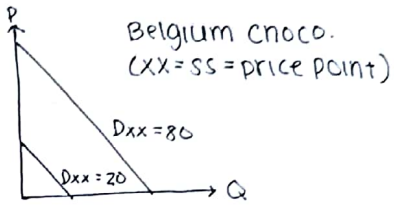
LECTURE 1

8-27-15

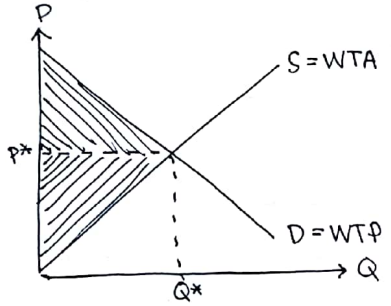
Rationality vs. Irrationality
1. Rationality is the fundamental assumption of consumer choice in economic models
   → But the truth is they are not always applicable
   usually wrong
   make predictions that are wrong
2. Irrationality fits the data better but causes normative tools for valuation to fall apart

Prediction (Positive) vs. Valuation (Normative): one in the same
1. Prediction uses economic models to predict impacts/rebound effects
2. Valuations are quantifying tools to see what policy is better

Ariely Experiment
→ preference reversal: choices Δ depending on anchoring effect
   ↳ advantage in negotiation to place number first
   ↳ "de-bias" through cognitive tasks to stimulate frontal lobe / rationality in the mind
→ Does demand from differing anchor points reflect actual utility?
   ↳ Ambiguous: does paying more = enjoy more?

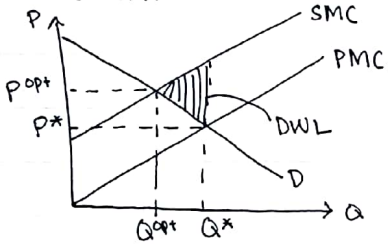


Perfectly Competitive Markets

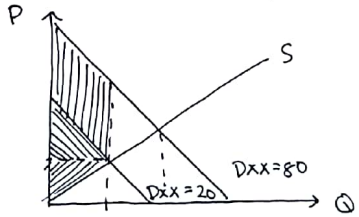


→ shows behaviors of consumers @ diff. prices
→ implies equilibrium is best (First Fund. Theorem)
   ↳ max producer + consumer surplus
   ↳ policy implic: laissez-faire (no gov't intervention)
→ Assumptions
   1. Perfect Comp: price takers w/no market power (low transaction costs)
   2. Perfect Info
   3. No externalities
   4. Consumers are rational utility maximizers
      ↳ understand consequences of choice
      ↳ decisions based on true preference

→ When assumptions fail:
   ↳ Externalities



   ↳ Internalities: affect people in market (not outside)



*what is the CS of the low anchor?

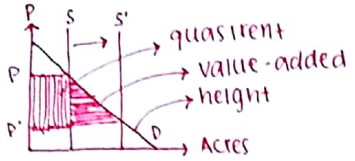
Failures of Consumer Rationality
1. Procrastination + self-control
   → pay gym membership, don't go, procrastinate cancellation
      ↳ D too high; PP: give discounts to go to the gym
2. Excessive discounting of future costs + benefits
   → don't take necessary meds
      ↳ D too low; PP: Social security for retirement / apps to remind you
   → don't save enough for retirement
      ↳ D too low; PP: Social security
3. Hot-cold empathy gap
   → people buy more food when hungry
      ↳ D too high; PP: in Berkeley there is a soda tax
   → ppl → believe they will use a condom when aroused
      ↳ D too low for birth control + UID; PP: IV for women

LECTURE 2

9-01-15

For Every Segment:
1. Present standard models + its positive/normative implications
2. Present phenomena that cannot be explained by standard models (anomalies)
3. Use psychological findings to explain anomalies
4. Modify standard models by incorporating new assumptions based on psychological findings
5. Discuss implications of new model + what it says about public policy
6. Explore applications + extensions of the model

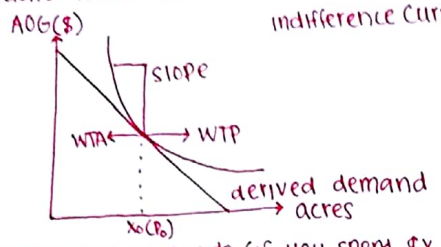
WTP/WTA is the price you are willing to buy/sell
→ positive: allow us to predict impact of gov't policy
→ normative: allows us to put a value on gov't policy



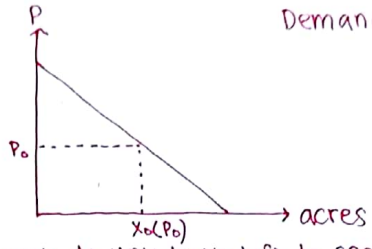
|||| quasirent: value lost from Δ in acres
≡ new value created for gain

height of the demand curve
→ max WTP for one more
→ max WTA for one less

Standard Model for Demand Curve



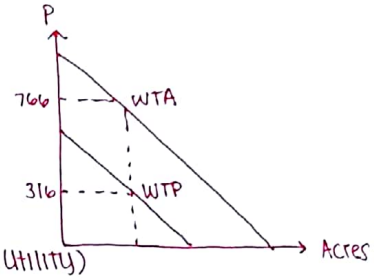
Indifference Curve



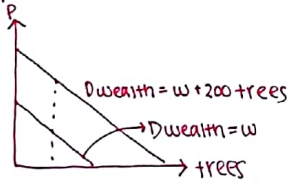
Demand Curve

→ AOG: all other goods (if you spend $x on acres, how much do you have left to spend?
→ slope = marginal rate of substitution (MRS = WTP/WTA): how many acres you're willing to give to get one unit of AOG (MU acres / MU AOG)
→ derived demand: budget constraint for P_0; consume at MWTP = price
→ thus, demand should be the same whether based on WTA or WTP to first order approx

Empirical Observations
→ Group 1 WTP to protect forest: $316
→ Group 2 WTA to allow purchase of forest: $7666
  ↳ Positive POV: under assumption of rationality + one demand curve, standard model may be incorrect (WTP ≠ WTA)
  ↳ Normative POV: how to use valuation
    → contingent valuation: placing value on environ amenities
→ Contingent valuation experiment:
  ↳ WTP have a larger endowment than WTA in this experiment
  ↳ anomaly = endowment effect (against Hicksian model of Rational Utility)



Normal Good + Income Effect
→ $\frac{\partial x}{\partial I} > 0$ for any given price, when income goes up, demand goes up
  ↳ could the income effect explain defference b/t WTP + WTA
    → income effect: when 200 trees are planted in local park, you feel "wealthier" that your WTP goes up by 5.6
      ↳ implausibility argument
→ embed difference in endowment in contingent val. for policy



"confounded" Factors
→ income effect cannot be totally ruled out
→ heuristics: subjects may habitually apply strategies learned in bargaining settings
  ↳ buying price below max WTP + selling price above min WTA
→ contingent valuation surveys are unnatural — cause confusion
  ↳ hypothetical situations or lying
→ To test true anomaly, you need a more rigorous methodology: randomized control trials w/ real stakes

Experiments
1. Tokens v. money
   → based on market principles by trading money w/ money
2. Mugs v. money
   → expect ½ to be traded after market clearing price
   → endowment affect (rule out heuristics + hypothetical)
3. Mugs v. Candy Bar v. Choice
   → ownership = worth more; choice ≈ 50%
   → rule out income effect

} people value goods they currently possess > goods they do not possess

LECTURE 3

9-03-15

Endowment effect
→ an individ monetary valuation of a good depends on whether or not they are initially endowed w/ a good (ex of reference point)
→ giving up a unit affects people more than gaining
  ↳ how you adjust will vary a lot
  ↳ more important is the domain of gains or loss (not buying or selling)
    → ex: stolen mug, reference point hasn't adapted, buy a new one
      ↳ recuperating a loss instead of a gain
→ ex: Bronze v. Silver medal
  ↳ most reference points was a smile

Physiological Findings

* People's valuations on goods tend to be dependent on a reference stimulus
  1. Size is relative
  2. Color is relative
  3. Hearing pitch is relative

Economics as a Science

1. Observation
2. Theory (model)
3. Hypothesis
   → testable predictions: if theory is correct, what will we see?
   → dispositive: when theory does not work
4. Test
   → further observation for future/further insight if hypothesis is correct
5. Revise theory (if dispositive)

Reference Dependence in Satisfaction + Happiness

→ comparison signals are everywhere now
→ ave. income of neighbors decreases your happiness by more than your own income
  ↳ split w/education level (high school + college)
    → people compare themselves to other like people
→ Olympic medal satisfaction depends on expectations

Loss Aversion

→ people care more about losses relative to reference point than gains
→ dual entitlement: transactions are referenced to existing transactions
  ↳ firms entitled to reference profit + employee to reference contract
  ↳ new social understanding on what is fair

Reference Dependence and Loss Aversion

→ model utility in term of the difference between consumption + reference point
  ↳ modeled separately for each dimension of consumption
  ↳ loss aversion: marginal disutility of a loss > marginal utility of a gain

$u(c_1, c_2; r_1, r_2) = v(c_1 - r_1) + v(c_2 - r_2)$

exogenous parameters | choice variables | value functions

$v(x) = x, \quad x \geq 0$

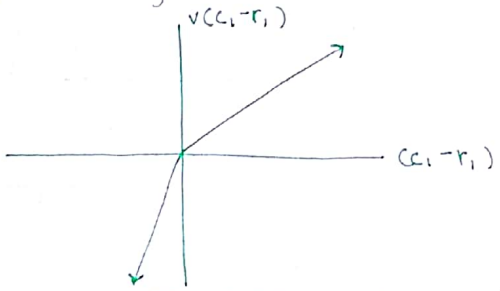
$v(x) = 2x, \quad x < 0$

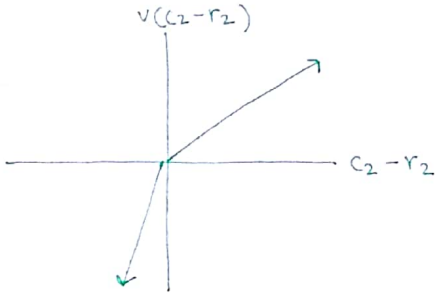
* domain of loss

observed parameter in most loss aversion domain

* $x = c - r$

→ Prospect theory





→ ex: $c_1 + r_1$ = mugs, $c_2 + r_2$ = money
  ↳ $u(c_1, c_2; r_1, r_2) = v(4c_1 - 4r_1) + v(c_2 - r_2)$
    $v(x) = x$ when $x \geq 0$
    $v(x) = 2x$ when $x \leq 0$
  ↳ buying price: $u(0, 0; 0, 0) = u(1, -P_b; 0, 0)$
  ↳ selling price: $u(-1, P_s; 0, 0) = $ "
    → loss aversion hits 2 dimensions — good 1 + good 2
      ↳ selling price is 4x the buying price

* coefficient 4 is the absolute utility holding losses + gains constant
  ↳ in absence of reference dependence, mug is worth $4

LECTURE 4

9-08-15

* Rationality is the glue that holds microecon theory together, but when you relax these assumptions of rationality then you are able to make better normative valuations but tools/models fall apart
  → are there anomalies? income effect?
  → reference dependence to explain human behavior (positive) + now what (normative)?

Basic Consumer-Choice Theory

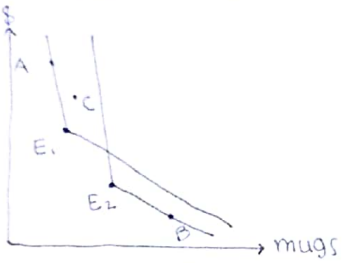
→ rational people have complete + transitive preferences
→ core of microeconomics: utility maximization
  ↳ engine of models w/incentives + constraints to make a prediction of human behavior
  ↳ point of utility func. is to order or rank
    → if you can rank/represent preferences in utility func, then there is some ranking
  ↳ cannot escape from assumption people like some things more
    → can use monetary valuation to execute normative judgments in trades that would not otherwise happen

→ but some people cannot rank their preferences!
↳ revealed preferences do not create rational ordering to predict future behavior
↳ ex: Apple > Pear, Pear > Banana, Banana > Apple (not transitive)
→ Note: you can get a lot of money!
↳ give an apple, offer a banana for apple + 5¢, offer pear for banana + 5¢
→ 1948: Milton Friedman (Ballard ex): take best shot that can be predicted from physics

Proof by Contradiction
IF: $A \succ B$ + $A \prec B$
and if: $X \succ Y$, $Y \succ Z \Rightarrow X \succ Z$ } if true: $A \succ A$ ⚔

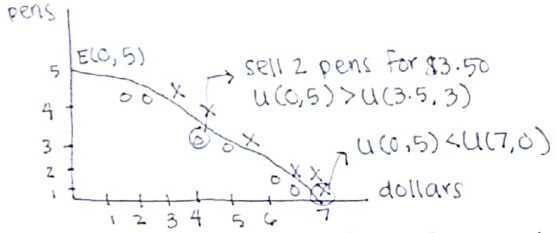
→ Preference reversals (if not driven by rationality like the income effect) are smoking gun violations of rationality

Indifference Curves

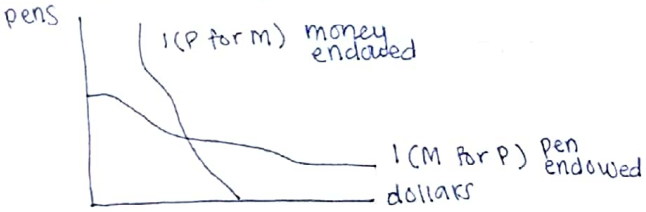


→ Intersecting IC are violations of rationality
↳ cannot be used to consistently rank a person's options
↳ allow for preference reversal
→ From E_1, $A \succ B$
→ From E_2, $B \succ A$
→ model cannot predict if C is preferable to A or B
* reference dependent has a kink @ the reference point
→ utility maximizing ICs are like mountains
↳ cannot build utility max func.
↳ this one crosses over space

→ Knetsch Experiment: $4.50 or 5 90¢ pens
↳ For one individ:



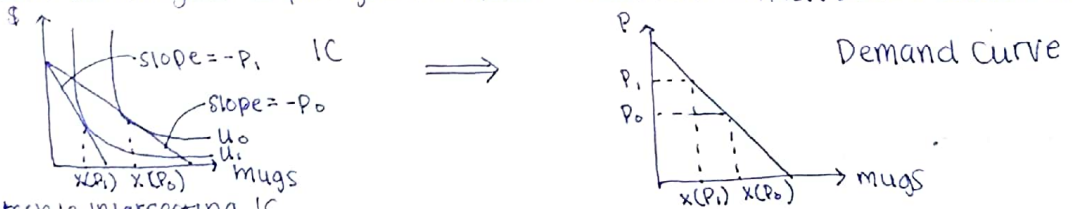
↳ For sellers + buyers



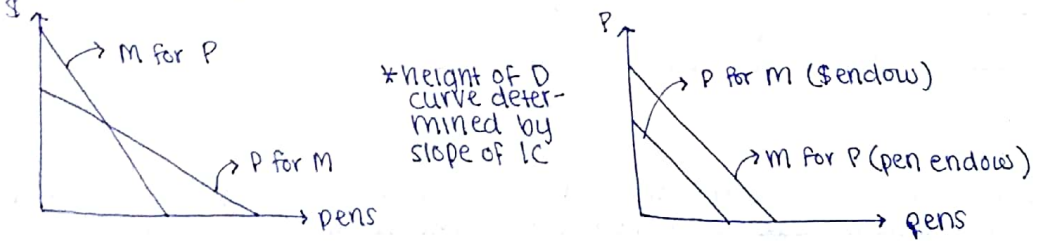
↳ ICs do not cross because people are buyers or sellers (affect shape but intersection is due to endowment)
→ buying to selling causes IC to be kinked
→ IC cross due to difference in reference point
↳ causes buy part of one IC to intersect the sell part of the other

State-Dependent Preferences
→ state-dependent preferences are not inherently irrational so long as preferences are consistently conditional on a state (i.e. buying ice cream v. umbrella on a rainy or sunny day)
→ Is an exogenous Δ in endowment a Δ in state?
↳ VERY controversial

Indifference Curve to Demand Curve
→ assume normal good: as price goes up, income + substitution effects drive q consumed down



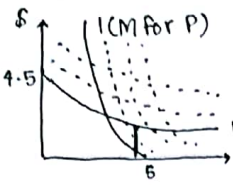
→ Knetsch's intersecting IC



LECTURE 5

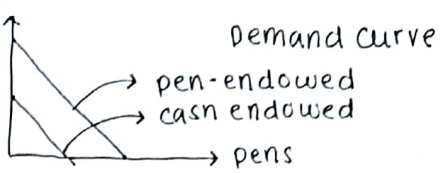
9-10-15

Demand Curves
→ Knetsch: intersecting demand / IC curves
↳ cross due to reference point + not due to buyer/seller difference!
→ slope of IC = MRS = WTP/WTA = height of the demand curve
↳ both represent dollars a person will trade for a pen
↳ assume non-intersecting IC curve relative to same reference points

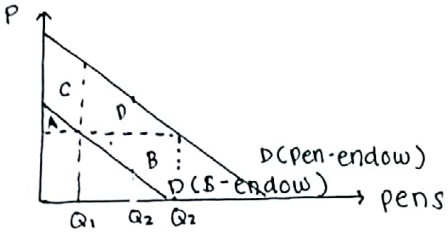


IC

pen-endowed will have steeper IC than the money-endowed given any quantity



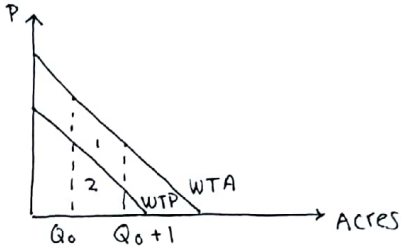
→ compare 2 bundles in terms of CS, holding income constant



CS_{MAP} @ 1 = A + C
CS_{MAP} @ 2 = A + C + D } 2 > 1
CS_{PAM} @ 1 = A
CS_{PAM} @ 2 = A − B } 1 > 2

* If in the domain of losses relative to reference point, CS will decr. despite your total wealth being constant

→ Contingent valuation of wetlands
↳ putting a value that markets do not but gov't cares
↳ can't determine benefit to society from an acre of wetland
→ what is society's reference point?
↳ may assume to be at status quo, but people may feel at a loss
↳ instead of a gain, may look like a reclamation of losses
↳ cannot come to unambiguous agreement
↳ policy of charging firms for destroying wetlands has decr. freq. of major spills



→ easy to manipulate people w/ reference point b/c they don't know how losses will feel

Benefit - Cost Analysis (Applied Welfare Economics)

