N7. Zoning

But first a digression on causality and *instruments* and then go back to finish N6, Glaeser and Kahn.

- Consider an model of the demand for orange juice

$$\ln Q^D = a^D + b^D \ln P + \varepsilon^D$$

- Suppose regress $\ln Q$ on $\ln P$. What is the problem?

—Endogeneity. Equilibrium price and quantity are determined by supply and demand.

$$\ln Q^S = a^S + b^S \ln P + \varepsilon^S$$

—So $\ln P$ is positively correlated with demand shock ε^D. Will bias estimate of b^D downward.

- Solution. Find an instrument. Something correlated with $\ln P$ but not ε^D. What is a *great* instrument here?

- Can run two-stage least squares: regress $\ln P$ on instrument. Then regress $\ln Q$ on *fitted value* of $\ln P$ (i.e. the value on the regression line from stage 1.)

- What make weather in Florida such a great instrument?

—Highly correlated with ln P

—Not correlated with demand shock. Freezing weather in Florida doesn't mean the people will want to drink more orange juice.

- Other example of an instrument

—Question: does unionism have geographic spillovers

—Coal mines as an instrument

- Now look at Glaser and Kahn

$$\ln D = \beta_0 + \beta_1 Cars + \varepsilon$$

—Hypothesis is that $\beta_1 < 0$ and that causality goes from cars to density

—Worried that ε may negatively correlated with $Cars$ because other factors that cause locations to be dense may lead the location to have fewer cars. So negative correlation is *spurious*

—Suggestion instruments with cars by French legal origin variable, argue it is correlated (negatively) with $Cars$ through gas taxes.

—But French legal origin also likely correlated (negatively) with ε so not a valid instrument!

Zoning: The Effect of an Urban Growth Boundary (UGB)

- Suppose initially in equilibrium in the monocentric model

—$\hat{u}_1$ is the boundary of the city

—All four equilibrium conditions are satisfied

- Suppose an *urban growth boundary* at $\hat{u}_1$ yet population increases to $H_2 > H_1$. UGB means that land beyond $\hat{u}_1$ can only be used for farming. (In alternative cases have an *urban service boundary*, no sewers beyond this point.)

- What are new equibrium conditions?

—City size, once endogenous is now fixed. So need one less condition. Which one goes?

- 3 Conditions

(i) Consumers demand maximizes utility given location

(ii) Consumers are indifferent to locations $u \in [0, \hat{u}_1]$

(iii) Old condition (iii) no longer holds, i.e. now $R_2(\hat{u}_1) > \overline{R}$

(iv) Demand equals supply

$$\int_0^{\hat{u}_1} \frac{1}{L_2(u)} du = H_2$$

Winners and Losers

Compare equilibrium with UGB to one without it

- Land prices higher.

—H_1 individual original owners will benefit (if own land). How do we know this?

—New people, $H_2 - H_1$ of them, are worse off.

- Density is higher to get positive welfare effects, need to pull in some kind of externality

- Suppose externality is in communting. Social cost of commuting is

$$t^S = t + e,$$

where e is the amount of the externality. What is optimal social policy here?

—Solve for equilibrium with transport cost equal to t^S. Let $\hat{u}^S$ be the boundary of the city here. Note $\hat{u}^S$ is less than $\hat{u}$, the equilibrium level. But why is a commuting tax more efficient than setting an urban growth boundary of $\hat{u}^S$? In what way are the allocations different?

Leapfrogging

- Suppose have new population $H_2 > H_1$

- Suppose have UGB at $\hat{u}_1$. But have point $\overline{u}$ at which zoning stops. So residential use is prohibited for $u \in (\hat{u}_1, \overline{u})$ but $u > \overline{u}$ is unregulated.

- Equilibrium with leapfrogging. Suppose have point $\tilde{u} > \overline{u}$ and a rent function $\tilde{R}$ and land demands $\tilde{L}(u)$ satisfying

(1) Demands are utility maximizing for households locating at u

(2) Households are indifferent between locating anywhere on $u \in [0, \tilde{u}]$

(3) $\tilde{R}(\overline{u}) = \overline{R}$

(4) Demand equals Supply

$$\int_0^{\hat{u}_1} \frac{1}{\tilde{L}(u)} du + \int_{\overline{u}}^{\tilde{u}} \frac{1}{\tilde{L}(u)} du = H_2$$