= - $2,450,000.

Combining the cash flow from the hedge with the cash flow from the loan results in a net outflow of $2,325,000, which translates into an annual rate of 9.3 percent:

= ($2,325,000 x 4) / $100,000,000 = 0.093

This is precisely the implied borrowing rate that Johnson locked in on September 20. Regardless of the LIBOR rate on December 20, the net cash outflow will be $2,325,000, which translates into an annualized rate of 9.3 percent. Consequently, the floating rate liability has been converted to a fixed rate liability in the sense that the interest rate uncertainty associated with the March 20 payment (using the December 20 contract) has been removed as of September 20.

b. In a strip hedge, Johnson would sell 100 December futures (for the March payment), 100 March futures (for the June payment), and 100 June futures (for the September payment). The objective is to hedge each interest rate payment separately using the appropriate number of contracts. The problem is the same as in Part A except here three cash flows are subject to rising rates and a strip of futures is used to hedge this interest rate risk. This problem is simplified somewhat because the cash flow mismatch between the futures and the loan payment is ignored. Therefore, in order to hedge each cash flow, Johnson simply sells 100 contracts for each payment. The strip hedge transforms the floating rate loan into a strip of fixed rate payments. As was done in Part A, the fixed rates are found by adding 200 basis points to the implied forward LIBOR rate indicated by the discount yield of the three different Eurodollar futures contracts. The fixed payments will be equal when the LIBOR term structure is flat for the first year.

8. Jacob Bower has a liability that:

• has a principal balance of $100 million on June 30, 2008,

• accrues interest quarterly starting on June 30, 2008,

• pays interest quarterly,

• has a one-year term to maturity, and

• calculates interest due based on 90-day LIBOR (the London Interbank Offered

Rate).

Bower wishes to hedge his remaining interest payments against changes in interest rates.

Bower has correctly calculated that he needs to sell (short) 300 Eurodollar futures contracts to accomplish the hedge. He is considering the alternative hedging strategies outlined in the following table.

**Initial Position (6/30/08) in**

**90-Day LIBOR Eurodollar Contracts**

*Strategy A Strategy B*

*Contract Month (contracts) (contracts)*

September 2008 300 100

December 2008 0 100

March 2009 0 100

a. Explainwhy strategy B is a more effective hedge than strategy A when the yield curve

undergoes an instantaneous nonparallel shift.

b. Discuss an interest rate scenario in which strategy A would be superior to strategy B.

CFA Guideline Answer

a. Strategy B’s Superiority

Strategy B is a strip hedge that is constructed by selling (shorting) 100 futures contracts maturing in each of the next three quarters. With the strip hedge in place, each quarter of the coming year is hedged against shifts in interest rates for that quarter. The reason Strategy B will be a more effective hedge than Strategy A for Jacob Bower is that Strategy B is likely to work well whether a parallel shift or a nonparallel shift occurs over the one-year term of Bower’s liability. That is, regardless of what happens to the term structure, Strategy B structures the futures hedge so that the rates reflected by the Eurodollar futures cash price match the applicable rates for the underlying liability-the 90day LIBOR-based rate on Bower’s liability. The same is not true for Strategy A. Because Jacob Bower’s liability carries a floating interest rate that resets quarterly, he needs a strategy that provides a series of three-month hedges. Strategy A will need to be restructured when the three-month September contract expires. In particular, if the yield curve twists upward (futures yields rise more for distant expirations than for near expirations), Strategy A will produce inferior hedge results.

b. Scenario in Which Strategy A is Superior

Strategy A is a stack hedge strategy that initially involves selling (shorting) 300 September contracts. Strategy A is rarely better than Strategy B as a hedging or risk-reduction strategy. Only from the perspective of favorable cash flows is Strategy A better than Strategy B. Such cash flows occur only in certain interest rate scenarios. For example Strategy A will work as well as Strategy B for Bower’s liability if interest rates (instantaneously) change in parallel fashion. Another interest rate scenario where Strategy A outperforms Strategy B is one in which the yield curve rises but with a twist so that futures yields rise more for near expirations than for distant expirations. Upon expiration of the September contract, Bower will have to roll out his hedge by selling 200 December contracts to hedge the remaining interest payments. This action will have the effect that the cash flow from Strategy A will be larger than the cash flow from Strategy B because the appreciation on the 300 short September futures contracts will be larger than the cumulative appreciation in the 300 contracts shorted in Strategy B (i.e., 100 September, 100 December, and 100 March). Consequently, the cash flow from Strategy A will more than offset the increase in the interest payment on the liability, whereas the cash flow from Strategy B will exactly offset the increase in the interest payment on the liability.

MINI CASE: Detroit Motors’ Latin American Expansion

It is September 1990 and Detroit Motors of Detroit, Michigan, is considering establishing an assembly plant in Latin America for a new utility vehicle it has just designed. The cost of the capital expenditures has been estimated at $65,000,000. There is not much of a sales market in Latin America, and virtually all output would be exported to the United States for sale. Nevertheless, an assembly plant in Latin America is attractive for at least two reasons. First, labor costs are expected to be half what Detroit Motors would have to pay in the United States to union workers. Since the assembly plant will be a new facility for a newly designed vehicle, Detroit Motors expects minimal resistance from its U.S. union in establishing the plant in Latin America. Secondly, the chief financial officer (CFO) of Detroit Motors believes that a debt-for-equity swap can be arranged with at least one of the Latin American countries that has not been able to meet its debt service on its sovereign debt with some of the major U.S. banks.

The September 10, 1990, issue of *Barron’s* indicated the following prices (cents on the dollar) on Latin American bank debt:

|  |  |
| --- | --- |
| Brazil | 21.75 |
| Mexico | 43.12 |
| Argentina | 14.25 |
| Venezuela | 46.25 |
| Chile | 70.25 |

The CFO is not comfortable with the level of political risk in Brazil and Argentina, and has decided to eliminate them from consideration. After some preliminary discussions with the central banks of Mexico, Venezuela, and Chile, the CFO has learned that all three countries would be interested in hearing a detailed presentation about the type of facility Detroit Motors would construct, how long it would take, the number of locals that would be employed, and the number of units that would be manufactured per year. Since it is time-consuming to prepare and make these presentations, the CFO would like to approach the most attractive candidate first. He has learned that the central bank of Mexico will redeem its debt at 80 percent of face value in a debt-for-equity swap, Venezuela at 75 percent, and Chile 100 percent. As a first step, the CFO decides an analysis based purely on financial considerations is necessary to determine which country looks like the most viable candidate. You are asked to assist in the analysis. What do you advise?

Suggested Solution for Detroit Motors’ Latin American Expansion

Regardless in which LDC Detroit Motors establishes the new facility, it will need $65,000,000 in the local currency of the country to build the plant. The analysis involves a comparison of the dollar cost of enough LDC debt from a creditor bank to provide $65,000,000 in local currency upon redemption with the LDC central bank.

If Detroit Motors builds in Mexico, it will need to purchase $81,250,000 (= $65,000,000/.80) in Mexican sovereign debt in order to have $65,000,000 in pesos after redemption with the Mexican central bank. The cost in dollars will be $35,035,000 (= $81,250,000 x .4312).

If Detroit Motors builds in Venezuela, it will need to purchase $86,666,667 (= $65,000,000/.75) in Venezuelan sovereign debt in order to have $65,000,000 in bolivars after redemption with the Venezuelan central bank. The cost in dollars will be $40,083,333 (= $86,666,667 x .4625).

If Detroit Motors builds in Chile, it will need to purchase $65,000,000 (= $65,000,000/1.00) in Chilean sovereign debt in order to have $65,000,000 in pesos after redemption with the Chilean central bank. The cost in dollars will be $45,662,500 (= $65,000,000 x .7025).

Based on the above analysis, Detroit Motors should consider approaching Mexico about the possibility of a debt-for-equity swap to build an assembly facility. Of course, there are many other factors, such as tax rates, shipping costs, and labor costs that also should be considered. Assuming all else is equal, however, Mexico seems to be the most attractive candidate.