→ Knetsch: vote for a) making bridge wider decr. traffic by 10 min or b) fixing the bridge that causes an extra 10 min of travel
↳ Knetsch: if there are identical costs + measurable outcomes, then people choose on basis of their loss aversion
→ if a policy causes a loss (or eliminates loss) = value according to WTA
→ gain (gain) = WTP
↳ implications: can drain entire CS by valuing gain by WTP, adapt, value loss according to WTA, + let people adapt = absurd + not solving problem of rationality
→ no valid tool for measuring consumer welfare
↳ under rational assump, can use observed demand curves (WTP or WTA)
↳ endowment effect violates this assump ⇒ multiple D curves ⇒ which is the true value?
→ If we knew reference points, we could use ref.-dep. model to make predict.
↳ use corresponding D to reference point
↳ WTA + WTP based on observed choice behavior
→ issue of Knetsch: no value on everything
↳ inequity can be a harmful result
→ can adapt to a loss of traffic relief but harmful effects can last! (i.e. species destroy)

* Behavioral econ provides models w/ better predictions (positive) at the cost of not being able to use the model for normative purposes

First Fundamental Welfare Theorem

→ philosophical normative assump: people know what will make them the best off + they will not harm other people
↳ presumption of human sovereignty — not conclusion!
→ libertarian paternalism: alt to laissez-faire (choosing for people)
→ sellers w/ reference dependent pref w/ loss aversion
↳ supply curve is higher than standard model (less willing to trade)
→ does not affect predictive power (positive) of model b/c derived from observed choice behavior
→ in terms of social surplus (normative), unknown if curves represent value
↳ Knetsch: these supply curves represent value + FWT still holds
→ opinions vary but BCA typically rejects WTA as a measure of value

Market Experience + the Endowment Effect

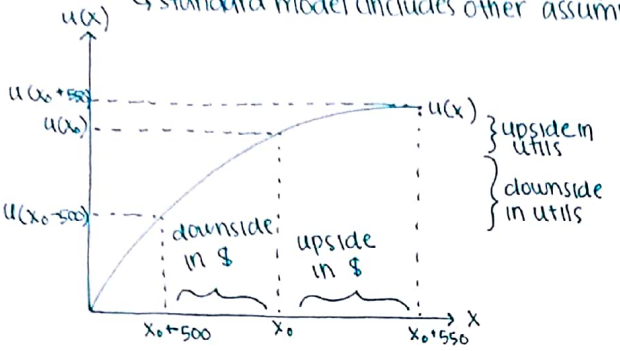
→ List exp: non-exp non-dealers exp. endowment effect but no one else does
↳ exp. dealers treat goods as cash equivalents (like token)
→ Does exp cause dealers to lose ee or does the lack of ee make you trade more?
↳ those that incr. their trade were more likely to trade
→ Does market solve the rationality problem caused by ee?
↳ only in markets where people trade repeatedly + frequently
↳ Genesove + Mayer: home owners who faced loss relative to original price paid listed condos at higher asking price, took long to find a buyer, fewer trades, likely to fail, received higher price if sold ⇒ have ref.-dep. pref. w/ loss aversion
→ smaller effect among investor-owners (cash eq)
↳ loss aversion causes large problems in big ticket trades

LECTURE 6

9-15-15

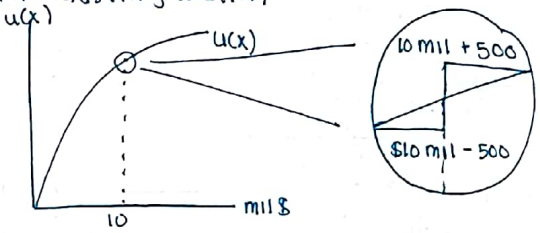
Expected Utility Theory

→ $EU(G) = \sum_{s \in S} P_s u(x_s)$: rational model where utility of the game is the sum of the probability of a certain state occurring times the utility you receive from that state
↳ standard model (includes other assump') vs. rational model
→ people decide whether to take risks by weighing the utility of the upside against the disutility of the downside
→ diminishing marginal utility of wealth: the more money you have, the less you care about gaining more
↳ downside weighs more heavily than upside
↳ care more about downside → poorer → care more about money
↳ Dim $MU_x \iff u_x' > 0 + u_x'' < 0$
↳ not to do w/ loss aversion (funda. different!)
→ is money an inferior good?

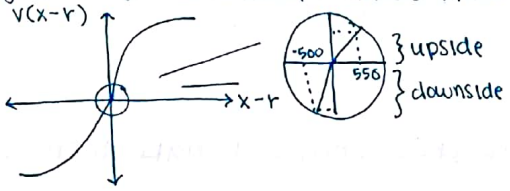


Risk Aversion

→ people are willing to pay to avoid risk (insurance) + require payment to accept risk (higher returns for stocks than bonds); unwilling to accept some "better than fair" games
→ Coefficient of Relative Risk Aversion: $\gamma = -u''(x)/u'(x)(x) = \partial MU_x/\partial x \cdot x/\partial MU_x$
↳ elasticity: % Δ in MU_x, $x = \varepsilon_{MU_x, x}$
→ Barberis, Huang + Thaler Exp: 4 subject groups (MBA students, financial advisors, CIOs / directors of equity research, + private-wealth division of US bank) to represent some sense of diff. socio-economic status
↳ game 50% losing 500 + 50% of winning 50%
↳ high rejection rates meaning they would reject a gamble of 50% losing $10,000 + 50% gaining $20 mil
→ $500/$550 gamble is small relative to individ existing wealth
↳ for tiny changes in x, the utility func. u(x) is almost perfectly linear
→ @ endowment → flat utility = neutral risk
→ if u(x) was sufficiently curved to predict risk aversion over $500, it would also predict rejection of $20 million gamble
→ investor worth $10 mil should invest $10,000 in a 50% chance to triple their wealth



→ matt Rabin: EU predicts people will lose interest in money so rapidly
↳ if turn down 50-50 bet of losing $100 or gaining $110
→ always turn down 50-50 bets of losing $1000 or gaining any sum of money
↳ if turn down 50-50 bet on $1000-$1050
→ always turn down 50-50 bets of losing $20000 or gaining any sum
↳ implausible degrees of risk aversion
→ Ken Arrow: no matter how risk averse, EU theory says there is always a small enough better-than-fair gamble you will accept unless there is a kink in u(x)
↳ a reference-dependent utility func. w/ loss aversion always has a kink no matter how small the stakes
↳ implies even a wealthy investor will reject a small-stakes gamble
→ people should be netting all risks + not look at separately
→ narrow bracketing



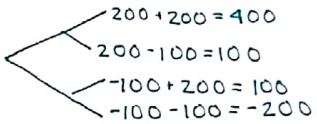
Excessive Small-Stakes Insurance (Ex)

→ Syndor's Calibration Model: overweighing small probability of an accident + loss aversion w/ respect to future losses
↳ Typical home owner insurance choices + baseline: paid $100 on top of baseline premium to lower their deductible to $500 w/ a claim rate (proxy probab. of damage) under 5%
→ pay $100 for insurance w/ expected value under $25
→ ave. owner paid 5x the expected value of a lower deductible
→ implausible EU model: owners need to be 200-1000 x more risk averse than typical
↳ means they will reject a gamble of 50% lose $1000, + gain any sum
→ Reference-dependence model predicts customer's choices quite well
↳ home owners make insurance choices based on:
1. possible gains + losses (damage v. no damage on home)
2. Relative to reference point of expected net losses
3. At the time of the loss
↳ Premium is typ. paid long before any loss occurs so home owners correctly predict they will adapt to the loss of the premium so
1. their reference point is higher if they didn't adapt to loss of premium
2. correctly predict there will be no sense of loss from extra premium
3. Prospect of losing $500 in future feels really big relative to adaptive reference point

↳ willing to pay a relatively large amt to avoid chances of loss
→ Sydnor rules out other expectations/alt. explanations:
1. Risk misperception: owners think damage is more likely
2. Consumption commitments: extra loss may prevent payment of other bills
↳ necessary required spending affected by budget (fast + slow)
3. Borrowing constraints: owners cannot borrow to cover $500 loss
4. Pressure from sales agents
→ profit per contract: $75
↳ home industry profit in a year: $5.6 billion
* this kind of calibration exercise doesn't prove anything but is highly suggestive

Finance: Equity Premium Puzzle

→ Two types of investment
1. equity: you become part owner (return is high if firm does well, low if badly)
2. debt: give a loan (well or badly performed, you get principle + interest)
→ Mehra + Prescott: under standard model of EU, a 6% premium (equity return = 7% + debt = 1%) would require a coefficient of relative risk aversion of 30
↳ implausible: most real-world est ~ 1 (UK models from questionaire)
→ $u(x) = \ln(x)$ has coefficient of RRA = 1
→ Benartzi, Thaler: reference dependence plus narrow framing
↳ ex: $u(x) = \begin{cases} x & \text{if } x \geq 0 \\ 2.5x & \text{if } x \leq 0 \end{cases}$
→ Would you accept 50% gain $200, 50% lose 100?
↳ expected value: 50
↳ expected utility under reference dependence: $\frac{1}{2}(200) - \frac{1}{2}(100)(2.5) = -25$
→ Accept the same gamble 2x?
↳ 25% gain $400, 50% gain $100, 25% lose $200
↳ expected value: $100
↳ expected utility under RD: $\frac{1}{4}(400) + \frac{1}{2}(100) - \frac{1}{4}(200)(2.5) = 25$



LECTURE 7

9-17-15

Equity Premium Puzzle Continued...

→ Narrow framing: frame choice one gamble at a time instead of both gambles together; another violation of standard model
→ myopic loss aversion:
↳ the more frequently you check stocks, more likely to feel a loss
→ using typ reference-dependence model, Bernartzi + Thaler est. that if investors check once a year, there will be a 6% equity premium
→ exp. utility checking a stock = violation of std model
→ Haigh + List experiment: 100 tokens to invest in a bet (1/3 get 2.5x or 2/3 nothing)
↳ 2 groups: frequent (after every round) + infrequent (after 3 rounds)
→ students: infrequent group invested 81% more than frequent
→ traders: infrequent invested 61% more than frequent
↳ market exp in high frequency market does not drive out loss aversion
↳ loss aversion: losses are felt more strongly than gains
→ Without narrow framing + w/RDP + loss aversion, you should accept a 50-50 bet to gain 550/lose 500 because ave. return > 0.
↳ "should": std model tells you how to behave to be better off
→ Why isn't the reference dependence model used?
1. Std model predicts the stock/the value of the company should be given no irrationality
2. Reference-dependent model is not finished
↳ cannot write mathematically + models are made after the observ. (not predictive)
3. Scientists have loss aversion to their theories
*society is not better off by using the std model when people are not rational but ppl can use the std model to improve themselves

Reference Dependence in Labor Supply

1. Intensive margin: hours worked
→ Camerer et al: cab drivers on high-wage vs. low wage days
↳ spot labor market: drivers choose their hours + wages Δ everyday (weather, events)
↳ std model predicts drivers will work longer hours on high wage days
→ long term max income for given hours
→ buying leisure when cheapest (i.e. buying goods on sale)
↳ compute day's wage (cannot be earnings/hr due to endogeneity) + regress hr worked on wage + drivers fixed effects (control for diff b/t drivers)
→ log of hours + wage: actual supply elasticity
↳ elasticity of supply: -0.186 to -0.618 = work less when wages rise (downward sloping supply @ a certain range)
↳ for exp drivers, elasticity for the most part is positive
↳ reference-dependent model w/loss aversion + narrow framing
→ narrow framing: drivers max daily utility rather than monthly or yearly
→ reference point: daily income target
↳ below target = loss (work hard); above target = gain (stop working)

→ utility max in the rational model trades off money + leisure
↳ if income targetting drivers drove the same hours a day, their income gone up by 7.8% on ave.
↳ if labor-supply elasticity was 1, income would↑ 15.6% on ave (+ more leisure)
↳ For experienced drivers: does experience drive out loss aversion?
→ Or do they stop narrow framing or develop willpower against it?
→ Why does experience make a difference for cabbies but not financial tradesrs?

2. Extensive margin: labor-force participation
→ Neumark + Postlewaite: labor supply decisions of married women
↳ National Longitudinal Survey of Youth: tracks ppl to adulthood (wide data set)
↳ Logit regression of whether or not a woman works when:
1. own wage (+ demographic + local unemployment rate) > standard labor supply
2. Husband's income (+ other household income) L(wage, non-labor income, pref, demand-side factors)
3. whether sister-in-law works
4. whether husband makes less than sister's husband
↳ standard model predicts 0 or neg effect on c + d
→ leisure comes from leisure + consump of goods
↳ if family's income↑ ⇒ maybe more gifts ⇒ make you less likely to work
↳ Results: likelihood of women working incr.
→ 7% if sister-in-law works
→ 16-25% if husband makes less than sister's
* A RD model predicts rapid incr. in women's labor force participation in the US after WW II than std

Reference-Point Determination

→ Assumptions of reference points
1. R = immediate status-quo consumption (i.e. mugs)
↳ alt. assumption 1: consumption prior to exp (prediction: weaker endowment effect)
↳ alt assumption 2: expectation of future consumption (prediction: no endowment effect)
2. R = daily income target (i.e. taxi drivers)
↳ alt asump 1: R = yesterday's income (pred: more neg. elasticity)
→ regression to the mean: high income wage day yesterday means lower today
↳ alt assump 2: R = expectation of daily income, given daily wage (pred: positive elasticity)
3. R = sister or sister-in-law's household income (how could we predict?)
↳ hindsight bias: ex post, correct assumption seems obvious

→ Consistent theory of reference determination is important because
1. Positive economic model should predict ex-ante, not just explain ex-post
↳ prediction outside dataset is fundamental to positive economics
2. Scientific process requires that any hypothesis must be falsifiable
↳ prediction outside dataset is fundamental to testing theory

→ Evolution of behavioral model: candidates for reference point
1. Status quo: $r_t = c_t$
↳ explains a lot but clearly wrong in many cases
2. Lagged consumption: $r_t = \gamma c_{t-1} + (1-\gamma) r_{t-1}$ where $\gamma \in [0,1]$
↳ γ: weighted ave. of lagged consump
↳ $r_t = \gamma \sum_{\tau=1}^{T} (1-\gamma)^{\tau-1} c_{t-\tau}$: sum of discounted past assump.
↳ better model in many cases because it shows how the past affects the present
→ allows for adaptation
↳ γ: rate of adaptation (high values = fast adaptation γ more weight on recent past / past weight decays faster)
→ If $\gamma = 1$, then it is the status quo model ($r_t = c_{t-1}$)
→ If $\gamma = 0$, then it is the std model ($r_t = r_{t-1}$)
↳ Imp. feature of good behavioral econ model
→ extend existing models (often right) rather than replacing it
→ allow for clean parametric tests of whether std model is violated
↳ clearly wrong in many cases: Pell Grants
3. Recent Expectations
↳ Koszegi + Rabin: R = recent expectations of outcome
→ ex: expect a painful dental procedure, ⇒ mere checkup feels like a gain
→ ex: expect to spend $40 on item ⇒ $30 purchase feels like a gain ⇒ not buying at $50 may feel like a loss
↳ expectations adjust to new info immediately
→ but reference point does not immediately adjust to new expectation
↳ K-R model embeds lagged consump as one thing that affects recent expectations (expectation of future model is recent past)
→ If you don't expect exog. parameters to Δ, no reason to expect utility max consumption choices will change
↳ Abeler et al exp: for a boring task, they would have a 50-50 of getting paid for work or x amt fixed
→ when x = $3, a lot stopped working when earned $3 (same when x = $7)
→ x treatment affects subject's expectations about earnings ⇒ determines reference point

→ Koszegi-Rabin Model + Expectations
↳ $r = E(c^* | r, p, \theta)$ where $c^* = \max_{c \in C} c; r, p, \theta)$
→ individ reference point at any time is
1. their expectation / prediction of future consumption
2. under the assump that their consump will max preferences given
↳ prices + other exog parameters
↳ what their reference point would be if they are right
3. if they are right about what they would consume under that reference point

→ circular: given your reference point is what you think you will do, if you do it, you're right
→ model does not allow you to believe you will do something you won't actually do
↳ ex: w/endowment of (0,0)
→ expect to buy a mug ⇒ reference point (1,-p)
↳ provided buying a mug will actually max your utility func.
↳ reference point cannot be (1,-p) if you would not prefer to buy a mug at that price at that reference point

MIDTERM 1 REVIEW

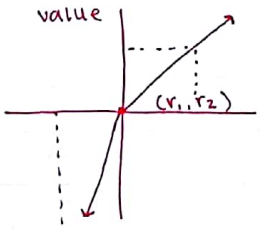
9-22-15

→ Economics as a Science
1. Observation
2. Theory/model
3. Hypothesis (testable predictions or dispositive hypothesis)
4. Test (future insight)
5. Revise theory if dispositive

→ Behavioral Models
1. Present std model + its positive/normative implications
2. Present anomaly not explained by std model
3. Use psychological findings to explain anomalies
4. Modify std model by incorporating findings
5. Discuss implications of new model (public policy)
6. Explore applications + extensions

→ Standard Model
1. Rational utility-maximizing agents
↳ complete + transitive preferences (able to rank bundles) ⇒ predict w/incentives + constraints
2. Perfectly competitive markets
↳ competitive (no market power), perfect info, no externalities, rational utility maximizers (understand consequences of choice, make decisions based on true preferences)
↳ First Fundamental Welfare Theorem: market equilibrium is efficient
→ normative presumption of human sovereignty
3. Non-intersecting IC + one demand curve (WTA = WTP)

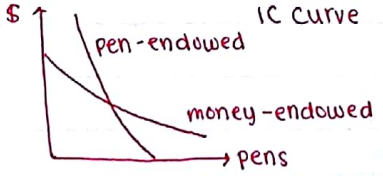
→ Failures of the Standard Model
1. Procrastination + lack of self-control
2. Excessive discounting of future costs + benefits
3. Hot-Cold Empathy Gap
4. Reference-Dependent Preferences
↳ preference reversal: preference ordering will depend on the process eliciting them
a. anchoring effect: attaching to a reference point
→ Ariely experiment: $XX Belgium chocolates where XX = last 2 # of SS
b. endowment effect: value goods you possess more than goods you do not
→ contingent valuation: WTA > WTP resulting in 2 demand curves (diff MRS)
↳ possibly due to income effect (highly unlikely), heuristics, or unnatural setting
→ Kahneman, Knetsch, Thaler: controlled mug + token (induced market) exp.
↳ candy + mug exp: rule out income
→ reference dependence in psychophysics: valuation of objects tend to be dependent on a reference stimulus
↳ color, size (Helson), pitch (Campbell, Lewis, Hunt)
↳ observational studies: comparison signals
→ Luttmer: happiness of income relative to neighbor's income
→ Medvec, Madey, Gilovich: happiness from olympic medal depends on expect.
→ loss aversion: people care more about losses relative to reference point than gains
↳ marginal disutility of loss > marginal utility of a gain
↳ dual entitlement: transactors referenced to existing transaction
↳ model: $U(c_1, c_2; r_1, r_2) = u(c) + v(kc_1 - kr_1) + v(mc_2 - mr_2)$
where $v(x) = x$ when $x > 0$ + $v(x) = 2x$ when $x < 0$

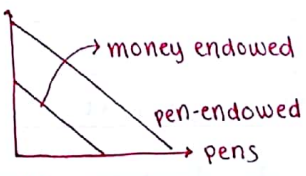


Δ in good c_1 relative to r_1

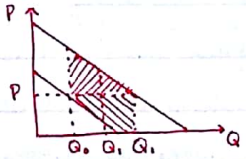
* k + m are the marginal consumption utility of c_1 + c_2, respectively

↳ Knetsch: pen + money endowment experiment

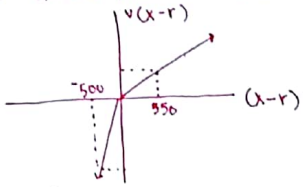




↳ breakdown of normative model
→ What truly reflects people's valuation of a good?
→ Given 2 demand curves, what is the benefit from moving from Q_0 to Q_1?



c. Perceived risk aversion: willing to pay to avoid risk, require pay for risk, reject better than fair games
→ diminishing marginal utility of consumption · downside weighs > upside
→ Barberis, Huang Thaler: 50-50 bet of +$550 + -$500
↳ most reject (more experience = likelihood is smaller)
↳ implausible
→ would reject 50-50 of -+$10K + +$20 mil
→ for small Δx, utility is almost linear
→ Rabin: If reject 50-50 of -$100 + +$110 then reject (50,50) of -$1000 + +$anything; if reject 50-50 of -+$1000 + +$1050 then reject -$20K + +$any
↳ implausible degrees of risk aversion
→ endowment effect
↳ Arrow: no matter how risk adverse, always a better-than-fair gamble small enough to accept unless there is a kink



↳ this is a ref-dep model w/loss aversion!

