



UNIVERSITÀ
DEGLI STUDI
FIRENZE

FLORE

Repository istituzionale dell'Università degli Studi di Firenze

Indicatori complessi

Questa è la Versione finale referata (Post print/Accepted manuscript) della seguente pubblicazione:

Original Citation:

Indicatori complessi / F.Maggino. - ELETTRONICO. - (2009), pp. 1-84. (Intervento presentato al convegno Università degli Studi di Milano Bicocca e Società Italiana di Statistica tenutosi a Milano nel March 27-28).

Availability:

This version is available at: 2158/370608 since:

Terms of use:

Open Access

La pubblicazione è resa disponibile sotto le norme e i termini della licenza di deposito, secondo quanto stabilito dalla Policy per l'accesso aperto dell'Università degli Studi di Firenze (<https://www.sba.unifi.it/upload/policy-oa-2016-1.pdf>)

Publisher copyright claim:

(Article begins on next page)



Università degli Studi di Firenze
Dipartimento di Studi Sociali

**Towards more participative
methods in the construction of
composite indicators.**

The case of weighting systems

Filomena Maggino

filomena.maggino@unifi.it



Contents

1. Introduction

2. Obtaining weights:
general principles

3. Obtaining weights:
objective and subjective approaches

4. Conclusions



Contents

1. Introduction

2. Obtaining weights:
general principles

3. Obtaining weights:
objective and subjective approaches

4. Conclusions



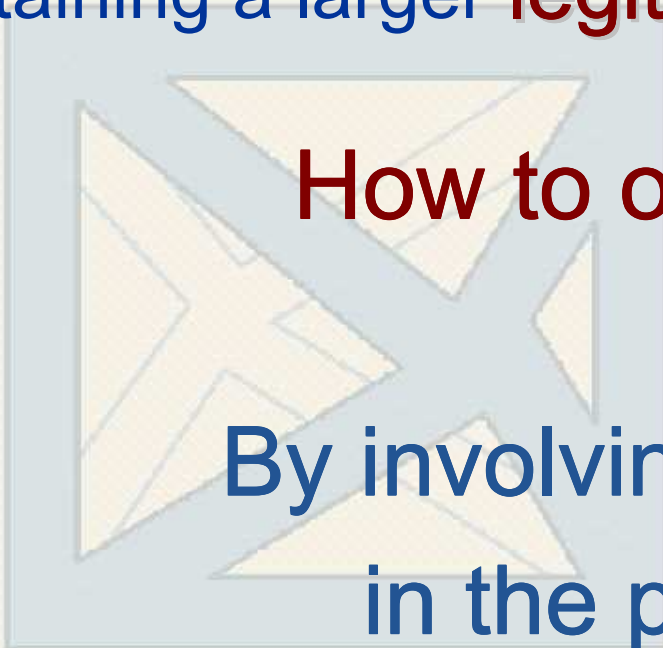
GOAL

→ Obtaining a larger **legitimacy** of social indicators ←

How to obtain this ?

**By involving individuals
in the process of**

social indicators construction





Methodology aimed at constructing indicators



“technology”



need to have specialistic training in order to apply the procedure in a **scientific** and **objective** way





Actually

the procedure,

even though scientifically
defined,

is far from being

objective and aseptic





Indicators construction
is developed through different **stages**.



Each stage requires
a **decision / choice** (methodological or not)
to be taken.



