ST260 Introductory to Statistics

Project Question: Detection of Rigged School milk prices

Each year, the state of Kentucky invites bids from diaries to supply half-pint containers of fluid milk products for its school districts. In several school districts in northern Kentucky (called the "tricounty" market), two suppliers-Meyer Dairy and Trauth Dairy - were accused of price-fixing - That is, conspiring to allocate the districts so that the winning bidder was predetermined and the price per pint was set above the competitive price. These two dairies were the only two bidders on the milk contracts in the tricounty market between 1983 and 1991. (In contrast, a large number of different dairies won the milk contracts for school districts in the remainder of the northern Kentucky market, called the "surrounding" market.) Data on all bids received from the dairies competing for the milk contracts between 1983 and 1991 are saved in the **MILK** file.

Variable	Description
Year	Year in which milk contact awarded
Market	Northern Kentucky Market (Tri-COUNTY or SURROUND)
Winner	Name of winning dairy
WWBID	Winning bid price of whole white milk (dollars per half-pint)
LFWBID	Winning bid price of low-fat white milk (dollars per half-pint)
LFCBID	Winning bid price of low-fat chocolate milk (dollars per half-pint)
District	School district number

Please answer the below questions:

(a). Did Meyer and Trauth conspire to rig their bids in the tricounty market? Economic theory states that, if so, the mean winning price in the rigged tricounty market will be higher than the mean winning price in the competitive surrounding market. Is there support for the claim that the dairies in the tricounty market participated in collusive practices?

(b). Market allocation is a common form of collusive behaviour in bid-rigging conspiracies. Under collusion, the same dairy usually controls the same school districts year after year. The **incumbency rate** for a market is defined as the proportion of school districts that are won by the vendor that won the previous year. Past experience with milk bids in a competitive environment reveals that a typical incumbency rate is 0.7. That is, 70% of the school districts are expected to purchase their milk from the dairy that won the previous year. Incumbency rates of 0.9 or higher are strong indicators of collusive bidding. Over the years, when bid collusion was alleged to have occurred in northern Kentucky, there were 51 potential vendor transitions (i.e. changes in milk supplier from one year to the next year in a district.) in the tricounty market, and 134 potential vendor transitions in the surrounding market. By comparing the two incumbency rates of the tricounty and surrounding milk markets, can you get the results to further support for the bid collusion theory?

Background information

- Collusive Market Environment: certain economic features of a market create an environment in which collusion may be found. These basic features include the following:

- Few sellers and high concentration. Only a few diaries control all or nearly all of the milk business in the market.
- Homogeneous products. The products sold are essentially the same from the standpoint of the buyer, i.e., the school district.
- Inelastic demand. Demand is relatively insensitive to price. Note: the quantity of milk required by a school district is primarily determined by school enrollment, not price.
- similar costs. The dairies bidding for the milk contracts face similar cost conditions. Note: approximately 60% of a dairy's production cost is raw milk, which is federally regulated. Meyer and Trauth are dairies of similar size, and both bought their raw milk from the same supplier.

- Collusive Bidding Patterns: The analyses of patterns in sealed bids reveal much about the level of competition, or lack thereof, among the vendors serving the market. Consider the following bid analyses:
  - Market shares. A market share for a dairy is the number of milk half-pint supplied by the diary over a given school year, divided by the total number of half-pints supplied to the entire market. One sign of potential collusive behavior is stable, nerly equal market shares over time for the dairies under investigation.
  - Incumbency rates. Market allocation is a common form of collusive behaviour in bidrigging conspiracies. Typically, the same dairy controls the same school districts year after year. The incumbency rate for a market in a given school year is defined as the percentage of school districts that are won by the same vendor who won the previous year. An incumbency rate that exceeds 70% has been considered a sign of collusive behaviour.
  - Bid levels and dispersion. In competitive sealed bid markets, vendors do not share information about their bids. Consequently, more dispersion or variability among the bids is observed than in collusive markets., where vendors communicate about their bids and have a tendency to submit bids in close proximity to one another in an attempt to make the bidding appear competitive. Furthermore, in competitive markets the bid dispersion tends to be directly proportional to the level of the bid: when bids are submitted at relatively high levels, there is more variability among the bids than when they are submitted at or near marginal cost, which will be approximately the same among dairies in the same geographic market.
  - Price versus cost/distance. In competitive markets, bid prices are expected to track costs over time. Thus, if the market is competitive, the bid price of milk should be highly correlated with raw milk cost. Lack of such a relationship is another sign of collusion. Similarly, bid price should be correlated to the distance the product must travel from the processing plant to the school (due to delivery costs) in a competitive market.
  - Bid sequence. School milk bids are submitted over the spring and summer months, generally at the end of one school year and before the beginning of the next. When the bids are examined in sequence in competitive markets, the level of bidding is expected to fall as the bidding season progresses. (This phenomenon

is attributable to the learning process that occurs during the season, with bids adjusted accordingly. Dairies may submit relatively high bids early in the season to "test the market", confident that volume can be picked up later if the early high bids lose. But, dairies who do not win much business early in the season are likely to become more aggressive in their bidding as the season progresses, driving price levels down.) Constant or slightly increasing price patterns of sequential bids in a market where a single dairy wins year after year is considered another indication of collusive behaviour.

– Comparison of average winning bid prices. Consider two similar markets, one in which bids are possibly rigged and the other in which bids are competitively determined. In theory, the mean winning price in the "rigged" market will be significantly higher than the mean price in the competitive market for each year in which collusion occurs.