AAE 343 Discussion Section 12

April 26th, 2019

I. Quick highlights of energy material

- Energy efficiency (again, key ideas from lecture: rebound effect, Jevon's paradox)
  - Related thought #1: Energy efficiency should be a win-win: can save money and reduce negative externalities by switching to efficient energy tech. The wedge between *current* and *cost-minimizing* efficiency levels in our tech is known as **energy efficiency gap.** Some argue this gap justifies government intervention through policy/subsidies.[1]
  - Related thought #2: **Energy efficiency labeling** (think "Energy Star" or "EnergyGuide") gives consumers an idea of energy costs, reduces info asymmetries or inattention. Coarse certification can make consumers and producers worse off, however! Producers stop making very efficient tech and bunch their products at the minimum certification standard, thus potentially crowding out innovation.[2]
- Renewable energy use in electricity grid
  - Wind and solar are now **cost-competitive** in some states/regions of US
  - Wind produced 6.3% of US utility-scale electricity generation in 2017
    - Iowa, Kansas, Oklahoma, & N. Dakota all have >30% of electricity share from wind
- Richer, smarter, more-diversified electric grid
  - Fixed electricity prices mean consumers do not face the **true marginal cost** of their energy consumption
    - To meet peak demand, utilities then must build excess supply capacity
  - **Real-time (dynamic) pricing** is now becoming possible – consumers charged via smart meters and can respond to price changes by decreasing electricity use
  - **Demand response (DR)** programs allow utilities to control consumers' (smart) devices during demand-heavy "events" to reduce electricity needs
    - Reduces supply capacity needs and smooths net electricity load over course of day
  - **Storage:** as technology to more efficiently store and transmit electricity become more common, real-time pricing and DR programs become less valuable.

II. Congestion

- Congestion pricing for roads is a response to excess demand generating negative externalities.
- The social costs imposed by an additional driver include slower commute times for everyone, increased air pollution from idling.
  - Potential solutions: improve road infrastructure, congestion pricing
  - Note: this is similar to the social costs imposed by using electricity during peak load hours. Both require investments in infrastructure (e.g., expanding grid networks, building additional power plants) to meet peak demand leading to higher costs as well as potentially increasing air pollution and inefficiencies in power generation.
- Thinking about interplay between private and public transport is key when creating policy to address both congestion and environmental externalities. See example in slide 12-13 of lecture 25. Comes back to cost-benefit analysis of public project and getting the counterfactual right.

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[1] If interested see "Assessing the Energy Efficiency Gap" (2017) by Gerarden et al.

[2] Sebastien Houde at ETH Zurich has written interesting work on this and similar themes.

Problem 1 *Connie's Congestion Conundrum* - Connie can commute to work on the highway, which is the most direct route but gets congested, or on backroads, which are longer but never have traffic. The commute time on the highway depends on the number of other people, N, on the road: $10 + N/4$, while the trip on the backroads is always 30 minutes.

1. How does Connie decide whether to take the highway or the backroads?
2. How many drivers use the highway in equilibrium?
3. Is this efficient? What is the optimal number of highway drivers?
4. What tax would induce the efficient outcome?

TopHat Questions Suppose city planners in NYC decide to impose a congestion tax on cars driving in lower Manhattan. They expect to reduce traffic jams by 25 percent and raise a certain amount of revenue to improve public transit.

Question 1 What happens to congestion if the price elasticity of demand for driving downtown is *higher* than anticipated (answer graded)?

(A) There will be **more** congestion reduction than anticipated.

(B) There will be **less** congestion reduction than anticipated.

(C) The anticipated congestion reduction will be **unchanged**.

Question 2 What happens to the generated tax revenue if the price elasticity of demand for driving downtown is *higher* than anticipated (answer graded)?

(A) The tax revenue will be **more** than anticipated.

(B) The tax revenue will be **less** than anticipated.

(C) The anticipated tax revenue will be **unchanged**.

Problem 2 Two weeks ago, Uber formally filed paperwork to announce its IPO – rumored at a price tag of above $100 billion. Stepping away from a discussion about how silly that number seems[3], let's think about some economic implications of disclosures in their S-1 filing.

(1) A newly-revealed part of Uber's growth strategy is attracting riders away from public transportation. Based on material covered in recent lectures, why do urbanists find this super problematic?

(2) What are some examples of direct public-transport substitute products offered by US ride-sharing apps like Uber, Lyft? Do they seem a valid way to respond to urbanists' critiques?

[3] Nope, I can't step away! I'm not financial analyst in any way, shape or form, but a track record of annual losses on the order of $2b, a lagging and geographically restricted market share in your primary business area, and major global cities' development of regulations designed to hinder your growth do not seem to promise future profits that come anywhere close to justifying that number ☺.

Review Problem 1 *Mining Minerals* - Suppose there are 100 tons of a mineral in the ground, which you plan to extract over 3 years. Assume your discount rate is greater than zero and your marginal extraction costs are zero.

1. Using intuition from the Hotelling model, which is the most likely extraction path over the first, second, and third years?

	Path A	Path B	Path C	Path D
1^{st} year	33.33	100	40	20
2^{nd} year	33.33	0	34	35
3^{rd} year	33.33	0	26	45

2. How does the price change over time? How does the present value of the marginal net benefit change over time?

Review Problem 2 *Graphing Fun 1*- Sketch a graph showing demand for a nonrenewable resource. Add a constant MEC, and then add a MC curve that includes the MUC. Label the height that represents MUC at the market clearing price and quantity. How does this picture change when more of the resource is discovered?

Review Problem 3 *Graphing Fun 2* - Sketch a graph of the two-period Hotelling model that relates quantity extracted in the first and second periods to the MNB of that extraction. How does the graph change if the discount rate increases? Label Q_0^* (first period extraction) in each case.

Review Problem 4 *Graphing Fun 3*- Consider the fishery model covered in class and section. Draw the sustainable yield curve, and add labels for TR, TC, TP, S^{MSY}, S^{OA}, and S^{ESY}. What changes if total costs to participating in the fishery decrease? What doesn't change?

Review Problem 5 *Graphing Fun 4* - Sketch a graph showing different (linear) marginal extraction costs for two fishing boats. Label the curves so that boat A catches each fish more cheaply than boat B.

1. Pretend boats A and B represent the entire industry, and add the MEC_{Agg} curve.
2. Add a horizontal line representing a constant per unit price of fish. Identify the aggregate catch size without regulation.
3. Draw in a TAC that is lower than the open access level. Pretend this TAC is enforced with ITQs, and add a line representing the MEC faced by boat A and boat B implied by your TAC. Label the height that represents the permit price, and the quantity of fish that boat A and boat B catch.
4. Conceptually, what happens to the ITQ price and allocation shares of boats A and B if a third boat C enters with lower extraction costs? Assume the TAC remains unchanged but A and B are willing to trade permits.