→ Calibration Model (Sydnor): overweighting small p of accident + loss averse to future losses
↳ people are willing to pay large amounts for home insurance despite small r to avoid chance of loss (adapt to loss from premium)
→ Narrow framing: frame outcome one at a time instead of together
↳ myopic loss aversion: more freq. check stocks = more loss averse
→ Haigh + List: infrequent group invest more than frequent
→ Menra + Prescott: equity premium puzzle
↳ camerera: taxi drivers + daily income targets (neg. elasticity of supply)

→ Possible Explanations + Normative Issues
↳ Reconciling w/standard model * have expectation-based reference points
→ state-dependent preferences: consistently conditional on state (endowment = Δ in state?)
→ market experience: (List) dealers vs unexperienced nondealers (cash equivalents)
↳ Genesove + Mayer: only in markets w/frequent trades
→ Knetsch: use WTP/WTA depending if in loss or gain dimension if cost + outcomes are identical
↳ does not account for adaptation nor other costs beyond economic
↳ Normative Issues
→ no valid tool for measuring welfare b/c true value is unknown
→ cannot concretely place in mathematical model
→ need a consistent theory of reference determination
↳ Neumark + Postlewaite: R = sister-in-law's household income
→ cannot predict
↳ R = status quo, lagged, expectation, daily income target, yesterday's income, expected income, etc. (hindsight bias: seems obvious after the fact)
↳ important because
1. Positive models should predict ex ante (outside data set) + ex post
2. Scientific process requires falsifiable hypothesis
→ prediction beyond data important for testing theory

→ Candidates for Reference Point Determination
1. Status quo: $r_t = c_t$
↳ explains mugs + contingent valuation but does not acc. for adaptation rates
2. Lagged consumption: $r_t = \gamma c_{t-1} + (1-\gamma) r_{t-1}$ where $0 \leq \gamma \leq 1$
↳ γ parameter: adaptation; high values = more weight on recent past
→ $\gamma = 0 \Rightarrow$ standard model where $r_t = r_{t-1}$
→ $\gamma = 1 \Rightarrow$ status quo
↳ allows for clean parametric tests to see if std model is violated
↳ does not take into account of expectations
3. Recent expectations: $r = E(c^* | r, p, \theta)$ where $c^* = \max_c u(c; r, p, \theta)$
↳ Koszegi + Rabin: requires rational expectations given your ref point is what you think you will do
→ rational expectations: belief about distribution of future parameters + preferences are correct
→ includes consumption utility
→ explains why there may be no endowment effect
→ no current expectations b/c ref point does not immediately adjust to new info

LECTURE 8

9-29-15

Importance of Intertemporal Choice

→ Almost all current choices have future consequences
1. Investment type choice: immediate costs, delayed benefits
↳ ex: exercise know to be healthy later
2. Temptation type choice: immediate benefits, delayed costs
} almost always uncertainty + intertemporal tradeoffs in every decision we make
→ Implications for
1. Happiness/Social Welfare: retirement savings, long term health impacts
2. Public Policy in the US:
↳ gov't debt (SS/retirement, medicare/senior health insurance)

↳ health care: 17.9% GDP, 27/34 OECD countries on life expectancy
→ If people are rational utility-maximizers (rational pref + expectations)
↳ they choose what makes them best off for the rest of their lives
↳ no reason for gov't intervention

* rational: what people do is what they wanted most

Modeling Intertemporal Choices

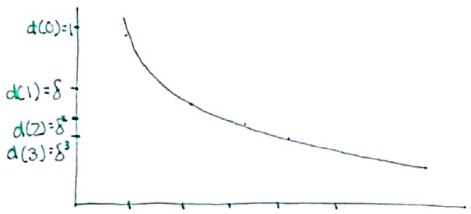
→ Plan: any sequence of outcomes that unfolds over time
↳ sequence of time periods: $t = 0, 1, 2, \cdots, T$
↳ outcomes for each period: $x_0, x_1, x_2, \cdots x_T$
→ we will think of this in one dimension (measured in monetary value)
↳ Plan: $P = \{x_0, x_1, x_2, \cdots x_T\}$ (vectors which define an outcome)
→ Typically, former the outcome are in the future, the less we take them into account
↳ not necessarily care less (psych reasons differ)
↳ we discount the future, assuming circumstances don't change (knee pains @ 20 vs @ 80)
→ depends on preferences for future, time, + delay (not money)
→ ex: P1 = {10K, 10K, 10K, 10K, 45K} + P2 = {15K, 15K, 15K, 15K, 15K}

Standard Model: Exponential Discounting (Discounted Utility)

→ Paul Samuelson (1937): DU model
↳ instantaneous utility function: $u(\cdot)$; in each period, individ. will get "instantaneous utility" from the per-period outcomes in a plan $[u(x_0), u(x_1), u(x_2), \text{etc.}]$
→ assume this is continuous over time + ignore preference Δs over time
↳ based on instantaneous utility, consumers will value the plan in 2 stages
1. Discount instantaneous utilities generated by a plan for each period by some factor $d(t) \in (0,1)$
→ $\partial d/\partial t < 0$ (discount more future into the future)
2. Sum discounted instantaneous utilities over all periods
→ $U(P) = \sum_{t=0}^{T} d(t)\,u(x_t) = d(0)u(x_0) + d(1)u(x_1) + \cdots + d(T)u(x_T)$
→ choose plan that generates the highest discounted utility
↳ discount factor gets smaller exponentially over time: $d(t) = \delta^t$ where $\delta \in (0,1)$
→ values go down at a constant percent discount relative to previous period
→ thus DU becomes

$$U(P) = \sum_{t=0}^{T} \delta^t u(x_t) \qquad \delta \to 1 = \text{account future more}$$

$$= u(x_0) + \delta u(x_1) + \delta^2 u(x_2) + \cdots$$



→ ex: P1 = {10, 10, 10, 10, 45}
P2 = {15, 15, 15, 15, 15}
↳ $10 + 10(0.9) + 10(0.9)^2 + 10(0.9)^3 + 45(0.9)^4 = 63.9145$
↳ $15 + 15(0.9) + 15(0.9)^2 + 15(0.9)^3 + 15(0.9)^4 = 61.4265$ } greater

Implications + Anomalies

→ ex: Group 1 (temptation) chooses \$100 today rather than \$105 in 2 weeks
Group 2 (prudence) chooses \$105 in 52 weeks rather than \$100 in 52 weeks
→ under DU, preferences over delayed outcomes should not change, holding everything constant
↳ $t = 1, 2$, etc. represents 2-week periods
→ implies $u(100) > \delta u(105) \Rightarrow \delta < u(100)/u(105)$ } preferences of delay Δ over time
→ $\delta^{26} u(100) < \delta^{27} u(105) \Rightarrow \delta > u(100)/u(105)$ } per period discount is not constant
→ Time consistency: for any 2 plans, A + B, which differ beginning at some period t, an individ who prefers A over B at any point in time before t, will also prefer A over B at time t (+ vv)
↳ per period discount factor is constant over time
↳ exhibit preference reversals if preferences do not satisfy time consistency
↳ on average, preferences do not satisfy time consistency (preference reversals depend on how far you are receiving your money) which suggests
1. Standard DU model cannot explain observed results (anomaly)
2. Irrationality: individ exhibit preference reversals in intertemporal choice
3. Discount factors Δ depending on where we are in time

LECTURE 9

10-01-15

Time Inconsistency

→ Preferences are time consistent iff:
1. For any two plans, A + B, which differ beginning at some point t,
2. an individ who prefers A over B at any point in time before t,
3. will also prefer A over B at time t
] and vice versa

→ Simple case: A + B at t=1
↳ time consistency means $u(x_0, x_1^A, x_2^A \cdots) > u(x_0, x_1^B, x_2^B \cdots) \Rightarrow u(x_1^A, x_2^A \cdots) > u(x_1^B, x_2^B, \cdots)$
↳ when we move through time, preferences should be the same
→ but what about the 52nd week? preferences Δ!
↳ due to exponential discounting, DU predicts time consistency
→ per period discount factor is constant over time
→ If $u(x_0) + \delta(x_1^A) + \delta^2(x_2^A) + \cdots + \delta^T u(x_T^A) > u(x_0) + \delta u(x_1^B) + \delta^2 u(x_2^B) + \cdots + \delta^T u(x_T^B)$ is true then $u(x_1^A) + \delta(x_1^A) + \cdots > u(x_1^B) + \delta u(x_2^B) + \cdots$ is true
→ but they way you feel about delayed tradeoffs will change
→ preferences do not satisfy time consistency $\Leftrightarrow$ exhibit preference reversals

→ Preferences on average do not satisfy time consistency which suggests
1. Anomaly: standard DU model cannot explain observed results
2. Irrationality: individ exhibit preference reversals in intertemporal choice
3. Apparently discount factors change depending on where we are in time
→ Questions to consider
↳ Is this just a case of state-dependent preferences?
→ Is "facing a choice about what happens right now" a different state than "facing a choice about what happens in the future"? (only when thinking about temptation)
↳ Do immediate choices arouse temptation (craving) but future choices do not?
→ "State of temptation" fundamentally different from "not in state of temptation"?
↳ some say preferences are time consistent even if choices aren't
↳ but there may be many psych reasons preference reversals occur
→ Two thoughts
1. Some economists will say anything to preserve reality
2. No right answer to the question
↳ In terms of how behavior deviates from rationality, policy implications of time inconsistent choices are the same (positive)
↳ normative implications are vastly different
→ Under DU, it is not preferable to restrict your future choice set
↳ Proof by Contradiction
1. Suppose you choose X when choice set is $\{X, Y, Z\}$ & Y when choice set is $\{Y, Z\}$
→ but you prefer to have your choice set restricted to $\{Y, Z\}$
2. Since X was chosen from $\{X, Y, Z\}$ it must be the case that $X \succ Y$
3. But since $\{X, Y, Z\}$ results in X & $\{Y, Z\}$ results in Y, then $\{X, Y, Z\} \succ \{Y, Z\}$
4. This contradicts (1) so (1) cannot be true
↳ "Adding choices to your choice set can only make you better off"
→ unless you know you have a self-control problem
→ back to poor normative tools b/c there are different versions of ourselves

Examples of Preference Reversals

→ Green, Fristoe, Meyerson Experiment: which do you prefer?

	A	B
1	20 for now	[50 in 1 wk
2	20 for now	50 in 1 mon.]
3	[20 for now	50 in 3 mon.
4	20 for now]	50 in 6 mon.

	A	B
1	[20 in 1 wk.	50 in 3 mon + 1 wk
2	20 in 2 wk]	50 in 3 mon + 2 wk
3	20 in 1 mo	[50 in 4 mon
4	20 in 3 mo	50 in 6 mon]

↳ Results
→ $20 vs. $50: 21% waited for $50 when $20 was available now
100% waited for $50 when $20 wasn't available until 3 months
→ $100 vs $250: 30% ——— $250 when $100 was available now
71% ——— wasn't available until 3 months
→ $500 vs $1250: 40% ——— $1250 when $500 was available now
88% ——— wasn't available until 3 months
→ no one was willing to wait 20 yr for $250 but 33% were when $100 not avail until 10 yrs
↳ the now is less tempting when stakes go up
↳ when "now" is longer, as stakes incr. some people become more patient
↳ do stakes make temptation a bigger deal or make self-control stronger?
→ Implications
1. Virtually no one can claim to be perfectly time consistent
2. Preference reversal $\leftrightarrow$ non-constant δ
3. For policy, it matters how long people will start exerting self-control
→ Malmendier, DellaVigna: health clubs in Boston
↳ membership options: 10-visit pass ($10 per visit), unlimited ($70 per month)
↳ most chose unlimited & visited on ave. 4.3 per month ($17 per visit)
↳ Implications
1: When costs & benefits are in the future, members prefer attendance over non-attendance
→ want to invest for a long-term reward ("no pain, no gain")
2. When costs in present & benefits in the future, members prefer non-attendance over attendance
→ preference reversal
→ investment no longer seems worth it (i.e. get out of bed)
↳ Normative question: which set of preferences should we take seriously?

Time Invariance of Discounting

→ Assumption of DU is implied, per-period discount factor δ should be the same regardless of the day
↳ Assume $u(x) = x$
→ If \$250 now $\sim$ \$$X_t$ in t months, your implied monthly δ under DU is
$250 = \delta^t X_t \Rightarrow \delta^t = 250/X_t \Rightarrow \delta = (250/X_t)^{1/t}$
→ If $t=1$ & $X_1 = 300$ then $\delta = 250/300 = 0.8$
→ Implies (for X_{12} & X_{120}) under DU
↳ $250 = \delta^{12} X_{12} \Rightarrow X_{12} = 250/\delta^{12}$
$= 250/(0.83)^{12}$
$= \$2339$
to wait 1 yr

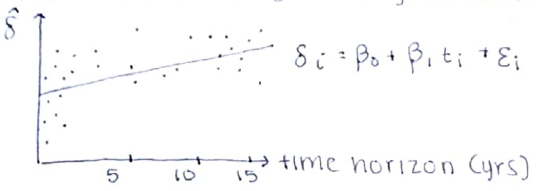
$X_{120} = 250/\delta^{120}$
$= 250/(0.83)^{120}$
$= \$1.3$ quadrillion

→ Thaler experiment: for $t = 6, 12, 120$ months, elicit X_t such that \$250 now ~ \$$X_t$ in t months

Time delay	1 month ($t=6$)	1 yr ($t=12$)	10 yrs ($t=120$)
median X_t	300	400	1000
implied monthly δ	0.83	0.96	0.99
APR	94%	60%	15%

↳ subjects are willing to wait much longer for relatively small returns than DU predicts
→ therefore DU model is implausible
↳ implied monthly discount factor δ is not constant
→ increasing in time delay: subjects appear more patient in the LR than SR
→ therefore DU model is invalid

→ Frederick, Loewenstein, & O'Donoghue
↳ published est. of δ: money for coupons, health, corn, pain, heroin



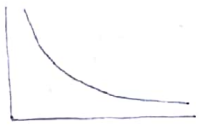
↳ regression line shows increasing δ in time horizon
↳ <1 year demonstrated low implied δ (less patient)
↳ exclude 1 yr = intertemp preferences would be flatter, suggesting people are patient so long as there are no pay offs in the near future

Psychology of Intertemporal Choice

1. Ability to imagine the future clearly] economists prior to Samuelson
2. Ability to tolerate self-denial
3. Future time-perspective (FTP) theory: Simon et al
   ↳ cognitive dimension:
   → How far in the future you can visualize what your life might be like?
   → How well do you recognize the impact of current choices on future outcomes?
   ↳ Dynamic dimension:
   → How strongly do you feel/care the anticipated future impacts of current choices?
4. Willpower & self-control: Bucciol et al
   ↳ How strongly do you experience temptation?
   ↳ How much willpower do you have to overcome temptation?

* Psychology of intertemporal choice is highly complex
  ↳ What if you have long-range FTP, but little self control?
  ↳ What if your ability to visualize the future drops of sharply after 1 wk? 1 yr?

→ DU model is a psychological disaster
↳ Samuelson's DU model replaces all of that complexity w/a single parameter δ
1. Self-control is completely ignored
   → If δ is small enough to capture short-term temptation, it can't explain long-term patience (no scope: assume perfect self control)
2. Future time perspective theory is ridiculously simplified
   → ability to visualize & feel the future decreases smoothly, starting immediately
   → assumes you can do this constantly



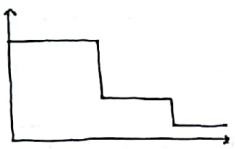
↳ Samuelson knew his model was ridiculous!