Appendix 11A Question

1. Explain how Eurocurrency is created.

Answer: The core of the international money market is the Eurocurrency market. A *Eurocurrency* is a *time* deposit of money in an international bank located in a country different from the country that issues the currency. For example, Eurodollars are deposits of U.S. dollars in banks located outside of the United States. As an illustration, assume a U.S. Importer purchases $100 of merchandise from a German Exporter and pays for the purchase by drawing a $100 check on his U.S. checking account (demand deposit). If the funds are not needed for the operation of the business, the German Exporter can deposit the $100 in a time deposit in a bank outside the U.S. and receive a greater rate of interest than if the funds were put in a U.S. time deposit. Assume the German Exporter deposits the funds in a London Eurobank. The London Eurobank credits the German Exporter with a $100 time deposit and deposits the $100 into its correspondent bank account (demand deposit) with the U.S. Bank (banking system) to hold as reserves. Two points are noteworthy. First, the entire $100 remains on deposit in the U.S. Bank. Second, the $100 time deposit of the German Exporter in the London Eurobank represents the creation of Eurodollars. This deposit exists *in addition to* the dollars deposited in the U.S. Hence, no dollars have flowed out of the U.S. banking system in the creation of Eurodollars.

**CHAPTER 12 INTERNATIONAL BOND MARKETS**

**ANSWERS & SOLUTIONS TO END-OF-CHAPTER QUESTIONS AND PROBLEMS**

QUESTIONS

1. Describe the differences between foreign bonds and Eurobonds. Also discuss why Eurobonds make up the lion’s share of the international bond market.

Answer: The two segments of the international bond market are: foreign bonds and Eurobonds. A foreign bond issue is one offered by a foreign borrower to investors in a national capital market and denominated in that nation’s currency. A Eurobond issue is one denominated in a particular currency, but sold to investors in national capital markets other than the country which issues the denominating currency.

Eurobonds make up over 80 percent of the international bond market. The two major reasons for this stem from the fact that the U.S. dollar is the currency most frequently sought in international bond financing. First, Eurodollar bonds can be brought to market more quickly than Yankee bonds because they are not offered to U.S. investors and thus do not have to meet the strict SEC registration requirements. Second, Eurobonds are typically bearer bonds that provide anonymity to the owner and thus allow a means for evading taxes on the interest received. Because of this feature, investors are generally willing to accept a lower yield on Eurodollar bonds in comparison to registered Yankee bonds of comparable terms, where ownership is recorded. For borrowers the lower yield means a lower cost of debt service.

2. Briefly define each of the major types of international bond market instruments, noting their distinguishing characteristics.

Answer: The major types of international bond instruments and their distinguishing characteristics are as follows:

*Straight fixed-rate* bond issues have a designated maturity date at which the principal of the bond issue is promised to be repaid. During the life of the bond, fixed coupon payments that are some percentage rate of the face value are paid as interest to the bondholders. This is the major international bond type. Straight fixed-rate Eurobonds are typically bearer bonds and pay coupon interest annually.

*Floating-rate notes (FRNs)* are typically medium-term bonds with their coupon payments indexed to some reference rate. Common reference rates are either three-month or six-month U.S. dollar LIBOR. Coupon payments on FRNs are usually quarterly or semi-annual, and in accord with the reference rate.

A *convertible bond* issue allows the investor to exchange the bond for a pre-determined number of equity shares of the issuer. The *floor value* of a convertible bond is its straight fixed-rate bond value. Convertibles usually sell at a premium above the larger of their straight debt value and their conversion value. Additionally, investors are usually willing to accept a lower coupon rate of interest than the comparable straight fixed coupon bond rate because they find the call feature attractive. *Bonds with equity warrants* can be viewed as a straight fixed-rate bond with the addition of a call option (or warrant) feature. The warrant entitles the bondholder to purchase a certain number of equity shares in the issuer at a pre-stated price over a pre-determined period of time.

*Zero coupon bonds* are sold at a discount from face value and do not pay any coupon interest over their life. At maturity the investor receives the full face value. Another form of zero coupon bonds are stripped bonds. A *stripped bond* is a zero coupon bond that results from stripping the coupons and principal from a coupon bond. The result is a series of zero coupon bonds represented by the individual coupon and principal payments.

A *dual-currency bond* is a straight fixed-rate bond which is issued in one currency and pays coupon interest in that same currency. At maturity, the principal is repaid in a second currency. Coupon interest is frequently at a higher rate than comparable straight fixed-rate bonds. The amount of the dollar principal repayment at maturity is set at inception; frequently, the amount allows for some appreciation in the exchange rate of the stronger currency. From the investor’s perspective, a dual currency bond includes a long-term forward contract.

*Composite currency bonds* are denominated in a currency basket, such as SDRs or ECUs, instead of a single currency. They are frequently called *currency cocktail bonds*. They are typically straight fixed-rate bonds. The currency composite is a portfolio of currencies: when some currencies are depreciating others may be appreciating, thus yielding lower variability overall.

3. Why do most international bonds have high Moody’s or Standard & Poor’s credit ratings?

Answer: Moody’s Investors Service and Standard & Poor’s provide credit ratings on most international bond issues. It has been noted that a disproportionate share of international bonds have high credit ratings. The evidence suggests that a logical reason for this is that the Eurobond market is only accessible to firms that have good credit ratings to begin with.

4. What factors does S&P Global Ratings analyze in determining the credit rating it assigns to a sovereign government?

Answer: In rating a sovereign government, S&P’s analysis centers around an assessment of institutional, economic, external, fiscal, and monetary factors. The rating assigned to a sovereign is particularly important because it usually represents the ceiling for ratings S&P will assign to an obligation of an entity domiciled within that country.

5. Discuss the process of bringing a new international bond issue to market.

Answer: A borrower desiring to raise funds by issuing Eurobonds to the investing public will contact an investment banker and ask it to serve as lead manager of an underwriting syndicate that will bring the bonds to market. The lead manager will usually invite other banks to form a managing group to help negotiate terms with the borrower, ascertain market conditions, and manage the issuance. The managing group, along with other banks, will serve as underwriters for the issue, i.e., they will commit their own capital to buy the issue from the borrower at a discount from the issue price. Most of the underwriters, along with other banks, will be part of a selling group that sells the bonds to the investing public. The various members of the underwriting syndicate receive a portion of the spread (usually in the range of 2 to 2.5 percent of the issue size), depending upon the number and type of functions they perform. The lead manager receives the full spread, and a bank serving as only a member of the selling group receives a smaller portion.

6. You are an investment banker advising a Eurobank about a new international bond offering it is considering. The proceeds are to be used to fund Eurodollar loans to bank clients. What type of bond instrument would you recommend that the bank consider issuing? Why?

Answer: Since the Eurobank desires to use the bond proceeds to finance Eurodollar loans, which are floating-rate loans, the investment banker should recommend that the bank issue FRNs, which are a variable rate instrument. Thus there will a correspondence between the interest rate the bank pays for funds and the interest rate it receives from its loans. For example, if the bank frequently makes term loans indexed to 3-month LIBOR, it might want to issue FRNs, also, indexed to 3-month LIBOR.

7. What should a borrower consider before issuing dual-currency bonds? What should an investor consider before investing in dual-currency bonds?

Answer: A dual currency bond is a straight fixed-rate bond which is issued in one currency and pays coupon interest in that same currency. At maturity, the principal is repaid in a second currency. Coupon interest is frequently at a higher rate than comparable straight fixed-rate bonds. The amount of the dollar principal repayment at maturity is set at inception; frequently, the amount allows for some appreciation in the exchange rate of the stronger currency. From the investor’s perspective, a dual currency bond includes a long-term forward contract. If the second currency appreciates over the life of the bond, the principal repayment will be worth more than a return of principal in the issuing currency. However, if the payoff currency depreciates, the investor will suffer an exchange rate loss. Dual currency bonds are attractive to MNCs seeking financing in order to establish or expand operations in the country issuing the payoff currency. During the early years, the coupon payments can be made by the parent firm in the issuing currency. At maturity, the MNC anticipates the principal to be repaid from profits earned by the subsidiary. The MNC may suffer an exchange rate loss if the subsidiary is unable to repay the principal and the payoff currency has appreciated relative to the issuing currency. Consequently, both the borrower and the investor are exposed to exchange rate uncertainty from a dual currency bond.

PROBLEMS:

1. Your firm has just issued five-year floating-rate notes indexed to six-month U.S. dollar LIBOR plus 1/4%. What is the amount of the first coupon payment your firm will pay per U.S. $1,000 of face value, if six-month LIBOR is currently 7.2%?

Solution: 0.5 x (.072 + .0025) x $1,000 = $37.25.

