A composite indicator of sustainable well-being: the relative importance of weights in the European Strategy for Sustainable Development

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OBJECTIVES

- Investigate the relation between the institutional **set of indicators** for sustainability (**European Strategy for Sustainable Development - EU SDS**) and **life satisfaction of EU citizens**

- Explore the feasibility of developing a composite indicator by using two approaches for weighting the components:
  - **Objective** (weights are derived from a regression model linking life satisfaction individual data with the underlying indicators)
  - **Subjective** (normative weights: experts' judgment).

LIFE SATISFACTION AND SUSTAINABLE DEVELOPMENT

- **Reported subjective well-being** (SWB): assumed to be a valid measure for individual well-being
  - One of the last attempt to validate SWB: Oswald and Wu (2010) suggest that SWB data contain genuine information about the objective quality of human lives (e.g. living conditions).
  - SWB is recognized to be multidimensional (i.e. many determinants)

- **Sustainability** is defined as *the ability of humanity to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs"*. And then *"sustainable development is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional changes are made consistent with future as well as present needs"*. (World Commission on Environment and Development,1987. Our Common Future)
  - Sustainability is a multidimensional phenomena (multi pillars approach: environment, economy, society)

Determinants of SWB: micro level

- The pure micro-level analysis has focused on the **personal determinants of life satisfaction** such as age, gender, race, family condition (i.e. marital status and children), education, religion, health, employment status, amount of leisure, income (absolute and relative)
- Many studies have then tried to merge the micro perspective (as being unemployed) with the **macro perspective** by including aggregate variables (as the unemployment rate).

Determinants of SWB: macro level (1)

- Diener and Suh (1997) argue that subjective well-being measures and social indicators are necessary to evaluate a society and add substantial information to the economic indicators. Diener and Seligman (2004) stress some beyond-monetary indicators which influence national well-being: **governance**, **social capital**, **religion**.
- Helliwell (2003) brings arguments in favor of using life satisfaction as a way to evaluate the quality of a society. By using the World Values Survey, he combines individual and societal variables so to assess the effect of individual and national income (GDP), the average **level of interpersonal trust**, the quality of institutions and **life expectancy rate** (measuring public health) on citizens' WB.

Determinants of SWB: macro level (2)

- Di Tella, MacCulloch and Oswald (2003) in «Macroeconomics of Happiness» show that macroeconomic forces such as **GDP growth, unemployment** and **inflation rate** have statistically significant effects on reported well-being in 12 European countries and the United States.
- Alesina, Di Tella and MacCulloch (2004) analyze the influence of **inequality** over life satisfaction in two "cultural samples" of European and American citizens. Controlling for individual income and other personal characteristics as well as for year and country dummies, they focus on inequality as measured by Gini coefficient. They find that individuals have a lower tendency to report themselves happy when inequality is high and this is particularly true in Europe.