LECTURE 10

10-06-15

Remember: Psych of Intertemporal choice
1. Ability to imagine the future clearly] economists prior to Samuelson
2. Ability to tolerate self-denial
3. Future time-perspective theory (Simons)] modern psychologists
4. Willpower & self-control (Bucciol)

Samuelson's DU model replaces complexity w/single parameter δ
1. Ignore self-control
2. FTP theory oversimplified
   → probably a period of good visualization & then a drop (not a smooth curve like above)
   → high probability of heterogeneity

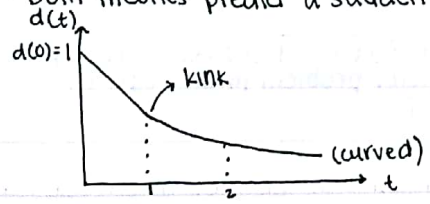


DU has been used for positive/normative purposes
→ easy to work with exponential func (mathematically tractable)

Behavioral Model: Quasi-Hyperbolic Discounting

→ Self-control theory & FTP theory essentially the same
1. Self-control: people inflate all present impacts relative to any future impacts
2. FTP: people deflate all future impacts relative to any present impacts
   ↳ def. of "present" may be longer under self-control theory

→ Both theories predict a sudden drop off in discount factor beyond present
↳ people have "present-biased" preferences
↳ $d(t)$ = total discount factor for any period
↳ kink is "good enough"
→ but not in context of policy



→ Simple math: "beta-delta" model (one Δ to samuelson model)
↳ Discount factor is a "quasi-hyperbolic" function of time:

$$d(t) = \begin{cases} \delta^t \text{ for } t=0 \\ \beta\delta^t \text{ for } t>0 \end{cases} \quad \text{where } \delta \in (0,1) + \beta \in (0,1]$$

→ β: short-term patience
→ δ: long-term patience (willingness to delay)
→ future period discounted by δ + β
↳ reserve possibility of perfect self-control + FTP so δ can = 1
↳ present bias = low β

↳ Discounted utility of plan $P = \{x_0, x_1, x_2, \ldots x_T\}$ becomes
$U(P) = u_0 + \beta \sum_{t=1}^{T} \delta^t u_t \Rightarrow U(P) = u_0 + \beta\delta u_1 + \beta\delta^2 u_2 + \delta\beta u_3 + \ldots$
beta has a large effect — beta has less of an effect
→ You can think of this as deflating the future by $\beta < 1$ (FTP theory)
or inflating the present by $1/\beta > 1$ (self-control theory)
↳ $U(P) = u_0/\beta + \delta u_1 + \delta^2 u_2 + \delta^3 u_3 + \ldots$
↖ temptation: inflate present
↳ Everything about DU remains the same but this Δ explain enormous phenomena

→ Thaler 1981 study: x_t such that \$250 now ~ $\$x_t$ in t months

time delay	1 month (t=1)	1 yr (t=12)	10 yrs (t=120)
median x_t	300	400	1000
implied monthly δ under DU	0.83	0.96	$0.99 \approx \delta$
implied β under beta-delta	0.84	0.63	0.25
implied x_t under beta-delta		335	994

$x_0 = \beta\delta^t x_t$
$\beta = x_0/\delta^t x_t$
$x_t = x_0/\beta\delta_t$

↳ guesstimate $\delta = 0.99 \Rightarrow \beta = 250/(0.99 \cdot 300) \approx 0.84$ (why?)
↳ b/c implied discount factor depends on time delay under β, δ, the model predicts subject choices much better than DU
→ when model is exogenously varied from short-term to long-term
$x_{12} = 250/(0.84 \cdot 0.99^{12}) = 335$

→ Explain preference reversal anomaly: \$100 @ time t vs. \$105 @ time t+1
1. 100 now > 105 in 2 wks
$u(100) > \beta\delta u(105) \Rightarrow \beta\delta < u(100)/u(105)$
2. 100 in 52 wks < 105 in 54 wks
$\delta^{26}\beta u(100) < \delta^{27}\beta u(105) \Rightarrow u(100) < \delta u(105) \Rightarrow \delta > u(100)/u(105)$
↳ so $\beta\delta < u(100)/u(105) < \delta$ so $\beta < 1$

→ If $\delta = 0.9$, $\beta < 0.59$ when

	A	B
1	\$20 now	[\$50 in 1 wk / \$50 in 1 mon]
2	\$20 now	
3	[\$20 now / \$20 now]	\$50 in 3 mon
4		\$50 in 6 mon

	A	B
1	[\$20 in 1 wk / \$20 in 2 wks]	\$50 in 3 mon + 1 wk / \$50 in 3 mon + 2 wk
2		
3	\$20 in 1 mon	[\$50 in 4 mon / \$50 in 6 mon]
4	\$20 in 3 mon	

→ The beta-delta model is incomplete: predictions of model is uncertain
↳ ex: do a pset on t=0, t=1, or t=2
→ each day there is a movie (pset or doing a movie)
↳ movie @ t=0 is worth 1
movie @ t=1 is worth 3/2
movie @ t=2 is worth 5/2
] student has $\beta = \frac{1}{2} + \delta = 1$
*time period is one day so we assume δ=1 without a loss of generalization
→ suppose @ t=0, she can commit to doing pset on any date
↳ @ t=0, cost = 1; @ t=1, cost = 3/4; @ t=2, cost = 5/4

Table of Utilities

perspective	t=0	t=1	t=2	ranking
instantaneous	1	3/2	5/4	0, 1, 2
t=0	1	3/4	5/4	1, 0, 2
t=1		3/2	5/4	2, 1

*@ t=2, she must do her hw @ t=2

→ If she can bind herself @ t=0, then hw occurs @ t=1
↳ dynamically inconsistent preferences: when t=1, puts off hw to t=2
↳ When will seh do the pset?
→ answer depends on student's belief about future impatience
↳ Recall $u_0 = u_0 + \beta(u_1 + u_2) \Rightarrow$ indiff in terms of delay b/t t=1 + t=2
$u_1 = u_1 + \beta u_2 \Rightarrow$ now cares about delay
↳ Is the student aware of time inconsistency?
→ Let $\hat{\beta} \in [\beta, 1]$ be her belief about future β where $\beta < \hat{\beta} < 1$
↳ then @ t=0, she believes period-1 self will choose based on
$\hat{u}_1 = u_1 + \hat{\beta} u_2$
↳ if $\beta = 1 \Rightarrow$ no pref / naive about FTP

LECTURE 11

10-08-15

Naïveté + Sophistication

→ Naïveté: ($\hat{\beta} = 1$) believes future selves will have short-run discount factor $\beta = 1$ (no self control problem)
↳ overconfident about future willpower / believe no self-control problem in the future
↳ assumes future self will follow through on her favorite plan
$u_0 = u_0 + \beta u_1 + \beta u_2$
$u_1 = u_1 + \beta u_2$
$\hat{u}_1 = u_1 + u_2$

→ Sophistication: ($\hat{\beta}=\beta$) believes future selves will have the same short-run discount factor as present
  ↳ realistic pessimist: choose on constrained choice set because she recognizes her future options may no longer be there
  ↳ believes they will have a self-control problem in the future
  ↳ knows future self may not follow through w/favorite plan
    ($\hat{U}_1 = u_1 + \beta u_2$ (actual preference))

→ Remember movie/HW Ex: Unpleasant Task

Table of Utilities

perspective instan.	t=0	t=1	t=2	Rank	
t=0	1	3/2	5/2	0,1,2	* = naif
t=1	1 °	3/4 *	5/4	1,0,2	° = sophisticate
	—	3/2	5/4 *°	2,1	

↳ naif: solve by moving forward
  → costs of doing pset @ diff. times
    ↳ @ t=0, $c_0=1$, $c_1=3/4$, $c_2=5/4$
    ↳ @ t=1, $c_1=3/2$, $c_2=5/4$
  → @ t=0, naif prefers to do hw @ t=1 + believes she will do so, but @ t=1 she changes her mind + puts it off one more period
  → incremental procrastination: by repeatedly procrastinating a little bit at a time
    ↳ naif causes max harm
    ↳ b/c w/each round of procrastin. she believes she is causing only a little harm
    ↳ overly optimistic about future self-control

↳ sophisticate: backwards induction
  → @ t=0 a sophisticate prefers to do it at t=1
  → looking forward to t=1, she realizes she will not stick to the plan + will do it at t=2
  → thus deletes t=1 from choice set
  → from t=0, her max utility plan is to do her hw immediately
    ↳ delaying little ⇒ delaying a lot
    ↳ avoid worst-case outcome = gets out of the way
  → sophisticate procrastinates less than naif
    ↳ correctly pessimistic about self-control
    ↳ eliminates unrealistic plans from choice set
  → looks like she has self control but just managing self-control problem
  → engaging in game theory w/true info (naif has false info)

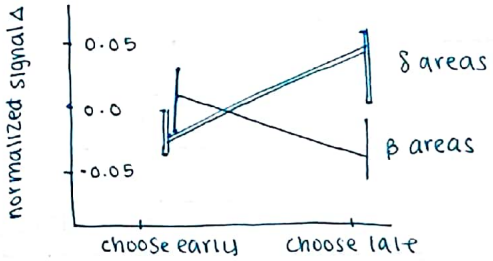
Neuroeconomics + the Two-Self Model

→ neuroeconomic idea: two decision makers inside the human brain
  ↳ δ self makes long-run decisions based on cognitive thought
    → associated w/cognitive areas of the brain (e.g. lateral pre-frontal cortex)
  ↳ β self makes short-run decisions based on immediate reaction
    → associated with limbic system

→ McClure et al 2004: Hypothesis
  1. LPFC is activated whenever intertemporal choice is being made
  2. LS is activated when an immediate reward is available

→ Testing the hypothesis
  ↳ use functional magnetic resonance imaging (fMRI) to see activated parts of brain
  ↳ observe when individual is making intertemporal choices
  ↳ experiment: intertemporal choice:
    a) $\$x$ at period t
    b) $\$x' > x$ at period $t' > t$
    ] t = now = after experiment

→ Results
  ↳ cognitive areas (δ) lit up whenever any choice was presented
  ↳ Limbic areas (β) lit up whenever immediate options were available
  ↳ β areas dominated when subject chose immediate gratification
  ↳ δ areas dominated when subject chose delay gratification



→ Implications of β + δ preferences
  ↳ two selves inside each person
  ↳ when payoffs in future, δ self in control + when in present, β self in control

→ Dellavigna + Malmendier (2006): health clubs
  ↳ @ t=0, δ self is in control ("cognitive" decision to buy a membership)
  ↳ @ t=1, β self is in control ("limbic" decision to go to the gym)

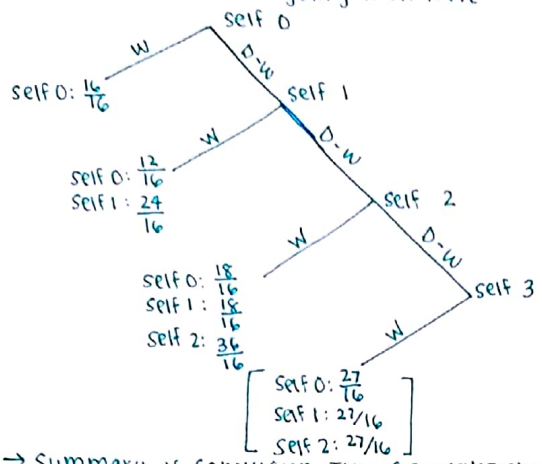
Game Theory Model

→ Strategic interaction of 2 selves ↗ no temptation or cost/benefits at t=0
  ↳ Player one: δ self chooses whether or not to buy a membership
  ↳ Player two: β self chooses whether or not to go to a gym based on player 1 decision
  ↳ dynamic game (sequential choice) solved using backward induction

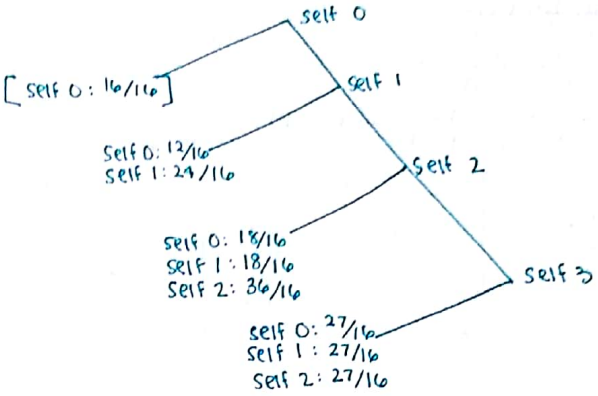
→ Pleasant task (naif vs. sophistication)
  ↳ ex: student has coupon for movies in t=0,1,2,3 + value of movie is 1, 3/2, 9/4, 27/8 respectively + student has $\beta=1/2$ + $\delta=1$
  ↳ Table of Utilities

perspective	mov_0	mov_1	mov_2	mov_3	rank
insta.	8/8	12/8	18/8	27/8	3,2,1,0
t=0	16/16	12/16	18/16	27/16	3,2,0,1
t=1	—	24/16	18/16	27/16	3,1,2
t=2	—	—	18/18	27/16	2,3
t=3	—	—	—	—	

→ Naif: Game tree for going to a movie



→ Sophisticate: Game tree



→ Summary of Conclusion: Two Generalizable Effects
1. Present-bias effect: causes procrastination when costs are immediate + preproperation when rewards are immediate
↳ true for naifs + sophisticates
2. Sophistication effect: sophisticates does it sooner than naif in all cases
↳ Procrastinate less because she is correctly pessimistic about future misbehavior, so she does it early to protect against future procrastination
↳ Preproperates more: because she is correctly pessimistic about future misbehavior, so she does it early because she can't control future preproperates

→ General Principle
↳ If future misbehavior raises cost of current misbehavior, then sophisticates mitigate effect of short-run impatience
↳ If future misbehavior lowers the costs of current misbehavior, then sophistication exacerbates the effect of short-run impatience

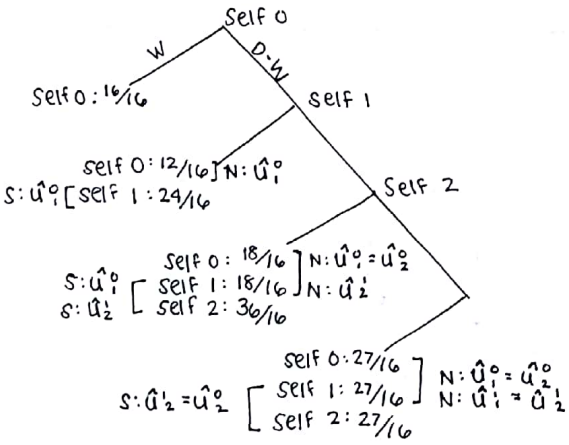
→ no right answer to which makes better choice overall

→ issue of awareness of (or beliefs about) future self-control problems doesn't arise in the exponential model b/c without β, there is no dynamic inconsistency to predict or mis-predict

LECTURE 12

10-13-15

Review: We have $\hat{u}^s_t$ = self t's beliefs about self J's preferences
→ different between sophisticates + naifs (naifs always believe they will follow through)
↳ why does sophisticate do the task sooner than naif?
→ knowing that the outcomes she wants most aren't actually possible, she can commit to doing the unpleasant task sooner but can't commit to doing the pleasant task later
↳ Two generalizable effects
1. Present-bias effect (create tendency to procrastinate)
2. Sophistication effect
→ procrastinate less (investment) if they can in their pref
→ preproperates more (temptation)
↳ not necessarily more self control but realistic of options available
↳ General Principle
→ If I misbehave now, I will have a higher cost in the future, so take the option away
→ "caving in" now is the cost of making a suboptimal decision (better movie v. Depp)



Distinguishing a Naif vs. a Sophisticate

→ We use the pset example (when you will do your hw)
Cost of Doing Pset at Time t

perspective	t=0	t=1	t=2	Ranking
Instantaneous	4/4	6/4	10/4	0, 1, 2
t=0	4/4	3/4	5/4	1, 0, 2
t=1	—	6/4	5/4	2, 1
t=2	—	—	10/4	2

→ evidence of loss aversion + present-bias is relatively easy to find
↳ difficult to find conclusive evidence to tell whether a person is a naif or sophisticate
→ choices overlap + cannot observe preferences without choices
↳ in experiment, can give monetary reward for correct predictions

→ sophisticate pays ¼ for commitment device at t=0
↳ look at outcomes she is choosing between (now vs. period one)
→ look @ utility in t=0 [u(commitment) = -3/4 + u(no commitment) = -4/4]
↳ t=0 self will be made better off

→ misprediction of future behavior indicates naivete (ex-ante t=0 naif predicts he will do it at t=1)
↳ rules out sophistication

→ the use of commitment devices indicates sophistication (ex-ante t=0 sophisticate would like to be forced to do it at t=1)
↳ rules out perfect naivete

→ Normative issue: what is the "true" preference?
↳ one version of self is better off/another worse off (want long-term or tempted self better off?)
→ no obvious or intuitively clear what self to choose
↳ standard model: see true preference due to rank order
→ whatever you choose is best (libertarian)
→ no philosophical justification on grounds to find true preference
↳ perceived welfare of β vs. δ self
↳ std model rooted in fundamentally arbitrary choices
→ translating economics to math ≠ clear normative choice
→ does not relieve ethical obligation to examine the philosophical underpinning

→ Identifying a naif
↳ misprediction of future behavior
→ ex: gym members who predict they will go but don't
→ ex: online gamers bind ex-ante but use a "one-more-game" button to help them stop = naive

→ Identifying a sophisticate
↳ use of commitment devices
→ ex: savers w/withdrawal restrictions
→ ex: students who prefer unnecessary deadlines
→ ex: online gamers who commit ex-ante to a max length game time

→ Answer matters a lot (as usual w/questions of rationality)
↳ positive: diff assump about beliefs vs. diff. predictions of model
↳ normative: diff assump about beliefs ⟷ diff welfare analysis

Evidence of Misprediction

→ DellaVigna + Malmendier (2006): study gym-goers' behavior at 3 US health clubs
↳ customer has 2 options:
1. monthly $70 for unlimited
2. $10 per visit
] average attendance 4.3 per month, $17 per visit (> per visit fee)
↳ Gym-goers usually choose monthly contract
→ observations consistent w/naive present bias
1. when immediate cost + delayed benefit are both in the future, the naif prefers a plan of going to the gym a lot + believes they will do so
↳ misprediction caused by irrational expectations
2. monthly membership is cheaper way to implement preferred plan
3. when immediate costs is in the present, it suddenly outweighs the benefit
↳ self control problem caused by irrational expectations
→ Also consistent w/sophisticated present bias
1. sophisticates also prefer plan of exercising a lot but realize they won't follow thru
↳ do not have irrational expectations
2. Unlimited attendance means immediate cost is reduced
↳ monthly membership similar to commitment device
3. Willing to pay a premium in exchange for motivational benefit
→ nuage agenda: Δ people's choice architectures which will cause them to think diff thru (1) commitment devices, or (2) tweaking little u's (immed. benefit in short-term)
↳ How do we know DM results are caused by naive misprediction or sophisticated demand for commitment?