2. Consider 8.5 percent Swiss franc/U.S. dollar dual-currency bonds that pay $666.67 at maturity per SF1,000 of par value. It sells at par. What is the implicit SF/$ exchange rate at maturity? Will the investor be better or worse off at maturity if the actual SF/$ exchange rate is SF1.35/$1.00?

Solution: Implicitly, the dual currency bonds call for the exchange of SF1,000 of face value for $666.67. Therefore, the implicit exchange rate built into the dual currency bond issue is SF1,000/$666.67, or SF1.50/$1.00. If the exchange rate at maturity is SF1.35/$1.00, SF1,000 would buy $740.74 = SF1,000/SF1.35. Thus, the dual currency bond investor is worse off with $666.67 because the dollar is at a depreciated level in comparison to the implicit exchange rate of SF1.50/$1.00.

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3. A five-year, 4 percent Euroyen bond sells at par. A comparable risk five year, 5.5 percent yen/dollar dual currency bond pays $833.33 at maturity. It sells for ¥110,000. What is the implied ¥/$ exchange rate at maturity? Hint: The dual-currency bond pays 5.5 percent interest on a notional value of ¥100,000, whereas the par value of the bond is not necessarily equivalent to ¥100,000.

Solution: Since the dual currency bond is of comparable risk, it will yield 4 percent like the straight Euroyen bond selling at par. Thus,

¥110,000 = ¥5,500 x PVIFA(n = 5, i = 4%) + S5(¥/$) x $833.33 x PVIF(n = 5, i = 4%)

= ¥5,500 x 4.4518 + S5(¥/$) x $833.33 x .8219

= ¥24,484.90 + S5(¥/$) x $684.91

This implies that the expected S5(¥/$) is 124.856.

MINI CASE: SARA LEE CORPORATION’S EUROBONDS

Sara Lee Corp. is serving up a brand name and a shorter maturity than other recent corporate borrowers to entice buyers to its first-ever dollar Eurobonds. The U.S. maker of consumer products, from Sara Lee cheesecake to Hanes pantyhose and Hillshire Farm meats, is selling $100 million in bonds with a 6 percent coupon. These are three-year bonds; other corporate bond sellers including Coca-Cola Co., Unilever NV, and Wal-Mart Stores, Inc., have concentrated on their five-year maturities.

“It is a well-known name and it is bringing paper to a part of the maturity curve where there is not much there,” said Noel Dunn of Goldman Sachs International. Goldman Sachs expects to find most buyers in the Swiss retail market, where “high-quality American corporate paper is their favorite buy,” Dunn said.

These are the first bonds out of a $500 million Eurobond program that Sara Lee announced in August 1995, and the proceeds will be used for general corporate purposes, said Jeffery Smith, a spokesman for the company.

The bond is fairly priced, according to Bloomberg Fair Value analysis, which compared a bond with similar issues available in the market. The bond offers investors a yield of 5.881 percent annually or 5.797 percent semiannually. That is 22 basis points more than they can get on the benchmark five-year U.S. Treasury note.

BFV analysis calculates that the bond is worth $100,145 on a $100,000 bond, compared with the re-offer price of $100,320. Anything within a $500 range on a $100,000 bond more or less than its BFV price is deemed fairly priced. Sara Lee is rated “AA-” by Standard & Poor’s Corp. and “A1,” one notch lower, by Moody’s Investors Service.

In July 1994, Sara Lee’s Netherlands division sold 200 million Dutch guilders ($127 million) of three-year bonds at 35 basis points over comparable Netherlands government bonds. In January, its Australian division sold 51 million British pounds ($78 million) of bonds maturing in 2004, to yield 9.43 percent.

What thoughts do you have about Sara Lee’s debt-financing strategy?

Suggested Solution to Sara Lee Corp.’s Eurobonds

Sara Lee is the ideal candidate to issue Eurobonds. The company has worldwide name recognition, and it has an excellent credit rating that allows it to place new bond issues easily. By issuing dollar denominated Eurobonds to Swiss investors, Sara Lee can bring new issues to market much more quickly than if it sold domestic dollar denominated bonds. Moreover, the Eurodollar bonds likely sell at a lower yield than comparable domestic bonds.

Additionally, it appears as if Sara Lee is raising funds in a variety of foreign currencies. Sara Lee most likely has large cash inflows in these same currencies that can be used to meet the debt service obligations on these bond issues. Thus Sara Lee is finding a use for some of its foreign currency receipts and does not have to be concerned with the exchange rate uncertainty of these part of its foreign cash inflows.

**CHAPTER 13 INTERNATIONAL EQUITY MARKETS**

**ANSWERS & SOLUTIONS TO END-OF-CHAPTER QUESTIONS AND PROBLEMS**

QUESTIONS

1. Exhibit 13.8 presents a listing of major national stock market indexes as displayed daily in the print edition of the *Financial Times*. At [www.ft.com](http://www.ft.com) you can find an online tracking of these national stock market indexes that shows performance over the past day, month, and year. Go to this website and compare the performance for several stock market indexes from various regions of the world. How does the performance compare? What do you think accounts for differences?

Answer: This question is designed to provide an intuitive understanding of the benefits from international diversification of equity portfolios. Over different time periods, different market forces will affect each national market in unique ways. Some markets will have yielded a positive return and others a negative return. Consequently, since all markets will not have moved in unison, i.e., are not perfectly correlated, international diversification provides volatility reduction to the portfolio investor.

2. As an investor, what factors would you consider before investing in the emerging stock market of a developing country?

Answer: An investor in emerging market stocks needs to be concerned with the depth of the market and the market’s liquidity. Depth of the market refers to the opportunities to invest in the country. One measure of the depth of the market is the concentration ratio of a country’s stock market. The concentration ratio frequently is calculated to show the market value of the ten largest stocks traded as a fraction of the total market capitalization of all equities traded. The higher the concentration ratio, the less deep is the market. That is, most value is concentrated in only a few companies. While this does not necessarily imply that the largest stocks in the emerging market are not good investments, it does, however, suggest that there are few opportunities for investment in that country and that proper diversification *within* the country may be difficult. In terms of liquidity, an investor would be wise to examine the market turnover ratio of the country’s stock market. High market turnover suggests that the market is liquid, or that there are opportunities for purchasing or selling the stock quickly at close to the current market price. This is important because liquidity means you can get in or out of a stock position quickly without spending more than you intended on purchase or receiving less than you expected on sale.

3. Compare and contrast the various types of secondary market trading structures.

Answer: There are two basic types of secondary market trading structures: dealer and agency. In a dealer market, the dealer serves as market maker for the security, holding an inventory of the security. The dealer buys at his bid price and sells at his asked price from this inventory. All public trades go through the dealer. In an agency market, public trades go through the agent who matches it with another public trade. Both dealer and agency markets can be continuous trade markets, but non-continuous markets tend to be only agency markets. Over-the-counter trading, specialist markets, and automated markets are types of continuous market trading systems. Call markets and crowd trading are each types of non-continuous trading market systems. Continuous trading systems are desirable for actively traded issues, whereas call markets and crowd trading offer advantages for smaller markets with many thinly traded issues because they mitigate the possibility of sparse order flow over short time periods.

4. Discuss any benefits you can think of for a company to (a) cross-list its equity shares on more than one national exchange, and (b) to source new equity capital from foreign investors as well as domestic investors.

Answer: A MNC that has a product market presence or manufacturing facilities in several countries may cross-list its shares on the exchanges of these same countries because there is typically investor demand for the shares of companies that are known within a country. Additionally, a company may cross-list its shares on foreign exchanges to broaden its investor base and therefore to increase the demand for its stock. An increase in demand will generally increase the stock price and improve its market liquidity. A broader investor base may also mitigate the possibility of a hostile takeover. Additional, cross-listing a company’s shares establishes name recognition and thus facilitates sourcing new equity capital in these foreign capital markets.

5. Why might it be easier for an investor desiring to diversify his portfolio internationally to buy depository receipts rather than the actual shares of the company?

Answer: A depository receipt can be purchased on the investor’s domestic exchange. It represents a package of the underlying foreign security that is priced in the investor’s local currency and in a trading range that is typical for the investor’s marketplace. The investor can purchase a depository receipt directly from his domestic broker, rather than having to deal with an overseas broker and the necessity of obtaining foreign funds to make the foreign stock purchase. Additionally, dividends are received in the local currency rather than in foreign funds that would need to be converted into the local currency.