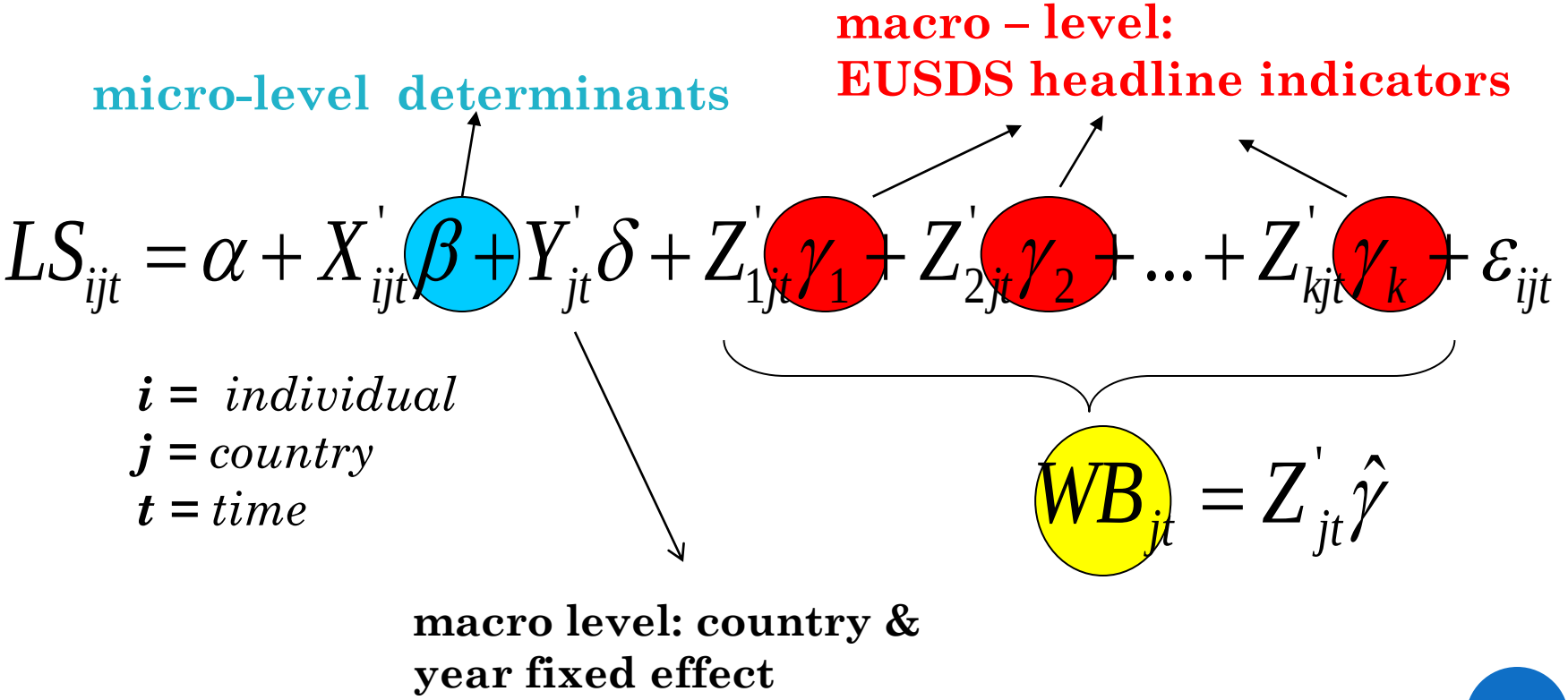
Sustainable development: the European Union view

- The EU SDS is the result of the European Council held in 2001 in Göteborg:
  - Long-term strategy for economically, socially and ecologically sustainable development (UN declaration on Sustainable Development signed in 1992 in Rio de Janeiro).
- In 2006 the European Council put forward a Renewed Strategy.
- The EU SDS is concerned with quality of life, equity between and within the generations.
- The overall strategy tackles **environmental protection, social equity and cohesion, economic prosperity and external responsibilities**.

EU SDS

Theme	EUSDS headline indicator
Socio-economic development	Real GDP per capita growth rate
Sustainable consumption and production	Resource productivity
Social inclusion	At risk of poverty rate & social exclusion (in our sample over 65)
Demographic changes	Employment rate of older workers
Public health	Life expectancy at birth, total (years)
Climate change and energy (1)	Total Greenhouse Gas Emissions (in CO2 equivalent)
Climate change and energy (2)	Share of renewables in gross inland energy consumption
Sustainable transport	Energy consumption of transport relative to GDP
Global partnership	Official development assistance
National resources	Common farmland species

The Model


micro-level determinants
macro – level:
EUSDS headline indicators
$LS_{ijt} = \alpha + X'_{ijt}\beta + Y'_{jt}\delta + Z'_{1jt}\gamma_1 + Z'_{2jt}\gamma_2 + \ldots + Z'_{kjt}\gamma_k + \varepsilon_{ijt}$
i = individual
j = country
t = time
$WB_{jt} = Z'_{jt}\hat{\gamma}$
macro level: country & year fixed effect

Explanatory variables

- Micro – level determinants: age, age squared, gender, educational attainment, employment status, marital status, and household income (expressed in country-year specific income classes) – (Dolan et al. 2009)
- Macro – level determinants:
  - GDP per capita, unemployment rate, inflation rate (Di Tella et al. 2001)
  - EU - SDS headline indicators
  - Country dummies
  - Year dummies

Data

- Eurobarometer Surveys on Western European countries from 1997 to 2003
  - Countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom
- N. of Observations: 120,099
- Dependent variable:
  - "On the whole, are you very satisfied, fairly satisfied, not very satisfied or not at all **satisfied with the life you lead**?" ("very satisfied"=4, down to "not at all satisfied"=1)
- Estimation: Linear Regression Model, robust std errors clustered by country – year)

