Problem Set 5

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October 19, 2021

Let us consider a model of one-to-one matching market representing radio station mergers. Each year there is a national market where radio station owners target new station.The payoff to the merger between radio station buyer b and target t in market m is given by:

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

Now let us consider another version of this model with transfers. In this case, we will allow payoff functions to include target characteristics as well. we can write the payoff function now as follows:

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

Our goal is to estimate the parameters of the payoff functions that represent the relative importance of corporate ownership and geographic proximity compared to size sorting. For model 2 we will estimate α and β that would maximize the number of correct matches, and for model 2 will will estimate the parameters δ, α, γ, and β that would maximize the number of correct matches.

Having the assumptions that both buyer or target maximises their payoffs in equilibrium, and that all observed matches yield higher value than the counterfactual matches in equilibrium we can write the Maximum Score estimator corresponding to equations (1) and (2) as follows:

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

$$\sum_{y=1}^{Y}\sum_{b=1}^{M_y-1}\sum_{b'=b+1}^{M_y} 1[f(b,t|\beta) + f(b,t'|\beta) \geq p_{bt} - p_{b't'} \wedge f(b',t'|\beta) + f(b',t|\beta) \geq p_{b't'} - p_{bt}] \tag{4}$$

I followed the following steps to find the parameters of interest:
Step1: I convert price in millions of dollar, and convert population in millions of numbers
Step2: Create two separate data frames for each year (2007 and 2011)
Step3: Define a function that calculates the distance between the buyer and the target
step4: Make a data set with counterfactual mergers
step5: Calculate distance between real buyer and real target.
step6: Calculate distance between counterfactual buyer and counterfactual target
step7: I defined the payoff functions for the two models and calculate the payoffs for the actual and counterfactual functions.

Step8: Then I defined the objective functions to be maximized and finally estimated the models.

Model 1 results: [0.42965785 0.1916911]

The estimated value of α and β are 0.43 and 0.20 respectively. The value of α imply that having corporate ownership with an increased population increase the payoffs to mergers by 0.43 on average. This makes sense as corporate ownership in a location with a higher population would drive the value of the merger up since it gives the buyer the opportunity to operate in a more populated environment which is typically desired for businesses. The β coefficient indicate that one kilometer increase in distance results in 0.20 increase in payoff. However, this result is unexpected because closer distance between buyer and the target are expected to lead to more merger will talk place and to more payoff. However, this might happen when companies value targets in order to expand them in different distant locations.

Model 2 results: [-0.18012814 0.27826925 -0.14262909 0.42192668]

The estimates for δ, α, γ, and β are -0.18, 0.28, -0.15 and 0.42 respectively. The negative coefficient δ means that payoffs decreases when the parent company already has some number of radio stations in the population range of the target within a given market. The value of α is 0.28 implying that the payoffs increases by 0.28 on average due to having corporate ownership of radios with a area of large population.The value of γcoefficient is -0.15 meaning that the payoffs decrease by around 15 percent resulting from a unit increase in market concentration . Finally The value of β is 0.42 implying that one kilometer increase in distance results in 0.50 increase in payoff which is our unexpected result as we mentioned earlier. However, this might happen when companies value targets in order to expand them in different distant locations.

N.B: The encountered a problem that each time I run my codes I get different values for the parameters.