6. Why do you think the empirical studies about factors affecting equity returns basically showed that domestic factors were more important than international factors, and, secondly, that industrial membership of a firm was of little importance in forecasting the international correlation structure of a set of international stocks?

Answer: While national security markets have become more integrated in recent years, there is still a tremendous amount of segmentation that brings about the benefit to be derived from international diversification of financial assets. Monetary and fiscal policies differ among countries because of different economic circumstances. The economic policies of a country directly affect the securities traded in the country, and they will behave differently than securities traded in another country with other economic policies being implemented. Hence, it is not surprising that domestic factors are found to be more important than international factors in affecting security returns. Similarly, industrial activity within a country is also affected by the economic policies of the country; thus firms in the same industry group, but from different countries, will not necessarily behave the same in all countries, nor should we expect the securities issued by these firms to behave alike.

PROBLEMS

1. On the Tokyo Stock Exchange, Honda Motor Company stock closed at ¥2,907 per share on Monday, June 6, 2016. Honda trades as and ADR on the NYSE. One underlying Honda share equals one ADR. On June 6, 2016, the ¥/$ spot exchange rate was ¥107.57/$1.00.

a. At this exchange rate, what is the no-arbitrage U.S. dollar price of one ADR?

b. By comparison, Honda ADRs traded at $27.18. Do you think an arbitrage opportunity exists?

Solution:

a. The no-arbitrage ADR U.S. dollar price is: ¥2,907 ÷ 107.57 = $27.02.

b. It is unlikely that an arbitrage opportunity exists after transaction costs. Additionally the slight difference in prices is likely accounted for by a difference in information contained in prices since the Tokyo Stock Exchange closes several hours before the NYSE.

2. If Honda ADRs were trading at $31 when the underlying shares were trading in Tokyo at ¥2,907, what could you do to earn a trading profit? Use the information in problem 1, above, to help you and assume that transaction costs are negligible.

Solution: As the solution to problem 1 shows, the no-arbitrage ADR U.S. dollar price is $27.02. If Honda ADRs were trading at $31, a wise investor might sell short the relatively overvalued ADRs. Since the ADRs are a derivative security, one would expect the ADRs to decrease in price from $31 to $27.02. Assuming this happens, the position could be liquidated for a profit of $31 - $27.02 = $3.98 per ADR.

MINI CASE: SAN PICO’S NEW STOCK EXCHANGE

San Pico is a rapidly growing Latin American developing country. The country is blessed with miles of scenic beaches that have attracted tourists by the thousands in recent years to new resort hotels financed by joint ventures of San Pico businessmen and moneymen from the Middle East, Japan, and the United States. Additionally, San Pico has good natural harbors that are conducive for receiving imported merchandise from abroad and exporting merchandise produced in San Pico and other surrounding countries that lack access to the sea. Because of these advantages, many new businesses are being started in San Pico.

Presently, stock is traded in a cramped building in La Cobijio, the nation’s capital. Admittedly, the San Pico Stock Exchange system is rather archaic. Twice a day an official of the exchange will call out the name of each of the 43 companies whose stock trades on the exchange. Brokers wanting to buy or sell shares for their clients then attempt to make a trade with one another. This crowd trading system has worked well for over one hundred years, but the government desires to replace it with a new modern system that will allow greater and more frequent opportunities for trading in each company, and will allow for trading the shares of the many new start-up companies that are expected to trade in the secondary market. Additionally, the government administration is rapidly privatizing many state-owned businesses in an attempt to foster their efficiency, obtain foreign exchange from the sale, and convert the country to a more capitalist economy. The government believes that it could conduct this privatization faster and perhaps at more attractive prices if it had a modern stock exchange facility where the shares of the newly privatized companies will eventually trade.

You are an expert in the operation of secondary stock markets and have been retained as a consultant to the San Pico Stock Exchange to offer your expertise in modernizing the stock market. What would you advise?

Suggested Solution to San Pico’s New Stock Exchange

Most new and renovated stock exchanges are being established these days as either a partially or fully automated trading system. A fully automated system is especially beneficial for a small to medium size country in which there is only moderate trading in most issues. Such a system that deserves special note is the continuous National Integrated Market system of New Zealand. This system is fully computerized and does not require a physical structure. Essentially, all buyers and sellers of a stock enter through their broker into the computer system the number of shares they desire to buy or sell and their required transaction price. The system is updated constantly as new purchase or sale orders are entered into the system. The computer constantly searches for a match between buyer and seller, and when one is found a transaction takes place. This type of system would likely serve San Pico’s needs very well. There is existing technology to implement, the bugs have been worked out in other countries, and it would satisfy all the demands of the San Pico government and easily accommodate growth in market activity.

**CHAPTER 15 INTERNATIONAL PORTFOLIO INVESTMENT**

**ANSWERS & SOLUTIONS TO END-OF-CHAPTER QUESTIONS AND PROBLEMS**

QUESTIONS

1. What factors are responsible for the recent surge in international portfolio investment (IPI)?

Answer: The recent surge in international portfolio investments reflects the globalization of financial markets. Specifically, many countries have liberalized and deregulated their capital and foreign exchange markets in recent years. In addition, commercial and investment banks have facilitated international investments by introducing such products as American Depository Receipts (ADRs) and country funds. Also, recent advancements in computer and telecommunication technologies led to a major reduction in transaction and information costs associated with international investments. In addition, investors might have become more aware of the potential gains from international investments.

2. Security returns are found to be less correlated across countries than within a country. Why can this be?

Answer: Security returns are less correlated probably because countries are different from each other in terms of industry structure, resource endowments, macroeconomic policies, and have non-synchronous business cycles. Securities from a same country are subject to the same business cycle and macroeconomic policies, thus causing high correlations among their returns.

3. Explain the concept of the world beta of a security.

Answer: The world beta measures the sensitivity of returns to a security to returns to the world market portfolio. It is a measure of the systematic risk of the security in a global setting. Statistically, the world beta can be defined as:

Cov(Ri, RM)/Var(RM),

where Ri and RM are returns to the i-th security and the world market portfolio, respectively.

4. Explain the concept of the Sharpe performance measure.

Answer: The Sharpe performance measure (SHP) is a risk-adjusted performance measure. It is defined as the mean excess return to a portfolio above the risk-free rate divided by the portfolio’s standard deviation.

5. Explain how exchange rate fluctuations affect the return from a foreign market measured in dollar terms. Discuss the empirical evidence on the effect of exchange rate uncertainty on the risk of foreign investment.

Answer: It is useful to refer to Equations 15.4 and 15.5 of the text. Exchange rate fluctuations mostly contribute to the risk of foreign investment through its own volatility as well as its covariance with the local market returns. The covariance may be positive or negative, implying that exchange rate changes may add to exchange risk or offset it. Exchange risk is found to be much more significant in bond investments than in stock investments.

6. Would exchange rate changes always increase the risk of foreign investment? Discuss the condition under which exchange rate changes may actually reduce the risk of foreign investment.

Answer: Exchange rate changes need not always increase the risk of foreign investment. When the covariance between exchange rate changes and the local market returns is sufficiently negative to offset the positive variance of exchange rate changes, exchange rate volatility can actually reduce the risk of foreign investment.

7. Evaluate a home country’s multinational corporations as a tool for international diversification.

Answer: Despite the fact that MNCs have operations worldwide, their stock prices behave very much like purely domestic firms. This is puzzling yet undeniable. As a result, MNCs are a poor substitute for direct foreign portfolio investments.

8. Discuss the advantages and disadvantages of closed-end country funds (CECFs) relative to the American Depository Receipts (ADRs) as a means of international diversification. Answer: CECFs can be used to diversify into exotic markets that are otherwise difficult to access such as India and Turkey. Being a portfolio, CECFs also provide instant diversification. ADRs do not provide instant diversification; investors should form portfolios themselves. In addition, there are relatively few ADRs from emerging markets. The main disadvantage of CECFs is that their share prices behave somewhat like the host country’s share prices, reducing the potential diversification benefits.

9. Why do you think closed-end country funds often trade at a premium or discount?

Answer: CECFs trade at a premium or discount because capital markets of the home and host countries are segmented, preventing cross-border arbitrage. If cross-border arbitrage is possible, CECFs should be trading near their net asset values.