Empirical Evidence

VARIABLES	A	B	C
Male	-0.0261***	-0.0261***	-0.0327***
	(0.00587)	(0.00591)	(0.00903)
Age	-0.0171***	-0.0169***	-0.0170***
	(0.00121)	(0.00120)	(0.00171)
Age squared	0.000178***	0.000176***	0.000183***
	(1.20e-05)	(1.19e-05)	(1.77e-05)
Middle Education	0.0413***	0.0410***	0.0337***
	(0.00810)	(0.00818)	(0.00984)
Higher Education	0.0813***	0.0813***	0.0784***
	(0.00903)	(0.00911)	(0.0137)
Married	0.0995***	0.101***	0.113***
	(0.00818)	(0.00810)	(0.0146)
Separated	-0.0907***	-0.0904***	-0.0878***
	(0.0103)	(0.0103)	(0.0158)
Widowed	-0.0415***	-0.0394***	-0.0245
	(0.0115)	(0.0113)	(0.0153)
Student	0.133***	0.135***	0.133***
	(0.0133)	(0.0134)	(0.0211)
Unemployed	-0.301***	-0.300***	-0.320***
	(0.0214)	(0.0217)	(0.0361)
Retired	0.0106	0.0102	0.00330
	(0.0115)	(0.0115)	(0.0175)
House worker	-0.0186*	-0.0187*	-0.0392**
	(0.0110)	(0.0111)	(0.0186)
Household Income	0.0330***	0.0326***	0.0326***
	(0.00175)	(0.00173)	(0.00271)
GDP per capita		-0.0159***	-0.00334
		(0.00513)	(0.0141)
Inflation rate		-0.00396	0.0291***
		(0.00967)	(0.00391)
Unemployment rate		-0.00709	-0.0382***
		(0.00746)	(0.0103)

VARIABLES	A	B	C
Real GDP per capita growth rate			0.0367***
			(0.00927)
Resource productivity			0.222***
			(0.0398)
At risk of poverty rate elder			0.0169
			(0.0115)
Employment rate of older workers			-0.172***
			(0.0318)
Life expectancy at birth, total (years)			0.119***
			(0.0394)
Total Greenhouse Gas Emissions (in CO2 equivalent)			0.113***
			(0.0339)
Share of renewables in gross inland energy consumption			0.219***
			(0.0583)
Energy consumption of transport relative to GDP			0.0189***
			(0.00564)
Official development assistance			0.0456***
			(0.0140)
Common farmland species			0.00513
			(0.00551)
Observations	120,099	119,317	52,647
R-squared	0.196	0.196	0.151

Country and Year Dummies included in all the model specifications;
Robust standard errors (clustered by country and year) in parentheses;
Stars for significance level: *** p<0.01, ** p<0.05, * p<0.1

Sustainable well-being Composite indicators (1)

Def. *A composite indicator is above all the sum of its parts*

- Components: EU SDS headline indicators
  - Normalization is required prior to any data aggregation as the indicators in a data set have different measurement units.
  - Min-Max normalization: $n = \left[(X - \min) / (MAX - \min) \right] / 1000$
- Aggregation: linear
  - compensatory rule: weak sustainability approach.
- Composite Indicator:

$$CI_{SustDev} = \left(\sum_{i=1}^{k} w_i * n_i \right) / 100$$

$$w_i = weight$$

$$n_i = normalized\_component$$

Sustainable well-being Composite indicators (1 cont.)

- Weighting procedure:
  - Regardless of which method is used, weights are essentially value judgments.

A) Objective composite indicator:

- Weights: Significant coefficients from the linear regression estimation model → function of SWB;
  - objective because of a theoretical framework.

B) Subjective composite indicator:

