# Equity Metrics: How to Choose?

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# Measuring Equity

- How should we evaluate governmental policies in terms of equity/fair distribution?
- It is often suggested that equity is a “soft” or qualitative consideration, which cannot be measured.
- In fact, the opposite is true. There are currently a wide range of equity metrics used in academic scholarship and, to some extent, by governments or NGOs. Equity *is* measurable; the real difficulty is choosing between these metrics.

# Current Policy Evaluation Metrics that are Sensitive to Equity

- Cost-Benefit Analysis with Distributive Weights
- Social Welfare Functions
- Inequality Metrics (e.g., Gini coefficient)
- Poverty Metrics
- “Social gradient” metrics
- “Incidence” analysis
- Cost Effectiveness Analysis with Equity Weights

- CBA with dist. weights: Sum of weighted WTP/WTA amounts. $\sum w_i(\Delta y_i)$. Currently recommended in UK.

- Social welfare function: Ranks policies as function of individual "utilities." $s(u_1,u_2,\ldots,u_N)$. "Optimal tax," environmental policy scholarship (e.g., climate change).

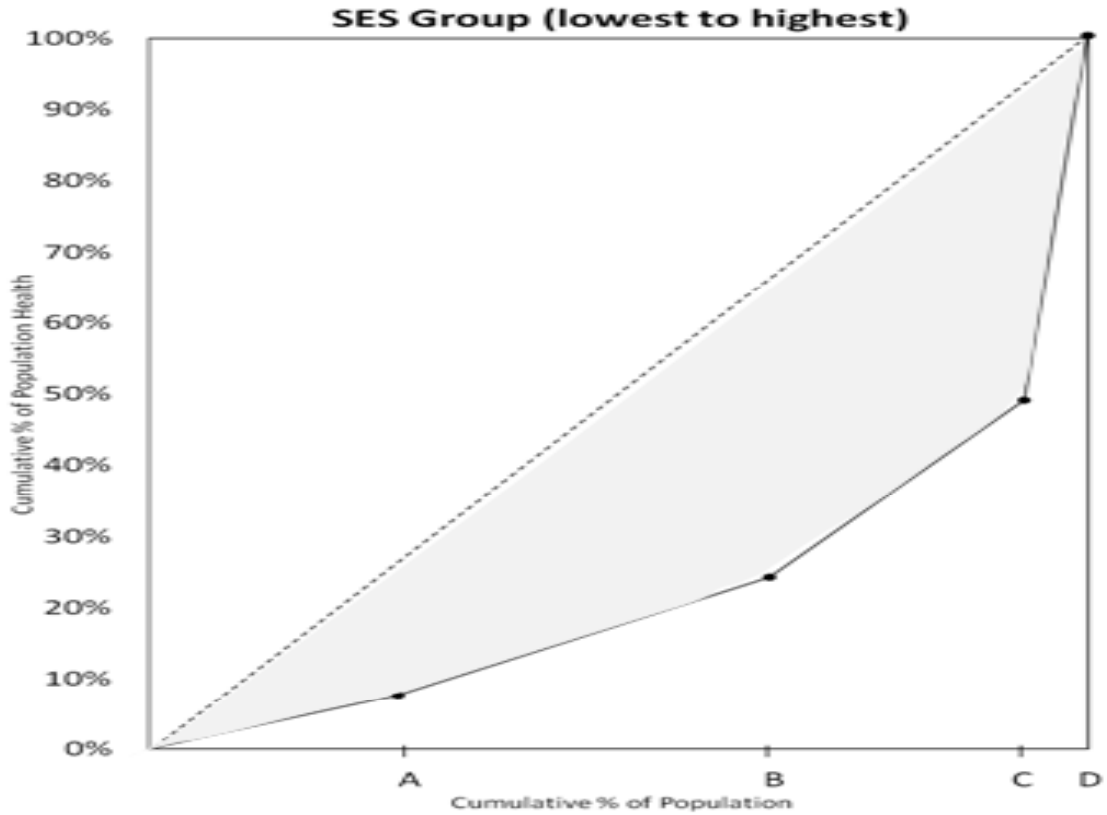
- Inequality metric: Measures distribution of some attribute across entire population. Gini, Atkinson, Theil, coefficient of variation. Often used to evaluate status quo, time trend, but *change* in inequality can be used as policy metric, e.g., predicted *change* in inequality of mortality risk associated with air pollution policies.

- Poverty metric: Measures distribution of some attribute, but insensitive to distribution above poverty line. Predicted *change* used as policy metric, e.g., for education, infrastructure, social programs. Usable, in principle, for regulatory policy.

- Tax incidence: Tax (or policy) burdens as fraction of individual incomes. "Regressive"/ "progressive. Often used for tax policy, but also some use in environmental policy.