LECTURE 13

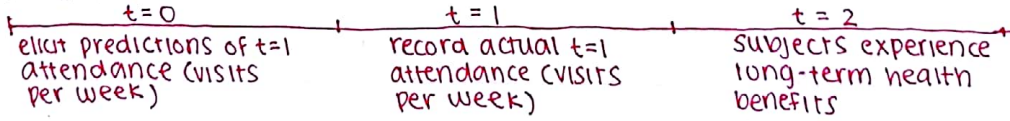
10-15-15

Review from Last Lecture

→ How do we know whether DM results are caused by naive misprediction or sophisticated demand for commitment?
↳ members also procrastinate cancelling their memberships
↳ before cancelling, consumers go for ~2.3 months w/o using membership
→ ave cost of cancellation delay $187 + est. transaction cost of cancellation is $15
↳ using est. of long-term health benefits of exercise, DM find that this degree of costly delay can only be explained by naivete

Evidence of Misprediction

→ Acland, Levy (2004): offer subjects an actual commitment contract (pay each time you attend gym)
↳ Δ immediate present benefits to induce decisions that should have been made based on long-term benefits but is not due to δ + β
↳ elicit predictions of future attendance under the contract
→ eliminate reason to tell the wrong number
↳ look for definitive evidence of naivete vs. sophistication
→ naifs will never pay more than the "face value" of the contract
→ sophisticates will never mispredict their future attendance
↳ Timeline

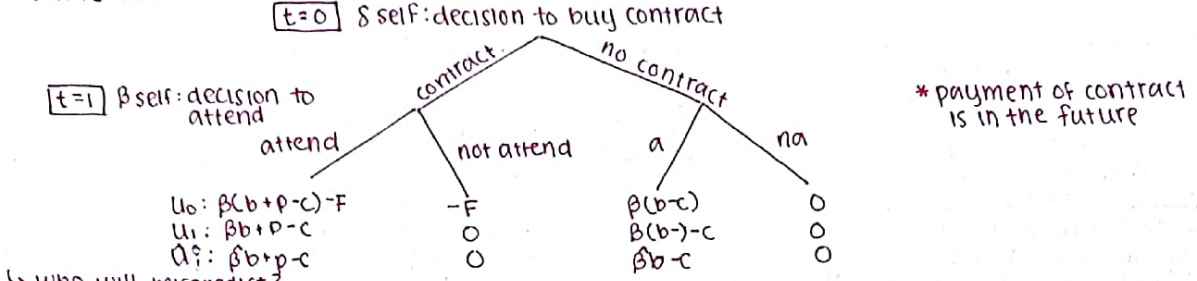


* not the same length but does not matter when δ=1

↳ Payoffs (utility)
→ C = immediate effort cost of gym attendance
→ F = fee for contract
→ P = payment per visit (w/contract is >0, w/o contract = 0)

→ b = Delayed health benefits
→ normalize all other utility to 0
→ assume $\delta = 1$ + $\beta < 1$

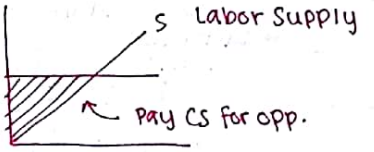
↳ Game Tree



* payment of contract is in the future

↳ Who will mispredict?
→ With contract:
↳ subject will attend if: $\beta b+p-c>0$
↳ subject predicts she will attend if: $\hat{\beta} b+p-c>0$
↳ subject mispredicts if: $\hat{\beta} b+p-c > \beta b+p-c \Rightarrow \hat{\beta} > \beta$
↳ misprediction indicates subject is naive (rules out perfect sophistication)

↳ Who will pay more than predicted face value?
→ Naif: Two cases
1. Subject predicts he would attend w/ or w/o contract
$\hat{\beta} b+p-c>0$ and $\hat{\beta} b-c>0 \Rightarrow b>c$
Buy if $\beta(b+p-c)-F > \beta(b-c)$
Indiff condition for WTP: $WTP = \beta p < p$
2. Subject predicts he would attend w/a contract but not w/o
$\hat{\beta} b+p-c>0$ but $\hat{\beta} b-c<0 \Rightarrow b-c<0 \Rightarrow b<c$
Buy if $\beta(b+p-c)-F>0 \Rightarrow F < \beta p+\beta(b-c)$
$WTP = \beta p+\beta(b-c)$
↳ conclude: naif will never pay more than face value



→ Sophisticate: wants commitment if
↳ attendance is as desireable as t=0
↳ and subject predicts she won't attend w/o contract
↳ and ——— will attend w/contract

$\beta(b-c)>0 \Rightarrow b-c>0 = b>c$
$\hat{\beta} b-c<0 \Rightarrow \beta b-c<0 \Rightarrow \beta b<c$
$\hat{\beta} b+p-c>0 \Rightarrow \beta b+p-c>0 \Rightarrow \beta b+p>c$

↳ Assuming all of this is true, how much will they pay?
→ Buy if $\beta(b+p-c)-F>0 \Rightarrow WTP = \beta p+\beta(b-c) > \beta p$ (only when $b-c>0$)
↳ If commitment value is high enough, sophisticate will pay above face value
→ If $\beta(b-c) > (1-\beta)p$ then $WTP > p$
→ Conclusion: WTP greater than predicted face value indicates subject is sophisticated

↳ Actual Experiment
→ offer subjects a certificate good for $p/visit during a specific "target" week
→ elicit WTP for certificate (incorporates predicted face value plus "commitment value")
→ ask them how many times they think they would go if they were given the certificate
↳ multiplying this by $p gives predicted face value
→ give them the certificate by surprise + record their actual incentivized attendance

↳ Two Questions:
1. How will predictions compare to actual attendance
2. How will WTP compare to predicted face value?

↳ Results

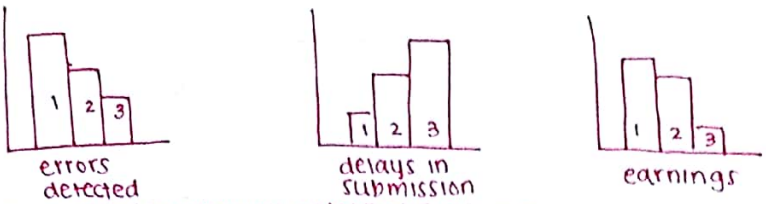
	Predicted attendance	Predicted face value	WTP for Contract	Actual Attendance	Ratio of Misprediction
p = $1	3.31	$3.81	$3.44	0.83	3.99
p = $2	3.67	$7.34	$ 7.20	1.02	3.60
p = $3	4.07	$12.21	$11.49	1.34	3.04
p = $	4.67	$23.35	$ 21.30	2.71	1.72
p = $	5.31	$37.17	$ 33.18	2.83	1.88

→ subjects over-predict by a factor of 2 to 4
→ WTP is almost always less than predicted face value (rule out risk aversion)
→ conclusion: subjects are naive rather than sophisticated

Case Studies

1. Work assignments + self control (Ariely + Wertenbroch: 2002 field experiment)
→ subjects: 2 sections of executive MBA classes at MIT (mid-career professionals)
→ 3 assignments w/grades + comments provided at the end of the semester
↳ Section 1: no choice deadlines set by instructors + evenly spaced
↳ Section 2: free choice deadlines set by students
→ Results
↳ subjects imposed commitment deadlines/devices on themselves
↳ Section 2 had higher average scores than section 1
→ Experiment 2
↳ subjects: 60 undergrads at MIT
↳ 3 proof reading tasks: 10¢ per correctly indentified error + $1 penalty for lateness
↳ 3 groups: evenly spaced, self-imposed, + single deadline

*constraint: risk cost of uncertainty



1-evenly spaced
2-self-imposed
3-end

→ 2: nudge(libertarian paternalism)]@ what benefit do we take freedom away (normative)
→ 1: hard paternalism

2. Consumption/Savings/Borrowing Choices
   → 2 Facts about high-school educated households (1998)
      1. 67.8% of households have credit card debt (rolling)
         → ave. debt for all hh was 11.7% of annual income
         → consistent w/short-run impatience
      2. Ave. hh w/head age 50-59 had illiquid assets worth 2.16 times annual income
         → consistent w/long run patience
   *under Samuelson model, you cannot explain savings + borrowing at the same time
   → Laibson et al (2007): est. β + δ using these findings
      ↳ get $\beta = 0.6$ over one year + yearly $\delta = 0.957$
      ↳ if assumed $\beta = 1$ (std model), then the model fits data very poorly
      ↳ "horse race" between models: comparing error terms (behavioral v. std model)
         → similar to implausibility argument
   → Ashraf, Karlan, Yin (2006)
      1. Ask bank customers in rural Philippines a series of time-discounting questions
         → to determine who are "β-δ" discounters
      2. Randomly offer ½ specially designed commitment savings acct
         → restrict ability to withdraw savings prior to subject-chosen deadline
      3. Measure uptake of commitment acct + total savings
         → 28.4% of treated subjects chose commitment acct
            ↳ indicates demand for commitment
         → treated subj. w/β-δ discounting were 15%-points more likely to take up
            ↳ similar to loss-averse messengers have neg. labor supply elasticity
         → treated group showed 81% incr. in total savings (C/3 drives this result)
            ↳ Ability to max utility without help?
            ↳ can people make good long-term choices in terms of temptation?

LECTURE 14 10-20-15

Review
→ Food Stamps study: people spend more on the beginning of the month
   ↳ health consequence: people w/diabetes go into shock more often when on program
   ↳ not consumption smoothing (when have diminishing marginal utility)
→ Ashraf, Karlan, Yin (2006): ask bank customers w/at least a savings acct in rural phillipines a series of time discounting questions to determine β-δ discounters
   ↳ randomly offered half a specially designed commitment savings acct (restricts withdraws prior to their chosen deadline) + measure uptake of commit. acct + total savings
   ↳ location may be chosen b/c there may be no previously imposed commitment or cheaper
   ↳ Results

			patient ($x<250$)	somewhat imp ($250<x<300$)	most imp. ($x>300$)	} δ patience
β patience (pref of delay)	indiff bt 200 pesos now + X in 1mn	patient ($x<250$)	34.4%	7.2%	4.1%	↑
		somewhat impatient ($x<300$, $x>250$)	11.7%	8.3%	3.3%	indiff bt 200 pesos in 6 mn + X in 7 mn
		most impatient ($x>300$)	8.7%	5.3%	17%	

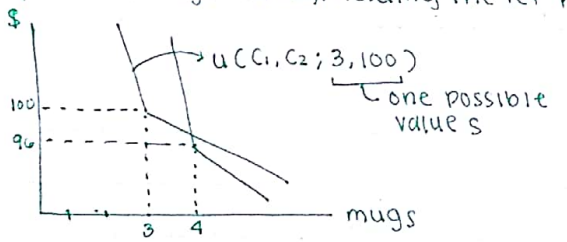
   *greater demand for commitment even if short-term impatient
      → demand for commitment: 28.4% of treated chose commitment
      → treated were 15% more likely to take up (like loss averse messengers w/neg labor-supply)
      → 81% incr in total savings
→ case 1: Work Assignments + Self-Control (revisited) w/Ariely + Wertmebroch
   ↳ subjects w/o imposed deadlines did worse than those w/
      → complete naivete caused max harm
   ↳ subjects w/evenly spaced deadlines did as well as the "no choice" group
      → complete sophistication eliminated harm
   ↳ subject's enjoyment of the task
      → No Deadline 37.9/100
      Self-Imposed 28.12/100
      No-Choice 22.1/100
      ↓ consider autonomy: enjoyment may be lower due to coercion or knowledge of other options

Normative Analysis
→ Welfare consequences depends on who we are asking (or which self?)
   ↳ do we know if the naif's choice more than them?
      → will people be better off when deprived of their own choices?
      → democracy: people govern themselves
   ↳ policy makers are elitist

→ Generalizable Lessons about Public Policy when costs are immediate
1. Present bias makes people procrastinate
↳ naifs may procrastinate badly + get hurt a lot
↳ more sophisticated, the less procrastination + damage (esp in presence of commitment devices)
2. Creating opportunities to make intertemporal decisions in advance typically makes sophisticates better off (libertarian paternalism)
↳ make naifs + TC's no worse off (no restriction of choice)
3. Forcing everyone to make "optimal" decisions
↳ can make sophisticates better off (esp. if there's no way to make ex-ante commitment)
↳ will probably make naifs considerably better off
→ but will think they are worse off
↳ but you better be really sure you know what is optimal
→ Ariely + Wertenbroch had a strong, externally valid evidence
→ Because you will never be perfectly correct, TCs will always be hurt
* friend + scooter ex: inflating future rather than discounting? (may not predict this)
→ elitist paternalism: you know better than others + know best choice

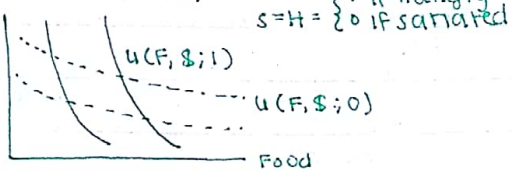
State-Dependent Preferences + Rational Expectations

→ Stationary assumption of std model (Frederick et al): instantaneous utility func. is the same in every period
↳ preferences over immediate outcomes are stable over time
→ But our preferences Δ over time in 3 broad categories
1. Short-term fluctuations
↳ Δ in physiological state (hunger, craving, etc.)
↳ Δ in psychological state (depression, road-rage, etc)
↳ Δ in circumstances (location, weather, etc.)
2. Long-term systematic changes
↳ Δ caused by past behavior (habit formation, acquired tastes, etc.)
↳ Δ caused by maturation (risk-preferences, physical activity, etc.)
3. Adaptation
↳ getting used to new reference point
→ Stigler + Becker (1977)
↳ define a state variable (S) to capture the state an individual is in
↳ define instantaneous utility as a func. of consumption conditional on state ($u(c; s)$)
↳ assume: holding state constant, preferences are rational + stable
↳ ex: pref over mug + money, holding the ref point constant



→ preferences over mugs + money depend on reference point $u(c_1, c_2; r_1, r_2)$
→ because the reference point is not stable, it looks like preferences are not stable
↳ i.e. get crossing indifference curves
→ IF we define the reference point as a state, pref over consump are stable so long as the state doesn't Δ
→ $S = (r_1, r_2)$ ← vector of ref point
$u(c; s) = u(c_1, c_2; r_1, r_2)$

↳ Likewise, it seems reasonable to assume, conditional on...
→ your state of hunger, pref over food + money are stable
→ your age, pref over risk are stable ⇒ $E u(G; S)$ + S = age
→ how long you've been going to the gym, pref over exercise are stable $u(Gym; s)$ ⇒ S = habit level
↳ rescue rationality of pref



→ Expectation of future state-dependent preference
↳ we have $\tilde{u}(C_T; S_T \mid S_t)$
→ $\tilde{u}$ is an individ. prediction of their utility in period T
↳ as a func. of actual period T consumption, C_T
↳ conditional on their actual period T state, S_T
↳ but predicted when they are in their current, period t state, S_t
↳ Given the state I'm in now, what do I predict my utility will be in a different state?
→ prediction when I'm hungry of my non-hungry pref for food + money
$\tilde{u}(F_T, \$_T; H_T \mid H_t)$
→ prediction when I don't have a habit of my gym pref once I have a habit
$\tilde{u}(Gym_T; Habit_T \mid Habit_t)$
→ prediction before buying a shiny obj. of my pref. once I've owned it for a while
$\tilde{u}(C_{1T}, C_{2T}; r_{1T}, r_{2T} \mid r_{1t}, r_{2t})$
↳ scooter ex: don't foresee how it will Δ pref.

LECTURE 15

10-22-15

Misprediction of State-Dependent Preferences: Rational-Expectation Anomalies

→ Read + van Leeuwen (1998): do we predict how pref Δ w/a Δ in state?
↳ subjects choose now to receive a healthy or unhealthy snack in 1 week
1. make choice after lunch (satiated) vs. end of day (hungry)
2. snack delivery scheduled right after lunch vs. end of day

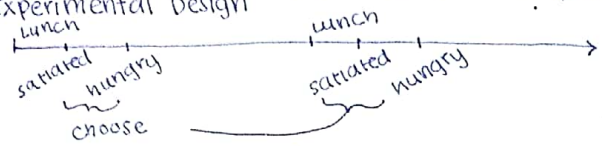
↳ Results: proportion choosing unhealthy snack

	will be hungry	will be satiated
now hungry	78%	56%
now satiated	42%	26%

* hunger is a state that is constantly Δing + imp. b/c it may be deeply rooted in psych. bias

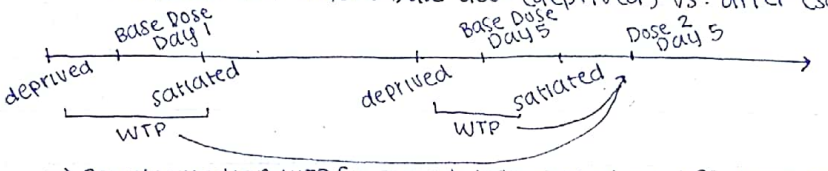
↳ subjects predict that they'll want an unhealthy snack (78% > 56% + 42% > 26%)
↳ subjects project their current pref onto their future selves (78% > 42% + 56% > 26%)
→ hungry subj. were more likely to opt for unhealthy snacks
↳ subjects appear to predict direction of pref Δ but not magnitude

↳ Experimental Design



78% > 56% ⇒ $\tilde{u}$(chips; H=1 | H=1) > $\tilde{u}$(chips; H=0 | H=1)
56% > 26% ⇒ $\tilde{u}$(chips; H=0 | H=1) > $\tilde{u}$(chips; H=0 | H=0)
↳ hungry failing to perceive how much they want unhealthy food in the future

→ Temporary Fluctuations: Addictive Cravings (serious state-dependent Δs)
↳ Giordano et al (2002): heroin addicts
→ subj. receive base dose of BUP on Day 1 + 5; elicit WTP for second dose of BUP on Day 5
→ Two dimensions of randomization
1. Elicitation on Day 1 v. Day 5
2. Elicitation before base dose (deprived) vs. after (satiated)



→ Results: median WTP for second dose, elicited on diff days, + in diff. states

	Day 1	Day 5
Deprived	$60	$75
Satiated	$35	$50

comparison to 2 advanced predictions; prediction vs. actual

* subject is satiated at time of 2nd dose
* but not necessarily at time of elicitation

↳ beta (between days): predict too little
↳ state (before + after dose): predict too much
] both effects shown in $60 vs $50

→ Subjects appear to have present-biased preferences ($35 vs. $50)
↳ Day 1: 35 = $\beta\tilde{u}$(Dose 2; sat | sat) = βu(Dose; sat)
Day 5: 50 = u(Dose 2; sat)] β = 0.7

* no Δ in misprediction - just Δ in discounting
"no wiggle room"
no scope for misprediction

→ They also appear to mispredict state-dependence ($60 vs. $50)
↳ Day 1: 60 = $\beta\tilde{u}$(Dose 2; sat | Dep) ⇒ $\tilde{u}$(Dose 2; sat | Dep) = 60/0.7 = 86
→ 60 is deflated by beta discounting
→ To explain 86 > 75, we can say predictions get better closer to the event

↳ Evidence from other temporary fluctuations in states:
→ Shoppers order + then return more winter clothing on very cold days
→ When not aroused, men fail to predict how they'll behave when aroused
↳ Conn (in Kahneman 2000): prediction of happiness after paralysis or winning lottery
→ Results of Good + Bad Mood Share

Event	Paraplegic		Lottery Winner	
Know someone?	No	Yes	No	Yes
1 month after	-41	-50	58	64
1 yr after	-37	-19	50	25

impact bias: how big initial impact will be + how long it will last

↳ under-predict initial + severely under-predict 1 yr after
→ misprediction of adaptation

→ Alternative Model: Projection Bias (Rabin)
↳ Key psych finding: People appear to predict the direction of Δ fairly accurately but fail to predict the magnitude of Δ; thus they violate rational expectations w/respect to state dependence
→ projection bias: when predicting future instantaneous utility, people project their pref in their current state onto their pref in future state
↳ total PB: fail to predict any Δ in pref
↳ partial PB: predict direction but not magnitude of Δ
→ dif b/t this + β-δ naif: naif project current pref. for future delay on future self
↳ PB: project current level of self control on future self
↳ similar phenomenon

↳ From period t, looking forward to some future period, T > t, the individ. believes future u will be
$\tilde{u}(c_T; s_T | s_t) = \alpha\, u(c_T; s_t) + (1-\alpha)\, u(c_T; s_T)$

how much they project current state to future self	how they feel about c_T if current state persisted	how they will actually feel about c_T in their actual future state

α = 0 ⇒ no projection bias (no mis prediction)
α = 1 ⇒ complete PB (mispredict completely)

→ predicted future utility ($\tilde{u}$) is an α-weighted sum of current + future utility
→ Person makes current choices based on predicted future pref
↳ β-δ: making present choices knowing your β + having considered future self will do based on β
↳ this is not to the point where people will do anything in future

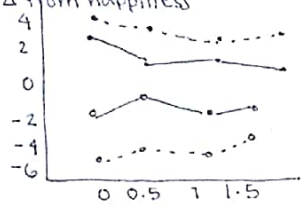
→ Ex: WTP for burger
↳ Pref. of burger + money [$c_t = (b_t, y_t)$] dependent on hunger $h_t \in \{0,1\}$
→ value of burger is $1 when h=0 + $5 when h=1

↳ $u(b_t, y_t; 0) = b_t + y_t$ what is the WTP when not hungry for a burger that will be eaten later
$u(b_t, y_t; 1) = 5b_t + y_t$ when they are hungry? $\alpha = 0.75$
we have $\alpha(u(b_T; n_t) + (1-\alpha)u(b_T; h_T)$
$0.75(1 - WTP) + 0.25(5 - WTP) = 0$
$WTP = 2$

Durable Goods: Shiny Object Bias + Pack Rat Effect

→ Loewenstein, O'Donoghue, Rabin (2003): Projection-Biased Reference Dependence
↳ consumers have ref-dependent pref w/ loss aversion
→ ref pant is lagged consumption but consumers project that ref point won't adapt
↳ when deciding buying or selling
1. inflate WTP when buying → inflate gain utility
2. inflate WTA when selling → inflate loss aversion
↳ ex 1: Loewenstein + Adler (1995) – mug exp WTP → ↑ when endowed
↳ ex 2: Kermer et al – Game
→ people who played predicted gain/loss + watchers did

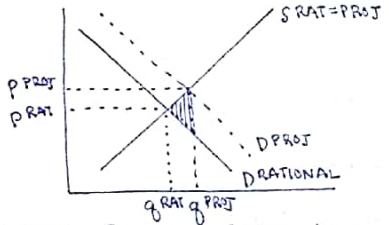
Δ from happiness



* no evidence of loss aversion
→ over predicted gain utility
→ over predicted loss aversion dramatically

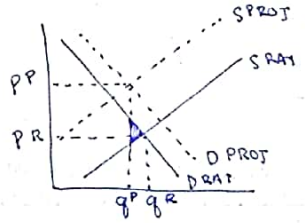
↳ Shiny-Object Bias: Because of projection bias, the buyer fails to foresee that she will rapidly adapt to having the durable good + thus sets a very high buying price because she mistakenly foresees a lifetime of joy from acquiring yet another durable good
↳ Pack-Rat Effect: Because of projection bias, the seller fails to foresee that she will rapidly adapt to not having the durable, + thus sets very high selling price to offset the perceived cost of a lifetime of pining for her lost durable
→ geo series: $\sum_{t=0}^{\infty} a\delta^t = \frac{a}{1-\delta}$ = infinite value of good (a = predicted value of good)

→ Potential effect on Std Model of Supply + Demand
↳ Likely PBRD market participants
1. Individ consumers who use the good for own consump
2. Firms + other prof. traders
↳ Case 1: Buyers have PB (ex: durable goods)



→ quantity is too high
↳ DWL from overprojection
→ Price too high
↳ transfer from consumers to firms
→ exacerbate environ. consu/problems
↳ overconsumption
→ shiny obj. lose luster fast so buy experiences!

