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Joint Research Centre

Resilience Framework: The Resilience of EU Members States to the Global Crisis

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*Composite Indicators and Scoreboards
Community of Practice
November 8, 2018, Ispra*



Integrating the resilience approach into the policymaking cycle is a challenge

A first synthesis analysis for Europe in a 2015 conference



(Picture from Adobe Stock)



We need a common framework using a systems approach

JRC developed a conceptual framework for resilience

in consultation with Commission-wide Research Network on Measuring Resilience (Resil.net)



JRC SCIENCE FOR POLICY REPORT

Building a Scientific Narrative Towards a More Resilient EU Society

*Part 1: a Conceptual
Framework*

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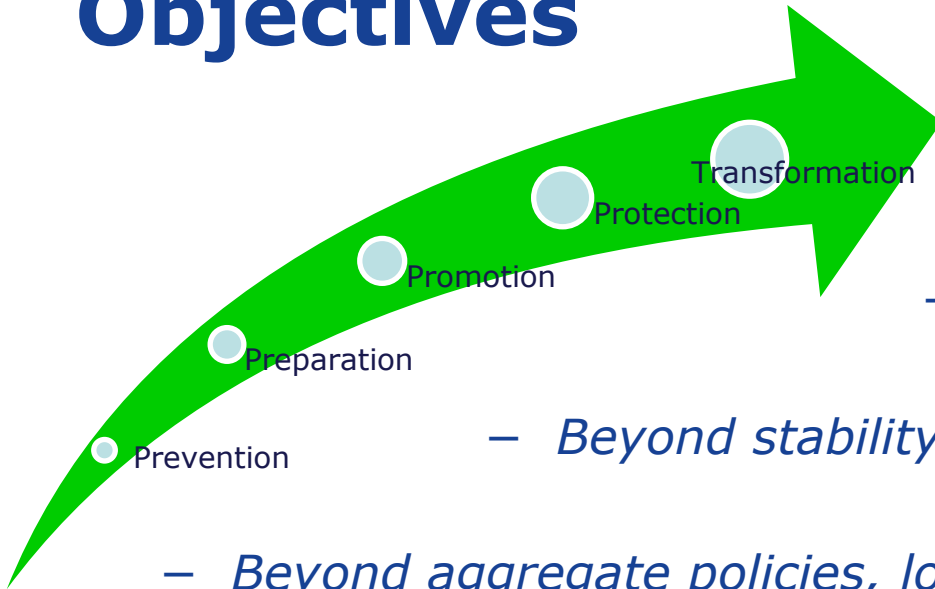


Joint Research
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EUR 28548 EN

Objectives

- **Bring resilience thinking** into policies



– *Beyond single policy areas*

– *Beyond stability: adaptation and transformation at core*

– *Beyond aggregate policies, look at citizens, communities, regions, ...*



- Foster the **monitoring** of resilience
 - *An operational framework*
 - *Indicators to cover the full system*

