11.202: Planning Economics
Section Lauren Lambie-Hanson

Rent Gradients and Land Use (von Thünen Model)

R = q(p-c) – qtd

R = Rent per unit of land
q = Output per unit of land
p = Market price per unit of output
c = Average production costs per unit of output
t = Travel cost per unit of output and unit of distance from market (often expressed in miles)
d = Distance from market

Frank's Pumpkin Example:
R = 1,000(4 - .50) – 1,000*.10*d
R = 3,500-100d

Assumptions:

- Lot size is fixed (like 1 acre lot size)
- All transactions occur at the central marketplace. No trading with other towns/regions/countries.
- The land surrounding the market is flat and of equal quality.
- The total cost of travel depends on 1) the good being transported and 2) the distance involved. Note that travel costs *per mile for the same good* are constant.
- The price of the crop can be held constant.

What happens when:

a. travel costs rise to 35 cents per mile?
b. travel costs fall to 5 cents per mile?
c. travel costs fall *and there is a limited demand for land*

Practice Problem

Consider the city of Hastings, which forms around a central place denoted by the city hall. All land is divided into 1-acre lots that are owned by landlords. The landlords rent each lot to the highest bidder and there are three groups of bidders: business people, households, and farmers. The demand curves for the three groups can be written as follows:

Business people $R_B = \$500 - 50d$ Households $R_H = \$400 – 25d$ Farmers $R_F = \$25$

Where R = the dollar rental that a group member is willing to pay for a given lot
d = the number of miles between the given lot and the city center

a) Giving as much detail as the possible, describe the pattern of land use in Hastings - what land is used for business, for households and for farming. Illustrate your description with a diagram.

b) In U.S. metropolitan regions, many of the urban poor live in central cities rather than the cheapest land at the edge of the region. What additional factors could we add to the model above that might explain how very low income people live on very valuable, close-in land?

Final Exam Review Topics

Note: This is NOT a comprehensive list of all the topics you need to know for the final exam. Be sure to review all lecture notes, readings, handouts, and problem sets.

Planning Economics (11.202)

Externalities and Public Goods

- What are negative externalities? Give some examples of actions that generate negative externalities. Positive externalities?
- How should government respond when facing externalities?
    - Give examples of scenarios leading to each
- Compare and contrast the equity and efficiency of these pollution policies: emission caps, emissions taxes, and cap and trade.
- What is the Coase Theorem? Why is it useful? What assumptions must exist in order for it to apply?
- What is the Tragedy of the Commons?
    - Review the example of cows on the commons
- What is the "free rider" problem? Give some examples.
- What are "pure public goods"? "Mixed public goods"?
    - What does it mean for a good to be rival? Non-rival? Give examples.
    - What does it mean for a good to be excludable? Non-exludable? Give examples.
- How do we find the market demand for a public good like flu protection?
- What is Tiebout's hypothesis on sorting?
    - How does Tiebout's hypothesis apply to the location of residents in the United States? Do we see the same patterns in Europe? Why or why not?

Discounting and the Time Value of Money

- What is a discount rate and what does it tell us?
    - Why does it make sense (in some situations) to use the market interest rate as the discount rate?
    - In what situations is it *not* appropriate to use the market interest rate?
- How do you calculate the present value of a payment (or stream of payments) to be made in the future?
- How do you calculate the future value of a present amount of money, growing at an interest rate of r?
- How do you calculate the net present value (NPV) of a given investment?
    - What does it mean if the NPV is positive? Negative? Equal to zero?
- What is internal rate of return (IRR) and how does it relate to the NPV?

City Structure/Firm Location

- What does Howard Hotelling's model of sunbathers on the beach tell us about firm location? How is this model applied to politics?
    - Consider a new hotdog seller locating on the beach. Why does the impact of this entry on existing firms depend on the nature of the firms' production functions?
    - How does entry impact walking costs? Compare changes in walking costs and production costs to find the optimal number of hotdog stands.
- Explain each of Alfred Marshall's three reasons for firm clustering.
    - Labor pooling
    - Specialized services (economies of scale)
    - Knowledge spillovers
- What is a location quotient and what does it tell us?
- What is the multiplier effect and what does it have to do with regional growth?
- What do we mean by agglomeration? What forces lead to agglomeration?
- How do we measure labor productivity in a region?
- What forces lead to economic decline in a region?
- What is Baumol disease? How is it related to urban planning and public finance?
- What is the difference between the "consumption city" and "information city" theories of why cities exist/thrive?
- What is a bid rent curve? How do bid rent curves relate to land use patterns in an urban area?

