# Alternative weighting structures for multidimensional poverty assessment

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# Introduction

- In a **multidimensional** poverty assessment the achievements with respect to different dimensions are aggregated according to a **weighting structure**
- Alternative weighting structures might affect
  - Overall poverty measure
  - Decomposition of poverty
  - Policy prescriptions for the design of anti poverty interventions
- We frame our analysis in the general framework proposed by Alkire and Foster (2011)

# The framework

- **Identification of the poor**: the well-being function of household *h* is

$$s_h = \sum_{j=1}^{d} \sum_{k=1}^{d_j} a_{hjk} w_{jk}, \quad 0 \le s_h \le 1$$

- If $P_h = \mu(s_h < \varphi)$ is equal to 1, then household *h* is poor
- **Overall poverty measure**: adjusted headcount ratio

$$M = \frac{1}{n} \sum_{h=1}^{n} P_h \left(1 - s_h\right)$$

- Alternative weighting schemes affect *M* via $P_h$ and $s_h$

# Three weighting structures

- **Equal weighting**: based on the assumption that all dimensions and all indicators within each dimension are equally important (e.g. MPI)
- **Frequency weighting**: proportion of the non-deprived in the society (Desai and Shah, 1988)
- **Hedonic weighting**: based on regressions of life satisfaction self-assessments on the indicators considered in the well-being function (Fleurbaey et al., 2009)

# Heterogeneity of reporting styles

- Individuals with the same actual level of well-being might provide different life satisfaction self-evaluations because they have in mind different concepts about what being satisfied with their life means
- The reporting styles used to self-evaluate life satisfaction have been shown to depend on individuals' own characteristics (Angelini et al. 2012 and forthcoming, Kapteyn et al., 2009)
- This heterogeneity limits the use of life satisfaction self-assessments for welfare comparisons

# Hedonic weights

- We consider three alternative econometric specifications to model life satisfaction self-assessments
  1. Ordered probit allowing for well-being indicators
  2. Ordered probit allowing for well-being indicators and a set of household and individual characteristics
  3. Hopit: generalization of ordered probit models that allows cut-off points to vary with individual characteristics
- Hopit formally addresses the individual heterogeneity in reporting styles

# Data

- Data are drawn from the second wave of **SHARE**
- This survey collects extensive and multidisciplinary valuable information to analyze the social exclusion of the elderly in Europe
- It collects **anchoring vignettes** to control for reporting styles in life satisfaction self-assessments
- Our final sample consists of 5,545 respondents (3,804 households) living in Sweden, Denmark, Germany, The Netherlands, Belgium, France, Spain, Italy, Greece and Czech Republic

| Dimensions | Indicators | Thresholds (minimum standard met if) | Percentage of households meeting the minimum standard |
|---|---|---|---|
| Economic | per-capita net income | equal or above 60% of median (country specific) | 78.80% |
| | per-capita net wealth | equal or above 60% of median (country specific) | 66.70% |
| Housing | dwelling accessibility | less than 16 steps to climb up/down to entrance | 82.60% |
| Health | chronic disease | none of household members have more than two chronic diseases | 44.50% |
| | ADL | none of household members have ADL problem | 86.30% |
| | EURO-D | none of household members have EURO-D caseness | 66.80% |

# Alternative weighting structures

| | Equal weights | Frequency weights | Hedonic weights (1) | Hedonic weights (2) | Hedonic weights (3) |
|---|---|---|---|---|---|
| per-capita net income | 0.1667 | **0.1851** | 0.1081 | **0.0569** | 0.1092 |
| per-capita net wealth | **0.1667** | 0.1567 | **0.1126** | 0.1167 | 0.1629 |
| dwelling accessibility | **0.3333** | 0.1940 | 0.1827 | 0.0986 | **0.0751** |
| chronic disease | 0.1111 | **0.1046** | **0.0659** | 0.1314 | 0.0788 |
| ADL | **0.1111** | 0.2026 | 0.2231 | **0.2626** | 0.2359 |
| EURO-D | **0.1111** | 0.1570 | 0.3075 | 0.3338 | **0.3380** |

# Dimensional decomposition of *M*

| | Equal weights | Frequency weights | Hedonic weights (1) | Hedonic weights (2) | Hedonic weights (3) |
|---|---|---|---|---|---|
| *M* | 0.1364 | 0.1496 | 0.1532 | 0.1881 | 0.1848 |
| *%* | | | | | |
| Economic | 33.13 | **35.46** | 19.48 | **12.34** | 19.42 |
| Housing | **36.03** | 12.67 | 10.75 | 4.14 | **3.11** |
| Health | **30.84** | 51.86 | 69.77 | **83.52** | 77.48 |

# Decomposition of *M* by country

| *M* | Equal weights | Frequency weights | Hedonic weights (1) | Hedonic weights (2) | Hedonic weights (3) |
|---|---|---|---|---|---|
| DE | 0.1685 | 0.1759 | 0.1471 | 0.1737 | 0.1722 |
| FR | 0.0823 | 0.1068 | 0.1400 | 0.1738 | 0.1759 |
| IT | **0.1834** | **0.1995** | **0.2233** | **0.2630** | **0.2561** |