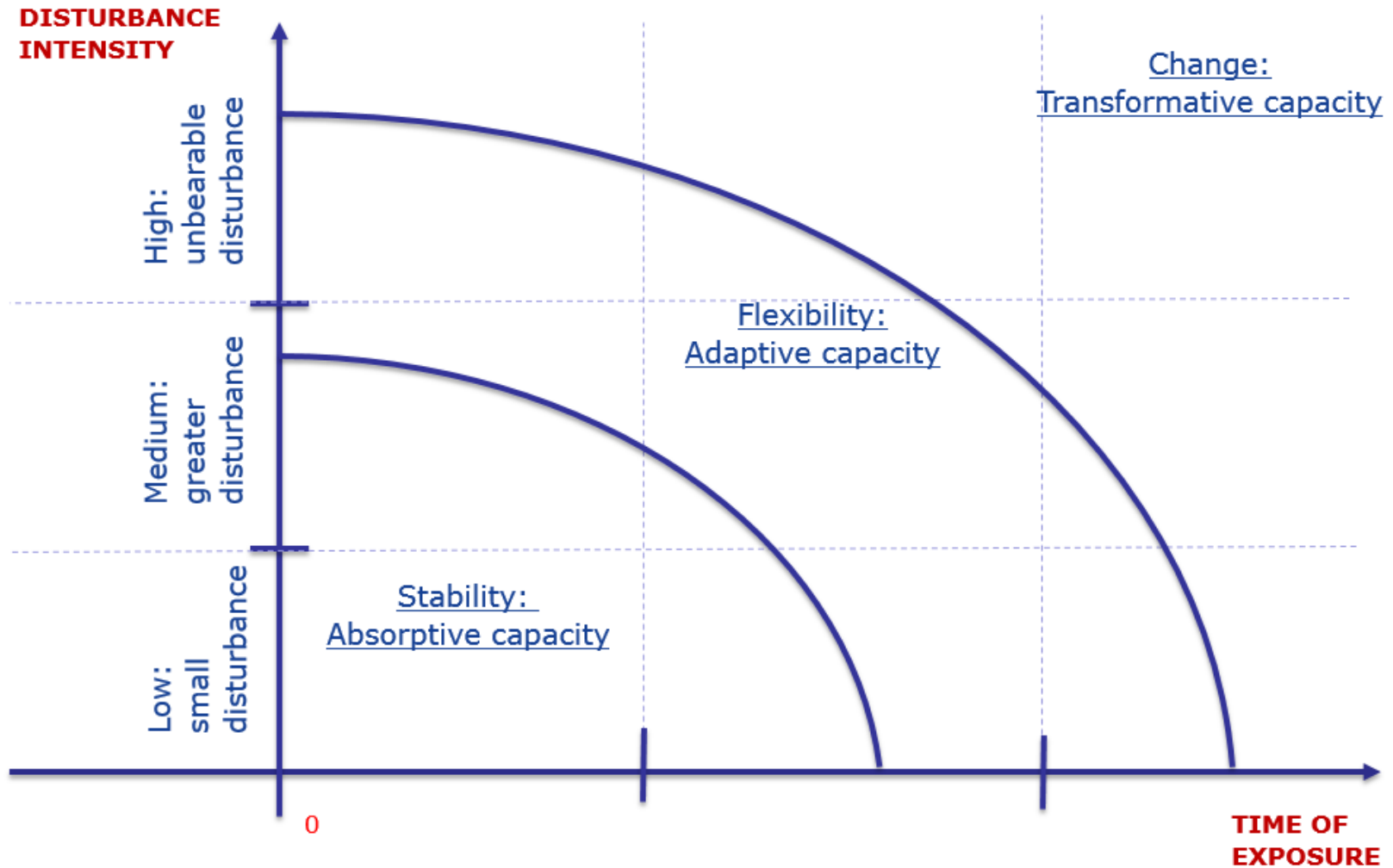
What is resilience?

Resilience is the ability of a system/society to deliver its current level of **societal wellbeing**, without compromising that of **future generations**, even when facing shocks and persistent structural changes.