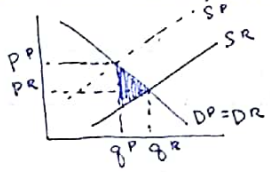
↳ Case 2: Buyers + Sellers (ex: housing markets



larger due to loss aversion

→ quantity is too low
↳ DWL from undertrading
→ Price too high
↳ transfer from buyers to sellers
→ exacerbate housing downturn

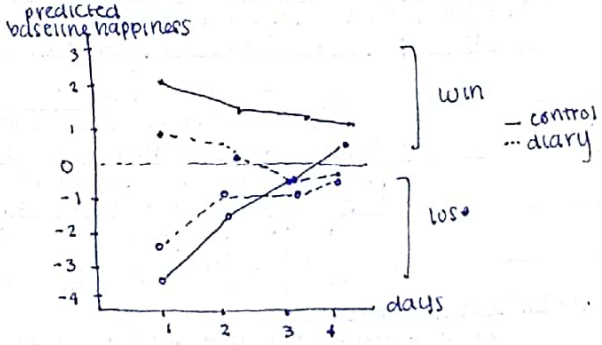
↳ case 3: Sellers (antique selling to auction)



→ quantity is too low
↳ DWL from underselling
→ Price too high
↳ transfer buyers to sellers

Narrow-Framing + Debiasing

→ Focalism: think cognitively of future (out of misprediction + overproj/narrow framing)
↳ Wilson et al (2000): ask happiness after football game win
→ control completed prospective diary task (treatment)
→ non-treated group predicted big impacts of winning + losing a game
↳ narrow frame: did not consider other things they will be doing/thinking of
↳ simple cognitive task forced broadening
→ Narrow framing is a really bad thing
↳ but remarkably easy to overcome
↳ Policy implications
→ can it be self-taught?
→ should it be taught in school?
→ should gov't impose de-biasing tasks at crucial decision points?



MIDTERM II REVIEW

10-27-15

Intertemporal choice: current choices with future consequences; two types – investments (immediate costs + delayed benefits) + temptation (immediate benefit, delayed costs)

→ almost always intertemp tradeoffs w/uncertainty in decisions we make

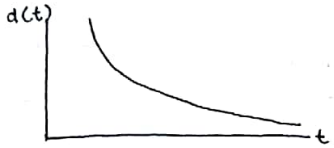
↳ Implications: Do people choose what will make them best-off in their life?

→ Social welfare/Happiness: retirement, long-term health

→ Public policy: gov't debt (SS, Medicare), healthcare (spending + outcomes)

→ In positive analysis, models may generate similar results but normative?

→ Standard Model: Exponential Discounting (DU model by Samuelson)



$$U(P) = \sum_{t=0}^{T} \delta^t u(x_t)$$

↳ sum of exponentially discounted instantaneous utilities over all periods

↳ smooth decrease: value goes down a constant % discount relative to previous period

↳ implies pref for delayed outcomes should not change, holding everything constant

↳ preferences should be time consistent: for any two plans (A + B) which differ beginning at some point t, an individ. who prefers A over B at any point in time before, will also prefer A over B at time t

→ per-period discount factor is constant over time

→ on average, preferences do not satisfy time consistenty on average which suggests

1. Anomaly: standard DU model cannot explain observations
2. Irrationality: individ exhibit pref. reversals in intertemp choice
3. Discount factor Δs depending on where we are in time

→ ex: u($100 today) > u($105 in 2 wks) but u($100 in 52 wks) < u($105 in 54 wks)

↳ the way you feel about delayed tradeoffs will Δ

↳ can this be a state-dependent pref w/temptation

↳ under DU it should never be strictly preferable to restrict choice

→ unless you know you have a self-control problem

↳ Examples of preference reversal

1. Green, Fristoe, Meyerson

	A	B
1	$20 now	[$50 in 1 wk / $50 in 1 mn]
2	———	
3	[———	$50 in 3 mn
4	———]	$50 in 6 mn

	A	B
1	[$20 in 1 wk / $20 in 2 wk]	$50 in 3 mn + 1 wk / $50 in 3 mn + 2 wk
2		
3	$20 in 1 mon	[$50 in 4 mn / $50 in 6 mn]
4	$20 in 3 mn	

→ $\delta < 0.4$ when $20 now but $\delta > 0.4$ when $20 in 1 month

2. "Now" is less tempting when stakes go up (more patient?)

↳ virtually no one can claim to be perfectly time consistent

↳ preference reversal ⟷ non constant δ

3. Malmendier, Dellavigna (2006)

↳ members chose unlimited membership ($70) but only visit 4.3 per month ($17 visit) but only $10 per visit w/10-visit pass

↳ when costs + benefits are both in the future, people invest for long-term reward but when costs are in the present + benefit in the future, they have pref reversal

4. Thaler: elicit $250 now ~ $X_t in t months

time delay	6 mon: t = 6	1 yr: t = 12	10 yr: t = 120
median x_t	300 (44% APR)	400 (60% APR)	1000 (15% APR)
implied monthly δ	0.83	0.96	0.99

↳ DU is implausible bc subjects are willing to wait longer for relatively small returns + so δ is not constant

→ Psychology of intertemporal choice

1. Future Time Perspective (FTP) Theory (Simons et al)

→ cognitive dimension: how far can you visualize what your life will be like? How well do you recogn. impact of current choices on future outcomes?

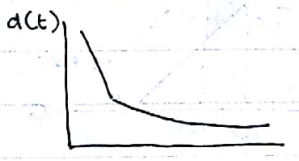
→ dynamic dimension: how strongly do you feel the anticipated future impacts of current choices?

2. Will power + self-control (Buccol)

→ How strongly do you exp temptation?

→ how much willpower do you have to overcome temptation?

long-range FTP but little self control? sharp drops in visualizing future



* DU oversimplifies: ignores self-control + assumes visualization + feeling of future smoothly decr.

→ Quasi-Hyperbolic Discounting

$U(P) = u_0 + \beta \cdot \sum_{t=1}^{T} \delta^t u_t$

↳ captures FTP + self-control theory w/short + long term patience (β + δ)

↳ present-bias: sudden drop of the discount factor beyond the "present"

↳ implies time delay

→ Naivete ($\hat{\beta} = 1$): believes future selves have short-run discount factor $\beta = 1$

↳ believes no self-control problem + that she will follow through w/her plan

↳ cause harm by procrast. b/c she thinks she is not

* present bias effect: causes procrast. when costs are immediate + preproperation when rewards are immediate

→ Sophisticate ($\hat{\beta} = \beta$): future self has same dis factor

↳ believes will have a self control issue + future self may not follow through w/plan

↳ backward induction to manage self-control by eliminating choice sets

↳ sophistication effect:

1. procrastinate less: correctly pessimistic about future misbehavior so does it early to protect future procrastination
2. She preproperates because she can't control future preproperation + is correctly pes

→ Neuroeconomics: Two "selves"
1. δ self (lateral pre-frontal cortex): long run decisions based on cognitive thought (delay grat)
2. β self (limbic system): short-run decisions based on immediate reaction (immed grat)
→ How to distinguish naif + sophisticates?
↳ naif: misprediction of future behavior
↳ sophisticate: use of commitment devices
↳ ex: Dellavigna + Malmendier (2006)
→ naive present bias
↳ misprediction caused by irrational expectations (when cost + benefits in the future)
↳ self control problem from irrational pref
→ sophisticate present bias
↳ no irrational expectations + use commitment device for benefit
→ Acland + Levy (2014): determine gym-goers were naive (over-predict attendance)
→ Application Examples
↳ Ariely + Werembroch (2002): work assignment + self-control
→ subjects w/ no deadlines imposed commitment devices on themselves
↳ this section had higher average scores than those w/deadlines
→ also saw those w/evenly spaced deadlines detected more errors, had less delay, + had higher earnings
↳ Laibson (2007): δ-β model for household income to explain high debt + high savings
→ Ashraf, Karlan, Yin (2006): 28% of treated subj. chose to take up commitment account
↳ showed 81% incr. in total savings
→ Normative Implications
1. Present bias makes people procrastinate
↳ more sophisticated a person, the less they procrastinate or get hurt
↳ naifs may procrastinate badly + get hurt a lot
2. Creating opp to make intertemp. decisions in advance typically makes sophisticates better off
3. Forcing everyone to make "optimal decision"
↳ can make sophisticates better off (esp if there are no ex ante commitments)
↳ probably make naifs better off
→ but make them think they are better off
↳ but what is optimal?
→ effect on personal liberty, which self we are looking at, cost/benefits
→ State-Dependent Preferences + Rational Expectations
↳ pref Δ over time in 3 broad categories
1. Short-term fluct: physio, psych, circumstances
2. Long-term, systematic Δ: past behavior, maturation
3. Adaptations
↳ Stigler + Becker (1977): $\tilde{u}(c_T; s_T | s_t)$ pref holding state constant is rational, but expectations?
→ misprediction Ex

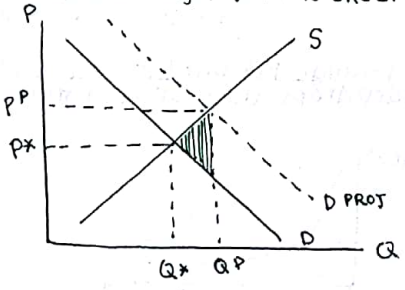
Reed + van Leeuwen: food

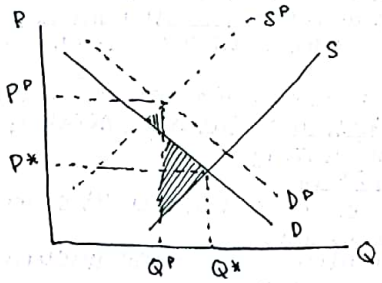
	will be hung	will be sat
hungry	78%	56%
satiated	92%	26%

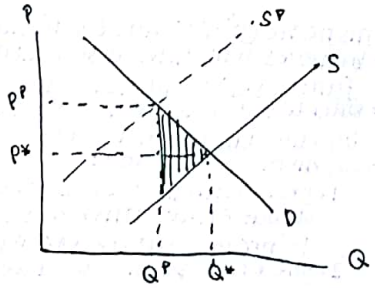
Giordano: heroin

	Day 1	Day 2
deprived	$60	$75
satiated	$35	$50

↳ state (columns) reveals projection bias + time (rows) reveal β discounting
↳ predict direction of pref Δ but not magnitude
→ have present bias pref w/misprediction of state dependence
↳ projection bias: people project their pref in current state onto future when predicting future utility
↳ causes a violation of rational exp. w/respect to state dependence
$\tilde{u}(c_T, s_T | s_t) = \alpha u(c_T; s_t) + (1-\alpha) u(c_T; s_T)$
↳ Projection-Biased Reference-Dependence: people have ref-dep ref w/loss aversion (w/lagged consump. reference point) but they project they will not adapt (↑ WTP + ↑ WTA
→ shiny-object bias: due to pb, buyer fails to forsee adaptation to durable + sets a high WTP, thinking she will receive a lifetime of joy
→ Pack rat effect: due to pb, a seller fails to foresee adaptation to not having a durable + thus sets high WTA to offset cost of lifetime loss.







* can use simple brief cognitive tasks to debias a person out of narrow framing

LECTURE 16 11-03-15

Standard Economics + Public Policy

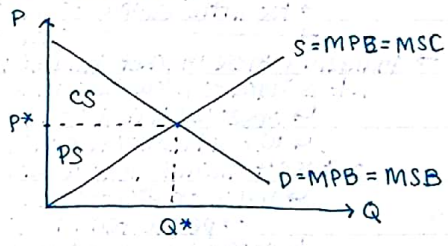
unregulated markets maximize social welfare (CS + PS) IF:

1. markets are competitive
   - → firms have no control over the prices they charge (many small firms)
   - → no barriers / free entry + exit
     - ↳ rules out monopolies + oligopoly
     - ↳ no natural monopoly from efficient economies of scale
2. Buyers + sellers have perfect info
   - → consumers know the true costs + benefits of consuming goods (value of trade)
     - ↳ rules out goods that consumers don't know are unsafe or unhealthy
   - → firms know the true cost of supplying goods to specific consumers
     - ↳ rules out goods w/moral hazard +/or adverse selection
3. There are no externalities (including public goods)
   - → all benefits/costs of consumption are received/borne by those who buy them
     - ↳ rules out externalities of goods that harm or benefit others
   - → all cost (benefits) of production are borne (received) by sell them
     - ↳ rules out goods that produce pollution

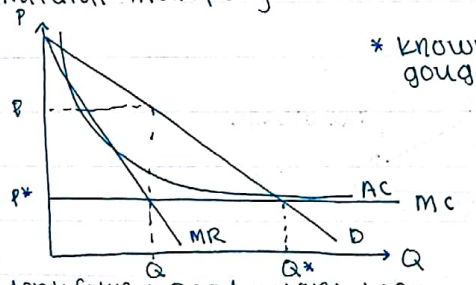
If the assumptions are true then the following must be true (correlated w/number)

1. If (1) is true, then price will be determined by the intersection of supply + demand
2. If (2) is true, S + D curves will correctly measure private value
   - → height of D = marginal private benefit
   - → height of S = marginal private cost
3. If (3) is true, then S + D curves correctly measure social value
   - → MPB = marginal social benefit
   - → MPC = marginal social cost

* the optimal price is the indifferent dollar-denominated utility



Natural Monopoly



* known as price gouging

If the above is true then

1. markets are Pareto efficient: no way to make anyone better off w/o making someone worse
2. markets are Kaldor-Hicks efficient: no way to increase total social surplus (sum of individual benefits) – stronger than (1)
3. No reason for gov't intervention: i.e. tax, subsidies, price controls, quotas, providing goods
4. Free markets are the best

Identifying Deadweight Loss

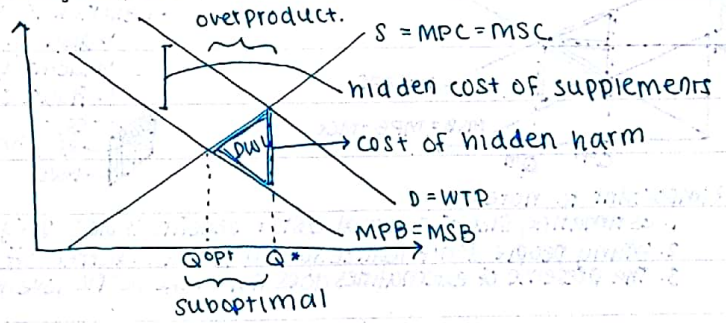
→ ex: imperfect info on consumer side of dietary supplements

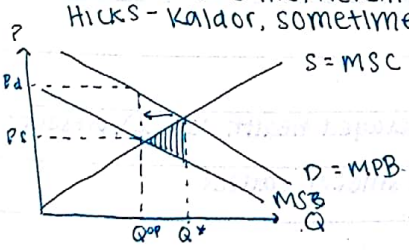
1. Model; S, D, MPB, MPC, MSB, + MSC
2. Identify equilibrium
3. ——— social optimum outcome
4. ——— suboptimal units
5. measure area b/t MSB + MSC

* DWL is not foregone CS

Violation of assumption causes market failures which means markets don't max social welfare

→ markets are inefficient (always Hicks-Kaldor, sometimes Pareto)





* DWL is the dollar value of harm

→ Gov't solution: impose tax equal to marginal external cost so that MPB = MSB

→ internalizing cost

→ petty criminals may arise

Relaxing Assumptions of Rational Utility +/or Profit Maximization

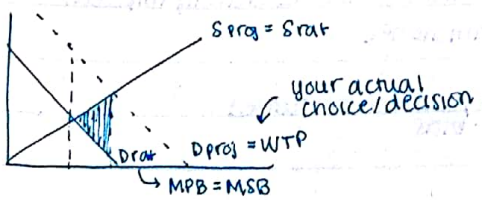
→ Standard model makes 2 additional assumptions

4. Consumers maximize utility rationally
5. Firms rationally maximize profits

] surprisingly controversial to claim false

↳ market failure is conceptually similar to extern.