*Some decisions are quite technical
others may involve value judgments*





It is quite difficult to make these decisions
objective

Generally

they are taken through a process accepted and
shared by the scientific community


But

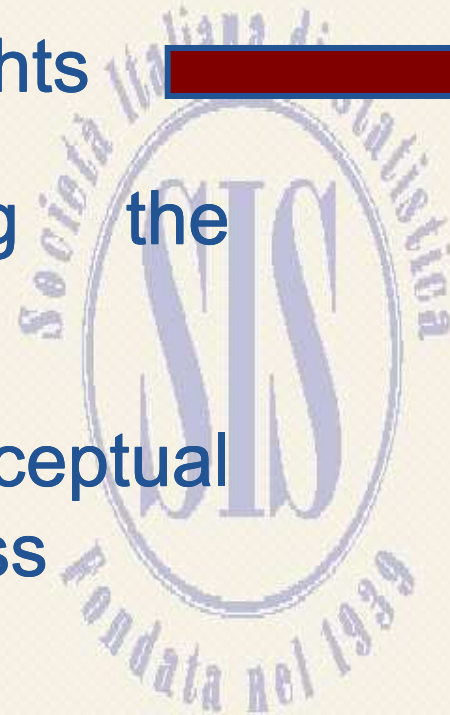
can we share methodological decisions /choices
by a larger community?





In particular ...

1. choosing analytical approach
2. choosing and obtaining weights 
3. choosing and identifying the aggregating technique
4. choosing models and conceptual approaches in order to assess
 - (i) robustness
 - (ii) discriminant capacity





Weights in indicators construction aim at assigning differential **importance** to the indicators to be aggregated.

this process does not represent simply a technical problem

weights



judgment values





Weights



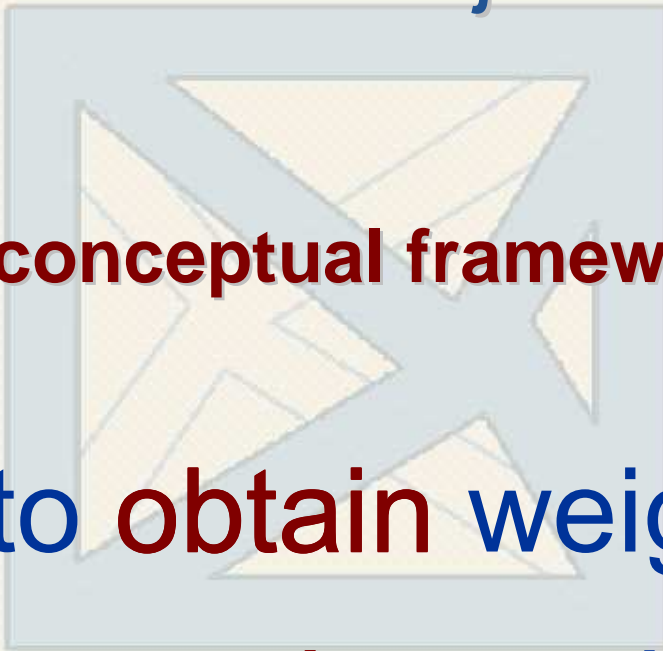
differential subjective weights

How to obtain subjective weights?