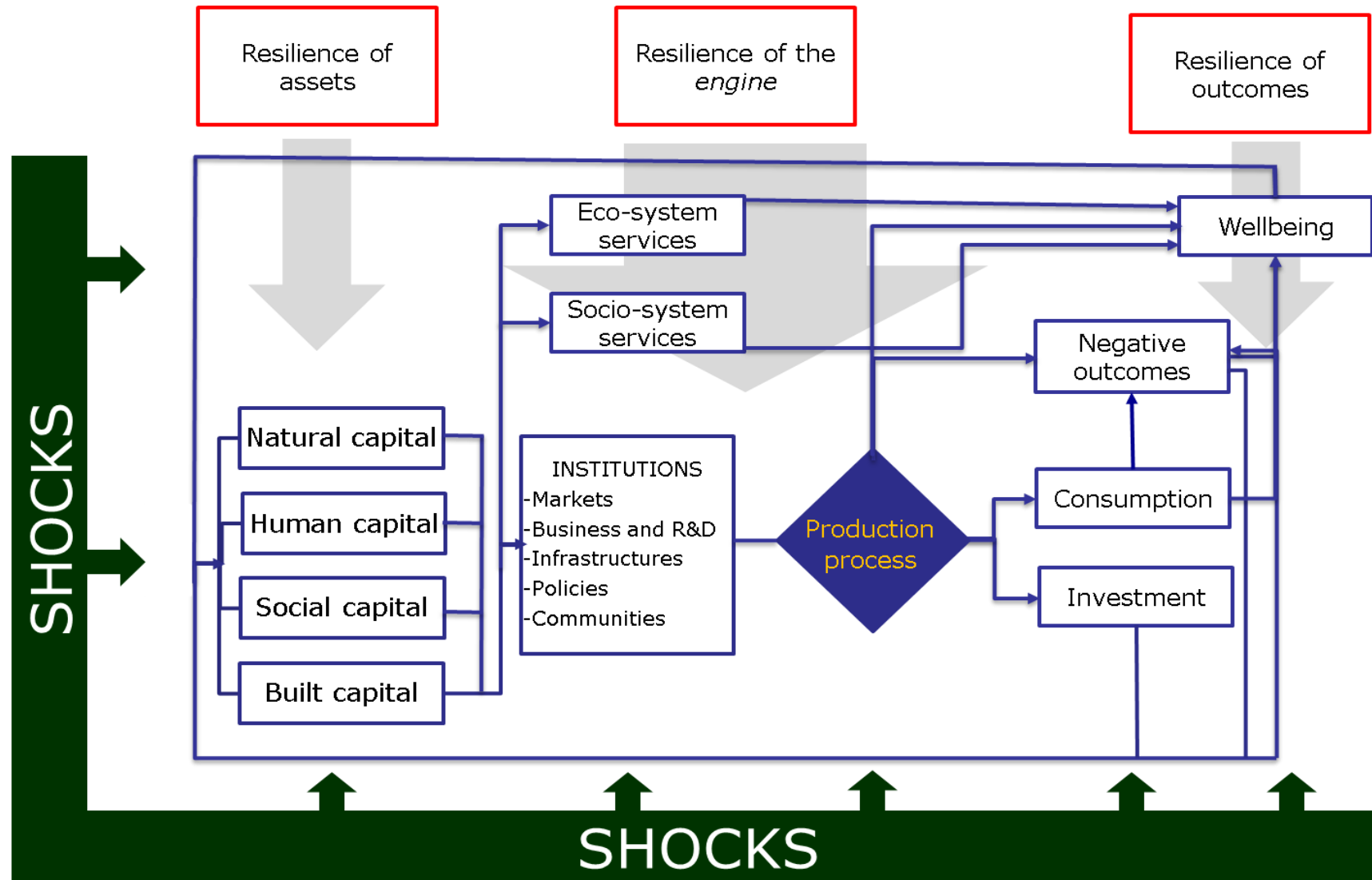


I.e., to stay on the original sustainable development path, or move to the new one.

Time and resilience capacities



The system view



Extending Costanza et al. (1997)

Measurement strategy: a three-step-approach towards a dashboard



System variables



Indicators of resilience



Resilience characteristics

Resilience to the 2008-2012 financial and economic crisis



- Which countries showed more (less) resilience during and after the crisis?
- Which are the country characteristics associated with resilient behaviour?

