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Answer key to HOMEWORK # 2

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HEDGING FOREIGN EXCHANGE RATE RISK: FORWARDS

1. North Bank has been borrowing in the U.S. markets and lending abroad, thus incurring foreign exchange risk. In a recent transaction, it issued a one-year \$2 million CD at 6 percent and funded a loan in euros at 8 percent. The spot rate for the euro was €1.45/\$ at the time of the transaction.
 - a. What will the Net Interest Income (\$Interest and principal at year-end on €loan – \$ Interest and principal of CDs) after one year if the euro does not change? Find the Net Interest Margin (spread). (Net Interest Margin = Net Interest Income/2 million).

Amount of loan in € = \$2 million x 1.45 = €2.9 million.

Interest and principal at year-end = €2.9m x 1.08 = €3.132m/1.45 = \$2.16 million

Interest and principal of CDs = \$2m x 1.06 = \$2,120,000

Net interest income = \$2,160,000 – \$2,120,000 = \$40,000

Net interest margin = \$40,000/2,000,000 = 0.02 or 2 percent.

- b. Information received immediately after the transaction closing indicated that the euro will depreciate to €1.47/\$ by year-end. If the information is correct, what will be the Net Interest Income (spread)?

Amount of loan in € = \$2 million x 1.45 = €2.9 million.

Interest and principal at year-end = €2.9m x 1.08 = €3.132m/1.47 = \$2,130,612.24

Interest and principal of CDs = \$2m x 1.06 = \$2,120,000

Net interest income = \$2,130,612.24 – \$2,120,000 = \$10,612.24

Net interest margin = \$10,612.24/2,000,000 = 0.0053 or 0.53 percent.

- c. What should have been the bank interest rate on the loan to maintain the spread you found in (a)?

In order to maintain a 2 percent spread, the interest and principal earned at €1.47/\$ should be: $€2.9(1 + R)/1.47 - 2.12 = 0.04$ mill.

Therefore, $(1 + R) = (2.16 \times 1.47) / €2.9 = 1.0949$, and $R = 0.0949$ or 9.49 percent

- d. The bank had an opportunity to sell one-year forward marks at €1.46. What would have been the spread on the loan if the bank had hedged forward its foreign exchange exposure?

Net interest income if hedged = $€2.9 \times 1.08 = 3.132 / 1.46 = 2.1452\text{m} - 2.12\text{m}$
= 0.0252 million, or \$25,205.48

Net interest margin = $.0252 / 2 = 0.0126$, or 1.26 percent

- e. What would have been an appropriate change in loan rates to maintain the spread found in (a) if the bank intended to hedge its exposure using the forward rates?

To maintain a 2 percent spread: $€2.9(1 + R)/1.46 = 2.16 \Rightarrow R = 8.74$ percent

The bank should increase the rates to 8.74 percent and hedge with the sale of forward € to maintain a 2 percent spread.

HEDGING FOREIGN EXCHANGE RATE RISK: FUTURES

2. An FI has assets denominated in British pound sterling of \$125 million and sterling liabilities of \$100 million.

- a. What is the FI's net exposure?

The exposure in terms of USD is \$25 million

- b. Is the FI exposed to a dollar appreciation or depreciation?

Because assets are greater than liabilities, this FI is exposed to appreciation of the USD, or declines in the pound value relative to the dollar.

- c. How can the FI use futures or forward contracts to hedge its FX rate risk?

The FI can hedge its FX rate risk by selling forward or futures contracts in pound sterling.

- d. What is the number of futures contracts to be utilized to hedge fully the FI's currency risk exposure? Consider that the minimum contract size for British pounds is £62,500.

The number of contracts, say N_f , is calculated as follows:

$$N_f = \$25 \text{ million} \times (\text{exchange rate } (\text{£}/\$) \text{ at the time of contracting}) / \text{£}62,500$$

Here you just needed to indicate how you will use the exchange rate (£/\$).

It was also correct to assume that the exchange rate at the time of contracting was \$1.60/£. In that case N_f would have been 250 contracts.

- e. If the British pound falls from \$1.60/£ to \$1.50/£, what will be the impact on the FI's cash position?

The cash position will witness a loss if the pound sterling depreciated in terms of the U.S. dollar.

The FI will lose 10 cents of a dollar for every £ in its net position. Taking into account that the net position in terms of USD was \$25 million, an appreciation of the USD by 10 cents would mean a loss of \$2.5 million in the net position of the FI.

Some of you have answered that the net position of the FI has increased in £ terms from £15,625,000 ($=\$25,000,000/1.60$) to £16,666,667 ($=\$25,000,000/1.50$). This is also correct as long as you realized that this is equivalent to a loss in \$ terms.

- f. If the British pound futures price falls from \$1.55/£ to \$1.45/£, what will be the impact on the FI's futures position?

Here you have to consider the marked-to-market characteristic of futures.

There would be a gain on the futures hedge because the USD appreciates, in which case the FI will be compensated. The gain is calculated as follows:

$$N_f \times 62,500 \times \Delta f_t = N_f \times (\text{£}62,500) \times (\$1.55/\text{£} - \$1.45/\text{£}); \text{ where } N_f \text{ is obtained according to question (d).}$$

If you were to consider that N_f would be 250, then the gain would be \$1,562,500.

Some of you considered that:

At \$1.55/£, the value of the future is $25,000,000/1.55 = \text{£}16,129,032$

At \$1.45/£ the value of the future is $25,000,000/1.45 = \text{£}17,241,379$

The above indicates that the value of the futures in £ has gone up. Notice again that when the value of the (future) position in £ goes up, the value in \$ goes down. Since this is a futures contract, the FI will be compensated for the loss in the value of its position in \$ which occurs when the \$ appreciates in terms of the £ (it changes from \$1.55/£ to \$1.45/£). This is important to explain.

