Recitation 2: Value of UI

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Questions you should be able to answer at the end

1. Different approaches use different causal effects. Why do we need one type of elasticity for one approach but not the other?
2. Baily-Chetty uses a Taylor expansion but not a comparative static, while Chetty (2008) does the opposite. Why?
3. How does each approach deal with state-dependent utility?

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Question to ponder afterwards:

1. These approaches are for binary losses. What about continuous risks?
2. Private insurance value comes from marginal utility. Why might social value depend on utility levels? Anything else?

Disclaimer: There's a lot of material

- I will prioritize material related to this year's class
- I will mostly skip material from past years' classes and math tools
- But feel free to post on Canvas or come to OH to discuss any of it!

Recap of Value of UI Approaches

1. Causal effect of UE onset (e.g. Gruber ’97, Fadlon and Nielsen ’19)
2. Causal effect of environment (e.g. Chetty ’08)
3. 1 + 2 + good ol’ directly revealed preference! (Landais and Spinnewijn ’20)
4. Causal effect of UI generosity (e.g. Shimer and Werning ’07...not what you read!)

Course Theme: Sufficient Statistics

- It's hard (and sometimes not transparent) to recover all "structural" model primitives (e.g. borrowing constraints, time discount rate, adjustment costs, etc.)
- It's easier (and sometimes more transparent) to estimate moments and causal effects
- Conditional on a model, those statistics can be sufficient for welfare analysis

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- Conditional on a model, those statistics can be sufficient for welfare analysis
  - *Baily-Chetty*: Taylor expansion to get causal effect of UE on c
  - *Landais and Spinnewijn (2020) MPC approach and Chetty (2006)*: Differentiate FOC to get causal effect of environment on c or e

Outline

Baily (1978)-Chetty (2006) Formula Recap

- Setup: Social planner allocating consumption in employed and unemployed states subject to (i) govt. budget balance and (ii) unobservable search effort
- Result: $\frac{u'(c_u)-u'(c_e)}{u'(c_e)} = \epsilon_{1-q,b}$
  - At optimum: Marginal benefits (LHS insurance value) = Marginal costs (RHS fiscal externality cost)

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  - At optimum: Marginal benefits (LHS insurance value) = Marginal costs (RHS fiscal externality cost)
- Derivation:
  1. Worker's private search effort problem
     - Chooses effort given benefits and taxes
  2. Planner's welfare problem s.t. budget balance + worker FOC
     - Chooses benefits and taxes given endogenous effort responses
  3. Consumption-based approach: Taylor expansion of MU difference
     - Turns (really hard to know) unobservable MU's into observable c's w/ (easier to know) unobservable γ

Moving Beyond the Consumption-Based Approach

- Problems:
  1. Consumption can be hard to measure
  2. Imposed CRRA structure w/ risk aversion γ as free parameter
  3. Ignores higher-order Taylor expansion terms
  4. Taylor expansion assume MU's are from same function (i.e. no state-dependence)
- Solution: Map models to other estimable elasticities

Relabeling to Derive an Alternative Method

- Baily-Chetty LHS “value of UI" was an across-state gap in MU: $v'(c) - u'(c)$
  - Taylor expansion turns this into variation in c scaled by how much the agent dislikes variation in c
- Nothing special in the model about c being consumption!

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Challenge questions: What are other observable actions? What would the “γ” be?

Hint: Recall non-financial interpretations of x_s in Landais and Spinnewijn (2020)

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Hint: Recall non-financial interpretations of x_s in Landais and Spinnewijn (2020)

See Fadlon and Nielsen (2019) JPubEc...and next part!

Outline

Arc of Paper

Applies general framework to measure value of marginal UI $ (i.e. across-state MRS) using:

1. Standard theory and empirics: consumption drop at UE onset
2. Standard theory, novel institutional setting: WTP for supplemental insurance
3. Novel theory and empirics: State-specific MPC's

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3. Novel theory and empirics: State-specific MPC's

Intellectual history: Early WP version did not particularly emphasize the MPC approach

General Framework (Paper Notation)

- Max EU given action z to lower UE risk and action x_s to change within-state c_s for $s \in \{e, u\}$:

$$V = \pi(z)v_u(c_u, x_u, z) + (1 - \pi(z))v_e(c_e, x_e, z) - z$$

- Consumption given income y_s and (relative) price p_s of action x_s to per unit of c_s:

$$c_s = y_s + \frac{1}{p_s}x_s$$

General Framework (Translated to Class Notation)