Determining and applying differential subjective weights



solid **conceptual framework** helping in clarifying how

- to **obtain weights**
- to **assign weights**





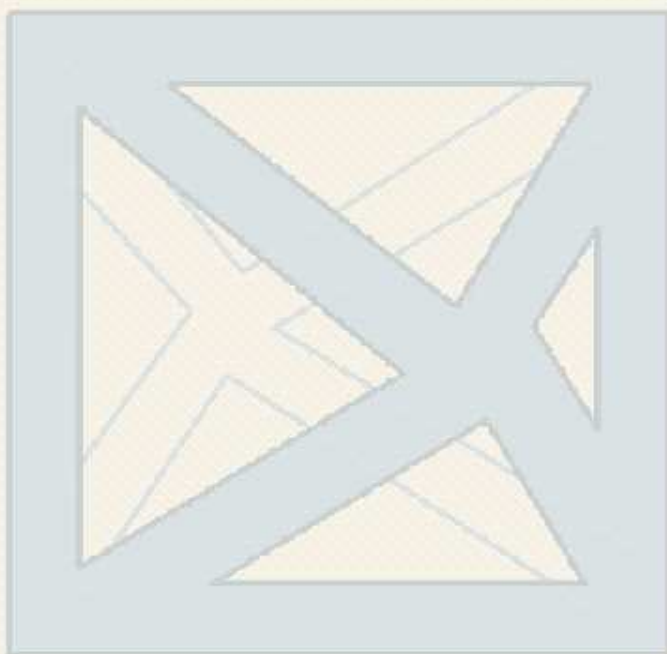
Contents

1. Introduction

2. Obtaining weights:
general principles

3. Obtaining weights:
objective and subjective approaches

4. Conclusions





General statements

General basic conditions concerning weights

The identified weights

- ↪ are *non negative* numbers
- ↪ *add up to unity*
- ↪ are related in some way to the corresponding *score*
- ↪ may require to be rescaled in order to have an *identical range* (0; 1)





General statements

Reproducing each sub-score's contribution to CI
a criterion has to be adopted



weighting system



improvement and refinement of the adopted
model of measurement.





General statements

Identification of a generic weighting system
needs to **take into account** :

- ↪ **rationale and theoretical framework** on which the measurement of the complex characteristics is founded and that will consequently regard the synthetic score
- ↪ **meaning and contribution of each sub-score** to the synthesis
- ↪ **quality of data and statistical adequacy of indicators**



General statements

Identification of a generic weighting system
needs decisions to be taken

⇒ proportional size of weights

a. equal or differential weighting

⇒ aggregation technique to be adopted

b. compensatory or non-compensatory





General statements

N.B.