- CEA: C/E ratio. C=cost, E = "effectiveness," e.g., health impact. If equity weights, $E = \Delta\sum w_i h_i$. CEA used in Australia, Canada, UK, NZ to evaluate pharmaceuticals and medical technology, and in US as regulatory tool.

Social gradient metrics: Correlation between some attribute and some measure of social status (SES, race). E.g., concentration curve. "Health equity" scholarship, under discussion at US EPA as "environmental justice" tool.



# Choosing Equity Metrics: A Framework

- Choosing between equity metrics is ultimately a normative/political question
- I suggest that the following framework can help policymakers think about the choice
- First, **in what way** is the metric equity-sensitive? In what manner does it satisfy the **Pigou-Dalton** principle (essence of equity)?
- Second, is the metric consistent with **efficiency** (the **Pareto principle**)?

# The Pigou-Dalton Principle

- The PD principle ("principle of transfers"): A "pure" (non-leaky) transfer from someone with more of a relevant attribute, to someone with less, which "shrinks the gap" between them, is an improvement.

  $(2, 6, 14, 20) \prec (2, 9, 11, 20)$

- This principle is the **cornerstone** of equity. It is the heart of the entire literature on inequality metrics. Moreover, the PD principle is satisfied, **in some manner**, by every existing equity metric.

# The Pigou-Dalton Principle: What Currency/Currencies?

- There are different possible "currencies" for the PD principle: income; some non-income attribute; or utility.
- For example, we can use the Gini coefficient (an inequality metric) to measure the distribution of income; the distribution of some "capability" (health, nutrition, education, shelter, subjective happiness, public goods, etc.); or the distribution of utility.
- Multiattribute inequality or poverty metrics: simultaneously satisfy PD principle with respect to multiple attributes.

# The Pigou-Dalton Principle: What Currency/Currencies?

- Income: Readily measurable, but fails to capture non-market goods.
- A single non-income attribute: An example: CEA with equity weights for individuals in poorer health status. Why ignore income and other well-being relevant attributes?
- Multiple attributes: Shouldn't we care about interaction between attributes, rather than focusing on distribution of each separately?
- Utility: An inclusive measure of well-being. How to construct? Normalized income as proxy?

# The Pigou-Dalton Principle: Population Wide or "Restricted"

- Inequality metrics : If an inequality metric is used to measure the distribution of some attribute (income, non-income attribute, utility), a PD transfer from *anyone* at a higher level to *anyone* at a lower lever is seen as reducing inequality.

  Although specific inequality metrics (Gini, Atkinson, Theil, coefficient of variation) differ in other ways, they all satisfy the PD principle on an unrestricted, population-wide basis.

- It can be shown that an unequal distribution can always be converted into a perfectly equal distribution by a **series** of PD transfers.

# The Pigou-Dalton Principle: Population Wide or "Restricted"?

- Poverty metrics. Satisfy the Pigou-Dalton principle with respect to transfers to below-threshold individuals, *not* between above-threshold individuals.
- With income threshold at $10,000, a poverty metric applied to the distribution of income will say

  ($5K, $9K, $20K, $30K) $\prec$ ($7K, $7K, $20K, $30K)

  *and*

  ($5K, $9K, $20K, $30K) $\prec$ ($7K, $9K, $18K, $30K)

  *but not*

  ($5K, $9K, $20K, $30K) $\prec$ ($5K, $9K, $25K, $25K)

# The Pigou-Dalton Principle: Population Wide or Restricted?

- Social gradient metrics. Satisfy the Pigou-Dalton principle with respect to transfers from high to low-status individuals, *not* reverse direction.
- Assume individuals are in four SES groups, A through D, and that health is measured in QALYs. Then

(A, 30), (B, 40), (C, 60), (D, 80) $\prec$ (A, 30), (B, 50), (C, 50), (D, 80)

*but not*

(A, 30), (**C**, 40), (**B,** 60), (D, 80)) $\prec$ (A, 30), (**C**, 50), (**B**, 50), (D, 80)

# Equity Metrics and the PD principle: A Summary Chart

| | Income? | Non-income attribute? | Utility? | Truncated? |
|---|---|---|---|---|
| SWF | | | Yes | |
| CBA with weights | Yes | | | |
| Inequality metrics | Yes (one version) | Yes (one version) | | |
| Poverty metrics | Yes (one version) | Yes (one version) | | Yes |
| Social gradient | | Yes (health) | | Yes |
| Incidence analysis | Yes | | | |
| CEA with weights | | Yes (health) | | |

Note: This table focuses on the versions of these metrics in current use

# Lifetime versus Sublifetime Equity: A Further Twist

- An equity metric might focus on individuals' "lifetime" **or** "sublifetime" holdings of some attribute (income, a non-income attribute, utility)
- Scholarship using inequality metrics applied to lifetime incomes. Inequality of lifetime income less than inequality of annual income; time trend and cross-national comparisons also different
- Literature on "chronic poverty." Natural disasters and other "shocks" will increase sublifetime poverty but may have little effect on chronic poverty
- Incidence analysis on lifetime basis. "Progressive" income tax is less progressive, consumption taxes less regressive
- Social welfare functions: usually applied to lifetime utilities

# The Pareto Principle

- This principle lies at the foundation of welfare economics. It says: if at least one person is better off with policy A than policy B, and no one is worse off, then A is a better policy.
- The Pareto principle is a rigorous and uncontroversial way to capture the idea of "efficiency."