10. Why do investors invest the lion’s share of their funds in domestic securities?

Answer: Investors invest heavily in their domestic securities mainly because there are barriers to investing overseas. The barriers may include excessive transaction costs, information costs for foreign securities, legal and institutional restrictions, extra taxes, exchange risk and political risk associated with overseas investments, etc. Investors may also disproportionately invest in domestic securities due to the behavioral bias toward familiarity.

11. What are the advantages of investing via international mutual funds?

Answer: The advantages of investing via international mutual funds include: (1) save transaction/information costs, (2) circumvent legal/institutional barriers, and (3) benefit from the expertise of professional fund managers.

12. Discuss how the advent of the euro would affect international diversification strategies.

Answer: As the euro-zone has the same monetary and exchange-rate policies, the correlations among euro-zone markets are likely to go up. This will reduce diversification benefits. However, to the extent that the adoption of euro strengthens the European economy, investors may benefit from enhanced returns.

PROBLEMS

1. Suppose you are a euro-based investor who just sold Microsoft shares that you had bought six months ago. You had invested 10,000 euros to buy Microsoft shares for $120 per share; the exchange rate was $1.15 per euro. You sold the stock for $135 per share and converted the dollar proceeds into euro at the exchange rate of $1.06 per euro. First, determine the profit from this investment in euro terms. Second, compute the rate of return on your investment in euro terms. How much of the return is due to the exchange rate movement?

Solution: It is useful first to compute the rate of return in euro terms:



€

This indicates that this euro-based investor benefited from an appreciation of dollar against the euro, as well as from an appreciation of the dollar value of Microsoft shares. The profit in euro terms is about €2,100, and the rate of return is about 21.0% in euro terms, of which 8.5% is due to the exchange rate movement.

2. Mr. James K. Silber, an avid international investor, just sold a share of Nestlé, a Swiss firm, for SF5,080. The share was bought for SF4,600 a year ago. The exchange rate is SF1.60 per U.S. dollar now and was SF1.78 per dollar a year ago. Mr. Silber received SF120 as a cash dividend immediately before the share was sold. Compute the rate of return on this investment in terms of U.S. dollars.

Solution: Mr. Silber must have paid $2,584.27 (=4,600/1.78) for a share of Néstle a year ago. When the share was liquidated, he must have received $3,250 [=(5,080 + 120)/1.60]. Therefore, the rate of return in dollar terms is:

R($) = [(3,250-2,584.27)/2584.27] x 100 = 25.76%.

3. In the above problem, suppose that Mr. Silber sold SF4,600, his principal investment amount, forward at the forward exchange rate of SF1.62 per dollar. How would this affect the dollar rate of return on this Swiss stock investment? In hindsight, should Mr. Silber have sold the Swiss franc amount forward or not? Why or why not?

Solution: The dollar profit from selling SF4,600 forward is equal to:

Profit ($) = 4,600 (1/1.62 – 1/1.60)

= 4,600 (0.6173 – 0.625)

= -$35.42.

Thus, the total return of investment is:

R($) = [(3,250-2,584.27-35.42)/2584.27] x 100 = 24.39%.

By ‘hindsight’, Mr. Silber should not have sold the SF amount forward as it reduced the return in dollar terms. But this is only by hindsight. Obviously, hedging decision must be made *ex ante*.

4. Japan Life Insurance Company invested $10,000,000 in pure-discount U.S. bonds in May 1995 when the exchange rate was 80 yen per dollar. The company liquidated the investment one year later for $10,650,000. The exchange rate turned out to be 110 yen per dollar at the time of liquidation. What rate of return did Japan Life realize on this investment in yen terms?

Solution: Japan Life Insurance Company spent ¥800,000,000 to buy $10,000,000 that was invested in U.S. bonds. The liquidation value of this investment is ¥1,171,500,000, which is obtained from multiplying $10,650,000 by ¥110/$. The rate of return in terms of yen is:

[(¥1,171,500,000 - ¥800,000,000)/ ¥800,000,000]x100 = 46.44%.

5. At the start of 1996, the annual interest rate was 6 percent in the United States and 2.8 percent in Japan. The exchange rate was 95 yen per dollar at the time. Mr. Jorus, who is the manager of a Bermuda-based hedge fund, thought that the substantial interest advantage associated with investing in the United States relative to investing in Japan was not likely to be offset by the decline of the dollar against the yen. He thus concluded that it might be a good idea to borrow in Japan and invest in the United States. At the start of 1996, in fact, he borrowed ¥1,000 million for one year and invested in the United States. At the end of 1996, the exchange rate became 105 yen per dollar. How much profit did Mr. Jorus make in dollar terms?

Solution: Let us first compute the maturity value of U.S. investment:

(¥1,000,000,000/95)(1.06) = $11,157,895.

The dollar amount necessary to pay off yen loan is:

(¥1,000,000,000)(1.028)/105 = $9,790,476.

The dollar profit = $11,157,895 - $9,790,476 = $1,367,419.

Mr. Jorus was able to realize a large dollar profit because the interest rate was higher in the U.S. than in Japan and the dollar actually appreciated against yen. This is an example of uncovered interest arbitrage.

6. Suppose we obtain the following data in dollar terms:

|  |  |  |
| --- | --- | --- |
| Stock market | Return (mean) | Risk (SD) |
| United States | 1.26% per month | 4.43% |
| United Kingdom | 1.23% per month | 5.55% |

The correlation coefficient between the two markets is 0.58. Suppose that you invest equally, i.e., 50% each, in the two markets. Determine the expected return and standard deviation risk of the resulting international portfolio.

Solution: The expected return of the equally weighted portfolio is:

E(Rp) = (.5)(1.26%) + (.5)(1.23%) = 1.25%

The variance of the portfolio is:

Var(Rp) = (.5)2(4.43)2 + (.5)2(5.55)2 +2(.5)2(4.43)(5.55)(.58)

= 4.91 +7.70 + 7.13 = 19.74

The standard deviation of the portfolio is thus 4.44%.

7. Suppose you are interested in investing in the stock markets of 7 countries--i.e., Australia, Canada, Germany, Japan, Switzerland, the United Kingdom, and the United States--the same 7 countries that appear in Exhibit 15.9. Specifically, you would like to solve for the optimal (tangency) portfolio comprising the above seven stock markets. In solving the optimal portfolio, use the input data (i.e. correlation coefficients, means, and standard deviations) provided in Exhibit 15.4. The risk-free interest rate is assumed to be 0.2% per month and you can take a short position in any stock market. What are the optimal weights for each of the seven stock markets? What is the risk and return of the optimal portfolio? This problem can be solved using MPTSolver.xls spreadsheet.

Solution:

Sample Period: 1980.1 -2012.12 (in U.S. dollar terms)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Correlation Coefficients | | | | | | |  |  |  |
| Stock Market | AU | CN | GM | JP | SW | UK | US | Mean (%) | SD (%) | Optimal Weight |
| Australia (AU) | 1 |  |  |  |  |  |  | 0.550 | 7.18 | -0.0557 |
| Canada (CN) | 0.69 | 1 |  |  |  |  |  | 0.549 | 6.11 | -0.2081 |
| Germany (GM) | 0.55 | 0.60 | 1 |  |  |  |  | 0.565 | 6.87 | -0.3597 |
| Japan (JP) | 0.39 | 0.40 | 0.41 | 1 |  |  |  | 0.437 | 6.59 | -0.0344 |
| Switzerland (SW) | 0.55 | 0.58 | 0.76 | 0.47 | 1 |  |  | 0.709 | 5.42 | 0.7968 |
| United Kingdom (UK) | 0.68 | 0.69 | 0.67 | 0.48 | 0.69 | 1 |  | 0.550 | 5.59 | -0.1285 |
| United States (US) | 0.63 | 0.77 | 0.65 | 0.38 | 0.65 | 0.72 | 1 | 0.647 | 4.59 | 0.9896 |

The monthly mean return and standard deviation of the optimal portfolio are 0.772% and 4.790%, respectively. Hence, the Sharpe ratio of the optimal portfolio is equal to 0.119 = (0.772-0.20)/4.790.

