Problem Set 5

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Unfortunately, I was not able to complete this assignment and my code does not fully run. I had issues getting my code to go through my objective functions. However, I wrote up what I did and just excluded results.

To begin, I created scaled population and price variables by dividing the original variables by one million. Next, I created a distance column using the geopy.distance function using the latitude and longitude data given. Then I created a separate dataframe for each year. To create my counterfactuals, I matched each buyer with each alternative target. This created a dataframe with 2421 observations - 989 from 2007 and 1432 from 2008.

I created equation 1, which is our payoff function and ran the actual matches and counterfactual matches through this function to get dataframes of the payoffs associate with each actual and hypothetical match. Finally, I made an objective function, equation 2, and ran through the associated payoffs. I then used the Nelder-Mead maximization method to estimate the parameters. If it had worked, I would have gotten a values for α and β that would maximize the number of correct matches estimated by the model.

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

$$\sum_{y=1}^{Y}\sum_{b=1}^{M_y-1}\sum_{b'=b+1}^{M_y} 1[f(b,t|\beta) + f(b',t'|\beta) \geq f(b',t|\beta) + f(b,t'|\beta)] \tag{2}$$

Similarly, I created equation 3, which is a payoff function with transfers, and ran the actual and counterfactual matches through this new function to get the payoffs associated with each one. I created a new objective function, equation 4, and ran the associated payoffs through it. I then used the Nelder-Mead maximization method to estimate the parameters. If it had worked, I would have gotten a values for δ, α, γ, and β that would maximize the number of correct matches estimated by the model.

$$f_m(b,t) = \delta x_{1bm}y_{1tm} + \alpha x_{2bm}y_{1tm} + \gamma HHI_{tm} + \beta distance_{btm} + \epsilon_{btm} \tag{3}$$

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