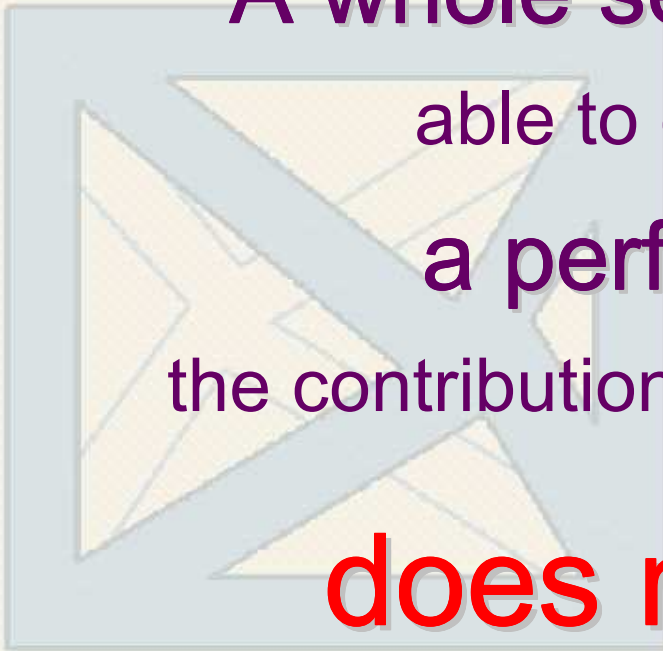
A whole set of weights

able to express in

a perfect way

the contribution of each indicator

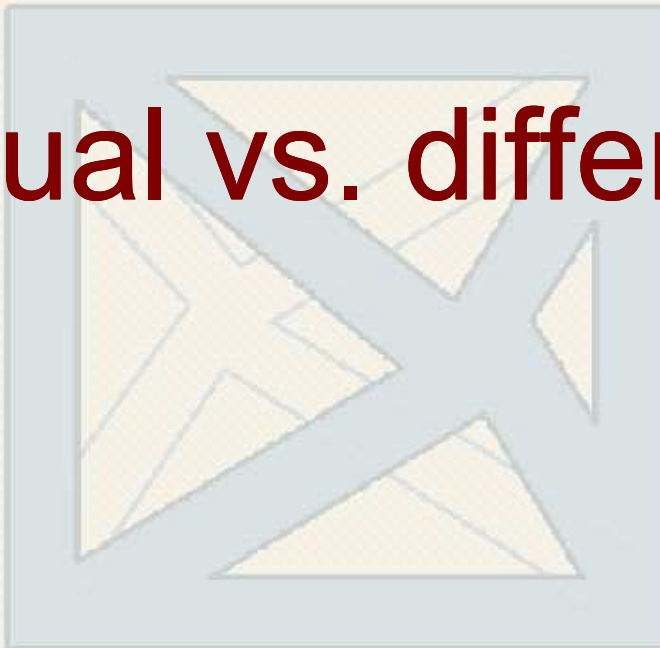
does not exist





General statements

Equal vs. differential weighting





General statements

First decision

Equal Weighting \Leftrightarrow Different Weighting

The choice will strongly influence
the final results





General statements

Equal weighting

Doubtful procedure mainly *when*

- different components have to be aggregated by different numbers of indicators (→ synthetic score = unbalanced structure);
- indicators exist measuring the same component (*double weighted* o *double counting*).





General statements

Differential weighting

Doubtful procedure mainly *when* not supported by

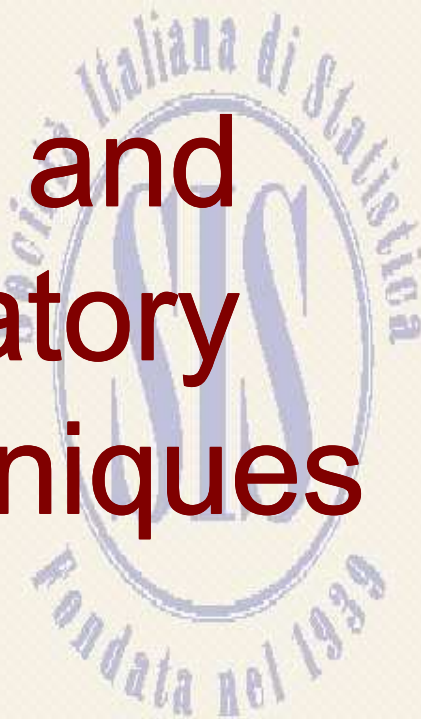
- theoretical reflections
- methodological concerns





General statements

**Compensatory and
Non-compensatory
aggregation techniques**





General statements

In order to avoid incoherencies between

theoretical meaning
of weights



actual application
of weights



a consistent aggregating technique is needed
by considering **compensability** among
the elementary indicators



General statements

Compensatory aggregating approach

- additive approach (simple addition)
- geometrical approach (multiplicative technique)

low values compensated by high values

synthetic score does not allow us to return to the original individual profiles

→ problems of interpretation ←



Statements in obtaining subjective weights

In obtaining **subjective weights** the decisions / choices do not rely on experts.





Statements in obtaining subjective weights

Identification of a subjective weighting system
needs to **take into account** :



theoretical issue

→ “importance” is a distinct construct?



psychometric properties of importance ratings

→ internal consistency and test-retest reliability





Statements in obtaining subjective weights

Identification of a subjective weighting system:
a **model** should be chosen by considering

