Univariate Assessment of Health Inequalities

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Overview

- Context
- Income versus Health
- UK Health Distribution
- Concepts of Inequality
- Inequality, Poverty and Social Welfare Measures
- Conclusion
Context

• Extended cost-effectiveness analysis
  – to produce distributions of health resulting from policies rather than just mean levels of health

• Adjusted health distributions
  – for fair differences in health leaving us with only the unfair differences in health

• Compare and rank adjusted health distributions
  – this requires further social value judgements
    • How we measure inequality
    • How we trade off inequality with efficiency
Income vs. Health

Key differences between income and health:

• Current vs. Past, present and expected future

• Unbounded vs. Upper bound

• Full equality achievable vs. Some irremediable and incompensable inequality

• Instrumental value vs. Intrinsic value

• Diminishing marginal value
UK Health Distribution

Individual Health Parade

Health Quintile Groups

Health Histogram

Lorenz Health
Concepts of Inequality

• Absolute versus Relative
  – Do we consider the inequality between a life of 100 years and 110 years more similar to inequality between
    • a life of 50 years and 60 years
    or
    • a life of 50 years and 55 years

• Total versus Shortfall/Poverty
  – Do we care about the whole health distribution or those below some minimum level of health
    • minimum level may be universal or group specific
Inequality Measures

- **Weak Principle of Transfers (Pigou-Dalton)**
  - Transferring from someone with more to someone with less should make the distribution more equal
    - so long as the amount transferred is less than double the difference between the initial endowments between the two individuals involved in the transfer (assuming fixed total)

- **Scale Invariant**
  - Equal proportional changes to each individual in the distribution should not effect the measure of inequality of the distribution e.g. ratio

- **Translation Invariant**
  - Equal absolute changes to each individual in the distribution should not effect the measure of inequality of the distribution e.g. gap
Poverty Measures

• Focus on only the part of the distribution below a poverty line

• Three I’s of Poverty
  – Incidence
    • How many people fall below the poverty line
  – Intensity
    • How far on average do those who are poor lie below the poverty line
  – Inequality
    • How much variation is there among those below the poverty line
Social Welfare Measures

- Inequality measurement tells us which distribution is more equal

- Social welfare measurement looks at both inequality and efficiency to tell us which distribution is better

- Stochastic dominance rules (e.g. Atkinson’s and Shorrocks’ Theorems) allow us to make very general statements about the ranking of distributions though only give a partial ordering

- More fully specified social welfare functions requiring stronger social value judgements explicitly quantify the equity efficiency trade off to give a complete ordering of distributions
Atkinson’s Theorem

Lorenz dominance

• For any strictly concave, symmetric, individualistic, increasing and additive social welfare function

• If the Lorenz curve lies everywhere above and the mean health is more than or equal then Lorenz dominance holds
Atkinson’s Theorem Example
Shorrocks’ Theorem

Generalised Lorenz dominance

- For any strictly concave, symmetric, individualistic, increasing and additive social welfare function
- If the generalised Lorenz curve lies everywhere above then generalised Lorenz dominance holds
- If Atkinson’s theorem holds Shorrocks’ theorem must also hold
Shorrocks’ Theorem Example

Individual Health Parade

Health Quintile Groups

Lorenz Health

Generalised Lorenz Health
Social Welfare Indices

- **Equally Distributed Equivalent (EDE)** Social welfare indices use the social welfare function in combination with a societal level of inequality aversion to determine the equally distributed equivalent of the unequal distribution
  - Can be used where stochastic dominance rules do not apply
  - Express the equity efficiency trade off in meaningful units

- **Relative Inequality** (e.g. Atkinson Index)
  \[
  A_e = 1 - \frac{h_{ede}}{\overline{h}} \quad h_{ede} = \left[ \frac{1}{n} \sum_{i=1}^{n} [h_i]^{1-s} \right]^{\frac{1}{1-s}}
  \]

- **Absolute Inequality** (e.g. Kolm “Leftist” Index)
  \[
  K_\alpha = \overline{h} - h_{ede} \quad h_{ede} = -\left(\frac{1}{\alpha}\right) \log\left(\frac{1}{n} \sum_{i=1}^{n} e^{-\alpha h_i}\right)
  \]

- **Poverty** (e.g. Sen Index)
  \[
  Q = H\left(1 - \frac{h_{ede}(p)}{z}\right) \quad h_{ede}(p) = \mu_p(1 - G_p)
  \]
SWF in Health Inequalities

- Iso-elastic social welfare function (Wagstaff, 1991)
  \[ W = [\alpha h_a^{-r} + (1-\alpha)h_b^{-r}]^{\frac{1}{r}} \]
  - \( \alpha \) represents the relative weight of the individuals
  - \( r \) represents the degree of inequality aversion

- Fair innings weights (Williams, 1997)
  - Equal relative weights (\( \alpha = 1-\alpha \))
  - Calibrates the inequality aversion (\( r \)) using “fair innings” quality adjusted life expectancy as equally distributed equivalent level of health
  - Uses calibrated SWF to determine equity weights

- Further calibrated (Dolan & Tsuchiya, 2009)
  - \( \alpha \) estimated to represent individual responsibility
  - \( r \) estimated to represent inequality aversion
Conclusion

- There are different ways of looking at inequality: absolute versus relative, total versus shortfall.

- SWFs can be used to integrate inequality and efficiency concerns.

- Stochastic dominance rules make minimal value judgements but only give partial rankings of distributions.

- More fully specified SWFs give a complete ranking by EDEs but require contentious value judgements about:
  - Absolute or relative inequality
  - Total or shortfall inequality
  - Level of inequality aversion

- In such situations it is advisable to look at a range of functions across a range of inequality aversion parameters.