- The *M* index for Germany is only 8% lower than the one for Italy under equal weighting, but more than 30% lower under hedonic weighting
- For France the *M* index is 55% lower than that of Italy under equal weighting but this differential shrinks to 31% under hedonic weighting (3)

# Efficacy of policy interventions

| | Equal weights | Frequency weights | Hedonic weights (1) | Hedonic weights (2) | Hedonic weights (3) |
|---|---|---|---|---|---|
| $M$ | 0.1364 | 0.1496 | 0.1532 | 0.1881 | 0.1848 |
| $\Delta M$ (%) | | | | | |
| per-capita net income | **-28.08** | -26.00 | -15.93 | **-4.63** | -9.04 |
| per-capita net wealth | **-41.13** | -40.51 | -29.96 | **-15.10** | -18.72 |
| dwelling accessibility | **-57.11** | -22.86 | -21.02 | -7.97 | **-6.44** |
| chronic disease | -33.72 | **-50.60** | **-10.05** | -35.67 | -25.87 |
| ADL | **-13.56** | -21.93 | **-25.72** | -18.87 | -16.72 |
| EURO-D | **-20.75** | -41.18 | -72.78 | -76.87 | **-78.63** |

# Conclusions

- We investigate the effects of changing the weighting scheme in a multidimensional poverty assessment
- We carry out an empirical analysis based on SHARE
- Changes in the weighting scheme have been shown to affect the overall poverty measurement, its decomposition by dimension and group, the prescriptions for the design of anti poverty interventions

# Vignette methodology

- A subsample of SHARE respondents is first asked to rate **their own life satisfaction** according to the question

  How satisfied are you with your life in general?

  1. Very dissatisfied, 2. Dissatisfied, 3. Neither satisfied nor dissatisfied, 4. Satisfied, 5. Very satisfied

- Afterwards, they are asked to evaluate the life satisfaction of two hypothetical individuals described in particular situations (anchoring vignettes)

# Vignette 1

- **John** is 63 years old. His wife died 2 years ago and he still spends a lot of time thinking about her. He has 4 children and 10 grandchildren who visit him regularly. John can make ends meet but has no money for extras such as expensive gifts to his grandchildren. He has had to stop working recently due to heart problems. He gets tired easily. Otherwise, he has no serious health conditions.

- How satisfied with his life do **you** think **John** is?