- ⇒ the criterion
- ⇒ the level
- ⇒ the techniques
- ⇒ the approach





Contents

1. Introduction

2. Obtaining weights:
general principles

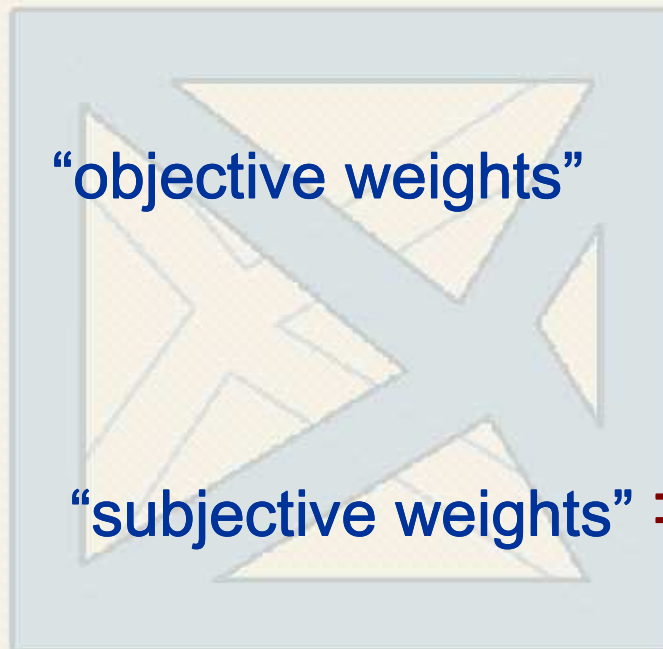
3. Obtaining weights:
objective and subjective approaches

4. Conclusions



Approaches for obtaining weights

Approaches for obtaining weights can produce:



a. statistical methods

b. multi-attribute approaches

c. scaling approaches

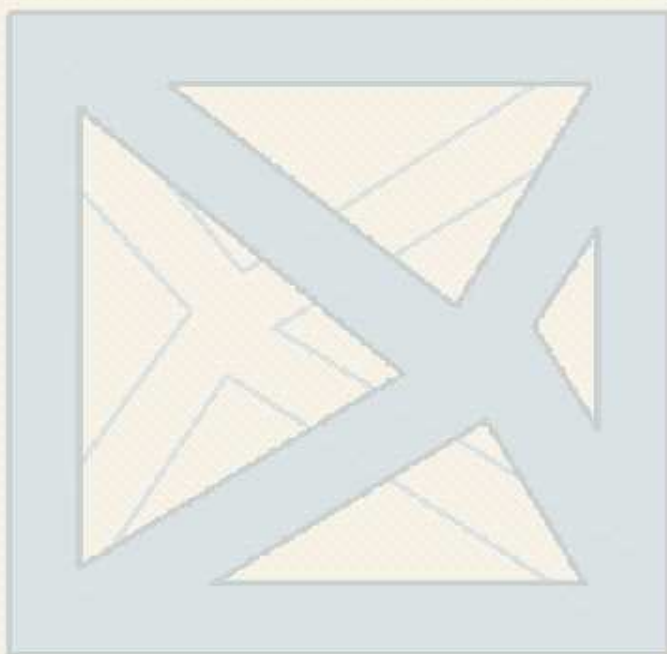




Approaches for obtaining weights

a. Statistical methods







Approaches for obtaining weights

b. Multi-attributes approaches





Multi-attributes approaches

Multi-Attribute Models

allow

subjective importance weights to be identified at
subjective level

through an indirect approach
by

- managing a certain number of **combined comparisons**
- applying methods aimed at **making decision among different available alternatives**



Multi-attributes approaches

Among these models we can distinguish:

1. Multi-Attribute Decision Making:

↳ Analytic Hierarchy Process (AHP) (pairwise comparison)

2. Multi-Attribute Compositional Models:

↳ Conjoint Analysis (CA)





Approaches for obtaining weights

c. Scaling approaches





Scaling approaches

They can be classified through their features:

- Dimensionality
- Nature of data
- Scaling technique
- Criterion for testing the model
- Standard of measurement
- Contribution to the measurement of each multiple measures