Microeconomics (11.203)

Demand and Supply

- Change in Demand vs. Change in Quantity Demanded
  - Give examples of scenarios leading to each
- Change in Supply vs. Change in Quantity Supplied
  - Give examples of scenarios leading to each
- Price Elasticity of Demand and/or Supply
  - Know what they are
  - Know how to calculate and interpret them
    - Keep in mind that we have used or seen 3 formulas for calculating elasticity. The most common is (% change in Q) / (% change in P) , but we have also seen point elasticity and arc elasticity formulas.
  - Know main (conceptual) factors determining level of elasticity
  - Understand differences in price elasticity of supply in the short run vs. long run
  - Know rules on price change and effects on total revenue, as determined by elasticity of demand
- Income Elasticity of Demand and Cross Price Elasticity of Demand
  - Understand what they are conceptually

Production Possibility Frontier, a.k.a. "Guns-Butter Curve"

- What is the PPF and what shape does it generally have?
- 3 goals of economics in regard to the PPF
- Why might a society not be producing on the PPF? Give examples.
- When does the PPF shift out? How exactly do we show this?

Consumer and Producer Surplus

- What are consumer surplus and producer surplus? How are they shown on a graph? How do they change when price changes?
- How are consumer and producer surplus altered when there is a price ceiling? A price floor?
- What is deadweight loss?
  - Who bears the burden of deadweight loss?
  - If we have deadweight loss, what does this imply about efficiency?

Consumer Choice and Utility Maximization

- Using information on prices and income, how do you construct a budget constraint (algebraically and graphically)?
  - Can you think of other inputs or resources a consumer has (besides money) that may need to be factored into a budget constraint?
- What is utility?
- Can we compare two or more people's utility? If so, how? If not, why?
- Know and understand the characteristics of measures of utility: 1) complete ordering, 2) transitive ordering, 3) non satiation, 4) diminishing marginal utility
- What are indifference curves and what do they show us?
  - What does the slope of an indifference curve represent?
  - Why is the shape of indifference curves interesting?
  - Can indifference curves ever cross?
  - Using a set of indifference curves and a budget constraint on a graph, can you find the optimal bundle of goods?
- Know how to maximize utility subject to a budget constraint in order to identify the optimal bundle of goods someone would buy.
  - What conditions must hold for utility to be maximized?
- Be able to parse out and explain the income and substitution effects
- Be able to assess income elasticity of demand and cross price elasticity of demand using analysis of indifference curves and budget constraints.

Production Costs

- What are isoquants and isocosts?
    - What are some inputs we may explore using isoquants?
    - What do we mean by Marginal Product of Capital? Marginal product of labor?
    - Can isoquants cross?
    - What do we mean when we say the values of the isoquants (like the numerical labels) are cardinal numbers, not ordinal? Why is this important?
    - What is significant about the point of tangency between isocosts and isoquants?
        - With fixed prices for capital and labor, can there be more than one isocost tangent to a given isoquant?
    - What do we mean by constant, increasing, and decreasing returns to scale? How would you exhibit each using isoquants?
    - In what ways is the shape of an isoquant meaningful?
- Total Cost, Average Total Cost, and Marginal Cost
    - How do you calculate them?
    - Where does MC intersect AC?
    - How do you use AC on a graph to calculate total cost? Be able to show the TC area on a graph.
    - Using the "snake-like" total cost curve, show the portions the correspond to increasing and decreasing returns to scale.
        - Add in a total revenue curve. Show the area of profit maximization
            - What two things do you notice about the profit-maximizing quantity?
- For a typical consumption good, how do you calculate market demand (or supply) given individuals' demand (or firms' supply)?

Perfect Competition

- What are the characteristics of perfect competition?
- What are some examples of firms operating in perfect competition?
- How is the market price set?
- What does the firm's demand curve look like? The market demand curve?
    - Besides demand, what two other things does the firm's demand curve represent?
- What quantity and at what price do individual firms produce?
- Why do firms have no incentive to raise or lower the prices they charge?
- Graph situations of individual firms making economic profit, zero economic profit, and loss
- Can firms make a profit in the long run? Why or why not?
- How is the long-run market supply curve different if firms face the same costs (same technologies) or different costs/technologies?
- What happens to prices, the number of firms, and profits if the government imposes a per-unit tax on producers?
- What happens to prices, the number of firms, and profits if the government imposes a lump-sum tax on producers?

