QUANTITATIVE STORYTELLING IN SOCIAL CONVERGENCE ANALYSIS

Marta Kuc @kuc_marta,
Faculty of Management and Economics, Gdansk University of Technology
Andrea Saltelli @AndreaSaltelli,
Centre for the Study of the Sciences and the Humanities, University of Bergen

Presentation plan

1. Introduction

2. The fortune of composite indicators

3. Quantitative story telling

4. Methodology

5. Research findings
   1. National vs. regional
   2. Different stakeholders

6. Conclusion

7. Further research

Introduction

- Can composite indicator tell more than one story?

- Convergence analysis

- Experiment:
    - Fixing the structure of CI while changing its scale,
    - Fixing its scale and changing the composition of its pillar
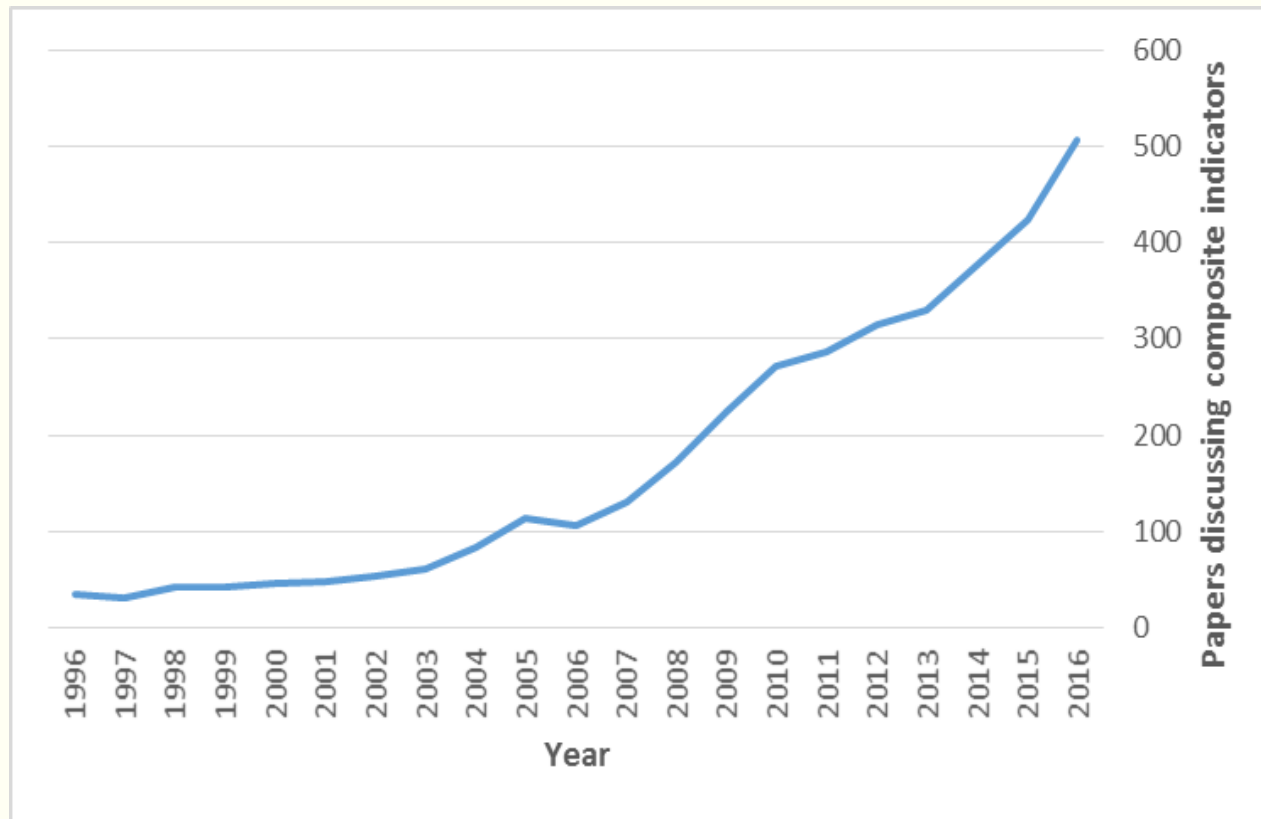
The fortune of composite indicators