Simplifying assumptions:

1. Exogenous UE risk e (and therefore ignore z)
   - Not important for consumption-based approaches
     - Why not? Why is it important for the revealed preference approach based on supplemental UI contract purchase?
2. Additively separable utility $v_s(c_s) - \psi(x_s)$
   - Done in paper to ignore cross-partials when differentiating FOC

$$V = e[v_e(c_e) - \psi(x_e)] + (1-e)[v_u(c_u) - \psi(x_u)] \quad \text{s.t.} \quad c_s = y_s + \frac{1}{p_s}x_s$$

1st-order conditions

$$ev_e'(c_e) = \lambda_e \tag{1}$$

$$e\psi'(x_e) = \lambda_e \frac{1}{p_e} \tag{2}$$

$$(1-e)v_u'(c_u) = \lambda_u \tag{3}$$

$$(1-e)\psi'(x_u) = \lambda_u \frac{1}{p_u} \tag{4}$$

Combine (1) and (3) for Baily-Chetty LHS in terms of Lagrange multipliers:

$v_u'(c_u) - u'(c_e) = (1-e)\lambda_u - e\lambda_e$ Combine (1) and (2) or (3) and (3) for Econ 101 intuition within-state across-actions:

$$\frac{\partial v_s(c_s)}{\partial c} = p_s \frac{\partial \psi(x_s)}{\partial x}$$

Setup Interpretation

Consider different types of x_s:

1. Spousal labor
2. Savings

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- How could we think of p_x and $\psi(x_s)$?
- Does this get us anywhere useful right away?

Making Progress to Observables

$$\frac{\partial v_s(c_s)}{\partial c} = p_s \frac{\partial \psi(x_s)}{\partial x} \quad \text{s.t.} \quad c_s = y_s + \frac{1}{p_s} x_s$$

- Goal: Get MRS $\frac{v'_u(c_u)}{v'_e(c_e)}$
- Good news: We see $v'_s(c_s)$!
- Bad news: No clue on what to do with p_s and ψ
- Strategy:

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- Bad news: No clue on what to do with p_s and ψ
- Strategy: Get within-state comparative statics w.r.t. wealth y_s
  - Usefulness: Will substitute out artificial construct p_s for an estimable elasticity
  - New challenge: Will have 2nd derivatives floating around

MPC Derivation mechanics

1. Differentiate FOC w.r.t. y_s (recall 1st reciation slides):

   $\Rightarrow \frac{\mathrm{d}c_s}{\mathrm{d}y_s} = \frac{v' * \text{“stuff”}}{v' * \text{“things”} + \text{“}stuff''}$

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2. Based on above expression, define $O(MPC_s) \equiv \frac{\frac{\mathrm{d}c_s}{\mathrm{d}y_s}}{1 - \frac{\mathrm{d}c_s}{\mathrm{d}y_s}}$:
   $\Rightarrow v'(c_s) = O(MPC_s) * \text{“other stuff”}$

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3. Divide within-state expressions to get MRS:

$$\underbrace{\frac{v'_u}{v'_e}}_{\text{What we want!}} = \underbrace{\frac{O(MPC_u)}{O(MPC_e)}}_{\text{Observable elasticties}} * \underbrace{\text{“ratio of other stuff”}}_{\text{Calibration/bounding exercise}}$$

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Intuition check: Low-income people have high MPC's. Does this imply they people have a high value of UI?

Outline

Alternative Approach #1: Consumption Drop

$$MRS \approxeq 1 + \underbrace{\gamma}_{\text{risk aversion}} (\Delta c)$$

- Standard 2nd order Taylor expansion

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$$MRS \approxeq 1 + \underbrace{\gamma}_{\text{risk aversion}} (\Delta c)$$

- Standard 2nd order Taylor expansion
- Andrews and Miller (2013) WP notes that $Cov(\gamma, \Delta c)$ might be important
- *Intellectual history aside*: WP version emphasized an additional state-dependence term...but relative MU is exactly what we're trying to figure out!

Alternative Approach #2: Revealed Preference Using Supplemental Insurance

- Sweden's labor unions offer the option to purchase supplemental UI
- What better way to assess how people value additional UI than their choices of purchasing additional UI!

