Assignment 2

Economics 33550: Spatial Economics

Due: March 18 at 5pm CT

Overview

In the second half of the course, we've encountered different ways to make dynamic spatial models tractable. In this assignment, you'll be asked to apply one of those methods to a pressing real-world problem with obvious dynamic and spatial dimensions: **climate change**.

In particular, your job will be to develop, solve, and quantify a spatial growth model of US economic activity at the county level as agents adapt to coastal flooding wrought by climate change. Steps (1)–(4) below will guide you through this process. You'll then pick a climate policy to implement and analyze its effects, paying particular attention to the importance of agents' dynamic decision-making (or lack thereof). Steps (5)–(6) will help you think about this importance.

As with the previous assignment, you'll be asked to make some of your own choices along the way. Even more than before, though, we encourage you to be realistic about how much you can accomplish before the deadline of **Friday, March 18 at 5pm CT**. Stick closely to an existing model—even reduce complexity where you can. Your priority should be to make it all the way through the assignment.

Instructions

1. **Preview your work.** State in clear, concise prose ...

   - which spatial growth model you'll adapt,
   - what feedback loop you'll add to integrate coastal flooding,
   - what data/forecasts you will use, and
   - what climate policy you will consider.

   Your model should include at least one mechanism through which agents' decisions affect the evolution of location characteristics. Each of the models from the "Spatial Growth" section of the syllabus satisfies this requirement. Moreover, your specification of coastal flooding ought to include mechanisms through which coastal flooding *affects and is affected by* economic activity; it's not enough to say "exogenous sea-level rise destroys the amenities of some coastal counties." If you need inspiration, review how Cruz and Rossi-Hansberg (2021) added global warming to Desmet, Nagy, and Rossi-Hansberg (2018). Finally, remember to restrict your attention to US counties.

2. **Specify your model.** Even though we're asking you to stick closely to an existing model, you still need to be explicit about the optimization problems, the market clearing conditions, and the equilibrium definition that constitute your economy. Now, too, you need to specify the climate block: how does economic activity determine the incidence and severity of coastal flooding, and how in turn does coastal flooding affect economic activity today and into the future? As in the previous assignment, your model specification should be written in prose (just like the "Model" section of a paper), but you're free to cite any relevant derivations that you want to lift from your chosen spatial growth model in lieu of copying them over verbatim. Whatever model you write down, be sure it conforms with your preview above.

3. **Specify your quantification strategy.** Provide the details for the data you will use. For parameters that you'll calibrate, justify your choices. For parameters that you'll estimate, explain your strategy. Are you going to invert the model to back out any fundamentals? How will you select an initial condition?

4. **Solve it!** The preceding instructions should have helped you make all the decisions you needed to before going to the computer. Now it's time to actually implement your plan. Simulate the model forward from your initial condition for at least 100 periods (preferably until convergence). Explain—or, better yet, *map*—how the spatial distributions of

   - population density,
   - productivity,
   - utility,
   - real income per capita, and
   - any other variables of interest

   evolve over time if no climate policies are imposed. Rationalize the evolution using the mechanisms in your model. You are allowed to recycle code from existing replication packages but you should not share code with each other. *Make sure to leave ample time for this step*—there are always unforeseen hurdles that must be surmounted.

5. **Implement your policy.** Solve for the equilibrium under your proposed climate policy. Demonstrate if and how the allocation—both across space and over time—differs from that in (4). Explain the results of your comparison using the mechanisms in your model.

6. **How important are anticipatory effects?** Does your model exhibit anticipatory effects, i.e., do agents' expectations about the future affect their decisions today? If so, discuss the extent to which these effects drive your results in (4) and (5). If not, discuss the extent to which their *absence* might be driving your results.

References

Cruz, Jose Luis and Esteban Rossi-Hansberg. 2021. "The economic geography of global warming." Working Paper 28466, National Bureau of Economic Research.

Desmet, Klaus, Dávid Kristián Nagy, and Esteban Rossi-Hansberg. 2018. "The geography of development." *Journal of Political Economy* 126 (3):903–983.