

Assignment 1

Economics 33550: Spatial Economics

Due: February 11 at 5pm CT

Overview

In the first two weeks of the course, you've been given an overview of quantitative spatial economics and an introduction to some of its workhorse models. Now it's time to get your hands dirty.

There are two goals of this assignment. The first is practical: We want to help you practice developing, solving, and quantifying spatial general equilibrium models. Steps (1)–(5) below will guide you through this process. The second goal is substantive: We want to demonstrate how the macro response to a shock or policy change depends on the spatial incidence of the shock and the spatial network through which it propagates. Steps (6)–(7) will help you discover this on your own.

The steps that follow will rarely make prescriptions; instead, they will guide you through choices. You'll be asked to pick a setting, specify a shock or policy, identify suitable data, etc. All we impose is that your model must include

- more than two locations (e.g. a continuum or N discrete)
- at least two of trade, migration, or commuting costs, and
- at least two sectors.

Beyond those requirements, you are free to tailor your work to your particular interests and resources. That said, this assignment is due **Friday, February 11 at 5pm CT**. While you are encouraged to be creative and ambitious, please be realistic about how much you can accomplish given your time constraints. It's better to submit a small extension done with care than a shoddy original.

Instructions

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

- what setting you will model,
- what data you will use,
- what shock or policy you will consider, and
- why this combination of shock and setting is interesting.

Aim your explanation at an economist that's outside the field. Keep it concise!

2. **Specify your model.** Now it's time to actually write down the optimization problems, the market clearing conditions, and the equilibrium definition that constitute your model. Remember that, at minimum, your model must include
- more than two locations (e.g. a continuum or N discrete)
 - at least two of trade, migration, or commuting costs, and
 - at least two sectors.

Given the time constraints, you're encouraged to tweak or simplify an existing model, like that in Caliendo et al. (2018). If you want to get more creative, select components from the "menu" in Redding and Rossi-Hansberg (2017). 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 existing papers in lieu of copying them over verbatim. Whatever model you write down, be sure it conforms with your preview above.

3. **Specify your shock or policy in model notation.** In (1), you stated in prose what shock or policy you will consider. Now specify the change in model parameters that best conforms with this verbal description.
4. **Specify your quantification strategy.** Provide the details for the data you will use: What variables are in it? How did you access it (public use vs. restricted)? For parameters that you'll calibrate, justify your choices. For parameters that you'll 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?
5. **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. Solve for the response to your shock or proposed policy change. Pick a relevant macro aggregate and determine how it changes (welfare, output, and TFP are usually good choices, but others are fine depending on your setting and shock). Rationalize the change using the mechanisms in your model and the changes you see across the spatial distribution. (Bonus points for cool maps!) 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.
6. **Modify your shocks.** Now we'll consider two changes to your analysis. The first will change the incidence of your shock or policy. The second will change how it propagates.
- (a) Suppose your shock hits at a different location (or set of locations) than before. Demonstrate if and how the aggregate and distributional responses differ from those in (5). Explain the results of your comparison using the mechanisms in your model.
 - (b) Propose a change to your network of trade/migration/commuting costs: Maybe you add a highway or double all costs or shift the distribution of costs in some way while holding their average level fixed. Demonstrate if and how the aggregate and distributional responses differ from those in (5). Explain the results of your comparison using the mechanisms in your model.

7. **Summarize and interpret.** What should we learn from your analysis about the spatial determinants of macro responses? Does it matter where the shock hits? Does the geography (i.e., the network of trade/migration/commuting costs) matter? How so? Be concise.

References

- Caliendo, Lorenzo, Fernando Parro, Esteban Rossi-Hansberg, and Pierre-Daniel Sarte. 2018. “The impact of regional and sectoral productivity changes on the U.S. economy.” *Review of Economic Studies* 85 (4):2042–2096.
- Redding, Stephen J. and Esteban Rossi-Hansberg. 2017. “Quantitative spatial economics.” *Annual Review of Economics* 9 (1):21–58.