

INTEREST RATE RISK: FUTURES

- 1. In each of the following cases, indicate whether it would be appropriate for an FI to buy or sell a forward contract to hedge the appropriate risk.**

- a. A commercial bank plans to issue CDs in three months.**

The bank should sell a forward contract to protect against an increase in interest rates.

- b. An insurance company plans to buy bonds in two months.**

The insurance company should buy a forward contract to protect against a decrease in interest rates.

- c. A savings bank is going to sell Treasury securities it holds in its investment portfolio next month.**

The savings bank should sell a forward contract to protect against an increase in interest rates.

- d. A U.S. bank lends to a French company. The loan is payable in euros.**

The bank should sell euros forward to protect against a decrease in the value of the euro, or an increase in the value of the dollar.

- e. A finance company has assets with a duration of six years and liabilities with a duration of 13 years.**

The finance company should buy a forward contract to protect against decreasing interest rates that would cause the value of liabilities to increase more than the value of assets, thus causing a decrease in equity value.

2. Hedge Row Bank has the following balance sheet (in millions):

Assets	<u>\$150</u>	Liabilities	\$135
		Equity	<u>15</u>
Total	<u>\$150</u>	Total	<u>\$150</u>

The duration of the assets is six years and the duration of the liabilities is four years. The bank is expecting interest rates to fall from 10 percent to 9 percent over the next year.

a. What is the duration gap for Hedge Row Bank?

$$DGAP = D_A - k D_L = 6 - (0.9)(4) = 6 - 3.6 = 2.4 \text{ years}$$

b. What is the expected change in net worth for Hedge Row Bank if the forecast is accurate?

$$\text{Expected } \Delta E = -DGAP[\Delta R/(1 + R)]A = -2.4(-0.01/1.10)\$150\text{m} = \$3.272 \text{ million}$$

c. What will be the effect on net worth if interest rates increase 110 basis points?

$$\text{Expected } \Delta E = -DGAP[\Delta R/(1 + R)]A = -2.4(0.011/1.10)\$150 = -\$3.6 \text{ million.}$$

d. If the existing interest rate on the liabilities is 6 percent, what will be the effect on net worth of a 1 percent increase in interest rates?

Solving for the impact on the change in equity under this assumption involves finding the impact of the change in interest rates on each side of the balance sheet, and then determining the difference in these values. The analysis is based on the equation:

$$\text{Expected } \Delta E = \Delta A - \Delta L$$

$$\Delta A = -D_A[\Delta R_A/(1 + R_A)]A = -6[0.01/1.10]\$150\text{m} = -\$8.1818 \text{ million}$$

$$\text{and } \Delta L = -D_L[\Delta R_L/(1 + R_L)]L = -4[0.01/1.06]\$135\text{m} = -\$5.0943 \text{ million}$$

$$\text{Therefore, } \Delta E = \Delta A - \Delta L = -\$8.1818\text{m} - (-\$5.0943\text{m}) = -\$3.0875 \text{ million}$$

3. Tree Row Bank has assets of \$150 million, liabilities of \$135 million, and equity of \$15 million. The asset duration is six years and the duration of the liabilities is four years. Market interest rates are 10 percent. Tree Row Bank wishes to hedge the balance sheet with Eurodollar futures contracts, which currently have a price quote of \$96 per \$100 face value for the benchmark three-month Eurodollar CD underlying the contract. The current rate on three-month Eurodollar CDs is 4.0 percent and the duration of these contracts is 0.25 years.

- a. **Should the bank go short or long on the futures contracts to establish the correct macrohedge?**

The bank should sell futures contracts since an increase in interest rates would cause the value of the equity and the futures contracts to decrease. But the bank could buy back the futures contracts to realize a gain to offset the decreased value of the equity.

- b. **Assuming no basis risk, how many contracts are necessary to fully hedge the bank?**

The number of contracts to hedge the bank is:

$$N_F = \frac{-(D_A - kD_L)A}{D_F \times P_F} = \frac{-(6 - (0.9)4)\$150\text{m}}{0.25 \times 0.96 \times \$1,000,000} = -1,500 \text{ contracts}$$

- c. **Verify that the change in the futures position will offset the change in the cash balance sheet position for a change in market interest rates of plus 100 basis points and minus 50 basis points.**

For an increase in rates of 100 basis points, the change in the cash balance sheet position is:

Expected $\Delta E = -DGAP[\Delta R/(1 + R)]A = -2.4(0.01/1.10)\$150\text{m} = -\$3,272,727.27$.

Since there is no basis risk, $[\Delta R/(1 + R)] = [\Delta R_F/(1 + R_F)]$, and the change in the value of the \$1,000,000 face value futures contract is:

$$\Delta F = -D_F \times N_F \times P_F \times \frac{\Delta R_F}{1+R_F} = -0.25 \times (-1,500) \times 0.96 \times \$1,000,000 \times (0.01/1.10) \\ = \$3,272,727.27$$

For a decrease in rates of 50 basis points, the change in the cash balance sheet position is:
 Expected $\Delta E = -DGAP[\Delta R/(1 + R)]A = -2.4(-0.005/1.10)\$150m = \$1,636,363.64$.

The change in the value of the futures contract is:

$$\Delta F = -D_F \times N_F \times P_F \times \frac{\Delta R_F}{1+R_F} = -0.25 \times (-1,500) \times 0.96 \times \$1,000,000 \times (-0.005/1.10) \\ = -\$1,636,363.64$$

- d. **If the bank had hedged with Treasury bond futures contracts that had a market value of \$95 per \$100 of face value, a yield of 8.5295 percent, and a duration of 10.3725 years, how many futures contracts would have been necessary to hedge fully the balance sheet? Assume no basis risk.**

If Treasury bond futures contracts are used, the face value of the contract is \$100,000, and the number of contracts necessary to hedge the bank is:

$$N_F = \frac{-(D_A - kD_L)A}{D_F \times P_F} = \frac{-(6 - (0.9)4)\$150m}{10.3725 \times \$95,000} = \frac{-\$360,000,000}{\$985,387.5} = -365.338509 \text{ contracts}$$

- e. **What additional issues should be considered by the bank in choosing between Eurodollar or T-bond futures contracts?**

In cases where a large number of Treasury bonds are necessary to hedge the balance sheet with a macrohedge, the FI may need to consider whether a sufficient number of deliverable Treasury bonds are available. The number of Eurodollar contracts necessary to hedge the balance sheet is greater than the number of Treasury bonds, the Eurodollar market is much deeper and the availability of sufficient deliverable securities should be less of a problem.