Figure 1, Search on www.scopus.com using as search string: TITLE-ABS-KEY("composite indicator") OR TITLE-ABS-KEY("composite index") OR TITLE-ABS-KEY("composite indices").*

The fortune of composite indicators

- Composite indicators are very popular in analysis of:
  - Well-being
  - Communication technology development
  - Innovation
  - Health care system performance
  - Real estate market analysis
  - Countries/regions' competitiveness
  - Quality of institution
  - Sustainable development
  - Standard of living

New wave of CI – spatial composite indicators

Pros of composite indicators

- Can summarise complex, multi-dimensional realities with a view to supporting decision makers

- Are easier to interpret than a battery of many separate indicators

- Can assess progress of countries over time

- Reduce the visible size of a set of indicators without dropping the underlying information base

- Facilitate communication with general public

- Enable users to compare complex dimensions effectively

Cons of composite indicators

- May send misleading policy messages if poorly constructed or misinterpreted

- May invite simplistic policy conclusions

- May be misused – e.g. to support desired policy

- The selection of indicators and weight could be the subject of political dispute

- May lead to inappropriate policies if dimensions of performance that are difficult to measure are ignored

- May fall short in the context of policy analysis and negotiation, where different options and different 'end in sight' are relevant

Two types of indices

- According to Ravallion:
  - Those built on economic theory – direct monetary aggregates or based on shadow prices
  - 'mashup indices' – HDI, MPI

Is a theory for composite indicators possible?

- OECD-JRC handbook （2008） – 10 steps how to build CI

- Questionable weighting procedure (Becker et al. 2017; Paruolo et al., 2017)- sensitivity analysis?

- Conceptual streams:
  - Concept of democratization of expertise
  - Concept of extended peer community
  - Concept of social discovery
  - Sign – Object – Interpretant (S-O-I)

Quantitative storytelling (QST)

- Tautology that every measure of society corresponds to a frame

- EBP – evidence based policy

- QST – corresponds to different constituencies and social actors

- QST – broadening the spectrum of available frames

- OECD PISA study (Araujo et al., 2017; Saltelii, 2017)

Methodology - CI

- The classical approach to constructing composite indicators implies the assignment of variables to a given pillar (based on researchers' own knowledge or experts opinion), then aggregation of variables within the pillar, and finally the aggregation into a holistic composite indicator. In our paper we decided to follow that the most popular approach.

Methodology - CI

- Destimulants transformation:

$$x_{ijt}^{s} = \frac{1}{x_{ijt}}$$

- Normalization formula:

$$x_{ijt}^{'} = \frac{x_{ijt}}{\max x_{ij,2005}}$$

Methodology - CI

- Composite indicator

$$CI_{it} = \frac{1}{p} \sum_{q=1}^{p} z_{iqt}$$

Methodology – Beta-convergence

- Beta convergence is a process in which countries with lower performance are improving faster than those with higher one (Sala-i- Martin, 1996).

$$g_i = a + b \log CI_{i,0} + \varepsilon_t$$

$$g_i = \frac{1}{T} \log\left(\frac{CI_{i,T}}{CI_{i,0}} \right)$$

Methodology – Beta-convergence

- The speed of convergence can be calculated according to formula (Barro, Sala-i-Martin, 2003):

$$\beta = -\frac{\ln(1+b)}{T}$$

Methodology – Sigma-convergence

- As it was mentioned before the occurrence of beta-convergence is a necessary condition for sigma-convergence, however based on the same equation we can investigate the existence of sigma-divergence (Friedman, 1992; Quah, 1993). To do so the following linear trend model was estimated:

$$V_W = \alpha_0 + \alpha_1 t + \varepsilon_t$$

$$V_W = \frac{\sqrt{\sum_{i=1}^{n}(CI_i - CI)^2 \dfrac{l_i}{L}}}{CI}$$

Research findings – same composites at different scales

- EU countries vs. EU NUTS-2 regions

- Variables:
  - Employment rate
  - Households income in PPS per capita
  - Long term unemployment
  - Participation rate in education and training
  - NEET – young people neither in employment nor in education and training

