Econ 3385: Measuring Market Power

Problem Set 5

In this problem set, we'll analyze `arlines_long.csv`. This dataset contains real data on average prices and quantity data from 3 major airlines (+ "other" airlines combined) at the origin-destination-quarter level for direct flights. The variables in the data are:

- `route_city`: Origin and destination airports.
- `route_id`: A numerical code for each route_city.
- `airline`: Airline.
- `airline_id`: A numerical code for each airline.
- `quarter`: This is an index of time. There are 4 quarters in the data.
- `price`: Price.
- `logp`: log(price).
- `passengers`: quantity of tickets sold.
- `logq`: log(passengers).
- `avg_hub`: A measure of the airline's "hub" status at the origin and destination airports - the average number of other flights that airline has from those airports.
- `avg_pop`: Average population of origin and destination.

You can use the code from the lecture 5 folder for hints.

Questions

1. Reshape the data so there are 4 price, 4 log price, 4 quantity, 4 log quantity, and 4 hub variables - one for each airline. A row in the reshaped data should be a route-quarter. For each route-quarter there is only one value of `avg_pop` (it doesn't vary across airlines for obvious reasons).
2. Let's estimate the following demand system:

$$log(Q_{jct}) = \alpha_j + \beta^{POP} avg\_pop_{ct} + \sum_{k=1}^{4} \beta_{jk} log(p_{kct}) + \epsilon^D_{jct}$$

   - Where j is an airline, c is a route, and t is a quarter.
   - Why is `avg_pop` in the demand equation?
   - What do the β_{jk} coefficients mean under the log-log specification?

3. Suppose prices are set in Nash-Bertrand equilibrium with constant marginal costs. Each route-quarter is a separate market.
   - Write down the pricing equations for the four airlines.
   - Suppose marginal costs are given by:

$$c_{jct} = \delta_0 + \delta_1 avg\_hub_{jct} + \nu_{jt} + \epsilon^S_{jct}$$

- Identify 8 valid instruments for the 4 endogenous variables under the assumption that $Cov(\epsilon^D_{jct}, \epsilon^D_{jc't}) = 0$ and $Cov(\epsilon^D_{jct}, \epsilon^S_{jc't}) = 0$.
- HINT: There are two types of instruments for each firm j's price.

4. Construct (if necessary) the instruments, and use all 8 instruments to estimate the 4 demand equations using 2SLS.
   - Report the estimated coefficients in a table.
   - Provide an interpretation. Don't worry if the "Other" price has the wrong sign in demand for AA, UA, or DL.
5. Compute implied marginal costs for AA, UA, and DL (not Other). HINT: be careful with the functional form of $Q(p)$!
6. Simulate a merger of AA and UA. Assume that UA+AA and DL price according to Nash-Bertrand, but "Other" holds prices fixed.
   - Report average price changes.
   - Report changes in profit.
7. Now do the same for AA+DL and UA+DL to give 3 counterfactual merger sims total. Compare the results and discuss.