Measurement strategy: a three-step-approach towards a dashboard



System variables

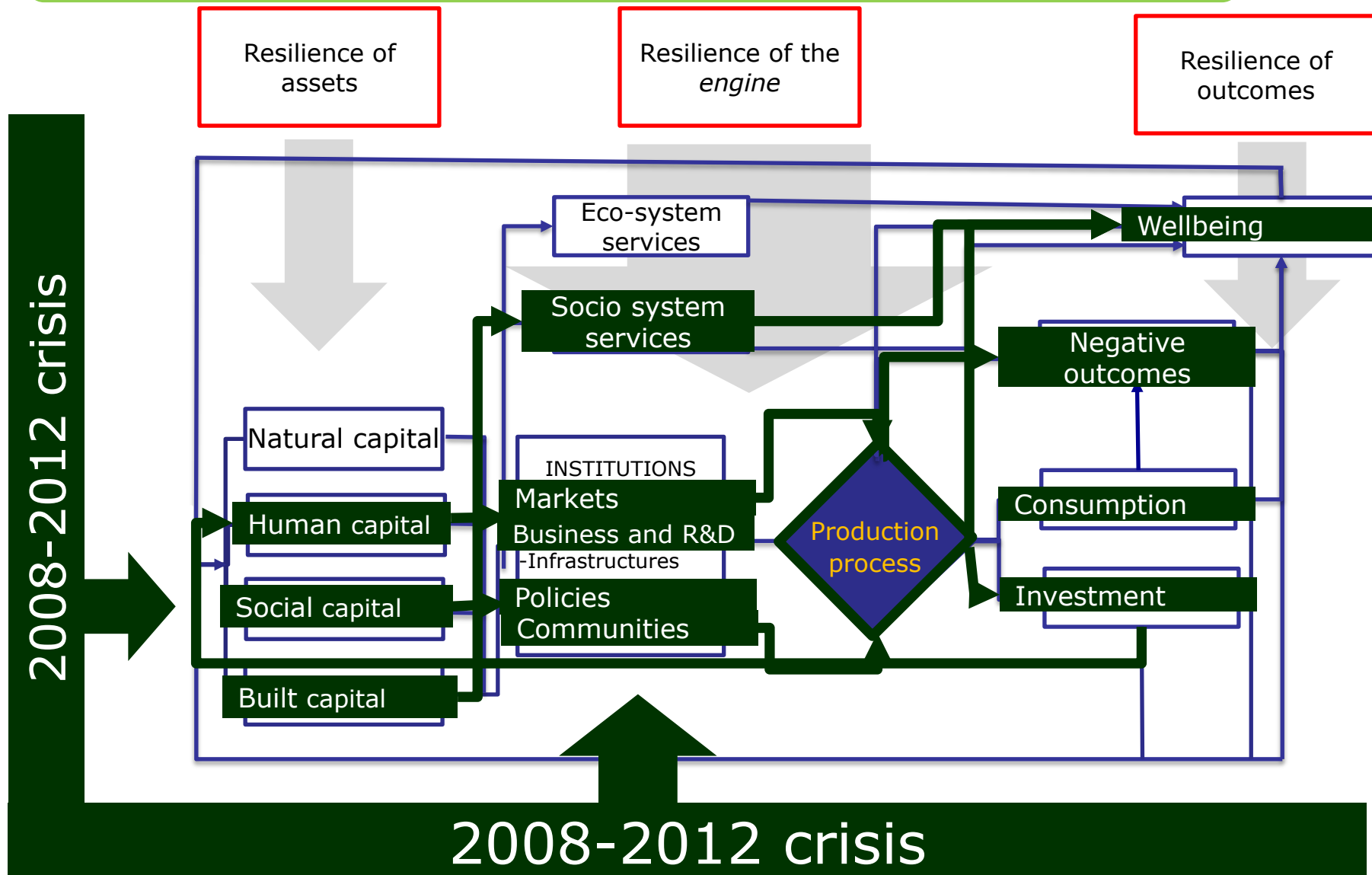


Indicators of resilience



Resilience characteristics

Step 1: system variables



Selecting the system variables

- Drawing on various socio-economic indicator sets
 - European Pillar of Social Rights
 - Macroeconomic Imbalance Procedure
 - Sustainable Development indicators
 - Europe 2020 strategy
 - Quality of Life indicators
 - ...
- Selection criteria
 - Spanning our system in a balanced way
 - Exhibiting a substantial variation during the crisis
 - Covering individual and societal wellbeing “beyond GDP”
 - Sufficient coverage in time and across countries
- A final list of 34 variables

34 system variables

	ASSETS	ENGINE	OUTCOMES
CORE	Investment	Government deficit Government debt Household loans House prices Inflation Labour productivity Corporate loans Private debt Stock prices	Employment rate GDP Unemployment rate
SYSTEM	Exp. on education Exp. on health	Exp. on labour market programs Expenditure on R&D	HH. consumption Household income
	Fairness Trust in people	Trust in EP Trust in legal system Social activity	Life satisfaction Happiness Health
	Stock of dwellings*	Share of temporary work Wages	Income inequality NEET** Social exclusion