Alternative Approach #2a: Revealed Preference (Bounds)

- At interior optimum, MRS=(probability-weighted) price ratio
- With discrete choice, instead recover bound:

$$MRS \geq (\leq) \frac{p_u}{p_e} \frac{1-\pi}{\pi}$$

  for buyers (non-buyers) with premium p_e, benefit p_u, risk-type π
- Moral hazard weakens bound when risk type π inferred from risk realizations
- Average the person-specific bounds to get (very loose) bounds on average MRS

Alternative Approach #2b: Revealed Preference (Point Estimates)

Structural choice model: $\underbrace{X_{it}\beta}_{\text{WTP for contract} \equiv MRS} - \underbrace{\frac{p_u}{p_e}\frac{1-\pi(Z_{it})}{\pi(Z_{it})}}_{\text{E[cost of contract]} \equiv \tilde{p_{it}}} + \underbrace{\epsilon_{it}}_{\text{structural error}} \geq 0$

- Demographics X is reduced-form way of capturing value of UI
- Exogenous shifters Z_{it} that affect risk but not value of UI

Logit regression: $Choice_{it} = X_{it}\beta - \gamma\tilde{p}(Z_{it}) + \epsilon_{it}$

$$MRS = \frac{X_{it}\beta}{\gamma}$$

Outline

Main Idea of Chetty (2008) JPE

Play around with only worker's private search effort FOC: $h'(q) = v(c_e) - u(c_u)$

- Differentiate FOC to get comparative statics (i.e. estimable elasticities)
- Consider impacts of unconditional asset transfer A and conditional UI benefit b on re-employment q
- End up with gap in marginal utilities in terms of elasticities

Intuition of Mechanics

- We want $v'(c_e) - u'(c_u)$
- An action's FOC reads off the MU of the action compared to its MC
  - Search is a costly action
  - Return to search is gain of moving from unemployment to employment
- Search effort FOC depends on MU of search effort and gap in levels of utility over consumption
- Comparative statics from search FOC get us $v'(c_e) - u'(c_u)$ and estimable elasticities

Details of Mechanics

Worker objective (same as Baily-Chetty w/ additive separability):

$$qu(c_u) - (1-q)v(c_e) - h(q)$$

FOC:

$$h'(q) = u(c_u) - v(c_e)$$

- Comparative static on transfer A to **both states**: $\frac{\partial q}{\partial A} = \{v'(c_e) - u'(c_u)\}/h''(q)$
  - "Liquidity effect" (≤ 0, but < 0 *only if* there's a MU gap)
- Comparative static on transfer b to **unemployed state**: $\frac{\partial q}{\partial b} = -u'(c_u)/h''(q)$
  - "Moral hazard effect" (< 0 by non-satiation)
- Combine comparative statics to get **value of insurance**!: $\frac{v'(c_e)-u'(c_u)}{v'(c_e)} = -\frac{\frac{\partial q}{\partial A}}{\frac{\partial q}{\partial A} - \frac{\partial q}{\partial b}}$
  - Value ≥ 0 (by above signs)

Aside: Cramer's Rule!

Matrix algebra to make comparative statics easier

- Especially useful with multiple FOC's where multiple margins may adjust
- See David Card's labor notes for a detailed discussion

Suppose you have a system of equations (i.e. totally differentiated FOCs): $Ax = b$

- *Consumer optimization example*: x is vector of differentiated endogenous choices, A is bordered Hessian with utility function 2nd derivatives, and b is the matrix of terms with differentiated exogenous parameters

Formula for entry x_i:

$$x_i = \frac{det(\mathbf{A}_i)}{det(\mathbf{A})}$$

where $\mathbf{A}_i$ replaces column i of $\mathbf{A}$ with vector $\mathbf{b}$

- Set all but one differentiated parameter = 0 to get comparative static

Aside on the Aside: Monotone Comparative Statics!

"Differentiate the FOC" when it's not differentiable due to functional form or discreteness

- Signing comparative statics is determined by assumptions on second derivatives/cross-partials
- Economic assumptions aren't really about differentiability
- More general conditions can deliver the same predictions

E.g. Rather than assume $u(\cdot)$ convex, assume *increasing differences*:

$$u(x^H, y^H) - u(x^L, y^H) \geq u(x^H, y^L) - u(x^L, y^L)$$

for $x^H > x^L$, $y^H > y^L$

Intuition #1: Slutsky Price Theory

$$\frac{v'(c_e)+u'(c_u)}{v'(c_e)} = -\frac{\frac{\partial q}{\partial A}}{\frac{\partial q}{\partial A}-\frac{\partial q}{\partial b}}$$