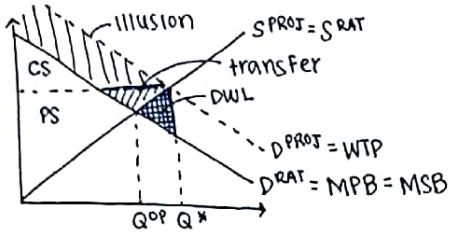
↳ this is an example of internality



LECTURE 17

11-05-15

Example of Internalities



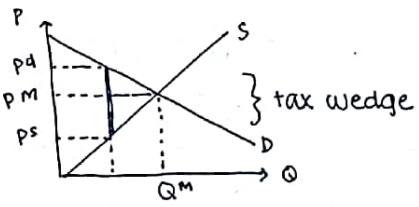
→ shiny object bias
  ↳ illusion cost: marginal utility people think they will get, failing to account for the cost (overpaying)
  ↳ transfer: money consumers pay for units they should not have
  ↳ internality: cost/benefit market actors do not take into account
    → cost to consumer = normative ambiguity
    → misallocated productive resource
→ DWL due to under-consumption in gym attendance ex due to projection bias about habit-formation + present-biased pref.

→ other examples of internalities
1. self-control problems, resulting in
   → too much demand for temptation goods (ex: soda tax)
   → — little ——— investment ——— (ex: SS, tax breaks for saving)
2. projection bias, resulting in
   → too much demand for goods w/negative habit formation effect
   → — little ——— positive ———
3. Loss aversion w/narrow bracketing, resulting in
   → too little supply of labor (on high wage days)
   → ——— capital to stocks (equity) versus bonds (major source of inefficiency)

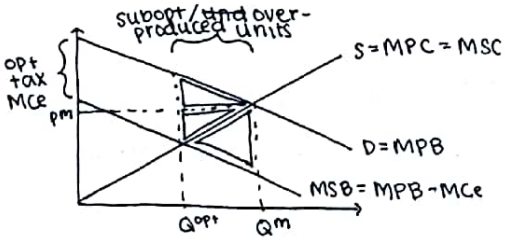
→ Analyzing these market failures is no different from analyzing classical market failures except w/o rationality:
1. It is hard to know how much people value things
   ↳ observed WTP for shiny objects will be higher than their true value.
   ↳ w/o an observable measure, how do we know their true value?
2. It isn't always clear whether people will think gov't is making things better
   ↳ naive or proj-biased consumers may think their choices are optimal already
     → people tend to grasp externality fixes but not internality
   ↳ people hate being told what to do (issues of autonomy)

Modeling a Tax

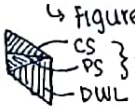
→ Two conditions must be satisfied
  ↳ supply must equal demand: $Q_S = Q_D$
  ↳ price to consumers must be greater than price to firms by amount of tax so $P_D = P_S + t$
→ tax drives a wedge between supply + demand



Modeling a Negative Consumption Tax



→ this assumes no production externality
  ↳ productive resources allocated elsewhere after tax
→ ex: risk to other drivers by driving heavy vehicle
  ↳ assume constant MCe per SUV
  ↳ identify DWL
  ↳ figure out who gets what



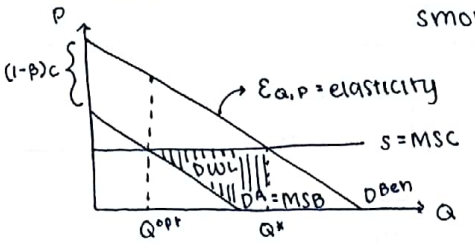
} total net cost offset by some CS + PS

→ important to note:
1. Estimating size of external costs + benefits is also very hard
2. many people don't realize society is made better off by correcting for externalities
3. The presence of externalities does not make people love being told what todo

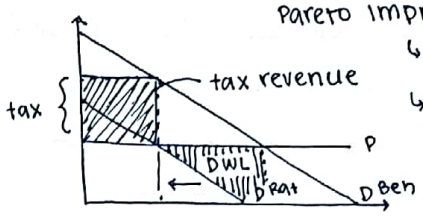
Smoking Example

→ simple model of present-biased smoking: immediate pleasure benefit (b), delayed health cost (c), present-biased pref w/ $\beta < 1$ + $\delta = 1$
  ↳ Rational utility max rule: smoke iff $b > c$
  ↳ Present-biased utility max rule: smoke iff $b > \beta c$
  ] whenever $c > b > \beta c$, the smoker causes themself a net loss
    → internality (portion of future cost ignored): $(1-\beta)c$
    → sophistication does not help (cannot control future behavior)
  ↳ set tax to size of internality: $t = MCi = (1-\beta)c$
    → smoke iff $U_{then}(smoke) - t > 0 \Rightarrow b - \beta c - (1-\beta)c = b - c > 0$
  ↳ equivalent statements:
    → tax Δs the short term benefit + thus Δs the smoker's choices (Δ short-term price)
    → ——— smoker's choice set ———
    → — functions as a "commitment device" + thus Δs the smoker's choices (coercively imposed)
→ Viscusi + Hersch (2007): c = $222 for men + c = $94 for women
→ Gruber + Koszegi (2001): c = $35
] estimate of c
→ typical estimates from both lab + field are 0.6–0.8 ($\beta = 0.7$)
→ GK: MCi = $10.50
  VH: MCi = $66.60 for men + $28.30 for women
] estimate of MCi; cost not accounted due to present-bias

*see the lecture notes for more details



smoking internality

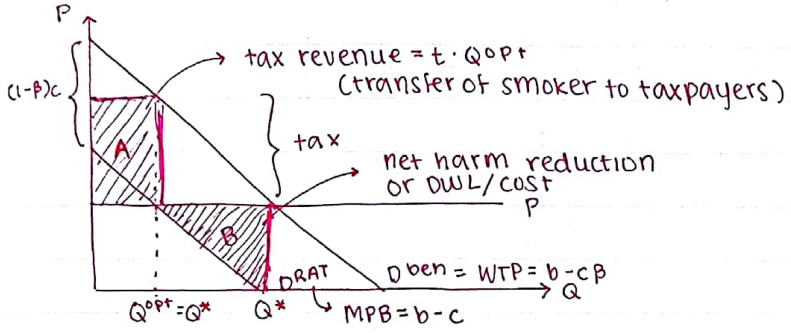


Pareto improvement
↳ so long as B>0 + B-A>0
↳ naif might not see this as an improv.

LECTURE 18

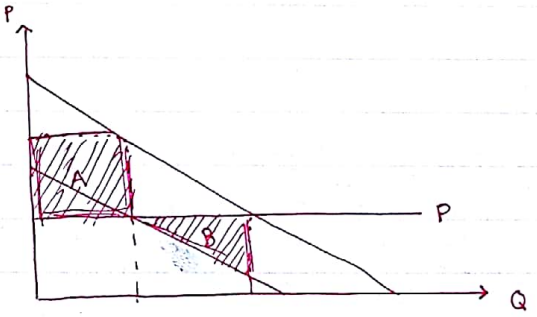
11-10-15

Pareto + Hicks-Kaldor Efficiency of Internality Tax



→ B>A: smoker on net is made better off
→ This is a Pareto improvement, but the naif may not think so
→ Pareto improvement
$\Delta u_i \geq 0$ for all i $(\forall i)$
$\exists i$ s.t. $\Delta u_i > 0$
(there exists an i such that $\Delta u_i > 0$)
→ some people do not adopt this b/c choices are different
→ paternalistic
→ If internality is large enough, smoker will be better off w/a tax

→ If internality is smaller, tax will hurt the smoker more than it helps
↳ B<A
→ This is a Hicks-Kaldor improvement but it isn't clear whether it is a good policy
↳ for naif or sophisticate
→ Hicks-Kaldor improvement
if $\Sigma_i \Delta u_i > 0$
→ can say this is reducing harm to other people



→ Consider: how is β calculated + is this accurate (positive consideration)? If you frame policy differently (benefit to individ or political benefit), does it change opinion?

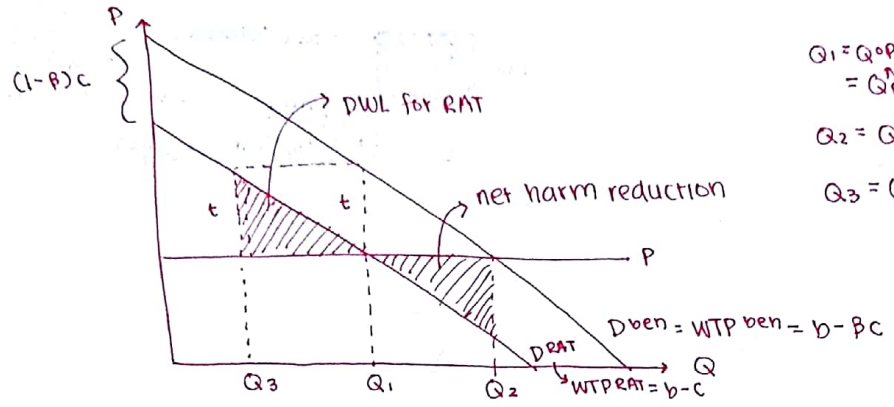
BCA and Asymmetric Paternalism

→ Definitions of paternalism involves the following ingredients
1. Paternalism is good for people according to the opinion of the paternalist
2. _____ overrides people's own choices + violates their liberty

→ Asymmetric Paternalism (Camerer, Issacharoff, Loewenstein, O'Donoghue, Rabin)
* Basic idea: good behavioral economics (1) removes paternalist from paternalism + (2) makes the violation of personal liberty essentially harmless
1. Mistakes Criterion
↳ recent research in benav. economics has identified a variety of decision-making errors that may expand the scope of paternalistic regulation
↳ to the extent that the errors identified by benav. research lead people not to behave in their own interests (as defined by themselves), paternalism may prove useful
2. Minimal Harm Criterion (NB >> 0)
↳ must create large benefits for those who make errors, while imposing little or no harm on those who are fully rational
↳ attractive rationale for paternalism + a careful, cautious, + disciplined approach
* If paternalistic policy can be shown to pass benefit-cost analysis by a landslide, then it probably satisfies asymmetric paternalism

→ Real World Examples
↳ Helmet Laws
1. Mistakes Hypothesis: riding w/o a helmet is tempting but most certainly irrational (fail to maximize true preferences)
2. Minimal Harm Hypothesis: rational types probably already wear helmets
↳ Portion size restriction (Soda ban: cannot sell more than 16-oz sodas)
1. many people discount health costs of drinking a lot of sugar + larger portions do not incr. your feeling of satiety
2. Buying 2 16-oz case is not that much more than one 32-oz
→ Yet there are people who may be unaffected by the policy but who are still opposed to it
↳ even though soda passes the asymmetric paternalism test
↳ "This is about personal responsibility. When I go out to eat, my daughters get water. I don't need the gov't to tell me to do that."
-State Senator Tony Smith, MI

→ Cigarette Tax
↳ What if some smokers are not irrational?



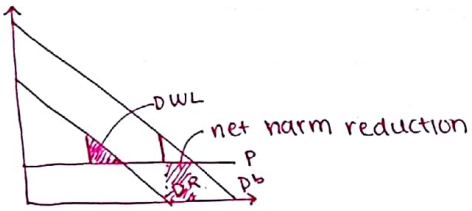
$Q_1 = Q^{opt}$ of all types
$= Q^{MKT}_{RAT}$ = market eq for rational

$Q_2 = Q^{MKT}_{ben}$

$Q_3 = Q^{tax}_{RAT}$

→ this is a HK improv if proportion of rational types is no greater than ½
↳ DWL = net harm reduction
↳ What if we make the tax smallers?

→ this is HK↑ unless proportion of rational types is very high



LECTURE 19

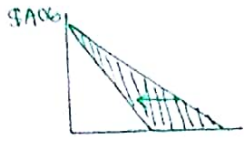
11-11-15

Review: Asymmetric Paternalism

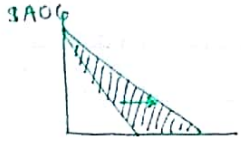
→ Good behavioral economics
1. Removes paternalist from paternalism
↳ make people better off according to their true pref (supported by strong evidence)
2. makes the violation of personal liberty essentially harmless
→ Example: insurance premium discounts for nonobese
↳ subsidy: employers have a "wellness plan" which includes $ for overcoming obesity (HIPAA)
↳ Asymm paternalism: yes!
→ don't think about taxpayers — look @ affected party when doing analysis
→ Ex: Insurance premium penalties for obesity
↳ insurance company w/ premium "surcharge" — like a tax
↳ AP? maybe. Depends on who is hurt + how large the benefit is
→ Creative Alternative: Self-imposed tax/subsidy (commitment contract) — helpful for partially sophisticates
↳ (1) Give lump sum of money + get it back when commitment is fulfilled
↳ (2) Pay penalty when fail + receive subsidy when succeed
↳ ex: stickk.com + gym-pact.com
↳ must think about
1. harm to rational types
2. nudging people in the wrong direction
3. _____ too far in the right direction
→ i.e. too high of a tax?

Libertarian Paternalism

→ Points to notice from diff definitions
↳ emphasis on role of the state
↳ emphasis on freedom to — to choose, to fail
↳ less emphasis on freedom from — from obesity, from one's own irrational brain
→ Good behavioral economists
1. Removes paternalist from paternalism
2. Nudges people to make better decisionss without violating their liberty
→ Thaler + Sunstein (2003 + 2008)
1. mistakes hypothesis
↳ people may make irrational choice they wouldn't have made w/complete information, unlimited cognitive abilities, + no lack of willpower
↳ paternalism: better off according to themselves
2. No restriction hypothesis
↳ policies maintain or increase freedom of choice w/no coercion involved
* looks like it must pass benefit-cost analysis, but it is not always obvious
→ Revisiting the AP examples
↳ insurance penalty will not satisfy libertarian paternalism
→ for private companies, it is alway LP!
↳ your choice to join!



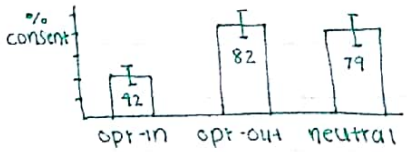
Insurance Budget Constraint



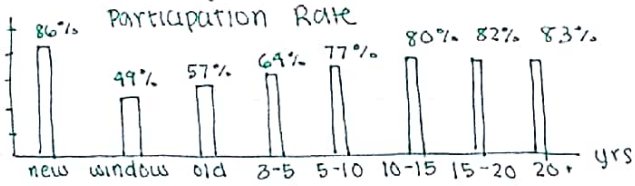
Insurance Discount

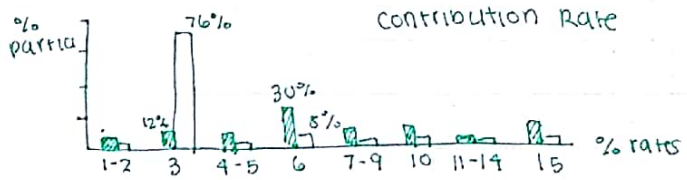
Default Bias

→ In 2003, 85% Am approved of organ donation but only 28% had signed a donor card
  ↳ in opt-in countries, consent percentage was much lower (<30%) than opt-out (>85%)
→ Johnson + Goldstein (2003)
  ↳ would you give consent to donate your organs if
    1. the default was to not donate (opt-in)
    2. _____ donate (opt-out)
    3. there was no default (neutral/active choice)



→ 401(k) retirement savings (tax-deffered savings that employers offer)
  ↳ contribute % of salary each month before taxes (some employers match)
    → pay taxes when you take out money to retire (in lower tax bracket)
  ↳ Madrian + Shea (2001): employer switched from opt-in to opt-out in 1998
    → window group: hired year before switch
    → new group: hired a year after the switch



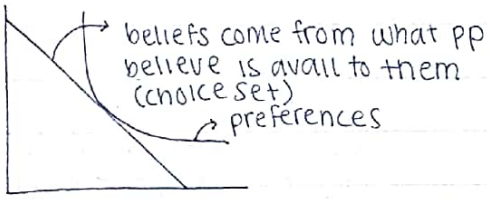


  ↳ most people believe this satisfies both AP + LP
    → consider autonomy loss: is it pertinent if you are nuding based on behavior biases that people are unaware of?

LECTURE 20

11-17-15

Overview



→ Economic theory of individual choice consists of
  1. Preferences: can rank things; choose from avail choice set
  2. Beliefs
→ Std economics makes 3 kinds of rationality assump:
  1. Rationality of preferences
  2. Rationality of expectations: fail to predict future choice set which results in suboptimal choices
  3. Unboundedness of Rationality
    ↳ people have limitless computational sophistication + ability
    ↳ and apply it correctly to all parts of all their choices
→ We've seen:
  ↳ Non-standard preferences → sometimes lead to irrational preferences
  ↳ _____ beliefs → usually lead to irrational expectations
→ We will see a tiny bit of bounded rationality → lead to irrational expectations/beliefs
  ↳ in the form of irrational inference
  ↳ also think of δ, β sophisticates
    → think about decision-making strategies (backward induction is hard! ex: chess)

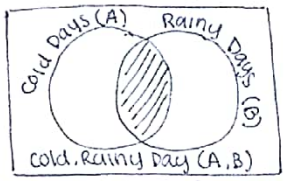
Probability Inference in Decision Making

→ Decision making under uncertainty (most decisions are)
  ↳ we do not know what conditions we are facing for certain (present)
  ↳ _____ will happen for certain (future)
→ General framework: people infer probabilities from a combination of
  1. past experience
  2. new information
→ Ex: employer deciding who to hire, doctor diagnosing HIV, police officer deciding who to search
→ What we get right: pieces of the puzzle
  1. Baseline probability/rate: your past experience
  2. Signals: new information that adjusts the base rate
→ What we get right: how the pieces are suppose to fit
  1. Base rate: if you liked past Spielberg movies then it is likely you'll like another
  2. Signals: if other tastes are strongly correlated, you should adjust probability estimate toward (positive correlation) or away from (negative) than your opinions
→ What we get wrong: actually putting the pieces together
  ↳ though people understand qualitatively, how to use base rates + signals to determine probabilities, they don't actually do it correctly, quantitatively

↳ Possible reasons
→ knowing qualitatively how info should Δ our estimates is easy
→ ——— quantitatively how much to adjust our estimates is very difficult
↳ mistakes are often large + systematic.