# Conflicts between Equity Metrics and the Pareto Principle

- CBA with distributive weights and SWFs automatically satisfy the Pareto principle. All other equity metrics potentially conflict with it.
- This is a powerful argument for the first approaches
- A possible solution for those who favor some other equity metric [??]: Seeing it as a "partial" metric -- as one component of a broader policy-evaluation framework

# Conflicts with the Pareto Principle: Some Examples

- Inequality metric applied to income: prefers ($50K, $50K, $50K, $50K) to ($50K, $50K, $50K, $80K)

- Poverty metric applied to income (with $10K threshold): indifferent as between ($4K, $8K, $20K, $100K) and ($4K, $8K, $30K, $100K)

- Social gradient metric applied to health: Improving the well-being of someone in the highest SES group is disapproved, because it increases health/SES correlation

# Conflicts with the Pareto Principle: Some Examples

| | Individual 1 | | Individual 2 | |
|---|---|---|---|---|
| | A | B | A | B |
| Outcome x | 10 | 20 | 20 | 10 |
| Outcome y | 15 | 15 | 15 | 15 |

Note that the total amount of each attribute is the same in outcome x and y. An inequality metric, applied to either attribute, or to both, will necessarily say that y is the better outcome, because it equalizes the attributes. But it's an open question whether the individuals are better off in y. Each might prefer the attribute package (10, 20) to (15, 15)

# Conflicts with the Pareto Principle: Some Examples

| | Outcome x | | Outcome y | | Outcome z | | Outcome w | |
|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B |
| Individual 1 | 15 | 1 | 16 | 2 | 3 | 17 | 4 | 18 |
| Individual 2 | 18 | 4 | 17 | 3 | 2 | 16 | 1 | 15 |

Each individual is indifferent between x and z, and between y and w. Thus Pareto principle says x equally good as z and y equally good as w.

However, an inequality metric, applied to either or both attributes, will say that y is better than x and z is better than w. This yields a contradiction.

# Conflicts with the Pareto Principle: Some Examples

| | Individual 1 | | | Individual 2 | | |
|---|---|---|---|---|---|---|
| | Income | Health | Utility | Income | Health | Utility |
| Outcome x | $300K | .55 | 1.72 | $30K | .6 | 1.55 |
| Outcome y | $200K | .6 | 1.73 | $70K | .55 | 1.58 |

Each individual has a utility function $u$ = log(income)/4.7 + health. (This reflects $50000/QALY and diminishing marginal utility of income.) Note that outcome y has an infinite C/E ratio, with or without equity weights for those in poorer health, so CEA always chooses x. But both individuals are better off in y.

# Equity Metrics as “Partial” Metrics

- Can inequality, poverty, social-gradient, or “incidence” metrics be combined with other tools so that conflicts with efficiency (the Pareto principle) are sure to be avoided?
- This is a complicated topic, which requires much more academic research.
- One positive result:  Equity-regarding SWFs can be decomposed into overall welfare multiplied by an inequality metric.

# Conflicts with the Pareto Principle: Not to Worry?

- It might be argued that, in practice, policies will always have both “winners” and “losers,” so that conflicts with the PP are not relevant.
- Conversely, it can be argued that a policy evaluation framework which potentially conflicts with the PP has “cracked foundations,” and should be rejected outright.
- What position to take, here, is itself a normative/policy question.

# How to Choose a Equity Metric: Some Questions for Policymakers

- First, **how** is the metric sensitive to equity?

  In what manner does it satisfy the **Pigou-Dalton principle**?

  -- In what currency (income, a non-income attribute, multiple attributes, utility)?

  -- On a population-wide basis or a restricted basis (poverty metrics, social gradient metrics)?

  -- In terms of lifetime holdings of the "currency" or sublifetime holdings?

# How to Choose an Equity Metric: Some Questions for Policymakers

- Second, is the metric consistent with **efficiency**?  Does the metric satisfy the **Pareto principle** (either on its own, or as one component of a broader policy-evaluation framework)? If not, is the metric still acceptable because such conflicts are "merely theoretical"?