- Could also get comparative static of **employed wage**: $\frac{\partial q}{\partial w} = v'(c_e)/h''(q) > 0$
- Algebra in the privacy of your own home:

$$\underbrace{\frac{\partial q}{\partial b}}_{\text{“uncompensated effect”}} = \underbrace{\frac{\partial q}{\partial A}}_{\text{“income effect”}} - \underbrace{\frac{\partial q}{\partial w}}_{\text{“substitution effect”}}$$

- “Income effect" can change behavior, but doing so increases welfare by facilitating q decision that would occur with unconstrained borrowing
- “Substitution effect" changes behavior due tothe wedge between the private and social returns to search effort
- **“Income” effects reveal welfare-enhancing smoothing while “substitution” effects reveal welfare-decreasing distortions**

Intuition #2: Revealed Preference

$$\frac{v'(c_e) - u'(c_u)}{v'(c_e)} = -\frac{\frac{\partial q}{\partial A}}{\frac{\partial q}{\partial A} - \frac{\partial q}{\partial b}}$$

- If it's hard for agent to smooth transitory income shocks, they're stuck exerting a lot of costly search effort
- Agent reveals that that's the case if an unconditional grant changes search similar to a conditional grant
- **How much agent chooses to "spend" unconditional transfer on avoiding costly search**

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Intuition check: A friend remarks that the above result is weird; if unemployment is awful, wouldn't we expect them to (1) keep searching hard but (2) still have high UI value?

Intuition #3: Estimating Risk Aversion With Labor Supply [Chetty (2006) AER]

- (Different from Chetty (2006) JPubEc on the Baily-Chetty formula!)
- *2006 Upshot*: Labor supply elasticities can recover risk aversion
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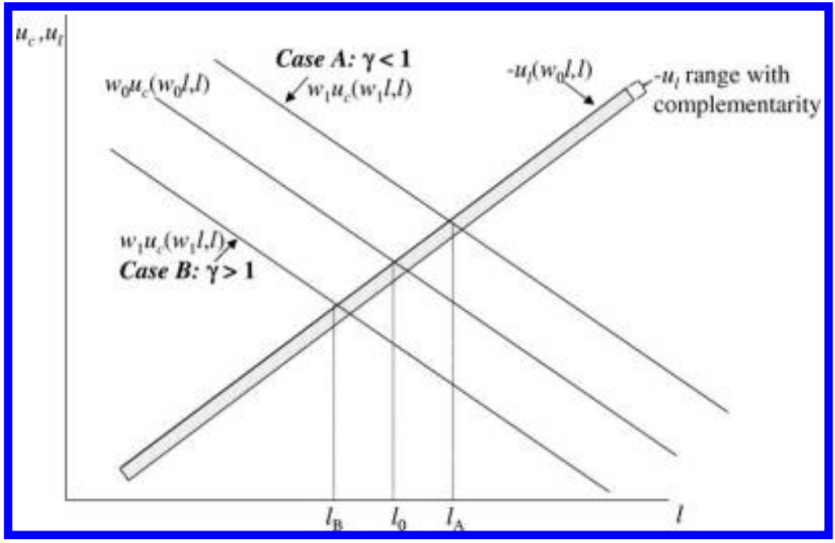
- *2008 Mapping*: **Uninsured, risk-averse agent will have large "income" effect**

Aside: Chetty (2006) AER Details

- Argument above relies on additive separability of labor and consumption ($u_{cl} = 0$)
  - Just as the Baily-Chetty formula relies on additive separability [1]
- If higher consumption makes work less painful ($u_{cl} > 0$), highly risk-averse agents may nevertheless increase hours when wage increases
  - i.e. marginal disutility of labor falls from increased consumption from income effect
  - *Idea of estimating complementarity*: Estimate consumption changes for consumer who experiences exogenous shock to labor supply (e.g. job loss, disability, etc.)
    - Hard to get causal *point* estimate, so rely on *bounds* (i.e. partial identification)

Aside: Chetty (2006) AER Graphical Intuition In Pictures



Aside: Chetty (2006) AER Graphical Intuition In Words (for last slide)