Monopoly

- Two main conditions for monopoly
- Why do we say that a monopolist's demand curve is "stable"?
- Legal vs. natural barriers to entry
- Know/be able to explain the two main sources of monopoly power: economies of scale and network externalities. Which is the "demand side" effect?
- Explain price discrimination, perfect price discrimination, and single price monopolies
- How does the typical monopoly graph change when there is perfect price discrimination?
- What does the marginal revenue curve show us?
- Where does the marginal revenue curve intersect the x-axis, relative to the demand curve? What is the relationship between the MR curve's slope and the demand curve's? Along which portion of the MR curve is demand elastic? Inelastic?
    - Given a linear demand function, how can we quickly find the MR function?
    - Given a nonlinear demand function, how can we find the MR function?

- At what point do monopolies choose to produce? How do they determine the price?
- What is the socially optimal (efficient) quantity? How about the socially optimal price?
- What is special about natural monopolies? (*Hint*: Think about returns to scale.)
- How do monopolists impact consumer surplus?
  - Who bears the tax and what happens to prices and quantity sold if the government imposes:
    - a per-unit tax on producers?
    - a lump-sum tax on producers?

Monopolistic Competition

- Main conditions for monopolistic competition
- What type of demand curve do firms face? How is it different from that a monopolist faces?
- At what quantity do firms choose to produce?
- Can firms make profit in the long run?
- In the long run, at what quantity do firms produce (in terms of average cost)? Show graphically.
- How might we argue that gas stations sell "differentiated products"?

Oligopoly and Game Theory

- What are the characteristics of oligopoly?
- Explain the kinked demand curve theory.
  - Above the kink, demand is elastic. Below the kink, demand is inelastic. Why is this relevant for pricing behavior? (*Hint*: think about the total revenue rules.)
  - What does the theory tell us about pricing behavior? Product differentiation?
- Consider a Cournot duopoly: firms choose the quantity they produce (rather than the price to charge)
  - Remember that in Cournot (and Bertrand) duopolies, we will assume the products sold are identical
  - Know how to use the market demand curve and information on each firm's marginal cost to find the firm's best response function.
    - What does each firm's best response function represent?
    - What is the significance of the intersection of the two best response functions?
  - Implications of Cournot:
    - Output is typically greater than in monopoly but less than in perfect competition
    - Prices are higher than in perfect competition, and lower than in monopoly
    - Firms could make more profit if they colluded and formed a cartel
- Consider a Bertrand duopoly: firms choose the price they charge (rather than quantity to sell)
  - Since the products are identical, remember that consumers choose to buy from the firm with the lower price
    - Given the assumption above, each firm has incentive to undercut competitor's price
    - Price is pushed down to MC
      - What happens if the firms don't have the same MC?
      - What happens if the MC for a given firm is not constant, but slopes up or down?
- How does the prisoner's dilemma apply to advertising or R&D decisions? What about to cheating on a cartel agreement (e.g., agreements on withholding production or charging high prices)?
  - What does it mean for players to make their moves simultaneously? Why is this important?
  - What is a Nash equilibrium?
  - What does it mean for a player to have a "dominant strategy"?
  - Are all games prisoner's dilemmas (PD)?
    - What other types of games could occur, and how do they differ from PD?
  - If a game is repeated (rather than played only once), what will likely happen if a firm cheats on a cartel agreement?

Miscellaneous

- What do we mean by opportunity cost? Can you give an example?
- What factors led to the recent housing boom/bust?
- Why are there bubbles in the market for housing, but not in the market for chicken noodle soup?
- What do we mean by "economic rent" and what does it have to do with Derek Jeter?
- How do we define unemployment?
- What is the Lerner Index? How do we calculate and interpret its values?

Review Questions 11.202

1. (11.202 Final Exam, 2002) Many cities from Sacramento to Boston have developed "Historic Preservation Districts" or "Old Towns" in which buildings retain the character and architectural style at the time the city was created.

a. Explain why such districts might be in the economic interest of both historic building owners and the city itself.

b. We can assume that building owners, like any other entrepreneur, will seek to maximize profits. Explain why it does or does not follow that the building owners, operating through the private market, will be sufficient to create historic districts. Construct a prisoner's dilemma game to illustrate your answer.

c. Various jurisdictions have adopted tax incentives (for example, a 10 year reduction in a building's property taxes) to encourage the formation of historic districts. Describe the benefits and problems in creating and administering a tax incentive of this kind.

