Derivatives
Revisions 3
Questions

Hedging Strategies Using Futures

1. Under what circumstances are **a.** a short hedge and **b**. a long hedge appropriate?

A ***short hedge*** is appropriate when a company owns an asset and expects to sell that asset in the future. It can also be used when the company does not currently own the asset but expects to do so at some time in the future.
A ***long hedge*** is appropriate when a company knows it will have to purchase an asset in the future. It can also be used to offset the risk from an existing short position.

2. Explain what is meant by a ***perfect hedge***. Does a perfect hedge always lead to a better outcome than an imperfect hedge? Explain your answer.

A perfect hedge is one that completely eliminates the hedger's risk. A perfect hedge does not always lead to a better outcome than an imperfect hedge. It just leads to a more certain outcome. Consider a company that hedges its exposure to the price of an asset. Suppose the asset's price movements prove to be favorable to the company. A perfect hedge totally neutralizes the company's gain from these favorable price movements. An imperfect hedge, which only partially neutralizes the gains, might well give a better outcome.

3. A company has a $20 million portfolio with a beta of 1.2. It would like to use futures contracts on the S&P 500 to hedge its risk. The index futures price is currently standing at 1080, and each contract is delivery of $250 times the index. What is the hedge that minimizes risk? What should the company do if it wants to reduce the beta of the portfolio to 0.6?

The formula for the number of contracts that should be shorted gives:

$$1.2 \times \frac{20{,}000{,}000}{1{,}080 \times 250} = \mathbf{88.9}$$

Rounding to the nearest whole number, 89 contracts should be shorted. To reduce the beta to .6, half of this position, or a short position in 44 contracts, is required.

4. "For an asset where futures prices are usually less than spot prices, long hedges are likely to be particularly attractive". Explain this statement.

A company that knows it will purchase a commodity in the future is able to lock in a price close to the futures price. This is likely to be particularly attractive when the futures are less than the spot price.

5. On July 1, an investor holds 50,000 shares of a certain stock. The market price is $30 per share. The investor is interested in hedging against movements in the market over the next month and decides to use September Mini S&P futures contracts. The index futures price is currently 1,500 and one contract is for delivery of $50 times the index. The beta of the stock is 1.3. What strategy would the investor follow?

A short position in $1.3 \times \frac{50{,}000 \times 30}{50 \times 1{,}500} = \mathbf{26}$, contracts is required

6. An airline executive has argued. "There is no point in our using oil futures. There is just as much chance that the price oil in the future will be less than the futures price as there is that will be greater than this price". Discuss the executive's viewpoint.

It may well be true that there is just as much chance the price of oil in the future will be above the futures price as that it will be below the futures price. This means that the use of a futures contract for speculation would be like betting on whether a coin comes up heads or tails. But it might make sense for the airline to use futures for hedging rather than speculation. The futures contract then has the effect of reducing risks. It can be argued that an airline should not expose its shareholders to risks associated with the future price of oil when there are contracts available to hedge the risks.

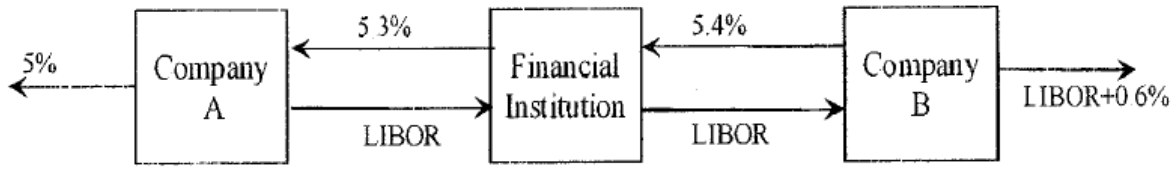
Swaps

1. Companies A and B have been offered the following rates per annum on a $20 million 5-year loan:

	Fixed rate	Floating rate
Company A	5.0%	LIBOR + 0.1%
Company B	6.4%	LIBOR + 0.6%

Company A requires a floating-rate loan; company B requires a fixed rate loan. Design a swap that will net a bank, acting as intermediary, 0.1% per annum and that will appear equally attractive to both companies.

A has an apparent comparative advantage in fixed-rate markets but wants to borrow floating. B has an apparent comparative advantage in floating-rate markets but wants to borrow fixed. This provides the basis for the swap.
There is a 1.4% per annum differential between the fixed rates offered to the two companies and a 0.5% per annum differential between the floating rates offered to the two companies. The total gain to all parties from the swap is therefore 1.4-0.5=0.9% per annum. Because the bank gets 0.1% per annum of this gain, the swap should make each of A and B 0.4% per annum better off. This means that it should lead to A borrowing at LIBOR-0.3% and to B borrowing at 6.0%. The appropriate arrangement is therefore shown below.



