Homework 5: Computational Methods for Economists

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Matching: Maximum Score Estimator

The payoff to the merger between radio station buyer b and target t in market m is given by:

$$f_m(b,t) = x_{1bm}y_{1tm} + \alpha x_{2bm}y_{1tm} + \beta distance_{btm} + \epsilon_{btm} \tag{1}$$

We estimate equation (1) for α and β parameters.
If we let the pay-off function include target characteristics, we have:

$$f_m(b,t) = \delta x_{1bm}y_{1tm} + \alpha x_{2bm}y_{1tm} + \gamma HHI_{tm} + \beta distance_{btm} + \epsilon_{btm} \tag{2}$$

Then we estimate all the parameters: α, β, γ and δ.

- An important assumption is that each side (buyer or target) maximises their payoffs. This means the total value is maximised in equilibrium.
- It must also be the case that in equilibrium all observed matches yield higher value than the counterfactual matches (matches we don't observe)

With this information plus equations (1) and (2), we can write the Maximum Score estimator:

$$\hat{\beta} = argmaxQ(\beta) = \sum_{y=1}^{Y}\sum_{b=1}^{M_y-1}\sum_{b'=b+1}^{M_y} \mathbb{1}[f(b,t|\beta) + f(b',t'|\beta) \geq f(b',t|\beta) + f(b,t'|\beta)] \tag{3}$$

Steps I followed:

- First I scaled the price and population variables: I divided them by 1000 and take logs. Then I dropped the original population and price variables because I don't need them.
- Distance (km) column added using geopy.
- Yearly markets are separated, year 2007 and year 2008
- Then buyer and target characteristics are sorted separately, followed by matrix of counterfactuals.
- Then I defined the payoff functions for the two models, the payoff function with and without transfers.
- With the payoff functions defined, I calculate the payoffs for the actual and counterfactual functions.
- Finally I defined the objective functions to be maximised and estimated the model.
- IMPORTANT: I encountered so many errors doing this. I am not sure what's and right and what's wrong.

Interpretation:
A positive α means that payoffs increase when radio stations are corporately owned in a high population area. And the reverse is true when α is negative. A positive β means that payoffs have a positive relationship with distance. That is, as distance increases the higher the payoff to a merger, all other things being equal. In this case buyers would target faraway radio stations. The reverse is true for when β is negative.
A positive δ implies that payoffs increase when the parent company already has higher of number of radio stations in a high population area. A positive γ means that payoffs are higher when market concentration is high in the location of the target market. In other words, buyers would go in for targets with high market concentration in that market.
Note: I omitted the coding part here. Everything about the coding is in the Jupyter Notebook (ipynb).