Research findings – I – beta-convergence

- National:

	coefficient	standard error	p-value
const.	0.0165	0.0043	0.0007
CI	-0,0375	0.0101	0.0014
R^2=0.39			

- Regional:

	coefficient	standard error	p-value
const.	0.0038	0.0015	0.0140
CI	-0.0099	0.0038	0.0140
R^2=0.25			

Source: Authors' own study.

Research findings – I – speed of convergence

- National:

$$\beta = 0.35\%$$

- Regional:

$$\beta = 0.09\%$$

Research findings – I – weighted C.V. dynamic
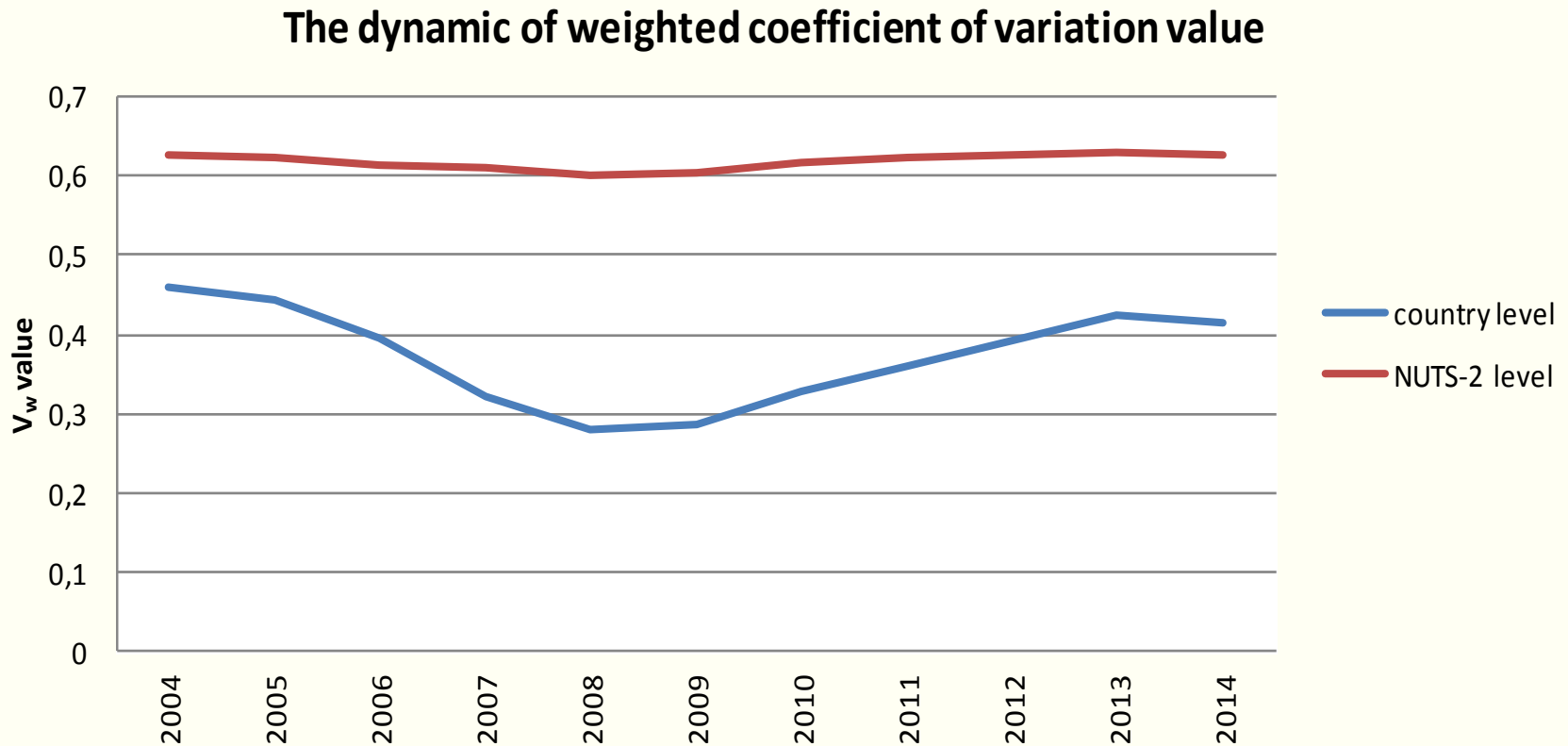
Figure 2. The dynamic of weighted coefficient of variation value.