* Accommodation units

** Youth not in Education, Employment or Training

Measurement strategy: a three-step-approach towards a dashboard



System variables



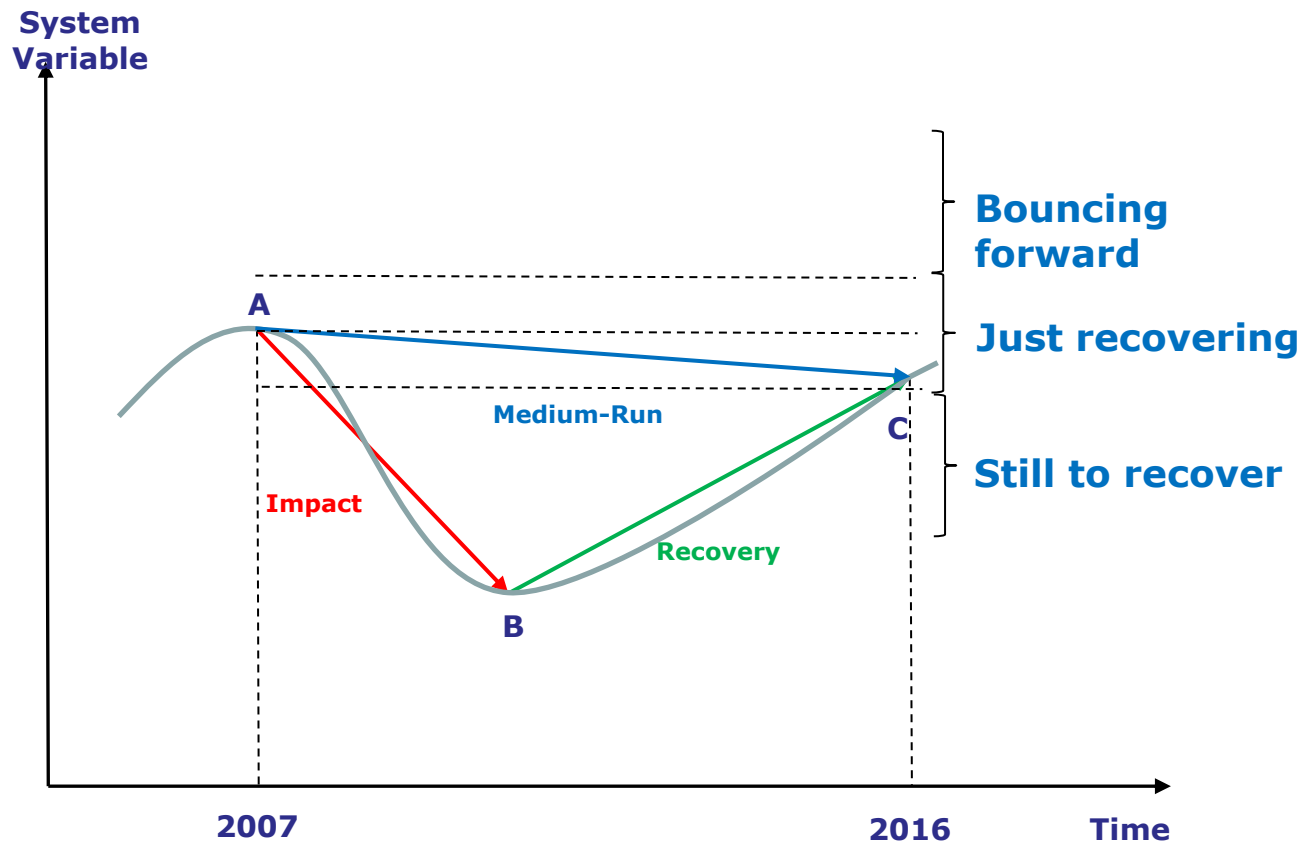
Indicators of resilience



Resilience characteristics