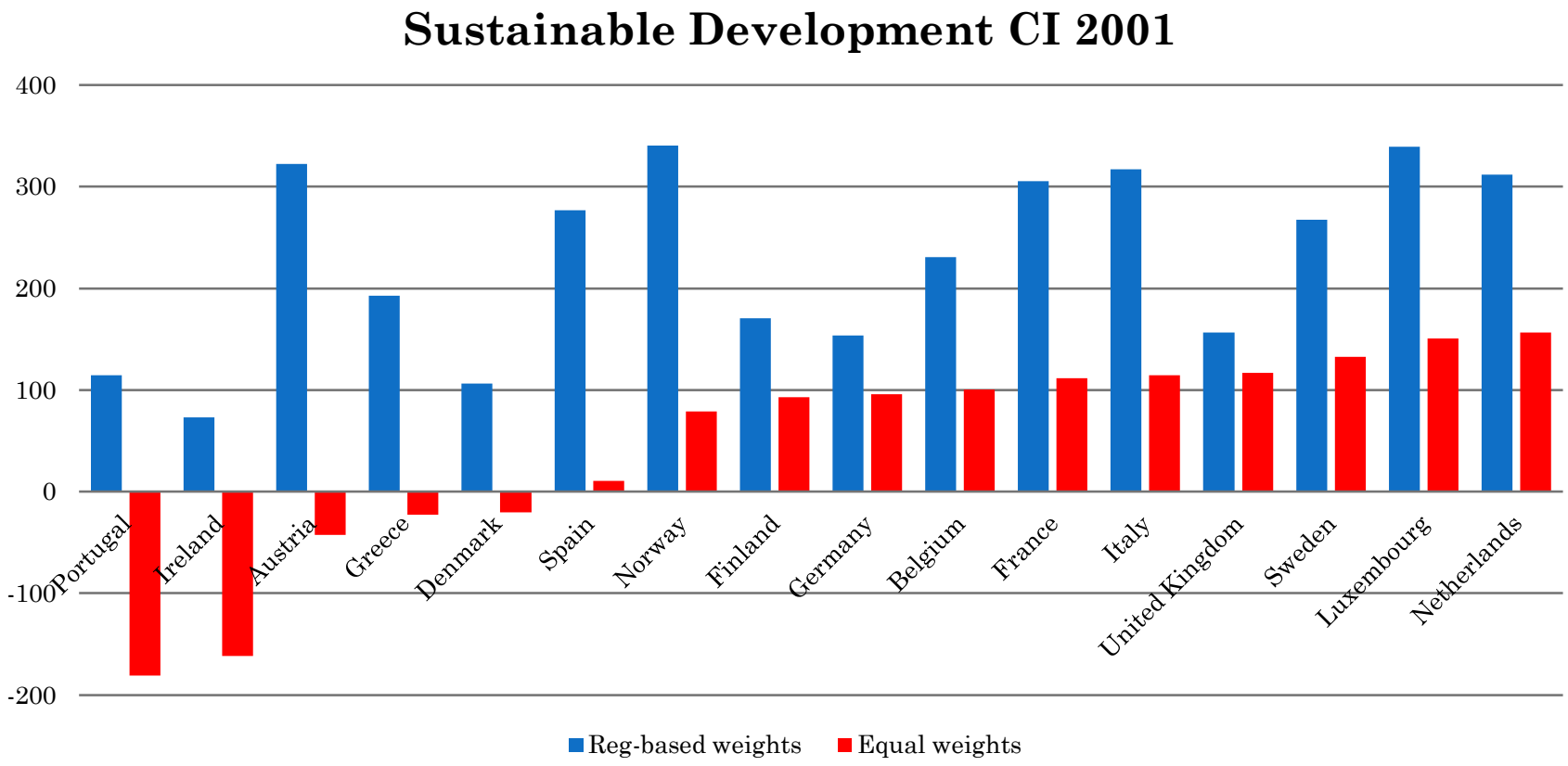
- Weights: Equal to 1 → assumption: all the EU SDS dimensions have equal importance in determining sustainable development

NB. Coefficients are taken in absolute value and normalized to one. Negative coefficients: swap the direction of the indicators before aggregation.

Sustainable Well-being Composite indicators (2)

Theme	EUSDS headline indicator	Estimated coefficients	Reg.Based Weights	Equal Weights
Socio-economic development	Real GDP per capita growth rate	0.0367***	3.9	*10*
Sustainable consumption and production	Resource productivity	0.222***	23.6	*10*
Social inclusion	At risk of poverty rate elder	0.0169	0	*-10*
Demographic changes	Employment rate of older workers	-0.172***	|18.0|	*10*
Public health	Life expectancy at birth, total (years)	0.119***	12.6	*10*
Climate change and energy (1)	Total Greenhouse Gas Emissions (in CO2 equivalent)	0.113***	12.0	*-10*
Climate change and energy (2)	Share of renewables in gross inland energy consumption	0.219***	23.2	*10*
Sustainable transport	Energy consumption of transport relative to GDP	0.0189***	2.0	*-10*
Global partnership	Official development assistance	0.0456***	4.9	*10*
National resources	Common farmland species	0.00513	0	*10*

International comparison: objective vs. subjective composite indicators (2001)