8. The HFS Trustees have solicited input from three consultants concerning the risks and rewards of an allocation to international equities. Two of them strongly favor such action, while the third consultant commented as follows: “The risk reduction benefits of international investing have been significantly overstated. Recent studies relating to the cross-country correlation structure of equity returns during different market phases cast serious doubt on the ability of international investing to reduce risk, especially in situations when risk reduction is needed the most.”

a. Describe the behavior of cross-country equity return correlations to which the consultants is referring. Explain how that behavior may diminish the ability of international investing to reduce risk in the short run. Assume that the consultant’s assertion is correct.

1. b. Explain why it might still be more efficient on a risk/reward basis to invest internationally rather than only domestically in the long run.

The HFS Trustees have decided to invest in non-U.S. equity markets and have hired Jacob Hind, a specialist manager, to implement this decision. He has recommended that an unhedged equities position be taken in Japan, providing the following comments and the table data to support his view: “Appreciation of a foreign currency increases the returns to a U.S. dollar investor. Since appreciation of the Yen from ¥100/$U.S. to ¥98/$U.S. is expected, the Japanese stock position should not be hedged.”

Market Rates and Hind’s Expectations

U.S. Japan

Spot rate (yen per $U.S.) n/a 100

Hind’s 12-month currency forecast (yen per $U.S.) n/a 98

1-year Eurocurrency rate (% per annum) 6.00 0.80

Hind’s 1-year inflation forecast (% per annum) 3.00 0.50

Assume that the investment horizon is one year and that there are no costs associated with currency hedging.

c. State and justify whether Hind’s recommendation (not to hedge) should be followed. Show any calculations.

Solution:

a. Cross-country correlations tend to increase during the turbulent market phase, reducing the benefits from international diversification in the short run.

b. Unless the investor has to liquidate investments during the turbulent phase, he/she can ride out the turbulence and realize the benefits from international investments in the long run.

c. The interest rate parity implies that the forward exchange rate would be ¥95.09/$:

F = [1.06/1.008](1/100) = $0.010516/¥ = ¥95.09/$,

which is compared with Hind’s expected future spot rate of ¥98/$. Clearly, the HFS Trustees can receive more dollar amount from selling yen forward than from the unhedged position. Relative to the forward rate, Hind underestimates the yen’s future strength.

9. Rebecca Taylor, an international equity portfolio manager, recognizes that optimal country allocation strategy combined with an optimal currency strategy should produce optimal portfolio performance. To develop her strategy, Taylor produced the table below, which provides expected return data for the three countries and three currencies in which she may invest. The table contains the information she needs to make market strategy (country allocation) decisions and currency strategy (currency allocation) decisions.

Expected Returns for a U.S.-Based Investor

Country Local Currency Exchange Rate Local Currency

Equity Returns Returns Eurodeposit Returns

Japan 7.0% 1.0% 5.0%

United Kingdom 10.5 -3.0 11.0

United States 8.4 0.0 7.5

a. Prepare a ranking of the three countries in terms of expected equity-market return premiums. Show your calculations.

b. Prepare a ranking of the three countries in terms of expected currency return premiums from the perspective of a U.S. investor. Show your calculations.

c. Explain one advantage a portfolio manager obtains, in formulating a global investment strategy, by calculating both expected market premiums and expected currency premiums.

Solution:

a. United Kingdom = first; United States = second; Japan = third.

b. Japan = first; United States = second; United Kingdom = third.

c. Computing expected currency premium helps the portfolio manager to decide whether to hedge currency risk.

10. The Glover Scholastic Aid Foundation has received a €20 million global government bond portfolio from a Greek donor. This bond portfolio will be held in euros and managed separately from Glover’s existing U.S. dollar-denominated assets. Although the bond portfolio is currently unhedged, the portfolio manager, Raine Sofia, is investigating various alternatives to hedge the currency risk of the portfolio. The bond portfolio’s current allocation and the relevant country performance data are given in Exhibits 1 and 2. Historical correlations for the currencies being considered by Sofia are given in Exhibit 3. Sofia expects that future returns and correlations will be approximately equal to those given in Exhibits 2 and 3.

Exhibit 1. Glover Scholastic Aid Foundation Current Allocation Global Government Bond Portfolio

Country Allocation (%) Maturity (years)

Greece 25 5

A 40 5

B 10 10

C 10 5

D 15 10

Exhibit 2. Country Performance Data (in local currency)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Country | Cash  Return  (%) | 5-year  Excess  Bond  Return  (%) | 10-year  Excess  Bond  Return  (%) | Unhedged  Currency  Return  (%) | Liquidity of  90-day  Currency  Forward  Contracts |
| Greece | 2.0 | 1.5 | 2.0 | --- | Good |
| A | 1.0 | 2.0 | 3.0 | – 4.0 | Good |
| B | 4.0 | 0.5 | 1.0 | 2.0 | Fair |
| C | 3.0 | 1.0 | 2.0 | – 2.0 | Fair |
| D | 2.6 | 1.4 | 2.4 | – 3.0 | Good |

Exhibit 3. Historical Currency Correlation Table (1998-2003, weekly observations)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Currency | €  (Greece) | A | B | C | D |
| € (Greece) | 1.00 | –0.77 | 0.45 | –0.57 | 0.77 |
| A | --- | 1.00 | –0.61 | 0.56 | –0.70 |
| B | --- | --- | 1.00 | –0.79 | 0.88 |
| C | --- | --- | --- | 1.00 | –0.59 |
| D | --- | --- | --- | --- | 1.00 |

* 1. Calculate the expected total annual return (euro-based) of the current bond portfolio if Sofia decides to leave the currency risk unhedged. Show your calculations.
  2. Explain, with respect to currency exposure and forward rates, the circumstance in which Sofia should use a currency forward contract to hedge the current bond portfolio’s exposure to a given currency.
  3. Determine which *one* of the currencies being considered by Sofia would be the *best* proxy hedge for Country B bonds. Justify your response with *two* reasons.

Sofia has been disappointed with the low returns on the current bond portfolio relative to the benchmark—a diversified global bond index—and is exploring general strategies to generate excess returns on the portfolio. She has already researched two such strategies: duration management and investing in markets outside the benchmark index.

* 1. Identify *three* general strategies (other than duration management and investing in markets outside the benchmark index) that Sofia could use to generate excess returns on the current bond portfolio. Give, for *each* of the three strategies, a potential benefit specific to the current bond portfolio.

Solution:

a. The unhedged expected annual portfolio return in euros is calculated as follows:

WG × (rG + eH,G) + WA × (rA + eH,A) + WB × (rB + eH,B) + WC × (rC + eH,C) + WD × (rD + eH,D)

= 0.25 × (2% + 1.5%) + 0.4 × (1% + 2% – 4%) + 0.1 × (4% + 1% + 2%)

+ 0.1 × (3% + 1% – 2%) + 0.15 × (2.6% + 2.4% – 3%)

= 0.875% – 0.4% + 0.7% + 0.2% + 0.3%

= 1.675%

= 1.68%

b. If Sofia expects the unhedged percentage return from exposure to a currency to be less than the forward discount or premium, she should use a forward contract to hedge exposure to that currency. The circumstance can also be expressed as:

*eH,i* < *cH* – *ci*

where:

unhedged expected currency return for country *i* = *eH,i*

forward premium or discount = *cH* – *ci*

c. Country D currency would provide the best proxy hedge for Country B bonds for any of the following reasons:

• The liquidity of 90-day currency forward contracts for country D is good.

• The relevant currencies − Country B and Country D (hedge) − are historically more highly correlated (0.88) and therefore Country D provides a more accurate proxy hedge.

• Sofia could capitalize on a negative view of Country D currency relative to Country B currency by establishing a short position in Country D currency.

d.

1. Bond Market Selection:

Because there are bonds from only five countries in the current portfolio, better risk-adjusted returns could be realized by diversifying into government bonds from other countries in the index that have low correlations with existing bonds.

2. Sector/Credit/Security Selection:

The current portfolio is invested exclusively in government bonds. Other sectors such as corporate bonds, asset-backed securities, and mortgage-backed securities could provide further diversification and potentially enhance portfolio risk-adjusted return.

3. Currency Selection:

Active currency management can be used to produce superior risk-adjusted returns. One could either hedge the entire portfolio from currency risk or implement expectations about specific currencies by fully hedging, partially hedging, or not hedging.