Rational Inference: Bayes' Rule

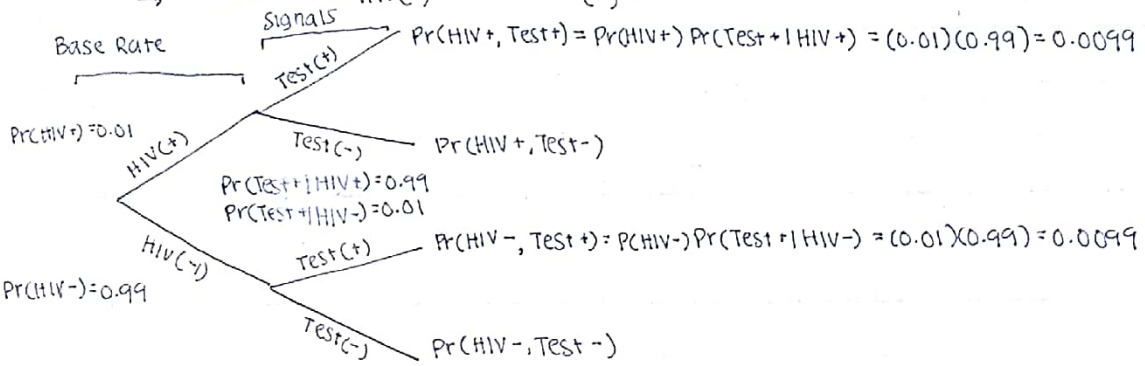
→ correct way to infer the probability of hypothesis, h, given a signal, i
→ Bayes' Rule: $Pr(h|i) = Pr(h,i)/Pr(i)$
↳ probability that hypothesis is true conditional on the signal being seen = probability that the hypoth. is true + signal is seen / unconditional probability that the signal would be seen, whether or not hypo is true
↳ derivation:



$Pr(A,B) = Pr(B) * Pr(A|B)$
$Pr(A|B) = Pr(A,B)/Pr(B)$

* $Pr(rainy, cold) = Pr(cold) \times Pr(rainy|cold)$
$Pr(rainy|cold) = Pr(rainy, cold)/Pr(cold)$

↳ Ex: Suppose 1% of pop is HIV(+) + there is a test such that
→ If a person is HIV(+), the test is (+) w/probability 0.99
→ ——— HIV(-) ——— (-) ———



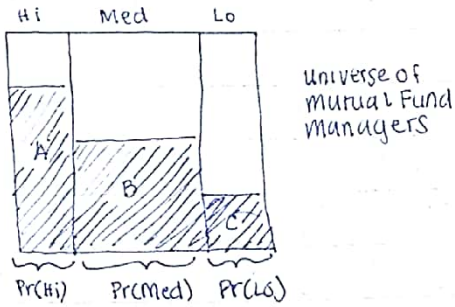
↳ What is the probability that someone is HIV(+) if their test is (+)?

$$Pr(HIV+|Test+) = \frac{Pr(HIV+, Test+)}{Pr(Test+)} = \frac{Pr(HIV+)Pr(Test+|HIV+)}{Pr(HIV+)Pr(Test+|HIV+) + Pr(HIV-)Pr(Test+|HIV-)} = \frac{0.0099}{2(0.0099)} = \frac{1}{2}$$

↳ What are people getting wrong?
1. Ignore the fact that there is more than one way to get a positive result
→ not correctly framing question
2. Ignore the fact that HIV is very rare in the population
→ getting a positive is skeptical
3. maybe
→ Ignore that the accuracy for test is same for positive + negative outcomes
↳ take account of base rate + ignore signals
→ Guessing wildly: anchoring?

↳ Example: mutual fund manager
→ Proportion of Hi, Med, Lo ability mutual fund manager (base rate)
$Pr(Hi) = 0.25$ $Pr(Med) = 0.5$ $Pr(Lo) = 0.25$
→ Probabilities of good quarter
$Pr(Good|Hi) = 0.75$ $Pr(Good|Med) = 0.5$ $Pr(Good|Lo) = 0.25$
A B C
→ If a manager is having a good quarter, what is the probability they are hi-ability?

$$Pr(Hi|Good) = Pr(Hi, Good)/Pr(Good) = A/A+B+C$$
$$= \frac{Pr(Hi)\,Pr(Good|Hi)}{Pr(Hi)Pr(Good|Hi) + Pr(Med)Pr(Good|Med) + Pr(Lo)Pr(Good|Lo)}$$



LECTURE 21

11-17-15

Stop + Frisk Example

Policy goal: get guns/drugs/criminal off the streets
NYPD policy: Stop people w/reasonable suspicion + frisk them to find out if they have a gun
→ Stop is justified if] see section notes
→ Frisk ———
↳ African Americans (23.4%): get s+f for 53% of the thing
↳ Whites, Asians, Native Am (47.3%): get s+f 13.3%
↳ Latinos (29.3%): get s+f 33.7%
→ is racially disproportionate s+f rational policy?

Model of statistical discrimination
→ value of finding an illegal gun: v(G)
→ cost of stop: c
→ probability of POC or White carrying an illegal gun: Pr(G|Poc) + Pr(G|W)
→ proportionate of stops that are POC: $r_{poc} \in [0,1]$ + stops that are white: $r_w = 1 - r_{poc}$
↳ police officer's choice variable

→ Average net value of all stops

$$EV = \underbrace{r_{POC} * Pr(G|POC)V(G)}_{E(POC)} * \underbrace{(1-r_{POC})* P(G|W)*V(G)}_{E(W)} - c$$

weighted average of expected value of stopping a POC + ev of stopping a white person — given probabil. a white or POC is carrying a gun — minus cost

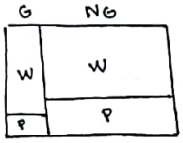
$$\frac{dEV}{dr_{POC}} = [\uparrow] + [\downarrow]$$

↳ which is what you want when $P(G|POC) > P(W|G|W)$

→ actual numbers: $P(G|POC) = 0.018$ + $P(G|W) = 0.038$

* deriving eliminates choice variable

→ We have: 5% of people in NYC carry an illegal gun
20% of those people are POC + rest our white
25% ——— who don't carry guns are POC. + rest are white



$$P(G|POC) = \frac{P(POC|G)P(G)}{P(POC)} = \frac{P(POC|G)P(G)}{P(POC|G)P(G) + P(POC|NG)P(NG)}$$

$$= \frac{(0.05)(0.2)}{(0.05)(0.2) + (0.95)(0.25)} \approx 0.04$$

Base Rate Neglect

↗ bounded rationality

→ Kanneman + Tversky (1974): "People rely on limited heuristics which reduces complex tasks of assessing probabilities + predicting values to simpler judgmental options. They are quite useful in general, but may lead to severe + systematic errors (bias)."

→ Bar-Hillel (1980): "People order info by its perceived degree of relevance. + let high relevance of info dominate low-relevance info; base rate fallacy is thus the result of pitting what seem to be merely coincidental, therefore low relevance base rates against more specific or causal info

→ Haselton et al (2009): "Effects of error-management are cases in which errors that were less costly over evolutionary history are favored over more expensive ones, producing bias in direction of less costly."

→ Evolution may be biased towards type II error:
↳ Type I error: false-negative — That's a stick. No, it's a snake!
↳ Type II error: false-positive — That's a snake! No, it's a stick.

→ Bias in modern setting
↳ Diagnosing HIV incorrectly can ruin lives
↳ Randomly s+f people of color can undermine social harmony

→ Psychological insight:
↳ It appears we pay too much attention to new info (signal)...
↳ ... + forget to account for past experience (base rate)

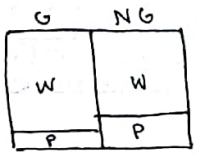
→ Quasi-Bayesian approach w/ base rate neglect
↳ Assume people put same probability on all possible hypothesis ⇒ treat base-rates as equal
→ people may not see it as equal but captures how it will ignored (be)
↳ Applying to HIV ex

$$P(HIV+|T+) = \frac{P(T+|HIV+)P(HIV+)}{P(T+|HIV+)P(HIV+) + P(T+|HIV-)P(HIV-)}$$

$$P_{BRN}(HIV+|T+) = \frac{P(T+|H+)}{P(T+|H+) + P(T+|H-)} = \frac{0.99}{0.99+0.01} = 0.99$$

→ $P(G|POC)$ under BRN?

$$P_{BRN}(G|POC) = \frac{P(POC|G)}{P(POC|G) + P(POC|NG)} = \frac{0.2}{0.2+0.25} \approx 0.44$$



← ignore width (base rate)
← only account for

LECTURE 22

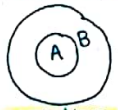
12-01-15

Heuristics + Biases

Two system: thinking fast + slow (S-B, base rates / signals, etc)
1. System-1: heuristics (thinking fast)
2. system-2: biases; system-1 inadequately interacting w/ system-2

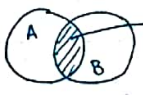
Conjunction Fallacy + Representative Bias

→ Consider simple set theory + Probability
↳ subsets + probabilities



↗ subset
If $A \subseteq B$ then $P(A) \leq P(B)$

↳ conjunctions + subsets



$A \cap B \subseteq B$
↳ intersection

↳ conjunction + Probabilities
Thus $P(A \cap B) \leq P(B)$ always

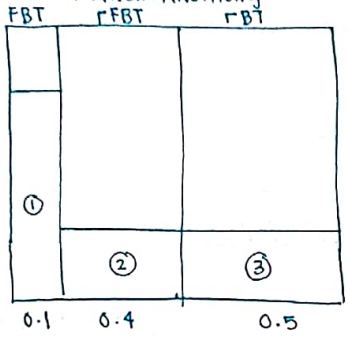
↳ conjunction fallacy: estimating the probability of a conjunction as greater than the probability of one of its "constituents"

→ consider Linda, 31, who is single, outspoken, + bright; majored in Philosophy; concerned w/ issues of discrimination + social justice; participated in anti-nuclear demonstrations
↳ What is more likely to be true?
A. Linda is a bank teller → (constituent)
B. ——— + is active in the feminist movement (conjunction)

] subset cannot be more likely but constituent is less representative

* system-2: conjunction is less likely
↳ system-1 ignores this + looks for rules of thumb (representative signal)

→ Representative heuristic: conditional probabilities are evaluated by the degree to which the hypothesis is "representative of" (i.e. similar to) the signal; P(h|i) ↑ if h resembles i
↳ causes conjunction fallacy
→ Representativeness bias: inferential errors caused by the systematic failure of the representativeness heuristic
→ Bayes' Rule w/ Linda Anomaly



↳ Assumptions: ½ all people are bank tellers
F = feminist
BT = bank teller
L = liberal

$P(FBT|L) = \frac{1}{1+2+3}$

$P(L|\neg FBT) = P(L|\neg BT) = 0.25$

$$P(BT|L) = \frac{P(BT,L)}{P(L)} = \frac{P(BT)P(L|BT)}{P(BT)P(L|BT) + P(\neg BT)P(L|\neg BT)} = \frac{1+2}{1+2+3}$$

$$P(FBT|L) = \frac{P(FBT,L)}{P(L)} = \frac{P(FBT)P(L|FBT)}{P(FBT)P(L|FBT) + P(\neg FBT \cup BT)P(L|\neg FBT \cup BT)} = \frac{1}{1+2+3}$$

↳ Base rate neglect
→ signal: i = "liberal" (L)
→ hypothesis: h = "bank teller" (BT) vs. h = "feminist bank teller" (FBT)

We have $P(L|BT) = (0.1)(0.75) + (0.9)(0.25) = 0.35$
$P(L|FBT) = 0.75$
$P(L|\neg BT) = P(L|\neg FBT) = 0.25$

$$P_{BRN}(BT|L) = \frac{P(L|B)}{P(L|BT) + P(L|\neg BT)} = \frac{0.35}{0.35+0.25} = 0.58$$

$$P_{BRN}(FBT|L) = \frac{P(L|FBT)}{P(L|FBT) + P(L|\neg FBT \cup \neg BT)} = \frac{0.75}{0.75+0.25} = 0.75$$

→ We know the probability of conjunction cannot be larger than probability of constituent
↳ heuristic causes bias → BRN is a math phenomena that captures the psychology

Availability Bias

→ Availability heuristic (K+T, 1974)
↳ Rule of thumb: assess the probability of an event by the ease with which instances of an event can be brought to mind
↳ We overestimate P(h|i) if
1. It is disproportionately easy for us to call to mind instances of h
2. From among the universe of hypothesis that could lead to a signal i

Cause	Estimate	Truth
Tornado	564	90
Fireworks	160	6
Asthma	506	1886
Drowning	1684	7380

→ Reasons for greater ease of "bringing to mind" ↝ also connections
1. Retrievability: events we have observed many times are more likely to be called to mind
↳ Natural assumption: frequency of observ is proportional to true frequency
↳ Reality: in many cases less frequent events are observed more frequently
→ claim: mass media makes this much worse
2. Salience: events that "stand out" in some way are more likely to be called to mind
↳ more news coverage when rare
→ Acland's Thoughts
↳ cases in which availability bias replaces Baye's Rule
→ ex: P(Homicide | Gun Death) vs. P(Suicide | Gun death)
↳ w/ signal "gun death", usually about homicide
↳ over-represented among instances of i (among situations, you receive signal)
↳ cases in which availability bias influences Bayes' Rule
→ ex: P(Illegal Gun | POC) vs. P(Illegal Gun | White)
↳ When we see the signal "POC" in media, it is usually not a person carrying a gun
→ h not over-represented among instances of i
↳ But when we see signal "illegal gun" in media, it is disproportionately POC
→ i is over-represented among instances of h

$$P(G|POC) = \frac{P(G)P(POC|G)}{P(G)P(POC|G) + P(\neg G)P(POC|\neg G)}$$

not over-rep ↝ P(G) ; P(POC|G) ↜ over-rep ; over-rep = avail bias ↜ P(¬G)P(POC|¬G) over-rep

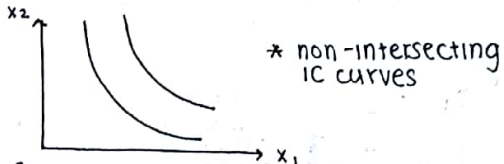
FINALS REVIEW

Standard Model

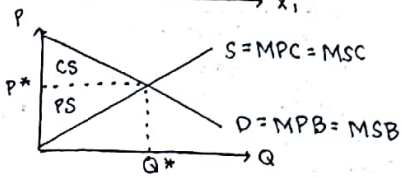
→ unregulated markets max social welfare if:

1. Perfectly competitive
   ↳ no market power, free entry/exit
2. Perfect info
3. No externalities
4. Rational utility maximizing agents
   ↳ complete + transitive
5. Firms rationally max profits

First Fundamental Welfare Theorem



* non-intersecting IC curves



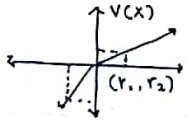
*one demand curve

Behavioral Models

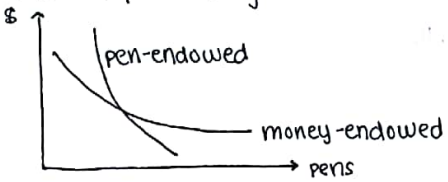
1. Reference-Dependent Preferences

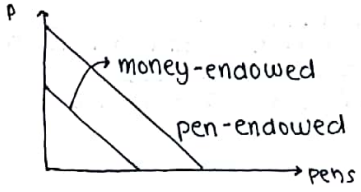
→ preference reversal due to

1. Anchoring effect (Ariely: Belgium chocolate)
2. Endowment effect (Kahneman, Knetsch, Thaler: mug, token, candy)
   ↳ psychophysical r.d.: color, size (Helson), pitch (Campbell), happiness (Luttmer), olympic (Meavec)
   ↳ loss aversion
   → dual entitlement
   → $u(c_1, c_2; r_1, r_2) = u(c) + v(kc_1 - kr_1) + v(mc_2 - mr_2)$
   where $v(x) = x$ when $x > 0$
   where $v(x) = 2x$ when $x < 0$

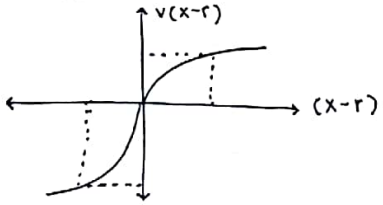


→ Knetsch: pen + mug





3. Risk aversion: diminishing marginal utility
   ↳ implausible levels (Rabin)



↳ ref-dep model w/loss aversion (Arrow)
↳ Calibration model (Sydnor)
↳ narrow framing
→ myopic loss aversion (Haigh + List, Menra + Prescott)
→ negative elasticity of supply (Camerera)

4. Possible Explanations w/n Std Model
   ↳ state-dependent ref point; expectation-based reference point
   ↳ market experience (List, Genesove + Mayer)

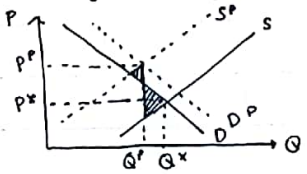
→ Normative issues
↳ no valid tools for measuring welfare (no mathematical model)
↳ ambiguous demand curves
↳ need consistent theory of reference point determination to predict ex ante + ex post + requires a falsifiable hypothesis for scientific process
→ status quo: $r_t = c_t$
→ lagged consumption: $r_t = \gamma c_{t-1} + (1-\gamma) r_{t-1}$ where $0 \leq \gamma \leq 1$
→ recent expectations (Koszegi + Rabin): $r = E(c^* | r, P, \theta)$ where $c^* = \max_c u(c; P, r, \theta)$

2. Intertemporal Choice

→ Std Model: Exponential Discounting (Samuelson): $U(P) = \sum_{t=0}^{T} \delta^t u(x_t)$
↳ smooth decrease + time consistent
↳ preference reversal (Green, Malmendier, + Thaler) due to
1. Future time perspective theory
2. Willpower + self control

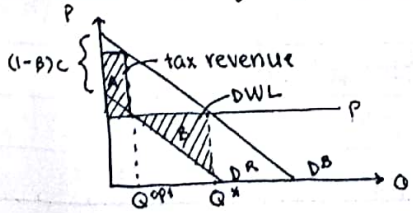
→ Quasi-Hyperbolic Discounting: $U(P) = u_0 + \beta \sum_{t=1}^{T} \delta^t u_t$
↳ present bias w/naivete + sophistication (Dellavigna + Malmendier)
→ Acland + Levy, Ariely + Weremoroch, Laibson, Ashraf/Karlan/Yin
↳ Normative issues
→ procrastination + creating opportunities to make decisions in advance
→ forcing "optimal" decision: what is optimal?

→ State-Dependent Preferences (Rabin, Loewenstein, O'Donoghue): $\tilde{u}(c_T; s_T | s_t) = \alpha u(c_T; s_t) + (1-\alpha) u(c_T; s_T)$
↳ prefs Δ over short-term fluctuations, long-term systematic Δs, adaptations
↳ projection bias
→ shiny obj. bias
pack rate effect



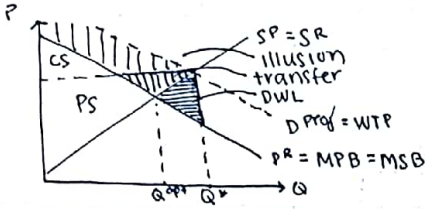
Public Policy

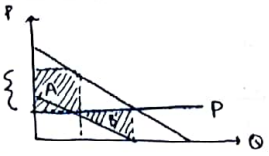
1. Pareto Efficiency/Improvement: B > A



2. Hicks - Kaldor Efficiency / Improvement
→ B<A

Internalities





→ examples
↳ shiny object bias (illusion)
↳ self control
↳ projection bias
↳ loss aversion
→ (1 - β)C

Asymmetric paternalism
1. Mistakes criterion
2. Minimal harm criterion
ex: soda tax, obesity surcharge

Libertarian Paternalism
1. Mistakes criterion
2. No restrictions hypothesis
ex: default bias

Probability Inference
→ Bayes' Rule $P(h|i) = P(h,i)/P(i)$

$$P(h|i) = \frac{P(i|h)P(h)}{P(i|h)P(h) + P(i|\neg h)P(\neg h)}$$

where h = hypothesis (base rate)
i = signal / inference

↳ Base rate neglect (Kahneman + Tversky)

$$P_{BRN}(h|i) = \frac{P(i|h)}{P(i|h) + P(i|\neg h)}$$

Type I error + Type II error (← evolutionary favored)

→ Two-System Heuristics + Biases
↳ conjunction fallacy when constituent is less representative
→ representative heuristic + bias
↳ availability bias: retrievability + salience