Economics Part II

Key concepts, nudges, behavioral economics, and present value revisited

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

Tragedy of The Commons: Electricity

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

More Key Concepts

- 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
  - Examples?

Climate Change Externalities

- CO₂ emissions (greenhouse gases) 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 gases falls on current generations while the benefits accrue to future generations
  - What about renewable energy sources (e.g., wind)?

Efficiency

Thermal Efficiency

\[0 \leq \eta \leq 1\]

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

- Try to exploit price differences in search of a profit opportunity
- Let’s put $100 into the foreign exchange market [energy in]
- See if we get $100 back [energy out]
- Making our money “work for us”
- Seeking a return on investment (ROI)

Behavioral Economics

- Sometimes markets don’t always work
- People aren’t always “rational!”
- Market prices don’t reflect true valuations
- Solutions?
  - Government regulations, subsidies, tax breaks
  - “Nudges” [organ donors; saving for retirement]
  - Home electricity reports

Sealed-Bid Auctions

- You place a bid for an item in a sealed envelope
- Auctioneer collects the envelopes and opens them, selecting the highest bidder
- Bidders are not generally present when the winning bid is chosen

Problems with sealed-bid auctions

- Informational asymmetries exist which can lead to inefficient outcomes
- Bids can be distorted by miscalculations about what other bidders might offer

Result: buyers bid (and often pay) more than they have to just to make sure they win, or ...
... another buyer wins even though they get less value out of the item than a losing bidder might have
### English Auction
- Bidders all gather in the same location and the auctioneer calls out higher and higher prices
- You keep bidding until the price exceeds your valuation of the prize (or you are the last bidder, whichever comes first)
- An efficient outcome because the person who values the item most gets it

### Vickery Auction
- Each person places a bid in a sealed envelope
- The highest bidder wins, but pays the second highest bid

Q: Which auction, the English or the Vickery, produces a better outcome?
A: The outcomes are the same. The person who values the item the most gets it.

### Vickery Auction — Intuition
- Bid more than your valuation risks winning when it’s not worth it
- Underbidding never saves you money and you risk losing the item when you were willing to pay the second highest bid
- Your bid is your reservation price, the price that makes you indifferent between winning or losing
- Bidders have an incentive to offer exactly what the item is worth without fear of over or underbidding

### Suppose Colby auctions one of its works of art by Alex Katz
- You think this piece is worth $1000
- I think it’s worth $800
- In a traditional sealed-bid auction, you might offer $750 hoping to get the painting at a good price
- I would win the contract by offering $800 even though I value it less than you do
- An inefficient outcome

### Pareto optimality
- In a Vickery Auction, you would bid $1000, win the piece, but only pay $800
- More efficient outcome because the art work goes to the person who values it the most
- Colby is no worse off so the College is indifferent between the two outcomes
- Society has benefited by $200 in the form of increased utility
- A pareto-preferred outcome

### Other Auctions

**Dutch Auction**: Auctioneer calls out a very, very high bid and then lowers it until someone responds. The first one to shout wins the item.

Let’s try a twist on an English Auction: Prof. King will auction off a dollar coin. Highest bidder gets the dollar, but when the bidding is over the second highest bidder pays me their bid.
Consider two companies (players) negotiating for tradable pollution permits.
- Alpha has $100,000 in the bank but no pollution permits to trade.
- Beta has excess pollution permits to trade but no spare cash in the bank. Beta values its pollution permits at $80,000.
- Alpha would like to obtain Beta’s pollution permits which it values at $100,000.
- This is a new market for both players and neither knows the equilibrium market price.

Suppose Alpha offers to trade Beta $90,000 for its pollution permits.
- If Beta agrees to the trade then Alpha’s payoff is $110,000 ($100,000 in pollution rights + $10,000 remaining cash).
- Beta’s payoff is the $90,000 in cash it receives from Alpha.

Suppose, however, that Alpha sends Beta a check for $90,000 but Beta decides to keep its pollution rights and the $90K.
- Alpha is left with just $10,000 cash.
- Beta walks away with a total payoff of $170,000 ($80,000 in pollution rights plus $90,000 cash).

Alternatively, if Beta sends its pollution rights to Alpha and Alpha keeps the permits without paying for them, Alpha’s payoff is $200,000 ($100,000 cash + $100,000 in pollution rights) while Beta is left with nothing.
- Finally, if neither player trades then they are left with their initial payoffs, $100,000 cash for Alpha and $80,000 in pollution rights for Beta.

How Do We Solve This Game?

Nash Equilibrium - a set of strategies in which each player selects their best response to their opponents action.

Boils down to a search for dominant strategies.
Search for Beta's best responses

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Search for Alpha's best responses

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Nash Equilibrium

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Problems

- Both would be better off if they traded pollution rights.
- Due to the nature of the payoffs, each player is driven from the cooperative outcome by the threat of defection by the other player.
- Each player, acting in their own self interest, leads the game to a pareto inferior outcome.
- This is an example of a noncooperative game.
Present value revisited

"Present Value" equals the "Future Value" n-periods from now discounted to the present

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

Example: Colby just borrowed $100.8 million by issuing 40-year bonds

- Will pay interest only on the loan and in 40 years must pay back the $100.8 million
- Colby has set aside roughly $5 million of its endowment to pay off the loan in 2055
- Assume an 8% average return on Colby’s endowment
- Is $5 million enough?

\[ PV = \frac{100.8 \text{ million}}{(1 + 0.08)^{40}} = 4.64 \text{ million} \checkmark \]

Useful transformations

If \( PV = \frac{FV}{(1 + r)^n} \), then \( PV \times (1 + r)^n = FV \)

- Suppose as a graduation present you get $500 and you decide to put it into a stock market-indexed IRA and leave it there until you retire
- How much will you have (FV) in this account if you work until age 67 (n=47)?
- Average stock market return from 1950 - 2009 was 7%

\[ r = \left( \frac{FV}{PV} \right)^{\frac{1}{n}} - 1 \]

However, if you put away $500/month for 47 years @ 7% interest you’d have just over $2.2 million at retirement.

Amortization

Defn: paying off a debt with a fixed amount in regular installments over a period of time

Examples: auto loan, home mortgages, some student loans

Intuition: most auto loans and mortgages involve a fixed payment per month throughout the period of the loan

- Initially, a significant portion of your payment goes toward interest on the loan
- Over time, a smaller portion of your payment goes toward interest on the loan as the portion of the payment reducing the principal increases

Auto loan example

- $26,000 auto
- 5 year loan
- 2% interest rate is compounded monthly
- Amortized over 60 months (constant payment)