2. (11.202 Final Exam, 2002) Consider the following statement:

"When a company calculates the net present value of a project, it discounts future revenues and costs by a bank's rate of interest because that interest rate reflects the rate the company must pay for any borrowed money. In other words, for a project to be profitable, funds invested in the project need to grow faster than the company's interest obligation to the bank. But in many cases, a company funds a project from its own funds and does not need to borrow any money. In those cases, since the company is supplying its own funding, the bank's rate of interest is of no relevance as a discounting factor."

Explain which parts of the statement (if any) you agree with and which parts (if any) you disagree with.

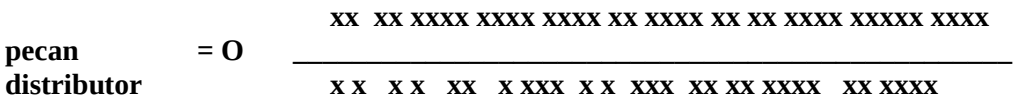
3. (11.202 Final Exam, 2004) The Boston Common is a public park whose upkeep is financed through taxes paid by Boston homeowners and businesses.

a. Describe *one* set of potential circumstances in which the Boston Common would provide an externality.

b. Describe *two different* sets of potential circumstances in which the Boston Common would not provide any kind of externality.

c. If the Boston Common does provide a positive externality, what relevance does this fact have for the Tiebout model of locational choice?

4. (11.202, ?) Pecans are produced in a number of locations across the country including Happy Valley, Georgia. In Happy Valley, pecans are produced by a set of small farms in perfect competition. Each farm has the same set of cost curves with average cost reaching a minimum of $2.00 per pound at a quantity of 200 pounds of pecans. The farms are located along a small road (see sketch). If a farmer wants to sell pecans, she must drive them to the pecan distributor at the west end of the road. The cost of a trip is $.10 cents per pound per mile. The distributor then sells the pecans to other parts of the country.



x = an individual farm

a) Today, the pecan distributor is buying farmers' output at today's national price of $2.80 per pound. Assuming each farmer owns her own land, use standard diagrams to separately sketch the equilibrium position of each of these three farms, identifying profit if any:
- A farm that is 2 miles east of the market
- A farm that is 6 miles east of the market.
- A farm that is 10 miles east of the market.

b) Suppose some of these farmers are approaching retirement age and would like to rent their land for others to farm. Explain the relationship between your answers in (a) and the amounts for which the three farms could be rented.

c) Suppose that starting next week, the U.S. relaxes import restrictions so that anyone is free to import unlimited quantities of pecans at the world price of $2.50 per pound. Explain how, if at all, these imports would change the potential rents you discussed in (b)?

Review Questions for 11.203

5. (2009 Test-Out Exam) Below are three possible values of the elasticity of the short run supply curve for housing (new plus existing housing).

$\varepsilon = +.1$
$\varepsilon = +1.3$
$\varepsilon = -.2$

a) (10 points) Which of the three numbers is most likely the correct value? Explain your reasoning.

b) (10 points) As you know, the economy is slowly recovering from the effects of a dramatic housing bubble in which the price of housing grew extremely rapidly for about six years before suddenly collapsing. Is there any relationship between the elasticity of the supply curve for housing and this bubble behavior? Explain why or why not.

6. In the aftermath of the 1992 Los Angeles riots, some people argued that the riots were ultimately attributable to newly imposed environmental regulations in the Los Angeles Air District. The argument focused on the city's furniture industry, a collection of small firms that provided employment for semi-skilled and low skilled workers. In producing furniture, the industry used large quantities of shellac and similar pollution-creating chemicals. The new environmental regulations in the Los Angeles Air District imposed high taxes on the price of these input chemicals which, according to the argument, ultimately led to unemployment that resulted in the riots.

a) Assume the furniture producers were perfect competitors operating in a national furniture market. Using appropriate graphs, illustrate how the taxes imposed on the input chemicals could lead to unemployment.

b) Assume that some number of these firms moved from the LA basin to rural Nevada because taxes on input chemicals were much lower there. Explain the assumptions you would need to make for this move from the Los Angeles basin to rural New Mexico was to be compatible with economic efficiency.