Source: Authors' own study.

Research findings – I – sigma convergence

	α_0	α_1	R^2
country level	0.3832 (0.000)	-0.0017 (0.7938)	0.0178
NUTS-2 level	0.6128 (0.000)	0.0009 (0.3695)	0.0918

Source: Authors' own study.

# Research findings – I – within countries disproportions

Convergence	Divergence	No evidence
1. Belgium	1. Denmark	1. Bulgaria
2. Germany	2. Greece	2. Czech Rep.
3. France	3. Spain	3. Ireland
4. Hungary	4. Croatia	4. Netherlands
5. Austria	5. Italy	5. Poland
6. Slovakia	6. Portugal	6. Finland
7. Sweden	7. Romania	
	8. Slovenia	
	9. Unitied Kingdom	

Source: Authors' own study.

Research findings – I – capital vs. other regions
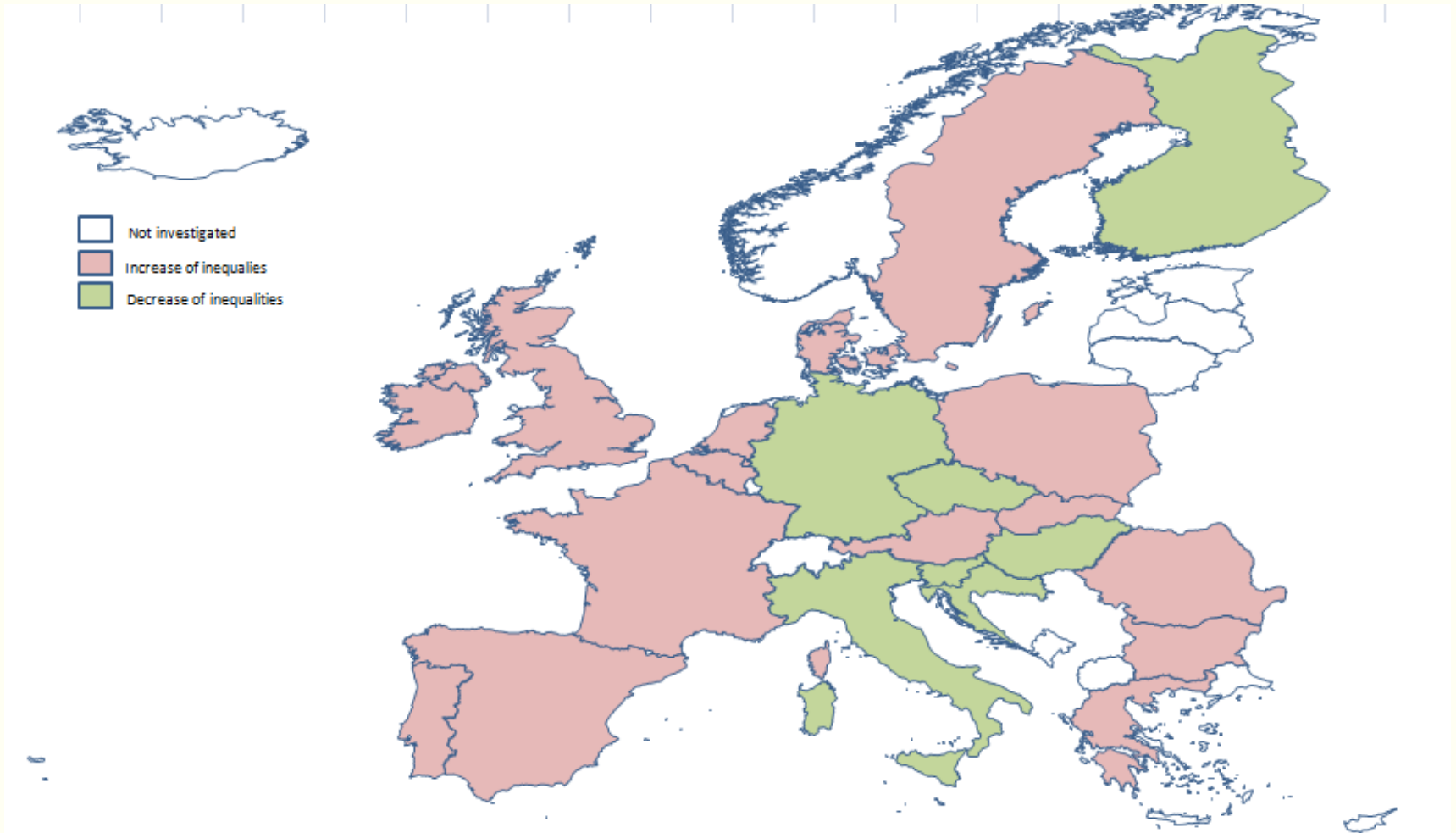
Source: Authors' own study.

