Hedging Strategies Using Futures

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BASIC PRINCIPLES

Short Hedge
- Short Position in Futures contract
- Appropriate when hedger already owns an asset and expects to sell it at some time in the future

Long Hedge
- Long Positions in a futures contract
- Appropriate when a company knows it will have to purchase a certain asset in the future and wants to purchase a certain asset in the future and wants to lock in a price now

ARGUMENTS FOR AND AGAINST HEDGING
- Non-Financial companies have no particular skills or expertise in predicting variables such as interest rates, exchange rates, and commodity prices.
- By hedging, companies can focus on their main activity without worrying about sharp rises in the price of commodity

- It assumes that shareholders have as much information as the company's management about the risks faced by a company. But mostly this is not true.
- Commissions and other cost
- Diversified Portfolio. Immune to risk faced by corporations

- A company that does not hedge can expect its profit margins to fluctuate.

BASIS RISK

- The asset whose price is to be hedged may not be exactly the same as the asset underlying the futures contract
- There may be uncertainty as to the exact date when the asset will be brought or sold.
- The hedge may require the futures contract to be closed out before its delivery month

Basis = Spot price of asset to be hedged - Futures price of contract used

Increase in Basis is strengthening of the basis
Decrease in Basis is Weakening of the basis

B1 = S1 - F1 and b2 = S2 - F2

B2 = S2-F2

Adding F1 both sides

S2 -F2 + F1 = b2 + F1 the effective price the asset is obtained for

Choice of Contract
- The choice of the asset underlying the futures contract
- The choice of the delivery month

Long hedgers normally prefer to close out the futures contract and buy the asset from their usual suppliers

In general, basis risk increases as the time difference between the hedge expiration and the delivery month increases.
Choose a delivery month that is as close as possible to, but then, the expiration of the hedge

CROSS HEDGING

Cross Hedging occurs when the two assets are different. Instead of hedging against jet fuel futures (Not actively traded) it might choose to use heating oil futures contract to hedge its exposure.
The hedge ratio is the ratio of the size of the position taken in futures contracts to the size of the exposure. While cross hedging, the ratio is not 1.0

ΔS: Change in spot price, S, during a period of time equal to the life of the hedge

ΔF: Change in futures price, F, during a period of time equal to the life of the hedge.

If we assume that the relationship between ΔS and ΔF is approximately linear (see Figure 3.2), we can write:

$$\Delta S = a + b\Delta F + \epsilon$$

where a and b are constants and ϵ is an error term. Suppose that the hedge ratio is h (i.e., a percentage h of the exposure to S is hedged with futures). Then the change in the value of the position per unit of exposure to S is

$$\Delta S - h\Delta F = a + (b - h)\Delta F + \epsilon$$

The standard deviation of this is minimized by setting $h = b$ (so that the second term on the right-hand side disappears).

Denote the minimum variance hedge ratio by h^*. We have shown that $h^* = b$. It follows from the formula for the slope in linear regression that

$$h^* = \rho\frac{\sigma_S}{\sigma_F} \tag{3.1}$$

Optimal Number of Contracts

Q_A: Size of position being hedged (units)

Q_F: Size of one futures contract (units)

N^*: Optimal number of futures contracts for hedging.

$$N^* = \frac{h^* Q_A}{Q_F}$$

Impact of Daily Settlement

$\hat{\sigma}_S$: Standard deviation of percentage one-day changes in the spot price

$\hat{\sigma}_F$: Standard deviation of percentage one day changes in the futures price

$\hat{\rho}$: Correlation between percentage one-day changes in the spot and futures.

The standard deviation of one-day changes in spot and futures are $\hat{\sigma}_S S$ and $\hat{\sigma}_F F$. Also, $\hat{\rho}$ is the correlation between one-day changes. It follows from equation (3.1) that the optimal one-day hedge is

$$h^* = \hat{\rho}\frac{\hat{\sigma}_S S}{\hat{\sigma}_F F}$$

so that from equation (3.2)

$$N^* = \hat{\rho}\frac{\hat{\sigma}_S S Q_A}{\hat{\sigma}_F F Q_F}$$

The hedge ratio in equation (3.1) is based on regressing actual changes in spot prices against actual changes in futures prices. An alternative hedge ratio, $\hat{h}$, can be derived in the same way by regressing daily percentage changes in spot against daily percentage changes in futures:

$$\hat{h} = \hat{\rho}\frac{\hat{\sigma}_S}{\hat{\sigma}_F}$$

Then

$$N^* = \frac{\hat{h} V_A}{V_F} \tag{3.3}$$

STOCK INDEX FUTURES

A stock index tracks changes in the value of a hypothetical portfolio of stocks. Dividends are usually not included in the calculation so that the index tracks the capital gain/loss from investing in the portfolio.

The weights could be assigned to stock price, market prices and market cap.

Stock Indices
The Dow Jones Industrial Average is based on a portfolio consisting of 30 blue chip stocks in the United States. The weights given to the stocks are proportional to their prices. The CME Group trades two futures contracts on the index. One is on \$10 times the index and the other is \$5 times the index. Mini DJ Industrial Average

The S&P500 Index is based on a portfolio of 500 different stocks: 400 industrials, 40 utilities, 20 transportation companies, and 40 financial institution. The weight of the stocks in the portfolio at any given time are proportional to their market cap. CME group trades two futures contracts \$250 times the index and \$40 times the index. The mini contracts are traded more actively.

The Nasdaq-100 is based on a portfolio of 100 stocks traded on the Nasdaq exchange with weights proportional to market cap. CME Group trades two futures \$100 times and \$20 times.

Hedging an Equity Portfolio

Stock index futures can be used to hedge a well-diversified equity portfolio. Define:

V_A: Current value of the portfolio

V_F: Current value of one futures contract (the futures price times the contract size).

If the portfolio mirrors the index, the optimal hedge ratio can be assumed to be 1.0 and equation (3.3) shows that the number of futures contracts that should be shorted is

$$N^* = \frac{V_A}{V_F} \qquad \textbf{(3.4)}$$

When the portfolio does not mirror the index, we can use capital asset pricing model.
The parameter **beta** from the capital asset pricing model is the slope of the best-fit line obtained when excess return on the portfolio over the risk-free rate is regressed against the excess return of the index over the risk-free rate.
When beta = 1.0, the return on the portfolio tends to mirror the return on the index; when beta = 2.0 the excess return on the portfolio tends to be twice the excess return on the index.

Beta 2 is twice more sensitive to market movement, then beta 1.

$$N^* = \beta\frac{V_A}{V_F}$$

Reasons for Hedging an Equity Portfolio

- Hedging is justified if the hedger feels that the stock in the portfolio have been chosen but is uncertain about the performance of the market's performance as a whole, but still is confident the portfolio would outperform the market.
- Wants to hold the portfolio for a long term but needs a short term protection in a uncertain market situation.

For Short position

$$(\beta - \beta^*)\frac{V_A}{V_F}$$

For Long Position

$$(\beta^* - \beta)\frac{V_A}{V_F}$$

STACK AND ROLL