Problem Set 1

Economics 33550: Spatial Economics

Due: February 5th at 9 pm CT, on Canvas

The first half of the class gives an overview of quantitative spatial economics and an introduction to some of its workhorse static models (the second part focuses on dynamic models). In this problem set, you will get your hands dirty and put into practice everything you learn in the first weeks of the class:

We will build a quantitative urban model of Chicago!

This assignment has two goals. The first is practical: it will help you develop, solve, and quantify spatial general equilibrium models. The second goal is substantive: we want to build a framework to quantify the effects of "real-world" policies that aim to modify the city structure of Chicago.

The instructions below do not make prescriptions. Instead, they will guide you through choices. You will be asked to pick a setting, identify relevant data, estimate the model, and perform some counterfactual analysis. You are free to tailor your work to your particular interests and resources. That said, this assignment is due February 5th at 9 pm CT. While you are encouraged to be creative and ambitious, please be realistic about how much you can accomplish, given your time constraints.

You can work individually or up to groups of three students. Please submit one final document per group.

Instructions

1. **Baseline framework.** As a starting point, revisit the canonical quantitative urban model summarized in Redding and Rossi-Hansberg (2017) and the applications of such kind of models to Berlin in Ahlfeldt et al. (2015), and to Detroit in Owens, Rossi-Hansberg, and Sarte (2020).

2. **Chicago Diagnostic:** Provide a brief diagnostic about the city structure of Chicago. See Section 2 in Ahlfeldt et al. (2015) and Owens, Rossi-Hansberg, and Sarte (2020) as references. This diagnostic aims to inform you about the key elements your model should have.

   Does Chicago have a "normal" city structure or what makes it different than other cities? For example, Owens, Rossi-Hansberg, and Sarte (2020) identify a coordination problem between residents and urban developers in Detroit. Based on this, they put residential externalities at the model's core.

3. **Specify your model.** Given the time constraints, you are encouraged to tweak or simplify an existing model, like the one in Ahlfeldt et al. (2015) or Owens, Rossi-Hansberg, and Sarte (2020).[1] If you want to get more creative, select components from the "menu of quantitative spatial models" in Section 2 of Redding and Rossi-Hansberg (2017). When adding, changing, or dropping elements of an existing model, make sure those modifications reflect the city structure of Chicago. Use your Chicago diagnostic from step 2 to carefully select elements.[2] Nevertheless, be aware of the time and feasibility constraints when specifying your model.

[1] You can also start from another existing urban model.

[2] Put in practice what we learned in Price Theory I: strip down a model to what is essential.

Write down your model as if you were writing the "Model" section of an academic paper. You need to specify all the building blocks, as well as solving for the model equilibrium(s). Please be clear and concise, and feel free to cite any relevant derivations you want to lift from existing papers instead of copying them verbatim.

4. **Counterfactual exercise.** Propose a counterfactual exercise within your model. We want to quantify the effect of a current or proposed policy. Examples of such policies are the construction of Obama's Presidential Center in Jackson Park, the construction of Chicago's 78th neighborhood close to South Loop, changes in the city transport network (roads, buses, Metra, subway), or even the Bear's ambitious sport development in Arlington Heights.

   You are free to choose any counterfactual exercise you find relevant. However, be aware that you will need to perform this exercise. You will need actual data and a feasible quantification strategy (see the following two steps).

5. **Data.** Describe the data you will use to estimate and quantify the model. What variables are in it? How did you access it (public use vs. restricted)? This part should look like the "Data" section of an academic paper.

   See Allen, Arkolakis, and Li (2016) and Owens, Rossi-Hansberg, and Sarte (2020) for potential data sources for Chicago.

6. **Quantification strategy.** How do you plan to estimate the model? How do you plan to quantify your counterfactual exercise? For parameters that you will calibrate, justify your choices. For parameters that you will estimate, explain your strategy. Are you going to fully invert the model to back out fundamentals? Are you going to use exact hat algebra to solve the model in changes?

7. **Solve it!** The preceding instructions should have helped you make all the necessary decisions before going to the computer. Now it is time to implement your plan. Perform your counterfactual exercise: solve for the response to your shock or proposed policy change. Rationalize your findings using the mechanisms in your model. (Bonus points for cool maps!)

   You can recycle code from existing replication packages, but you should not share codes between groups. Make sure to leave ample time for this step—there are always unforeseen hurdles that must be surmounted.

Final Document

The final document you will upload on Canvas (one per group) should have 6 sections (in this order):

1. Chicago diagnostic.
2. Model: set-up and equilibrium.
3. Proposed counterfactual exercise/policy evaluation.
4. Data.
5. Quantification strategy.
6. Results.

Please be concise.

References

Ahlfeldt, Gabriel M. et al. (2015). "The Economics of Density: Evidence From the Berlin Wall". In: *Econometrica* 83.6, pp. 2127–2189.

Allen, Treb, Costas Arkolakis, and Xiangliang Li (2016). "Optimal City Structure".

Owens Raymond, III, Esteban Rossi-Hansberg, and Pierre-Daniel Sarte (May 2020). "Rethinking Detroit". In: *American Economic Journal: Economic Policy* 12.2, pp. 258–305.

Redding, Stephen J. and Esteban Rossi-Hansberg (2017). "Quantitative Spatial Economics". In: *Annual Review of Economics* 9.1, pp. 21–58.