7. (2009 Test-Out Exam) Consider two cases of pricing that vary over time:

- At one point, the Coca-Cola Corporation was experimenting with soft drink machines whose prices changed automatically with the outside temperature so that higher prices are charged on hotter days and lower prices are charged on colder days.

- An electric power plant in Virginia was experimenting with time-of-day pricing in the summer such that electricity prices are higher during the day (when noontime temperatures average 104 degrees f) and are lower between 5:00 PM and 8:00 AM.

Both cases are obvious examples of price discrimination. But one of the cases might also be justified as an attempt to deal with a negative externality. What is the nature of the externality and how might we check on whether the externality is real?

8. (2009 Test-Out Exam) Consider an individual's utility function defined over two goods:

U = U(Meals in a Fancy French Restaurant, Glasses of Whole Milk)

where both the restaurant meals and the glasses of milk are measured in units per month.

a) Think about demand curves expressed in income rather than price. Draw two graphs. In the first graph, put the individual's income on the vertical axis and the quantity of meals in a Fancy French Restaurant on the horizontal axis). In the second graph, put the individual's income on the vertical axis and the number of Glasses of Whole Milk on the horizontal axis. (in both graphs, assume that the price of both goods are constant).

b) Draw a set of indifference curves and budget constraints that would give you the two "income demand curves" you have just drawn. Again, assume that prices of the two goods remain constant.

c) Consider a two-good utility function with the following property: the marginal rate of substitution between the two goods depends only on the ratio of the two goods. As long as the ratio of the two goods does not change, the marginal rate of substitution (i.e. the ratio of the marginal utilities) does not change.

Explain why the utility function you have drawn in (b) is or is not compatible with this property.

Selected Solutions:

3 a) Suburban residents enjoy the Common but do not pay any taxes to support it.

3 b) If the park only served city residents (who pay taxes) there would be no externality. If the park served city residents and tourists who paid various taxes while they were visiting here (i.e. sales taxes), that could create a situation where there was no externality.

3 c) It slightly undermines Tiebout sorting, but the effect is not large. Tradition dictates that there are not many restrictions on who can use local parks, so a resident of one town might enjoy the local parks of another town- something that would undercut the market Tiebout postulates. But most city services- schools, fire protection, police protection, water and sewers- can limit use to residents, which allows the Tiebout model to function.

5a) The most likely value is .1. To the extent that housing is responsive to price, higher prices should result in more housing supply. That rules out -.2. But at any point in time, most of the supply of (new plus existing housing) is existing housing which is basically not responsive to price. This means the curve should be quite inelastic which rules out 1.3. So the correct answer is + .1.

5b) There is a relationship. A bubble refers to a rapid increase in prices. When the demand curve for housing shifts out, the inelastic supply curve means that prices will rise sharply (rather than quantity increasing rapidly). The higher prices will convince more people that they need to buy a house either because they have to get into the market before it's too late or because they want a house as an investment. Therefore, the demand curve shifts out again, and so on. Same thing on the down side: When the demand curve shifts in, the inelastic demand means a big price fall rather than a fall in quantity. Falling prices mean demand may shift in further, etc.

6a) The starting picture is a perfectly competitive firm in equilibrium with price (set nationally) = marginal cost = minimum average cost. The imposition of the taxes in Los Angeles will cause the average and marginal cost curves to shift upward, but the price (set nationally) will stay constant. So the firm is now operating at a loss and will eventually have to close.

The closing of the firm will cause the demand curve for labor to shift in. Technically, to get unemployment, you would have to have a money wage that would not fall so that you had the official definition of unemployment: people willing to work at the existing wage but not jobs. But in this case, having the demand curve for labor shift in should be full credit.

6b) Answer: Assuming the plant was using the same chemicals in rural New Mexico that it used to use in Los Angeles, you would have to assume that there were many fewer people in rural New Mexico so the harm caused by the plant was much lower.

7) Answer: The power plant could argue that it has a negative externality when demand exceeds capacity resulting in "brown-outs" where customers get less than full power. This is similar to the problem of a road that gets congested at rush hour where everyone is imposing an externality on everyone else. One way to avoid this problem is to shift, where possible, demand to the evening by charging higher daytime prices (i.e. residences running the washing machine at night rather than during the day.

We can check whether the externality is real by checking whether the plan really is running very close to full capacity during summer days. If not, then there is no need to shift demand.

11.202 Planning Economics

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