3. On Monday morning, you sell one CME (Chicago Mercantile Exchange) yen futures contract containing ¥ 12,500,000 at a price of \$0.009433. Suppose the broker requires an initial performance bond of \$4,590 and maintenance performance bond of \$3,400.¹ The settlement prices for Monday through Thursday are \$0.009542, \$0.009581, \$0.009375, and \$0.009369, respectively. On Friday, you close out the contract at a price of \$0.009394.

THIS PROBLEM IS FROM THE BOOK "MULTINATIONAL FINANCIAL MANAGEMENT" BY ALAN SHAPIRO.

- a. Calculate the daily cash flows on your account.
- b. Describe any necessary movements of money to avoid your account falling below the maintenance performance bond.

Since I had the footnote unclear, I am not taking points for not answering this question. ***Please notice that the footnote 1 is now corrected. It needed to have the sentence that is underlined.***

See next page for the solution to (a) and (b).

¹ The *initial performance bond*, which in this problem is \$4,590, shows how much money must be in the account balance when the future contract is entered into. Money should be added to the account if because of losses on the futures contract –the balance in the account falls below the *maintenance performance bond*, which in this problem is \$3,400. Example: If you have a maintenance performance bond of \$1620; start with an initial balance of \$1,770 in your account on a future contract; and your contract loses, say \$680 in value, your account will be \$110 ($1,770 - 680 = 1,090$) below the maintenance performance bond of say \$1,200. You must add \$530 to your initial account to meet the initial performance bond ($\$1,770 - \$680 + \$530 = \1620).

(a)

Time	Action	Cash Flow on Contract
Monday morning	Sell one CME yen futures contract. Price is \$0.009433.	None.
Monday close	Futures price rises to \$0.009542. Contract is marked-to-market.	You pay out $12,500,000 \times (0.009433 - 0.009542) = -\$1,362.50$
Tuesday close	Futures price rises to \$0.009581. Contract is marked-to-market.	You pay out an additional $12,500,000 \times (0.009542 - 0.009581) = -\487.50
Wednesday close	Futures price falls to \$0.009375. Contract is marked-to-market.	You receive $12,500,000 \times (0.009581 - 0.009375) = +\$2,375.00$
Thursday close	Futures price falls to \$0.009369. Contract is marked-to-market.	You receive an additional $12,500,000 \times (0.009375 - 0.009369) = +\75.00
Friday	You close out your contract at a futures price of \$0.009394.	You pay out $12,500,000 \times (0.009369 - 0.009394) = -\312.50
		Net gain on the futures contract <u>\$ 487.5</u>

(b)

Monday	With a loss of \$1,362.50, your account balance falls to \$3,227.50 (\$4,590 - \$1,362.50). You must add \$172.50 (\$3,400 - \$3,227.50) to your account to meet the maintenance performance bond of \$3,400.
Tuesday	With an additional loss of \$487.50, your balance falls to \$2,912.50 (\$3,400 - \$487.50). You must add \$487.50 to the balance to meet the maintenance performance bond of \$3,400.
Wednesday	With a gain of \$2,375, your balance rises to \$5,975.
Thursday	With a gain of \$75, your account balance rises further to \$6,050.
Friday	With a loss of \$312.50, your account balance falls to \$5,737.50.

c. What is your cash balance with your broker as of the close of business on Friday?

$$4590 + 487.5 + 12,500,000 \times 0.009394 = \$122,503.5$$

without considering the movements of money to avoid your account falling below the maintenance performance bond.

With the movements of money to avoid your account falling below the maintenance performance bond:

$$\$ 5737.5 + \$12,500,000 \times 0.009394$$

CREDIT RISK FORWARD CONTRACTS

4. A portfolio manager enters into a forward contract on a credit spread for company W. This contract is based on the credit spread of a newly issued bond by this company which has caused an increase in the current level of spread by 320 basis points. Suppose that the agreed forward credit spread at the time the contract is written, is 320 points ($=CS_F$), that the credit contract is of an amount equal to \$20 million ($=$ notional principal), and that the modified duration is 4.

a. If at the expiration date of this option the credit spread for this newly issued bond of this company W is 400 basis points, what is the dollar amount of the payoff? Who will be obtaining the gains of this contract, the buyer or the seller of the contract?

The seller is the portfolio manager.

$$CS_T = 400 > CS_F (=320)$$

The seller receives the gains: $(400 - 320) \times 20 \times 4 = \$ 640,000$

b. If at the expiration date of this option the credit spread for this newly issued bond of this company W is 200 basis points, what is the dollar amount of the payoff? Who will be obtaining the gains of this contract, the buyer or the seller of the contract?

$$CS_T = 200 < CS_F (=320)$$

The buyer receives the gains: $(320 - 200) \times 20 \times 4 = \$960,000$

PUT OPTIONS

5. Some people argue that:

“Insurance companies are in the business of writing put options”.

Demonstrate that a homeowner’s insurance policy acts as a put option. To facilitate your demonstration, assume the following:

- The homeowner buys a \$15,000 insurance policy to compensate for any damage to his/her house. Thus, consider this \$15,000 as the premium.
- The deductible is \$25,000. That is, if the house suffers \$4000 damage from a storm, the homeowner pays for all repairs himself/herself. If the house suffers \$45,000 in damage from a storm, he/she pays \$25,000 and the insurance company pays the remaining \$20,000.
- Consider that the value of the house is \$200,000 and this is recognized in the insurance policy and agreed by the homeowner and the insurance company.