- x-axis: labor, y-axis: marginal utilities
- Downward-sloping line: Diminishing marginal utility of c
- Upward-sloping line: Increasing marginal disutility of l
- Intersection: FOC equality
- Initial LS l_0 at wage w_0
- After the wage increases to $w_1 > w_0$...
  - LS increases to l_A for CRRA parameter $\gamma < 1$ (i.e. $\downarrow$ risk aversion $\rightarrow\downarrow$ income effect)
  - LS increases to l_A for CRRA parameter $\gamma > 1$ (i.e. $\uparrow$ risk aversion $\rightarrow\uparrow$ income effect)
  - Income and substitution effects cancel out for $\gamma = 1$ (i.e. log utility)!
  - If $u_{cl} \neq 0$, the marginal disutility of l line also shifts when w increases
    - Drawn graph implicitly assumes $u_{cl} > 0$ because shaded is a downward shift

Aside: Exercise for the Very Ambitious Student

Gain a deeper understanding of the relationship between risk aversion, labor supply elasticity, and labor-consumption complementarity

1. Set up a Frisch consumption-leisure maximization (i.e. treating the Lagrange multiplier on income λ as a fixed parameter)
2. Use Cramer's Rule (!!!) to get comparative statics for consumption and leisure (w.r.t. parameters: wage w, non-labor income y, and λ)
3. Log-linearize Frisch demands for consumption and leisure (w.r.t parameters)
4. Relate the expressions from steps (2) and (3)

See David Card's labor lecture notes for more detail

Aside: Reconciling Chetty (2006) AER and Chetty (2008) JPE

- **Peter:** Interesting that labor supply paper delivering relatively low risk aversion estimate ($\gamma \approx 1$) but UI paper delivers relatively high insurance value estimate ($RR^* > 50\%$)
- **Me:** Chetty (2012) ECMA suggests optimization frictions attenuate labor supply elasticity estimates

Outline

Overview of Method

- (Not Shimer and Werning (2008) AER on a structural model of liquidity vs. insurance!)
- Worker's utility is monotonically increasing in the after-tax wage $\bar{w} - \tau$

  $\Rightarrow$ After-tax reservation wage of the unemployed is a sufficient statistic for welfare

  $\Rightarrow$ Sign of $\frac{\mathrm{d}\bar{w}-\tau}{\mathrm{d}UI}$ provides local optimality test

Main Intuition

- Worker reveals the net value of increased benefits that will be financed by taxes
- Increase in pre-tax reservation wage $\bar{w}$ captures “gross value" of UI, while increase in tax τ captures “gross cost" of UI
  - Analogous to LHS and RHS of Baily-Chetty formula

Why After-Tax?

- Of course $\bar{w}$ increases with b!
- But that also comes with a tax increase that they have to pay for
- Whether they value the UI more than the actuarially fair cost (which includes any behavioral response) determines whether an expansion raises or lowers the *after-tax* reservation wage

Preliminaries

- Reservation wage $\bar{w}$ is lowest wage sequential searcher willing to accept
  - Defined as fixed point (McCall 1970)
  - Accept job offer and work forever (for simplicity, can be relaxed)
- Budget-balanced UI benefits b financed by tax τ

$$\underbrace{U(\bar{w}-\tau)}_{\text{after-tax res. wage}} = \underbrace{U(b)}_{\text{UI}} + \underbrace{\alpha}_{\text{PV term}} \underbrace{\lambda}_{\text{arrival rate}} \int_{\bar{w}}^{\infty} \underbrace{[U(w)-U(\bar{w})]}_{\text{gain from job offer}} \underbrace{dF(w)}_{\text{offer distr.}}$$

- Worker indifferent between remaining unemployed and working at $\bar{w}$

  $\Rightarrow$ lifetime utility $V = \frac{U(\bar{w}-\tau)}{\rho}$ (discount rate ρ)

  This is the key equation!

My Personal Views on Shimer-Werning After-Tax Test

1. Requires an unreasonable amount of worker sophistication in job search strategies
   - *Paper's response*: Can elicit the pre-tax reservation wage and have the researcher use estimated moral hazard effects to recover the effect on the post-tax reservation wage
2. Requires unreasonable sophistication in self-reports
   - I believe consumers do implicit optimization to get close to MRS=price ratio, but I wouldn't trust someone's self report of their MRS between two goods
   - *Paper's response*: We motivate advancing reservation wage elicitation methods

Satisfying Properties

- Super clever!
- Theoretically robust
- Doesn’t require parametric assumptions
- Doesn’t require administrative data
- Can be used to study the value of **any** policy to help the unemployed