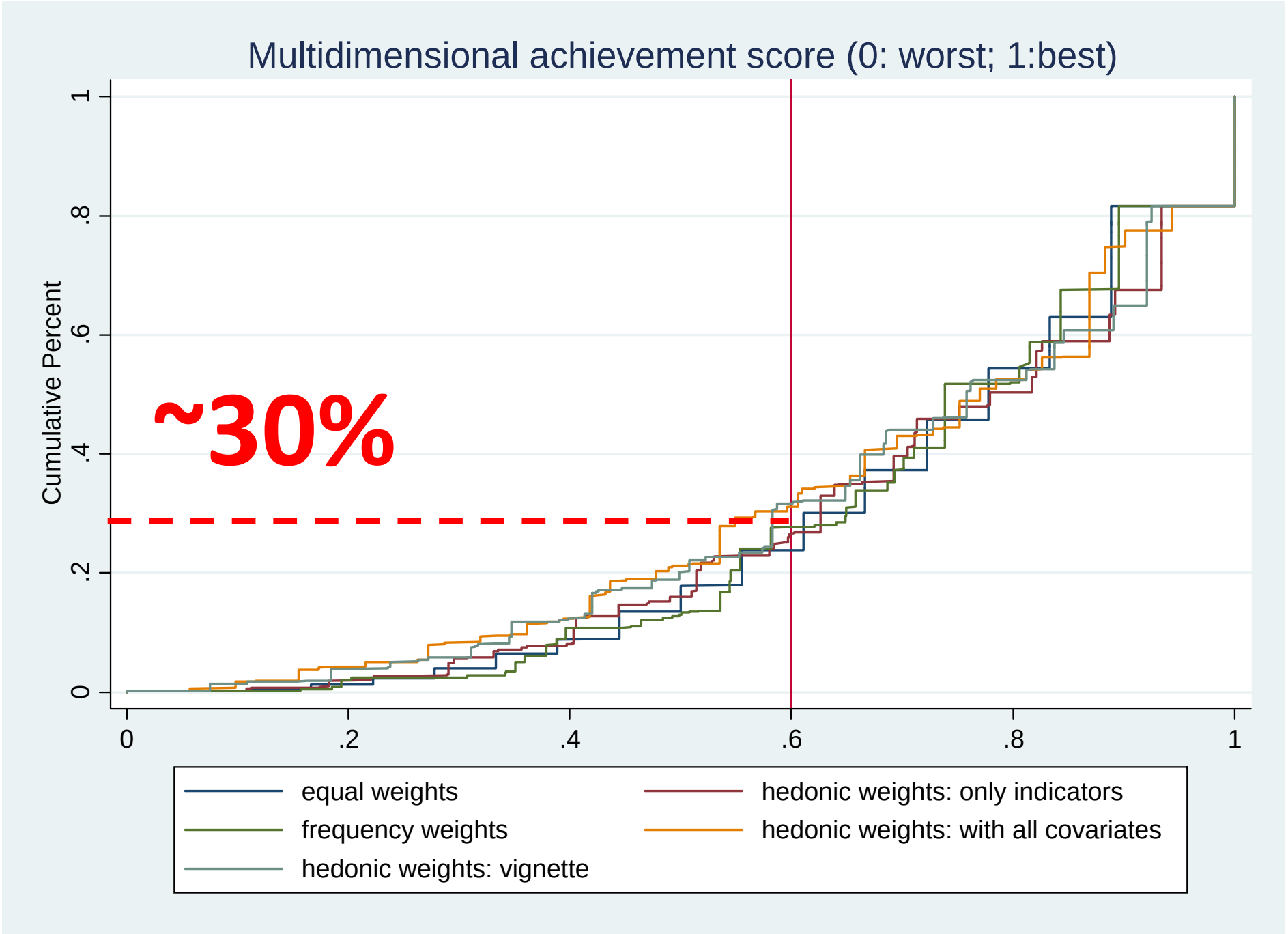
# Vignette 2

- **Carry** is 72 years old and a widow. Her total after tax income is about € 1,100 per month. She owns the house she lives in and has a large circle of friends. She plays bridge twice a week and goes on vacation regularly with some friends. Lately she has been suffering from arthritis, which makes working in the house and garden painful

- How satisfied with her life do **you** think **Carry** is?

# Life satisfaction assessments

| % | Self-assessments | Vignette 1 evaluations | Vignette 2 evaluations |
|---|---|---|---|
| Very dissatisfied | 0.63 | 5.78 | 1.3 |
| Dissatisfied | 4.8 | 38.59 | 11.83 |
| N. dissatisfied, n. satisfied | 17.48 | 40.35 | 30.58 |
| Satisfied | 56.77 | 14.32 | 48.65 |
| Very satisfied | 20.32 | 0.96 | 7.63 |


Multidimensional achievement score (0: worst; 1:best)
Cumulative Percent
0
.2
.4
.6
.8
1
~30%
equal weights
frequency weights
hedonic weights: vignette
hedonic weights: only indicators
hedonic weights: with all covariates

# Modelling life satisfaction self-assessments

- Let $Y_i$* be the unobserved latent life satisfaction perceived by individual $i$=1,…,$I$ and $X_i$ a vector of individual characteristics, we assume that

$$Y_i^* = X_i\beta + \varepsilon_i$$

where $\beta$ is a vector of unknown parameters, $\varepsilon_i \sim N(0,1)$ and $\varepsilon_i$ is orthogonal to $X_i$

- We observe the discrete life satisfaction self-evaluations $Y_i$, defined as

$$Y = j \quad \text{if} \quad \tau^{j-1} \le Y_i^* \le \tau^j, \; j = 1,...,5$$

$$\tau^0 = -\infty, \quad \tau^5 = \infty$$

# Modelling life satisfaction self-assessments

- The HOPIT model combines self-assessments and vignette evaluations to model individual heterogeneity in reporting styles (King et al., 2004)
- Self-assessments component

$$Y_i^* = X_i\beta + \varepsilon_i, \quad \varepsilon_i \sim N(0,1), \quad \varepsilon_i \perp X_i$$

- The cut-off points now depend on the individual characteristics $X_i$

$$Y_i = j \text{ if } \tau_i^{j-1} \le Y_i^* \le \tau_i^j, \quad j = 1,\ldots,5$$
$$\tau^0 = -\infty, \quad \tau^5 = \infty, \quad \tau_i^1 = X_i\gamma^1$$
$$\tau^j = \tau^{j-1} + \exp(X_i\gamma^j), \quad j = 2,3,4$$

# Modelling life satisfaction self-assessments

- Vignette evaluations component

$$Z_{il}^{*} = \theta_l + v_{il}, \quad v_{il} \sim N(0, \sigma_l^2), \quad v_{il} \perp \varepsilon_i, X_i, \quad l = 1,2$$

- On average, individuals perceive the life satisfaction of vignette persons in the same way (*vignette equivalence*)
- The cut-off points used to define $Z_{il}$ are the same as those used for the self-assessment component (*response consistency*)

$$Z_{il} = j \quad \text{if} \quad \tau_i^{j-1} \le Z_{il}^{*} \le \tau_i^{j}, \quad j = 1,\ldots,5$$

$$\tau^0 = -\infty, \quad \tau^5 = \infty, \quad \tau^1 = X_i\gamma^1, \quad \tau^j = \tau^{j-1} + \exp(X_i\gamma^j), \quad j = 2,3,4$$

# Modelling life satisfaction self-assessments

- The information provided by individual self-assessments is used to identify the parameter vector $\beta$
- Vignette evaluations are needed to identify the $\theta_l$, $\sigma_l^2$ and $\gamma_j$ parameters
- All the parameters of interest can be jointly estimated by maximum likelihood