Any countries turn out to be neutral to the choice of composite weighting scheme

EU SDS HEADLINE INDICATORS: 2001

Theme	Socio-economic development	Sustainable consumption and production	Social inclusion	Demographic changes	Public health	Climate change and energy (1)	Climate change and energy (2)	Sustainable transport	Global partnership	National resources
Headline Indicator	*Real GDP per capita growth rate*	*Resource productivity*	*At risk of poverty rate elder*	*Employment rate of older workers*	*Life expectancy at birth, total (years)*	*Total Greenhouse Gas Emissions (in CO2 equivalent)*	*Share of renewables in gross inland energy consumption*	*Energy consumption of transport relative to GDP*	*Official development assistance*	*Common farmland species*
Austria	0.5	1.3	24.0	28.9	78.5	108.0	22.2	104.2	0.3	90.9
Belgium	0.5	1.5	26.0	25.1	78.5	101.0	1.5	98.0	0.4	112.5
Denmark	0.3	1.5	24.0	58.0	76.8	102.0	11.4	99.8	1.0	97.7
Finland	2.1	0.8	18.0	45.7	78.0	106.0	22.4	99.6	0.3	116.6
France	1.1	1.9	11.0	31.9	79.1	101.0	6.9	99.1	0.3	97.3
Germany	1.3	1.6	12.0	37.9	78.3	85.0	3.0	96.3	0.3	94.0
Greece	3.9	1.0	33.0	38.2	78.4	122.0	4.5	98.2	0.2	.
Ireland	3.2	0.8	44.0	46.8	77.1	127.0	1.6	101.8	0.3	98.2
Italy	1.8	1.6	17.0	28.0	79.8	107.0	5.5	99.1	0.2	100.6
Lux.	1.4	2.7	7.0	25.6	77.8	80.0	1.3	102.8	0.8	.
Netherlands	1.2	2.5	8.0	39.6	78.2	101.0	2.4	98.4	0.8	95.6
Portugal	1.3	0.8	30.0	50.2	76.8	139.0	16.1	98.6	0.3	.
Spain	2.5	1.1	22.0	39.2	79.4	134.0	6.5	100.5	0.3	99.8
Sweden	1.0	1.5	16.0	66.7	79.8	96.0	28.3	98.5	0.8	96.6
UK	2.8	2.2	27.0	52.2	78.0	87.0	1.1	95.9	0.3	102.7
Mean	***1.6***	***1.5***	***20.0***	***42.1***	***78.3***	***103.9***	***9.6***	***98.9***	***0.4***	***99.8***
Min	***0.3***	***0.8***	***7.0***	***25.1***	***76.8***	***80.0***	***1.1***	***95.9***	***0.2***	***90.9***
Max	***3.9***	***2.7***	***44.0***	***66.7***	***79.8***	***139.0***	***28.3***	***104.2***	***1.0***	***116.6***

Conclusions (1)

- This paper investigates the relation between the headline indicators of the EU SDS and SWB in several European countries
- Findings: on average people in Europe are concerned about:
  - Sustainable consumption and production (resource productivity);
  - Sustainable energy production (renewables);
  - Demographic changes (i.e. employment rate of elders) but in the opposite direction to what policy makers believe to be suitable for sustainability of public finance;
  - Public health (life expectancy).

Conclusions (2)

- Sustainable Well-Being Composite indicators:
  - Objective (theoretical framework: SWB)
  - Subjective (equal weighting)

<u>In the international comparison</u>:

- Objective CI: countries are penalized by either high employment rate of elder or low levels of renewables and resource productivity.
- In 2001, the composite indicators' scores are much higher for regression-based weights than for equal weighting
- Any countries ends up to be neutral to the change of weights

→ rankings depends on the composite indicator's normative weighting scheme

Thanks for your attention

COMPOSITE INDICATORS: PROS & CONS

Box 1. Pros and Cons of Composite Indicators

Pros:	Cons:
• Thus make it possible to include more information within the existing size limit. • Place issues of country performance and progress at the centre of the policy arena. • Facilitate communication with general public (*i.e.* citizens, media, *etc.*) and promote accountability. • Help to construct/underpin narratives for lay and literate audiences. • Enable users to compare complex dimensions effectively.	• May disguise serious failings in some dimensions and increase the difficulty of identifying proper remedial action, if the construction process is not transparent. • May lead to inappropriate policies if dimensions of performance that are difficult to measure are ignored.

Source: OECD, 2008. Handbook on construction composite indicators: methodology and user guide. Pg. 14