2. Company X wishes to borrow US dollars at a fixed rate of interest. Company Y wishes to borrow Japanese yen at a fixed rate of interest. The amounts required by the two companies are roughly the same at the current exchange rate. The companies are subject to the following interest rates, which have been adjusted to reflect the impact of taxes:

	Yen	Dollar
Company X	5.0%	9.6%
Company Y	6.5%	10.0%

Design a swap that will net a bank, acting as intermediary, 50 basis points per annum. Make the swap equally attractive to the two companies and ensure that all foreign exchange risk is assumed by the bank.

X has a comparative advantage in yen markets but wants to borrow dollars. Y has a comparative advantage in dollar markets but wants to borrow Yen. This provides the basis for the swap. There is a 1.5% per annum differential between the Yen rates and a 0.4% per

annum differential between the dollar rates. The total gain to all parties from the swap is therefore 1.5%-0.4% = 1.1% per annum. The bank requires 0.5% per annum,, leaving 0.3% per annum for each of x and Y. The swap should lead to X borrowing dollars at 9.6%-0.3% = 9.3% and to Y borrowing Yen at 6.5%-0.3% = 6.2% per annum. The appropriate arrangement is therefore as shown below. All foreign exchange risk is borne by the bank.

3. A financial institution has entered into a **10-year** currency swap with company Y. Under the terms of the swap the financial institution receives interest at **3%** per annum in Swiss Francs and pays interest at **8%** per annum in U.S. Dollars. Interest payments are exchanged once a year. The principle amounts are **7** million Dollars and **10** million Francs. Suppose that company Y defaults on the payments at the end of year 6 when the exchange rate is **$0.80** per Franc. Assume that at the end of year **6** the interest rate is **3%** per annum in Swiss Francs and **8%** per annum in U.S. dollars for all maturities. All interest rates are quoted with annual compounding.
Evaluate the cost to the financial institution of the default of company Y.

Year	$ paid	Swiss Francs	Forward rate	Dollar Equiv.	Cash flows	Discount: 8%
6	560,000	300,000	0.8	240000	-320,000	320,000
7	560,000	300,000	0.8388	251640	-308,360	285,555
8	560,000	300,000	0.8796	263880	-296,120	253,858
9	560,000	300,000	0.9223	276690	-283,310	224,892
10	7m+560,000	10,300,000	0.967	9960100	2,400,100	1,764,145
					Default Cost	**679,838**

4. A currency swap has a remaining life of 15 months. It involves exchanging interest at 10% on £20 million for interest at 6% on $30 million once a year. The term structure of interest rates in both the United Kingdom and the United states is currently flat, and if the swap were negotiated today the interest rates exchanged would be 4% in dollars and 75 in sterling. All interest rates are quoted with annual compounding. The current exchange rate (dollars per pound sterling) is 1.8500. What is the value of the swap to the party paying sterling? What is the value of the swap to the party paying dollars?

The swap involves exchanging the sterling interest of 20×0.10=2.0 million for the dollar interest of 30×0.06=$1.8 million. The principal amounts are also exchanged at the end of the life of the swap. The value of the sterling bond underlying the swap is:

$$\frac{2}{(1.07)^{1/4}} + \frac{22}{(1.07)^{5/4}} = 22.182 \text{ million pounds}$$

The value of the dollar bond underlying the swap is

$$\frac{1.8}{(1.04)^{1/4}} + \frac{31.8}{(1.04)^{5/4}} = 32.061 \text{million pounds}$$

The value of the swap to the party paying sterling is therefore:

$$32.061 - (22.182 \times 1.85) = -\$8.976 \text{ million}$$

The value of the swap to the party paying dollars is +$8.976 million. The results can also be obtained by viewing the swap as a portfolio of forward contracts. The continuously compounded interest rates in sterling and dollars are 6.766% per annum and 3.922% per annum.

The 3-month and 15-momth forward exchange rates are $1.85e^{(0.03922-0.06766)\times 0.25} = 1.8369$ and $1.85e^{(0.03922-0.06766)\times 1.25} = 1.7854$. the values of the two forward contracts corresponding to the exchange of interest for the party paying sterling are therefore,

$(1.8 - 2 \times 1.8369)e^{-0.03933\times 0.25} = -\$1.855$ million
$(1.8 - 2 \times 1.7854)e^{-0.03933\times 1.25} = -\$1.686$ million

The value of the forward contract corresponding to the exchange of principal is

$(30 - 20 \times 1.7854)e^{-0.03933\times 1.25} = -\$5.4355$ million

The total value of the swap is -$1.855-$1.686-$5.435 = -$8.976 million