The Dojima Rice Market and the Origins of Futures Trading

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The Minimum Variance Hedge Ratio

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The Origins of the Futures Market

The Dojima rice market which existed under the rule of the Tokugawa Shogunate in the late 17th and early 18th century was the first example of a futures market in history, established to finance the samurai warriors (Schaede, 1989).

Therefore, the prime goal of the futures market is to facilitate the mitigation of risks which producers and investors are faced with in the underlying spot markets (Holmes, 1996)

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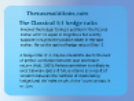
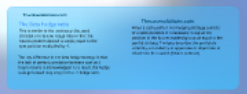
Three types of hedge ratios:

1. Classical 1:1 hedge ratio 
2. The Beta hedge ratio 
3. The Minimum Variance hedge ratio 

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The Classical 1:1 hedge ratio

Involves the hedger taking a position in the futures market which is equal in magnitude but exactly opposite in sign to the position taken in the spot market. Hence the optimal hedge ratio will be -1.

A hedge ratio of -1 may be unrealistic due to the lack of perfect correlation between spot and future returns (Hull, 2009): Perfect correlation is unlikely to exist between spot and future returns as a result of variation between the portfolio of assets being hedged and the index on which the future contract is written.

The Beta hedge ratio

This is similar to the previously discussed classical one-to-one hedge ratio in that the futures position desired is simply equal to the spot position multiplied by -1.

The key difference in the beta hedge strategy is that the lack of perfect correlation between spot and future returns is acknowledged. As a result, the hedge ratio generated may stray from a -1 hedge ratio.

When a cash position in a hedging strategy consists of a stock portfolio it is necessary to adjust the position in the futures market by a value equal to the portfolio's beta. The beta describes the portfolio's volatility, or tendency to appreciate or depreciate in relation to the market (futures contract).

The Minimum Variance Hedge Ratio (Johnson, 1960)

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This approach applies modern portfolio theory to the original target of risk minimization. The portfolio used is made up of a spot and futures position with the following equation representing the price change variance as demonstrated by Lindahl(1992);

$$\sigma^2(\Delta p_t) = x_s^2\sigma^2(\Delta s_t) + x_f^2\sigma^2(\Delta f_t) + 2x_s x_f cov(\Delta s_t, \Delta f_t)$$

$\Delta s_t, \Delta f_t$ and $\Delta p_t \rightarrow$ Price change witnessed over given period 't' of spot, futures and portfolio.

$x_s \& x_f \rightarrow$ The proportion of stock and futures contracts respectively in the portfolio. (in the MVHR approach, the spot position is fixed hence x_s=1.)

$\sigma^2 \rightarrow$ variance of the changes in price.