Research findings – Same scale different pillars

Stakeholder 1	Stakeholder 2	Stakohlder 3	Stakholder 4
1. Opportunities and access to the labour market 2. Dynamic labour market and fair working condition 3. Public support/ Social protection and inclusion	1. Opportunities and access to the labour market 2. Dynamic labour market and fair working condition 3. Public support/ Social protection and inclusion 4. Governance / Fairness	1. Opportunities and access to the labour market 2. Dynamic labour market and fair working condition 3. Public support/ Social protection and inclusion 4. Functioning of health care	1. Opportunities and access to the labour market 2. Dynamic labour market and fair working condition 3. Public support/ Social protection and inclusion 4. Governance/ Fairness 5. Functioning of health care

Research findings – II – Beta-convergence

Stakeholder no.1	coefficient	standard error	p-value
const.	0.0009	0.0020	0.6430
CI	-0.0093	0.0072	0.2050
R^2=0.2612			
Stakeholder no.2	coefficient	standard error	p-value
const.	-0.0001	0.0018	0.9506
CI	-0.0083	0.0064	0.2047
R^2=0.28			
Stakeholder no.3	coefficient	standard error	p-value
const.	0.0066	0.0036	0.0813
CI	0.0022	0.0122	0.8572
R^2=0.12			
Stakeholder no.4	coefficient	standard error	p-value
const.	0.0034	0.0028	0.2394
CI	-0.0038	0.0093	0.6842
R^2=0.25			

Source: Authors' own study.

