Welfare Economic Foundations of Cost-Benefit/Cost-Effectiveness Analysis
HCMG 901/301

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Outline
• Welfare economics in CE/CB context
• Welfare economics assumptions
• Pareto optimality / first theorem of welfare economics
• Always some efficient point that is socially preferred to any inefficient point (second theorem)
• Kaldor Hicks potential compensation test
• Willingness to pay, willingness to accept, and income effects
• Measuring willingness to pay / consumer surplus
• Cycling preferences

Goal of CBA/CEA
• Provide guidance on what policies “ought” and “ought not” be adopted
• “Ought” is normative term, not descriptive
  – Unless everyone benefits, unclear how to justify claims that policy should be adopted
• Neoclassical economists use principles of welfare economics as justification for “ought” claims
  – Empirical research by applied economists guided by welfare economic theory yield statements about what “ought” to be done
Role of Welfare Economics in CB and CE Analysis

• Cost-benefit analysis:
  – Welfare economics (WE) virtually entire normative theory underlying “ought claims”
• Cost-effectiveness analysis:
  – Measures of “cost” (versus spending) from a “societal” perspective usually drawn from WE
    • Main Exceptions
      – Lost productivity (commonly wages)
      – Unemployed Resources (?)
  – Measures of effect or benefit sometimes related to welfare economics
  – Valuation of effects: Not related in practice, but theory may be developing

Welfare Economic Foundations of CBA

• Welfare economics is a logically consistent normative theory of social choice among alternative resource allocations, given acceptance of some basic assumptions
• It evaluates:
  – Allocation of resources among products
  – Allocation of products across persons
• But requires assumptions that may or may not always be accepted

Welfare Economics Fundamental Assumptions
Fundamental Assumption 1: Individual Preferences

- Individual’s welfare based on individual’s own preferences
- If theory is to help with decisions, preferences must be
  - Measurable
  - Comparable across households
- Usually measured by use of willingness to pay
  - Amount you can take away from person obtaining a good (OR amount you need to pay person losing a good) while leaving person no worse off
  - Best defined and measured by what people actually pay (when you can observe them)
  - Not optimal, but often measured as answer to hypothetical question (contingent valuation)

Fundamental Assumption 2: Pareto Optimality

- Exchanges that make one individual better off and none worse off are referred to as Pareto-improving (Vilfredo Pareto, 1848-1923)
  - Such trades increase social welfare
- Allocation is Pareto optimal / “economically efficient” if all Pareto-improving exchanges have been made
  - i.e., that there is no remaining exchange that makes one person better off without making another worse off
- First theorem: a competitive equilibrium is “Pareto optimal” or “efficient” given distribution of resources (and given conditions needed for competitive markets to exist)

Competitive Equilibrium and Pareto Optimality

- “Competitive equilibrium (competitive market) Pareto optimal/economically efficient because:
  - If consumer buys, value to consumer greater than price
    - Consumer “better off”
  - If seller sells, value (of time and sweat) to seller is less than price
    - Seller “better off”
    → Both gain from exchange
  - At “equilibrium” no additional Pareto improving sales/purchases can/will be made
Typical Usage of Term Efficient

- Term “economic efficiency” differs from typical usage
- e.g., “Singapore overtook Hong Kong to top a ranking of the most-efficient health-care systems, as the government boosts spending on medical services to support an aging population” (1)
- In 2013, “efficiency” ranking based on Life expectancy (60%); relative per capita percentage of GDP (30%); and absolute per capita cost of health care expenditures (10%) (2)
- In 2014, included change measures (3)


Bloomberg 2014 Rankings

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<th>Rank</th>
<th>Country</th>
<th>Score</th>
<th>%LE</th>
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USA V Poland \( \frac{(8895-854)}{(78.7-76.8)} = \frac{4232}{YOLS} \)

Fundamental Assumption 3: Welfarism

- Principle that ordering of policies depends only on welfare of individuals
Social Welfare Functions

- Three welfare economics assumptions accommodate a range of social welfare functions
- Social welfare functions (SWF)
  - A “ranking of every possible pair of social states”
  - “Social preferences over different potential allocations”

Where’s the Social Welfare Function?

- Assume we have a… (SWF, can opener….)
- Social welfare function known by policy elite.
- Social welfare function revealed by political process
  - If distribution is politically stable, presumed optimal
  - If haven’t made rich pay their “fair share” lately, what is basis for saying it’s fair?
- Veil of Ignorance or Law of Averages.
- Will everyone agree?

Welfare Economic CBA vs Extra-Welfarist CEA

- Welfare economic CBA:
  - Health improvements valued only insofar as they improve welfare
    - Enjoyment, consumption, productivity
  - What if resulting decisions lead to Inequality?
- “Extra-welfarist” CEA:
  - Goal is to maximize specified health outcome
    - QALYs, YOLs, TFDA, etc.
    - Different outcomes may yield different rules
Fairness

- Welfare economics can include a notion of fairness
  - e.g., a “taste” for fairness
- Not an independent evaluative principle
  - See, e.g., Kaplow & Shavell 2006. Fairness vs. Welfare.
- Motivating example – tort liability vs. insurance + heightened traffic laws
  - Suppose insurance/traffic laws makes everyone better off
  - Welfare economics says choose it over tort liability even though “wrong-doers” are never punished

Must We Accept 3 Assumptions?

