Chapter 3

Hedging Strategies using Futures

Definition 3.1

- A short hedge is a hedge involving a short position in a futures contract
- A long hedge is a hedge involving a long position in a futures contract

Remark 3.2

- Short hedges are appropriate when you know you will sell the asset in the future
- Long hedges are appropriate when you know you will buy the asset in the future

Remark 3.2 (continued)

- Arguments for hedging: Minimizing risks arising from interest rates, exchange rates, and other market variables
- Arguments against hedging: Shareholders can do it themselves, risk may increase if competitors do not hedge, explaining a situation where there is a loss on the hedge and a gain on the underlying can be difficult

Definition 3.3

- The basis in a hedging situation is defined by

  $b_i=S_i-F_i$
- If b_i is increasing, we say that this is strengthening of the basis
- If b_i is decreasing, this is called weakening of the basis

Example 3.4

Assume a hedge is put in place at time 1 and closed out at time 2, $S_1=2.50$, $F_1=2.20$, $S_2=2.00$, $F_2=1.90$

- If hedger knows that asset will be sold at time 2, what is the effective price that is obtained for the asset with hedging?
- If hedger knows that asset will be purchased at time 2, what is the effective price that is paid for the asset with hedging?

Definition 3.5

- Cross hedging occurs if the asset underlying the futures price is not the same as the asset whose price is being hedged.
- The hedge ratio is the ratio of the size of futures contracts to the size of shares of the underlying held.
- The minimum variance hedge ratio h^* is the hedge ratio that results in the risk (measured by the variance) being minimal.

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Theorem 3.6

$$h^* = \rho_{SF}\sigma_S/\sigma_F$$

where σ_S and σ_F are the standard deviations of ΔS and ΔF, respectively, and ρ_{SF} is the correlation coefficient between ΔS and ΔF.

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Example 3.7

An airline expects to purchase 2 million gallons of jet fuel in one month and decides to use heating oil futures for hedging. One futures contract is on 42,000 gallons. It is given that the standard deviations of the changes in fuel price and in the futures price (per gallon) are 0.03 and 0.04, respectively, and the correlation coefficient between these two changes is 0.9.

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Example 3.8

An airline expects to purchase 2 million gallons of jet fuel in one month and decides to use heating oil futures for hedging. One futures contract is on 42,000 gallons.

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Example 3.8 (continued)

Month i	Change in fuel price per gallon x_i	Change in futures price per gallon y_i
1	0.029	0.021
2	0.020	0.035
3	-0.044	-0.046
4	0.008	0.001
5	0.026	0.044
6	-0.019	-0.029
7	-0.010	-0.026
8	-0.007	-0.029
9	0.043	0.048
10	0.011	-0.006
11	-0.036	-0.036
12	-0.018	-0.011
13	0.009	0.019
14	-0.032	-0.027
15	0.023	0.029

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Example 3.9

A stock index tracks changes in the value of a hypothetical portfolio of stocks. Futures contracts on stock indices are settled in cash.

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Example 3.9 (continued)

The beta β of a portfolio is defined by

$\beta_V=\rho_{VM}\sigma_V/\sigma_M$

and it satisfies (Capital Asset Pricing Model)

$\beta=(\mu_V-r_F)/(\mu_M-r_F)$.

Example 3.9 (continued)

We assume now:

- Value of S&P500 index: 1000
- Value of portfolio: 5,000,000
- Risk-free interest rate: r_F=4% p.a.
- Dividend yield on index: 1% p.a.
- Beta of portfolio: β=1.5
- One futures contract is $1010 and for delivery of 250 times the index