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.
Now if we let the pay-off function include target characteristics and transfer, we have:

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

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 merger 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 running the code. But I fixed most of the errors. But I am still not sure about the estimates.

My estimates:
For the payoff function without transfers, α and β are .315 and .076 respectively. The positive α means that payoffs to mergers increase when radios stations are corporately owned in a high population area. The β coefficient means that payoff increase by about 7.6 percent for every one kilometre increase in distance. This means buyers like to buy faraway targets, probably because they want to reach new audience
When I estimate the second payoff function with transfers, the estimates for δ,α, γ and β are .362, .282, -.015 and .0265 respectively. The signs of α and β did not change. The positive coefficient of δ means that payoffs increase significantly when the parent company already has some number of radio stations in the population range of the target within a given market. The γ coefficient means that for a unit increase in market concentration payoffs decrease by about 1.5 percent. High concentration means high competition, which would sometimes reduce payoffs, especially if the target is not competitive enough in the market.
Note: I omitted the coding part here. Everything about the coding is in the Jupyter Notebook (ipynb).