MINI CASE: SOLVING FOR THE OPTIMAL INTERNATIONAL PORTFOLIO

Suppose you are a financial advisor and your client, who is currently investing only in the U.S. stock market, is considering diversifying into the U.K. stock market. At the moment, there are neither particular barriers nor restrictions on investing in the U.K. stock market. Your client would like to know what kind of benefits can be expected from doing so. Using the data provided in the above problem (i.e., problem 12), solve the following problems:

(a) Graphically illustrate various combinations of portfolio risk and return that can be generated by investing in the U.S. and U.K. stock markets with different proportions. Two extreme proportions are (I) investing 100% in the U.S. with no position in the U.K. market, and (ii) investing 100% in the U.K. market with no position in the U.S. market.

(b) Solve for the ‘optimal’ international portfolio comprised of the U.S. and U.K. markets. Assume that the monthly risk-free interest rate is 0.5% and that investors can take a short (negative) position in either market.

(c) What is the extra return that U.S. investors can expect to capture at the ‘U.S.-equivalent’ risk level? Also trace out the efficient set. [The Appendix 11.B provides an example.]

Suggested Solution to the Optimal International Portfolio:

Let U.S. be market 1 and U.K. be market 2. The parameter values are: 1 = 1.26%, 2 = 1.23%, σ1 = 4.43%, σ2 = 5.55%, Rf = 0.5%.

Accordingly, σ12 = σ1σ2 ρ12 = (4.43)(5.55)(0.58) = 14.26, σ12 = 19.62, σ22 = 30.80.

(a) E(Rp) = 1.26w1 + 1.23w2

The variance of the portfolio is:

Var(Rp) = 19.62w12 + 30.80w22 + 2(14.26)w1w2

Some possible portfolios are:

w1 w2 E(Rp) Var(Rp)

1.00 0.00 1.26 19.62

0.75 0.25 1.25 18.31

0.50 0.50 1.245 19.74

0.25 0.75 1.238 23.90

0.00 1.00 1.23 30.80

(b) The optimal weights are w1 = 0.79 and w2 = 0.21.

(c) I  = Rf + λσUS

Here, λ = Slope of efficient set = (OIP - Rf )/ σOIP

OIP = (0.79)(1.26) + (0.21)(1.23) = 1.26%

σOIP2 = (0.79)2(19.62) + (0.21)2(30.8) + 2(0.79)(0.21)(14.26) = 18.55

σOIP = 4.28%

Therefore, I  = 0.5 + [(1.26 - 0.5)/4.28](4.43) = 1.29%

Extra return = 1.29 - 1.26 = 0.03%

**CHAPTER 16 FOREIGN DIRECT INVESTMENT AND CROSS-BORDER ACQUISITIONS**

**ANSWERS & SOLUTIONS TO END-OF-CHAPTER QUESTIONS AND PROBLEMS**

QUESTIONS

1. Recently, many foreign firms from both developed and developing countries acquired high-tech U.S. firms. What might have motivated these firms to acquire U.S. firms?

Answer: Many foreign firms might have been motivated to gain access to technical know-how residing in U.S. firms and at the same time monopolize its use. Refer to the reverse-internalization hypothesis discussed in the text.

2. Japanese MNCs, such as Toyota, Toshiba, Matsushita, etc., made extensive investments in the Southeast Asian countries like Thailand, Malaysia and Indonesia. In your opinion, what forces are driving Japanese investments in the region?

Answer: Most likely, these Japanese MNCs have invested heavily in Southeast Asia in order to take advantage of underpriced labor services and cheaper land and other factors of production. Refer to the life-cycle theory of FDI.

3. Since the NAFTA was established, many Asian firms especially those from Japan and South Korea made extensive investments in Mexico. Why do you think these Asian firms decided to build production facilities in Mexico?

Answer: Asian firms might have been motivated to gain access to NAFTA of which Mexico is a member and circumvent the external trade barriers maintained by NAFTA.

4. How would you explain the fact that China emerged as one of the most important recipient of FDI in recent years?

Answer: China attracted a great deal of FDI recently because foreign firms want to (i) take advantage of relatively inexpensive labor and other resources, and also (ii) gain access to the Chinese market that is often not accessible otherwise.

5. Explain the internalization theory of FDI. What are the strength and weakness of the theory?

Answer: According to the internalization theory, firms that have intangible assets with a public good property tend to undertake FDI to take advantage of the assets on a large scale and, at the same time, prevent misappropriation of returns from the assets that may occur during arm’s length transactions in foreign countries. The theory can be effective in explaining greenfield investments, but not in explaining cross-border mergers and acquisitions.

6. Explain Vernon’s product life-cycle theory of FDI. What are the strength and weakness of the theory?

Answer: According to the product life-cycle theory, firms undertake FDI at a particular stage in the life-cycle of the products that they initially introduced. When a new product is introduced, the firm chooses to keep production at home, close to customers. But when the product become mature and foreign demands develop, the firm may be induced to start production in foreign countries, especially in low-cost countries, to serve the local markets as well as to export the product back to the home country. As can be inferred from the boxed reading on Singer in the text, the product life-cycle theory can explain historical development of FDI quite well. In recent years, however, the international system of production has become too complicated to be explained neatly by the life-cycle theory. For example, new products are often introduced simultaneously in many countries and production facilities may be located in many countries at the same time.

7. Why do you think the host country tends to resist cross-border acquisitions, rather than green field investments?

Answer: The host country tends to view green field investments as creating new production facilities and new job opportunities. In contrast, cross-border acquisitions can be viewed as foreign takeover of existing domestic firms, without creating new job opportunities.

8. How would you incorporate political risk into the capital budgeting process of foreign investment projects?

Answer: One approach is to adjust the cost of capital upward to reflect political risk and discount the expected future cash flows at a higher rate. Alternatively, one can subtract insurance premium for political risk from the expected future cash flows and use the usual cost of capital which is applied to domestic capital budgeting.

9. Explain and compare forward vs. backward internalization.

Answer: Forward internalization occurs when MNCs with intangible assets make FDI in order to utilize the assets on a larger scale and at the same time internalize any possible externalities generated by the assets. Backward internalization, on the other hand, occurs when MNCs acquire foreign firms in order to gain access to the intangible assets residing in the foreign firms and at the same time internalize any externalities generated by the assets.

10. What can be the reason for the negative synergistic gains for British acquisitions of U.S. firms?

Answer: Negative synergies for British acquisitions of U.S. firms may reflect that British managers might have been motivated to invest in U.S. firms in order to pursue their own interests, such as building corporate empire, rather than shareholders’ interests. Negative synergies can be viewed as agency costs.

11. Define country risk. How is it different from political risk?

Answer: Country risk is a broader measure of risk than political risk, as the former encompasses political risk, credit risk, and other economic performances.

12. What are the advantages and disadvantages of FDI as opposed to a licensing agreement with a foreign partner?

Answer: The main advantage of FDI over licensing agreement with a foreign partner is that it provides protection against possible interlopers. The main disadvantage of FDI is that it is costly and time consuming to establish foreign presence in this manner and FDI is probably more vulnerable to political risk.

13. What operational and financial measures can a MNC take in order to minimize the political risk associated with a foreign investment project?

Answer: First, MNCs should explicitly incorporate political risk in the capital budgeting process and adjust the project’s NPV accordingly. Second, MNCs can form joint-ventures with local partners or form a consortium with other MNCs to reduce risk. Third, MNCs can purchase insurance against political risk from OPIC, Lloyd’s, etc.

14. Study the experience of Enron in India, and discuss what we can learn from it for the management of political risk.

Answer: This question can be used as a mini-case or mini-project. Students can utilize various business/financial publications, such as *Wall Street Journal*, *Financial Times*, and *Business week*, to study the issue.

15. Discuss the different ways political events in a host country may affect local operations of an MNC.

Answer: The answer can be organized based on the three types of political risk: Namely, transfer risk, operational risk, and control risk. Transfer risk arises from the uncertainty about cross-border flows of capital, payments, know-how, etc. Operational risk arises from the uncertainty about the host country’s policies affecting the local operations of MNCs. Control risk arises from the uncertainty about the host country’s policy regarding ownership and control of local operations of MNCs.

16. What factors would you consider in evaluating the political risk associated with making FDI in a foreign country.

Answer: Factors to be considered include: (1) the host country’s political and government system; (2) track record of political parties and their relative strength; (3) the degree of integration into the world system; (4) the host country’s ethnic and religious stability; (5) regional security; and (6) key economic indicators.

