

Regression and Hedging

Administrative Things

- Assignment 7 due on Thursday, April 8.
- Read *Decision Traps* for next week.

Today's Topics

- Use of regression in for determining how much to hedge.
 - Position of a corn-grower
 - The farmer can either not hedge, hedge the complete expected crop, or hedge some of the crop. In the last case, how much should be hedged?
 - Goal of hedging is to reduce variation and therefore increase utility.

Review from Last Time

- Perfect hedge
 - No variation in the future value of the asset, with no cost for the hedge, locking in the desired price.
- Introduction of uncertainty
 - What happens when the future quantity and price are both unknown?

Minimum Variance Hedge – The Fully Hedged Position

- Base situations have variation in “opposite directions”.
 - No hedge: Farmer sells crop at market price.
 - Fully hedged: Farmer sells futures contracts for expected production.
 - Neither avoids the variance due to price sensitivity.

➤ Combine these to hedge risks

- Farmer sells enough futures contracts to *obtain minimum variation* in total value of sold crop.
- Think of the relationship of price of a single bushel future contract as a function of the delivery price (contract) and the final price at the time the contract is exercised. It's a line with a slope of -1 .
- If the contract price = $E(\text{spot price})$, then purchasing a futures contract lowers the variance of the farmer's future wealth with no decrease in variation. It's a free ride!

➤ Aside on data – Price/quantity relationship

- Historical data for US probably has more correlation of production with price than would be the case if we had more local data.
- Correlation would be closer to zero for “my farm” since the ups and downs for my production are going to have less impact on prices than nationally.
- The size of the hedge is dependent on this type of correlation, so if “your” correlation is smaller, then this will underestimate the size of the hedge.

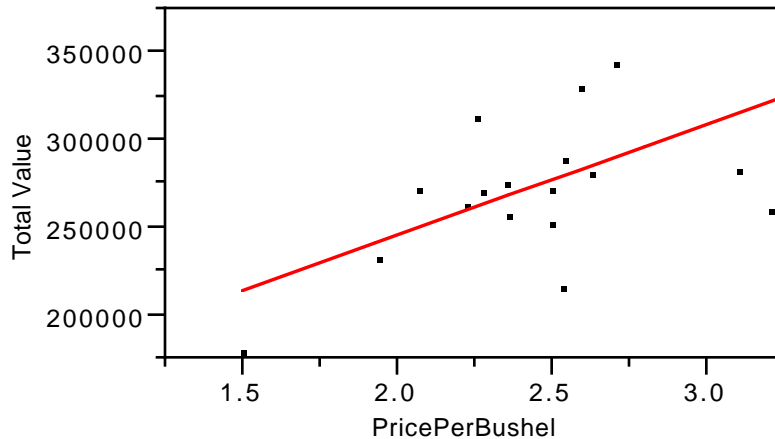
Why? Draw the pictures of total value on price for an uncorrelated farmer and a correlated farmer. Market forces of supply and demand naturally hedge the correlated farmer. They don't reduce the variation for the uncorrelated farmer.

➤ Regression of total value of crop on prices

- National data since 1980. (Annually, 1980-1997)

$$\text{Total Value} = 120085 + 62656.5 \text{ PricePerBushel}$$

- Total value for a 1,000 acre farm implies that this farmer should hedge about 63,000 bushels.



The units of the regression slope should help you here. Note that the response is in \$'s. The predictor is in \$'s/Bu, so the slope must have units in bushels.

- The expected production of the 1,000 acre farm over this period is about 275,000 bushels, so this hedge represents about 25% of the expected production.
 - Again, recall that this estimate is for a very correlated farmer. One that is less correlated would want to hedge more.
 - If the farmer was entirely uncorrelated, the hedge should be about the total value of the farm.

[Hedging the Farm Viewed As Financial Instruments](#)

➤ Future contract as an instrument

- Future contract “costs nothing” to enter. It’s a promise.
- Value of one contract is inversely proportional to the difference in selling price and the contracted price.

Eg. If the contract price for corn is \$2/Bu and corn is selling for \$2.50 at the time the contract is exercised (spot price), this investment has cost you \$0.50 (since you now have to spend \$0.50 to buy a bushel to deliver).

- You can buy as many of these as you want since they are essentially “self-financing” in the sense used in discussing (VW – RF).

- Would you want to purchase these?

They are just like any other instrument. Viewed alone, we would buy in proportion to $E(F)/\text{Var}(F)$.

The expected value depends on the relationship between the contract price and the spot price at time of delivery

- Relationship of spot price and contracted delivery price

In an efficient market, with lots of parties on either side, the difference in prices is going to be close to zero.

If it moves far from zero, speculators will enter market looking for arbitrage opportunities, driving the differences in prices back to zero.

- Bottom line: Unless you are a farmer, you don't want to purchase futures contracts. If you are a farmer, you don't want to purchase more than the minimum variance amount.

➤ Better data would be helpful

- To check these claims, we would need to look at the history of delivery and spot prices.

➤ Farming production as an investment

- Hard to view the farm as self-financing since we need to know the costs associated with the farm operations.
- If you own a farm with 1,000 acres, then you have many choices, such as how much to farm and how much to lease to others for farming.
- Leasing allows you to reduce your risks.

Similar to what we found with projects. If you have something with positive expected value, but too much risk, sell off some of the risk.

[Next Time](#)

- Subjective confidence intervals.