Joules to Dollars – Economics: Terms, Tools & Techniques

I. Terms

Costs

Accountants – view a firm's finances retrospectively, because they keep track of assets and liabilities that depend on past performance

Economists – are forward-looking with respect to firms and consumers, focusing on what cost is expected to be in the future and how we can rearrange our resources to lower cost and improve profitability

Opportunity cost – that which we forego, or give up, when we make a choice or decision

What was the opportunity cost of you coming to class today?

When Colby raises $100M and decides to use it to build a new athletic center rather than add that money to its endowment, the opportunity cost is the return the College could have earned on that money.

Sunk costs – an expenditure that has been made and can't be recovered and therefore shouldn't influence our decisions

- Colby's purchase of the Hains Building in downtown Waterville. The purchase price of the building before renovations shouldn't have an impact on what they decide to do with the building.
- Purchase a ticket to go to a concert here at Colby. Meet some friends and they invite you to do out for a pizza afterwards. The price of the concert ticket is a sunk cost in terms of your decision to go out or not. (opportunity cost may be a factor)

Short-run costs – Total costs = fixed costs + variable costs

- Fixed costs for a firm don't change regardless of how much the firm produces (utility costs)
- Variable costs change with the level of output (e.g., fuel costs)

Marginal cost – change in total cost per unit of output

Average cost – total cost per unit of output

Example: electricity pricing – average price: cents/kWh; block pricing: marginal price is the incremental change in price per kWh from one consumption block to the next

Pareto efficiency – a solution in which you can't reallocate resources without making someone worse off

Externalities – Exist when the welfare of an individual or firm depends not only on their own actions, but also on the actions of another

Tragedy of the Commons

Individuals behaving 'rationally' in pursuit of their own self-interest act in ways that undermine the best interests of society by depleting a common resource

Examples

- Public roads/traffic congestion
- Fisheries
- Ground water aquifers
- Public restrooms

Electricity demand

2014 paper in Ecological Economics by Ohler and Billger

- Used a survey of individuals in the Midwest about their personal and societal beliefs on the importance of energy conservation
- Compared this with actual energy consumption
- Found that a belief that "limiting electricity use is a social responsibility" has no effect on energy saving behavior
- Climate change and clean air suffer from the tragedy of the commons because people fail to reduce electricity use even when they understand that doing so is socially important
- Self interests have a significant impact on energy saving behaviors: individuals with a greater concern for comfort are more likely to increase energy use; people with a greater concern about energy costs use less electricity

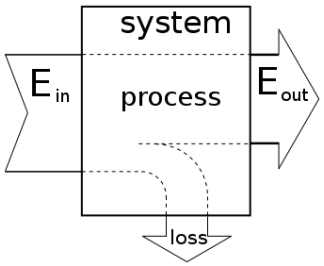
Climate Change Externalities

CO_2 emissions (greenhouse gasses) cause externalities both spatially and across time

- Spatially: developed nations are the largest emitters with the greatest capacity to reduce emissions but experience less damage by not acting than do developing nations
- Temporally: the costs of controlling greenhouse gasses falls on current generations while the benefits accrue to future generations
- What about renewable energy sources (e.g., wind)?

Efficiency

Thermal Efficiency



Efficient Markets

- Profit opportunities vanish [almost] instantaneously
- Toll booth
- Line at the grocery store
- Foreign exchange markets

Arbitrage

Trying to make a profit by buying and selling an asset in different markets.
Exploiting price differences for the same asset in different markets

REC [Renewable Energy Credits] arbitrage

- $0.16 for wind
- $250 for Solar – 1 credit per MwH; price is $250
- Tradable
- Homeowners in some states will sell these to utilities trying to comply with emissions regulations
- Colby can buy RECs to 'offset' their carbon emissions and achieve carbon neutrality
- See web site resource

II. Tools – discounting and net present value

Dynamic analysis – remember, economists tend to be forward-looking with regard to the behavior of firms and individuals

Q: Which is worth more: $100 today or $100 tomorrow? Why?
A: $100 today

- Inflation erodes the purchasing power of money
- Plus, $100 today represents an opportunity to 'invest' …
- … earning a rate of return [e.g., interest on savings] …
- … and thus increasing your purchasing power in the future

Present Value

- Suppose you put your $100 in a bank account earning 10% interest annually
- One year from now you'd have $110 in your account: 100×(1+.10)
- The **value today** of the $110 you'd realize a year from now is $100 [110/(1.10)]
- Suppose you left the money in your bank account for two years, earning 10% interest in each year
- After two years you would have $121 [100×1.10×1.10]
- The **present value** of the $121 you'd realize in two years is $100 $\left[{}^{121}/_{(1.10)^2}\right]$

Net Present Value

- The present value of a one-time net benefit received n years from now is:

$$PV[NB_n] = \frac{NB_n}{(1+r)^n}$$

- The present value of a stream of net benefits $\{NB_0, NB_1, \cdots, NB_n\}$ is:

$$PV[NB_0, \cdots, NB_n] = \sum_{i=0}^{n} \frac{NB_i}{(1+r)^i}$$

- Where r is the appropriate interest rate

Discounting the Future

- The process of calculating the present value of a future [net] benefit is also known as discounting
- In this context, r is the discount rate
- What about inflation?
- r is the real interest rate: nominal minus inflation

Handout: Colby's Biomass Facility

III. Techniques – market equilibrium

Analysis of Costs and Benefits

Fuel Price (in dollars)	Fuel Price (dollars per million Btu)
Cord Wood ($250/cord)	$11.36
Wood Pellets ($260/ton)	$15.64
Natural Gas ($1.69/therm)	$16.92
Heating Oil ($2.94/gallon)	$21.20
Kerosene ($3.54/gallon)	$26.22
Propane ($2.81/gallon)	$30.77
Electricity (baseboard) (15-18 cents/kwh)	$43.94-$52.75

Governor's Energy Office estimate of current prices
http://www.maine.gov/energy/fuel_prices/index.shtml

Equilibrium

- Competitive markets
- Price adjusts to bring about a situation in which the quantity demanded equals the quantity supplied
- If the price is too low, we have excess demand
- If the price is too high, we have excess supply

<slides here>

Work through graphs

Do an algebraic derivation of equilibrium and comparative statics (see Dahl book)

Talk about elasticity – log derivation

Macroeconomics flow chart – Ecological Economic System Model (handout)