17. Daimler, a German carmaker, acquired Chrysler, the third largest U.S. automaker, for $40.5 billion in 1998. But after years of declining profit and labor problem, Daimler sold off Chrysler to the U.S. private equity firm Cerberus for $7.4 billion in 2007. Study the DaimlerChrysler saga and identify the main factors for the failure of this cross-border merger.

Suggested answer: Daimler-Chrysler merger failed to produce synergy effect due to the failure to integrate the two companies with different corporate cultures, inability to cut down labor costs due to a strong labor union at Chrysler, and the competitive pressure from Japanese carmakers.

18. Lured by extremely low labor costs in Bangladesh, many MNCs in the so-called fast-fashion business, including H&M, Inditex, parent of the popular Zara brand, Marks&Spencer, and Gap, are heavily outsourcing to Bangladesh. As a result, garment industry has become a major source of employment and income to Bangladesh. However, the industry has recently suffered a spate of disasters. In September 2012, about 110 workers died in a blaze at the Tazreen Fashions factory outside Dhaka, the capital city. What’s worse, in April 2013, more than 1,100 workers perished in the collapse of the Rena Plaza Building in Dhaka. In your opinion, (i) what are the root causes of the disasters? (ii) what should be done to prevent future disasters?

Suggested answers: (i) The disasters may be primarily attributable to the weak legal protection of workers’ rights and the lack of proper government supervision of the health and safety conditions workers face in factories. (ii) Future disasters may be prevented by stronger legal and administrative protection of workers’ rights, better payments to the factory owners and workers to reduce the incentives to skirt the safety rules, better monitoring of workplaces by the outsourcing MNCs, and stronger organization among workers to better protect their own rights.

MINICASE: ENRON VS. BOMBAY POLITICIANS

1) Discuss the chief mistakes that Enron made in India.

Suggested answer: Enron was insensitive to the negative political sentiment against foreign investment in India and ignored the possibility that BJP may win the election and repudiate the contract with Enron. In addition, the deal was closed in a hurry and secretly, giving the impression that it might have involved corruption.

2) Discuss what Enron might have done differently to avoid its predicament in India

Suggested answer: Enron could have done a more accurate analysis of political risk and considered the possibility of election victory of the nationalist party. In addition, Enron could have purchased an insurance policy against this political risk from Overseas Private Investment Corporation or other insurers. Further, involving a local partner could have dampened the nationalistic sentiment in India.

**CHAPTER 17 INTERNATIONAL CAPITAL STRUCTURE AND THE COST OF CAPITAL**

**ANSWERS & SOLUTIONS TO END-OF-CHAPTER QUESTIONS AND PROBLEMS**

QUESTIONS

1. Suppose that your firm is operating in a segmented capital market. What actions would you recommend to mitigate the negative effects?

Answer: The best solution for this problem is to cross-list your firm’s stock in overseas markets like London and New York that are not segmented. But you should be aware of the associated costs such as the cost of adjusting financial statements, fees charged by the listing exchanges, etc.

2. Explain why and how a firm’s cost of capital may decrease when the firm’s stock is cross-listed on foreign stock exchanges.

Answer: If a stock becomes internationally tradable upon overseas listing, the required return on the stock is likely to go down because the shareholder base tends to be expanded across countries and the stock will be priced according to the international systematic risk rather than the local systematic risk. It is well known that for a typical stock, the international systematic risk is lower than the local systematic risk.

3. Explain the pricing *spill-over effect*.

Answer: Suppose a firm operating in a relatively segmented capital market (like China, for example) decides to cross-list its stock in New York or London. Upon cross-border listing, the firm’s stock will be priced internationally. In addition, the pricing of remaining purely domestic stocks (other Chinese stocks) will be affected in such a way that these stocks will be priced partially internationally and partially domestically. The degree of international pricing depends on the correlations between these purely domestic stocks and internationally traded stocks.

4. In what sense do firms with nontradable assets get a *free-ride* from firms whose securities are internationally tradable?

Answer: Due to the spillover effect, firms with nontradable securities can benefit in terms of higher security prices and lower cost of capital, without incurring any costs associated with making the securities internationally tradable. This is an example of free-ride.

5. Define and discuss *indirect world systematic risk*.

Answer: The indirect world systematic risk can be defined as the covariance between a nontradable asset and the world market portfolio that is induced by tradable assets. In the presence of internationally tradable assets, nontradable assets will be priced partly by the indirect world systematic risk and partly by the pure domestic systematic risk.

6. Discuss how the cost of capital is determined in segmented vs. integrated capital markets.

Answer: In segmented capital markets, the cost of capital will be determined essentially by the securities’ domestic systematic risks. In integrated capital markets, on the other hand, the cost of capital will be determined by the securities’ world systematic risk, regardless of nationality.

7. Suppose there exists a nontradable asset with a perfect positive correlation with a portfolio T of tradable assets. How will the nontradable asset be priced?

Answer: The nontradable asset with a perfect positive correlation with portfolio T (for tradable) will be priced as if it were tradable by itself. In a word, it will be priced solely according to its world systematic risk.

8. Discuss what factors motivated Novo Industries to seek U.S. listing of its stock. What lessons can be derived from Novo’s experiences?

Answer: Novo, a rapidly growing company, was domiciled in a small and segmented Danish market. This restricted the firm’s ability to raise capital at a competitive rate. As discussed in the text, Novo solved this problem by listing its stock in London and New York stock exchanges. This move enabled Novo to gain access to large capital sources and lower its cost of capital.

9. Discuss foreign equity ownership restrictions. Why do you think countries impose these restrictions?

Answer: Many countries restrict the maximum fractional ownership of local firms by foreigners. Mostly, these restrictions are imposed to ensure domestic control of local firms.

10. Explain the *pricing-to-market* phenomenon.

Answer: The pricing-to-market (PTM) refers to the phenomenon that the same securities are priced differently for different investors. A well-known example of PTM is provided by Nestle. Up until 1988 November, foreigners were only allowed to hold Nestle bearer shares; only Swiss residents were allowed to hold registered shares. As indicated in Exhibit 17.11 in the text, bearer shares were trading for about twice the price of registered shares.

11. Explain how the premium and discount are determined when assets are priced-to-market. When would the law of one price prevail in international capital markets even if foreign equity ownership restrictions are imposed?

Answer: The premium and discount are determined by (i) the severity of restrictions imposed on foreigners and (ii) foreigners’ ability to mitigate the effect of these restrictions using their own domestic securities. In a special case where foreigners can exactly replicate the securities under restriction, then PTM will cease to apply.

12. Under what conditions will the foreign subsidiary’s financial structure become relevant?

Answer: The subsidiary’s own financial structure will become relevant when the parent firm is not responsible for the financial obligations of the subsidiary.

13. Under what conditions would you recommend that the foreign subsidiary conform to the local norm of financial structure?

Answer: It may make sense for the subsidiary to confirm to the local norm if the parent is not responsible for the subsidiary’s debt and the subsidiary has to depend on local financial markets for raising capital.

Problems

Answer problems 1-3 based on the stock market data given by the following table.

Correlation Coefficients

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Telmex | Mexico | World | *SD*(%) | (%) |
| Telmex | 1.00 | .90 | 0.60 | 18 | ? |
| Mexico |  | 1.00 | 0.75 | 15 | 14 |
| World |  |  | 1.00 | 10 | 12 |

The above table provides the correlations among Telmex, a telephone/communication company located in Mexico, the Mexico stock market index, and the world market index, together with the standard deviations (*SD*) of returns and the expected returns (). The risk-free rate is 5%.

1. Compute the domestic country beta of Telmex as well as its world beta. What do these betas measure?

2. Suppose the Mexican stock market is segmented from the rest of the world. Using the CAPM paradigm, estimate the equity cost of capital of Telmex.

3. Suppose now that Telmex has made its shares tradable internationally via cross-listing on NYSE. Again using the CAPM paradigm, estimate Telmex’s equity cost of capital. Discuss the possible effects of international pricing of Telmex shares on the share prices and the firm’s investment decisions.

Solutions.

1. The domestic beta, , and the world beta, , of Telmex can be computed as follows:





Both the domestic and world beta turn out to be the same. As the market moves by 1%, Telmex stock return will move by 1.08%

.

2. 

3. 

As the equity cost of capital decreases from 14.72% to 12.56%, Telmex will experience an increase in its share price. In addition, with a reduced cost of capital, Telmex will be able to undertake more investment projects profitably.