Research findings – II – CI C.V. dynamic
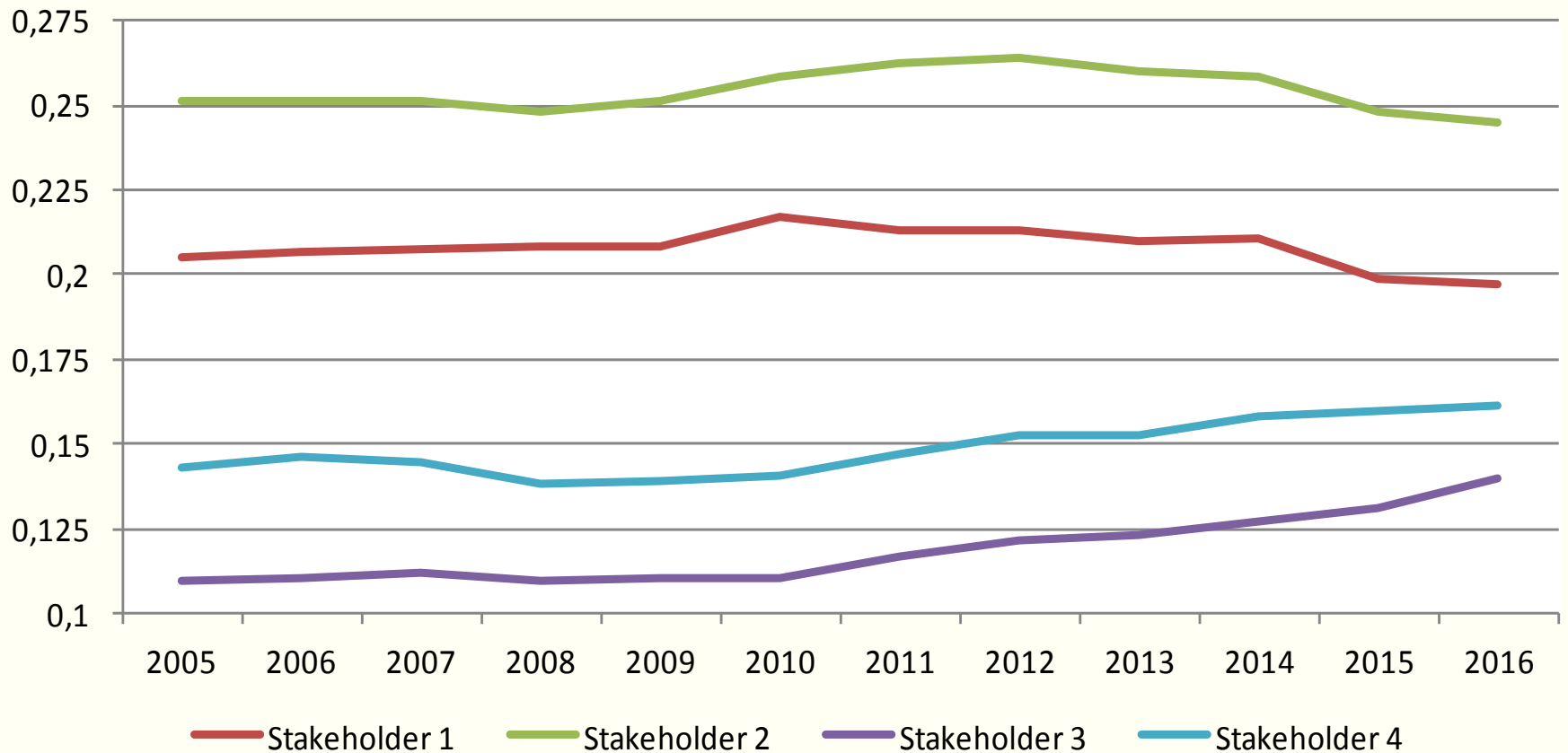

Figure 3. The dynamic of coefficient of variation of CI value.

Source: Authors' own study.

Research findings – II– sigma convergence

	α_0	α_1	R^2
Stakeholder 1	0.2150 (0.0000)	-0.0004 (0.4234)	0.2649
Stakeholder 2	0.2531 (0.0000)	0.0001 (0.7551)	0.2128
Stakeholder 3	0.1019 (0.0000)	0.0025 (0.0000)	0.8403
Stakeholder 4	0.1360 (0.0000)	0.0020 (0.0006)	0.7125

Source: Authors' own study.

Conclusions

- Modification of philosophy of CI

- Cohesion policy offers a convenient battleground to test this methodology

- Is countries convergence more important than regional or within-country?

- Should fairness be targeted by a cohesion policy?

- Should health care be targeted by a cohesion policy?

Further research

- Refining the analysis with more data

- Rebalancing weights to their target importance using SA

- Dynamic spatial panel model

marta.kuc@zie.pg.gda.pl

andrea.saltelli@svt.uib.no

THANK YOU