- No, but:
  - Logically consistent;
  - From a welfare economics perspective, analysis performed without use of these assumptions
    - Won’t be called a “cost-benefit” analysis
    - Won’t yield a recommendation that is called “efficient”
- Will need to come up with alternative normative theory
- And/or say that same principles as apply to costs do not necessarily apply to benefits
  - But why should different principles apply to different outcomes?

Intuitive Definitions of Best Welfare Economic Outcomes

- If “benefits” are measured by money people will give or accept for things, we should maximize net benefit
  - At least in theory, we can then spread (redistribute) maximized benefit any way we like
- As we said last week, CBA wants to replicate outcome that would have occurred if service in question could or would have been sold in perfectly competitive market.
Pareto Principle Precisely

- Undertake all actions which can make at least one individual better off without making anyone worse off
- If such actions are possible, the situation is not Pareto optimal or efficient
- If no such actions are possible, the situation is optimal or efficient

Pareto Principle Strengths

- Generally thought to be “mild” requirement
- Avoids need for interpersonal comparisons of individuals’ utility
Weaknesses
• Are preferences to be accepted as given?
  – Unknowledgeable, addicts, children?
• Should distributional considerations matter
  – Suppose based on cost-benefit analysis, programs improving access to poor are rejected while cosmetic surgery approved?

Actual Compensation
• If gainers actually compensate losers, Pareto Principle justifies any action that yields positive net benefits
  – Case 1: Action/No Action
    • Adopt strategy if $B > C$ because payment of opportunity cost compensates suppliers of inputs yet beneficiaries are still better off
  – Case 2: Mutually exclusive alternatives; two different groups
    • Adopt strategy $X$ if $B_X - C_X > B_Y - C_Y$ because payment of $B_Y - C_Y$ compensates those who prefer strategy $Y$ yet beneficiaries of strategy $X$ still better off

Second Theorem
Second Theorem

- Theorem: Given costless redistribution, there is always some efficient point that is socially preferred to any inefficient point.
- Example: Consider 2 programs, \( P_R \) and \( P_P \).
  - Rich person values \( P_R \) at 100k and gains 1 year.
  - Poor person values \( P_P \) at 20k and gains 2 years.
  - Cost per person (R or P), 70k.
- Inefficient to do both: cost 140k; value 120k.
- Inefficient to do neither: R can pay P between $20 and $30k, undertake \( P_R \) and still be better off.
- Providing \( P_P \) to P alone inefficient: cost exceeds benefit.
- Providing \( P_P \) to R alone with payment to P is efficient program (R can pay P…) .

Corollary of Second Theorem

- Corollary: Better to redistribute income in cash than in health.
- Modifications to corollary:
  - Complementarities (example: education).
  - Altruistic externalities:
    - If R’s valuation of poors’ receipt of program >$50,000.
- Income transfers can have real cost and can be difficult to target.

Potential Compensation Test
Limits of First Theorem

- Often want to go beyond exchanges in which no one is made worse off, but don't necessarily want to always pay compensation
- In late 1930's Kaldor and Hicks (K-H) separately proposed potential compensation test to "expand" policy uses of Pareto optimality
  - Exchanges in which persons made better off can hypothetically compensate losers and still be better off referred to as K-H-improving
  - Allocation is K-H efficient if all K-H-improving exchanges have been made
- Pareto improvements necessarily K-H improvements, but NOT vice versa

When is Potential Compensation Test Not Necessarily inequitable

- Some concern about substituting "potential" compensation for actual compensation
- May not be so bad when:
  - Incomes are similar
  - Projects distribute benefits (and costs?) equally across income levels? (Private insurance vs. social insurance)
  - Income distribution satisfies SWF or is "just"
  - Benefit measures are (inversely) adjusted for "welfare weights"
  - Rich are taxed much more heavily than poor
  - Decision made behind veil of ignorance

Differences Between Kaldor and Hicks

- Kaldor: K-H-improvement if amount gainers are willing to pay losers (willingness to pay, compensating variation (CV) is large enough to compensate losers for implementation of program (polluters WTP community)
- Hicks: K-H-improvement if amount losers are willing to pay gainers (willingness to accept, equivalent variation (EV)) is large enough to compensate gainers for withholding implementation of program (community WTP polluters)
- Contrary to Ronald Coase's nobel award contribution, compensating variation and equivalent variation need not be equal
  - Possible to justify action using one measure, but reject action using other
Coase Theorem Simplified

- Factory wants to pollute; neighborhood wants clear air
- Can’t have both
- Coase: But no real problem because same equilibrium will be reached independent of whether property right to pollute is given to factory owner or property right to clean air is given to neighborhood
- Theorem relies upon assumption that compensating variation equals equivalent variation
- When they are not equal, final equilibrium can differ depending upon who owns property right

Compensating vs Equivalent Variation

“The devil is in the details”

Welfare Economics Recap

- Individual’s welfare based on individual’s own preferences
- Preferences usually measured using willingness to pay
- In theory, best measure of willingness to pay is typically unobservable compensating or equivalent variation
  - Differences between 2 can affect policy recommendation
- In practice, willingness to pay typically measured as CONSUMER SURPLUS read off ordinary demand curve
  - CS: Difference between max WTP and what is payed
- In what follows, unpack WTP, compensating and equivalent variation, and consumer surplus
  - Unpacking raises issues with implementation of CBA
Compensating and Equivalent Variation are both measures of WTP, but value of these 2 measures can differ.