Scaling approaches

Scaling model		Dimensionality	Nature of data	Scaling technique	Criterion for testing the model	Standard of measurement: final (synthetic) score assigned to		
Additive	Uni-dimensional	Uni	Single-stimulus	Not-comparative	Internal consistency	Cases		
	Multidimensional	Multi	Single-stimulus	Not-comparative	Dimensionality of the items	Cases		
Cumulative	Thurstone model (differential scale)		Uni	Stimulus comparison	Comparative (pair comparison or rank-order)	Metrics between items	Items	
	Q methodology		Uni	Stimulus comparison	Comparative (rank-order or comparative rating)		Items	
	Deterministic	Guttman		Uni	Single-stimulus	Not-comparative	Scalogram analysis: reproducibility, scalability and ability to predict	Cases and items
		Multidimensional Scalogram Analysis (MSA)		Bi			Regionality and contiguity	Cases and items
		Partial Ordered Scalogram Analysis (POSA)		Bi			Correct representation	Cases and items
	Probabilistic	Monotone (one or more parameters)		Single-stimulus	Not-comparative	<ul style="list-style-type: none"> parameters estimation (maximum likelihood) goodness of fit (<i>misfit</i> and residuals analysis) 	Cases and items (without condensation)	
Perceptual Mapping	Multidimensional scaling		Multi	Similarities	Comparative (pair comparison)	Goodness of fit of distances to proximities (stress, alienation)	Items	
	Unfolding		Uni & Multi	Preferential choice	Comparative	Goodness of fit of distances to ordinal preferences	Cases and items	
Conjoint model		Multi	Preferential choice	Comparative (rank-order)	Goodness of fit of the model (part-worth) to the ranking	Items at individual level		



Scaling approaches

Among all these approaches we need to select those approaches that utilize data:

- whose nature is comparative or preferential
(in yellow in the previous table)
- produced by a comparative scaling technique
(in pink in the previous table)





Scaling approaches

Scaling models allowing subjective weights to be obtained are

- group weighting:

- *Thurstone model (differential scale)*

- *Unfolding model (perceptual mapping)*

- individual weighting:

- *Conjoint model*





Contents

1. Introduction

2. Obtaining weights:
general principles

3. Obtaining weights:
objective and subjective approaches

4. Conclusions



Conclusions

This work aims at systematically framing the issue and showing the possible approaches in order to obtaining weights in a subjective perspective



many technical issues should be clarified.





Conclusions

Difficulties

Obtaining subjective weights requires and relies on the accomplishment of large survey projects aimed at collecting “importance” data.

- Time
- Resources
- Sampling
- Field work
- ...





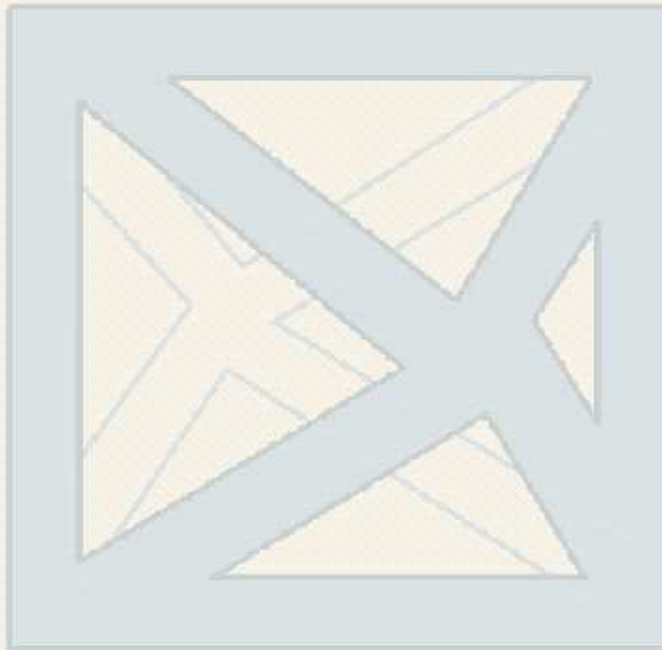
Conclusions

«Constructing composite indicators should take into account the agreement among citizens concerning the importance to be assigned to each indicator»

(Hagerty and Land, 2007)

Seen in this perspective, this topic can be placed in the ambit of an improvement of democratic participation to decisions (“res publica”).

Thank you for your attention



Presentation designer: trapani.marco@gmail.com