***Example: Optimal Hedge Ratio***

**Question:** Today is 1st January. An Australian pig farmer plans to sell pigs on 15th January. He’s afraid of the pig price falling.

Unfortunately there are:

* No Australian Securities Exchange (ASX) futures on hogs. So he’ll have to cross-hedge using United States CME hog futures.
* No US CME hog futures expiring in January. The next one expires on 13th February.

Revised: 15.3.17

Assume the following:

* 40% correlation between Australian hog prices and US CME hog futures prices;
* 30% pa standard deviation of Australian pig prices;
* 15% pa standard deviation of US CME hog futures prices.
* The Australian farmer plans to sell 300,000 pounds of pigs on 15Jan.
* One US CME hog futures contract is on 40,000 pounds of pigs.
* Australian pig prices are $0.70 per pound on 1Jan.
* US CME hog futures contracts maturing on 13Feb have a futures price of $0.63 per pound on 1Jan.

**Answer:** The Australian pig farmer should hedge against falls in the pig price by **selling** futures that expire on 13Feb. He should short the futures today (1Jan).

On 15Jan when he sells the pigs, he should then ‘close out’ the short futures by **buying** lean hog futures contracts that expire on 13Feb.

There will be basis risk caused by cross-hedging and the premature closing out of futures. But the risk can be minimised using the optimal hedge ratio ($h$):

$$h=ρ\_{S\_{T},F\_{0,T}}.\frac{σ\_{S\_{T}}}{σ\_{F\_{0,T}}}=0.4×.\frac{0.3}{0.15}=0.8$$

The hedge ratio can be interpretted as: “A 1% increase in the US CME hog futures price is expected to cause a 0.8% increase in the Australian pig price”.

Calculate the optimal number of futures contracts (n) to buy, which requires tailing since futures have margin accounts:

$$n\_{tailing}=h.\frac{V\_{S}}{V\_{F}}=h.\frac{Q\_{S}.S\_{t}}{Q\_{F}.F\_{t,T}}=0.8×\frac{300,000×0.7}{40,000×0.63}=6.67$$

Since fractions of futures contracts can’t be bought, round the answer to the nearest whole number of contracts which is 7.

Therefore the Australian pig farmer should short 7 futures contracts on 1Jan, then when he sells his pigs on 15Jan he should long another 7 contracts that also mature on 13Feb to close out his position. The hedge is imperfect since there will be basis risk.