Equivalence of CV vs EV?
- Initial budget constraint/ indifference curve
- Intersection with y axis?
- Intersection with x axis?
- Equilibrium

Price Reduction for X
- Revised budget constraint
  - Price of Y?
  - Price of X?
- New equilibrium?
Compensating Variation for Price Reduction

Length on relative Y scale, 2.3 units

Substitution and Income Effects

- Change in consumption of X between initial higher price and reduced price made up of 2 effects
  - Substitution effect
    - Measured by keeping individual on initial indifference curve but incorporating price reduction
  - Income effect
    - Changes in demand due to changes in discretionary income resulting from price changes
- Only want to include substitution effect in benefit measure of cost-benefit analysis

Substitution and Income Effects Graphically
Suppose We’d Started at Lower Price?

- Initial budget constraint/indifference curve
- Intersection with y axis?
- Intersection with x axis?
- Indifference curve/equilibrium?

Price Increase for X

- Revised budget constraint
  - Price of Y?
  - Price of X?
- New equilibrium?

Equivalent Variation for Price Increase

- Conclusion: CV (2.3) need not equal EV (2.75)!
From indifference curves to consumer surplus

Measuring Benefit When Indifference Curves Unavailable

- Don’t typically have access to individual’s indifference curves
  - Not usually the basis for measurement of WTP
- Instead, commonly measure CV/EV from revealed preference (individuals buying choices when confronted by price increases and decreases)
  - i.e., From demand curve
- Direct relationship between (unobserved) indifference curves and observed demand curve

Goal

- Move from utility curves (left) to demand curve (right)
Indifference Curves and Purchasing Decisions

Construction of Observable ("Ordinary") Demand Curve

Gain in Consumer Surplus, Price Drop from 2 to 1
Components of Gain in Consumer Surplus

• Increase in consumer surplus made up of:
  – Increase in surplus for existing use at higher price (red)
  – New surplus for additional use at lower price (blue)

Method may be best we have, but theoretically represents a shortcut for measuring WTP

Why isn’t consumer surplus as assessed using ordinary demand curve the theoretically correct measure for cost-benefit analysis?
Construct Tangencies with Single Indifference Curve

- Pure substitution effect (without income effect)

Construct Compensated Demand Curve

- Compensated demand curve always steeper than ordinary demand curve

Gain in Compensated Consumer Surplus
Pluses and Minuses of Compensated Demand Curve

• Positive: Represents pure substitution effects without income effects
• Negatives:
  – Don’t usually observe tangencies between budget constraints and single indifference curve
  – Don’t usually observe compensated demand curves
  – Thus difficult to calculate correct measure of consumer surplus
• How bad is using observable consumer surplus?

From Kaldor-Hicks proposal to Samuelson impossibility theorem

Kaldor-Hicks History

• Initially, welfare economics had no way to compare alternatives that did not represent Pareto improvements
**Kaldor-Hicks Proposal**

- Generate "redistribution possibilities curve" and see if better-off people can potentially compensate worse-off

**Kaldor-Hicks Problem**

- Given differences between CV and EV, possible that preferences can cycle: A can compensate B; B can compensate A

**Scitovsky Criterion**

- A preferred to B if A can compensate B and B CANNOT compensate A
- Reduces number of alternatives that can be ranked, but...
Samuelson Proof

- Lack of transitivity can extend through multiple options: A compensates B; B compensates C; C compensates A
- Proof: Impossible to rule out some intransitivity

Problems Posed by Income Effects

1) Should decisions be based on CV or EV?
2) Even if winners in A can compensate losers, impossible to rule out a chain of alternatives such that losers could pay off other people who could pay off winners in A
3) Even if these problems didn’t exist, difficult to measure what winners win and losers lose
   - Should be derived from unobserved compensated demand curve

Income Effects

- Commonly argued that income effects typically small enough to ignore (i.e., measurement problems discussed above disappear)
  - Because it is true?
  - Because it poses problems if not true?
- Situations exist when income effects are large
  - E.g., threat to cut off arm or a leg
  - Basis for recommendation that CBA be used to value small changes in probability rather than immediate life/death issues
- Not clear if we typically need to worry about income effects of not
CBA Guidelines

• Choose set of alternatives that maximizes excess of benefits, measured by true willingness-to-pay, over marginal social opportunity cost
  – “Marginal:” Actual changes in cost from doing project
  – “Social:” Value of all resources consumed, not just “purchased” resources
  – “Opportunity cost:” Value of resources in next best use

• True WTP should:
  – Be adjusted for risk and risk preferences
  – Include spillover benefits