Step 2: Metrics and indicators of resilience

2.1. Metrics for individual system variables



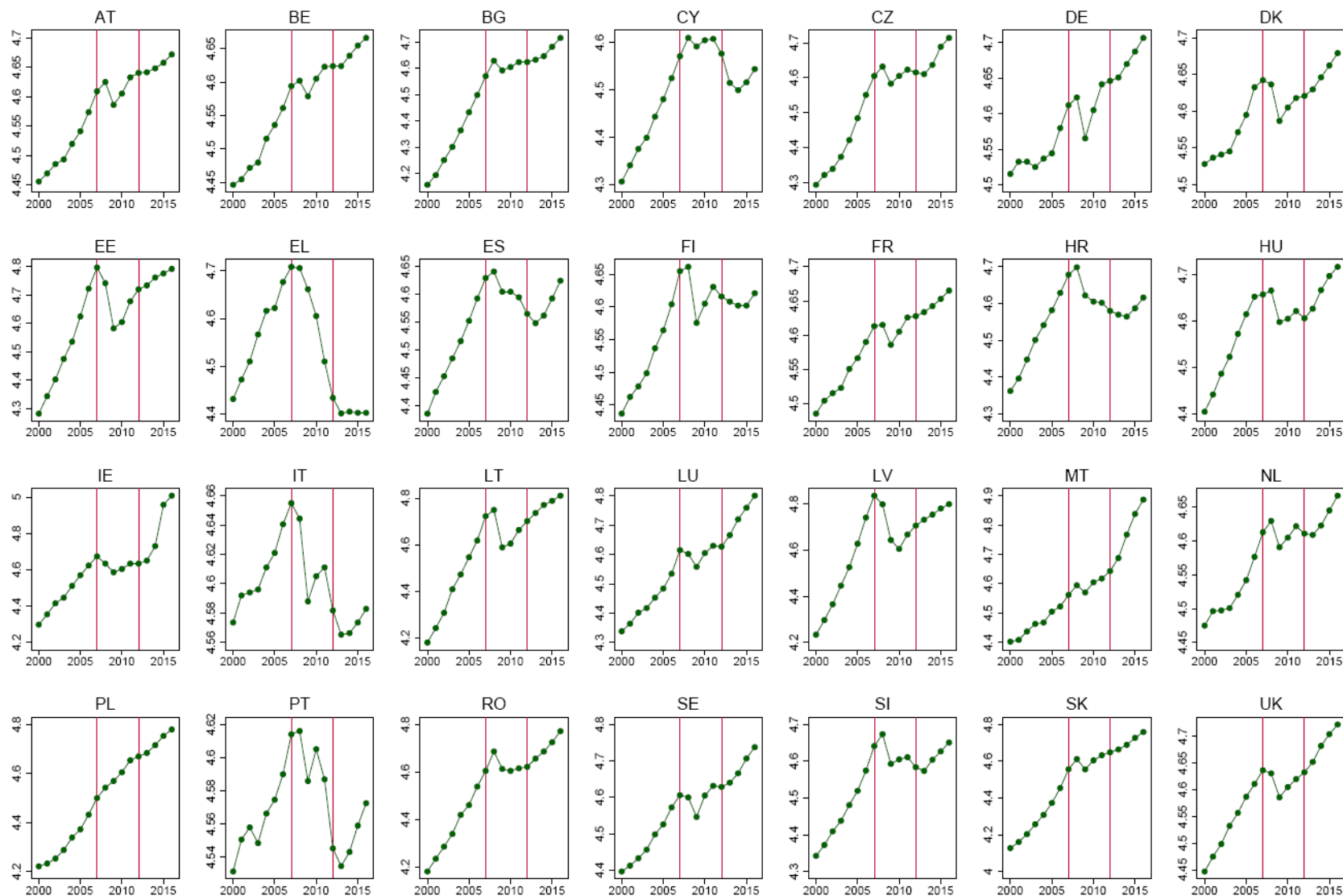
Impact
Absorption

Recovery
Absorption/
Adaptation

Medium-Run
Adaptation

Bounce-Forward
Adaptation/
Transformation

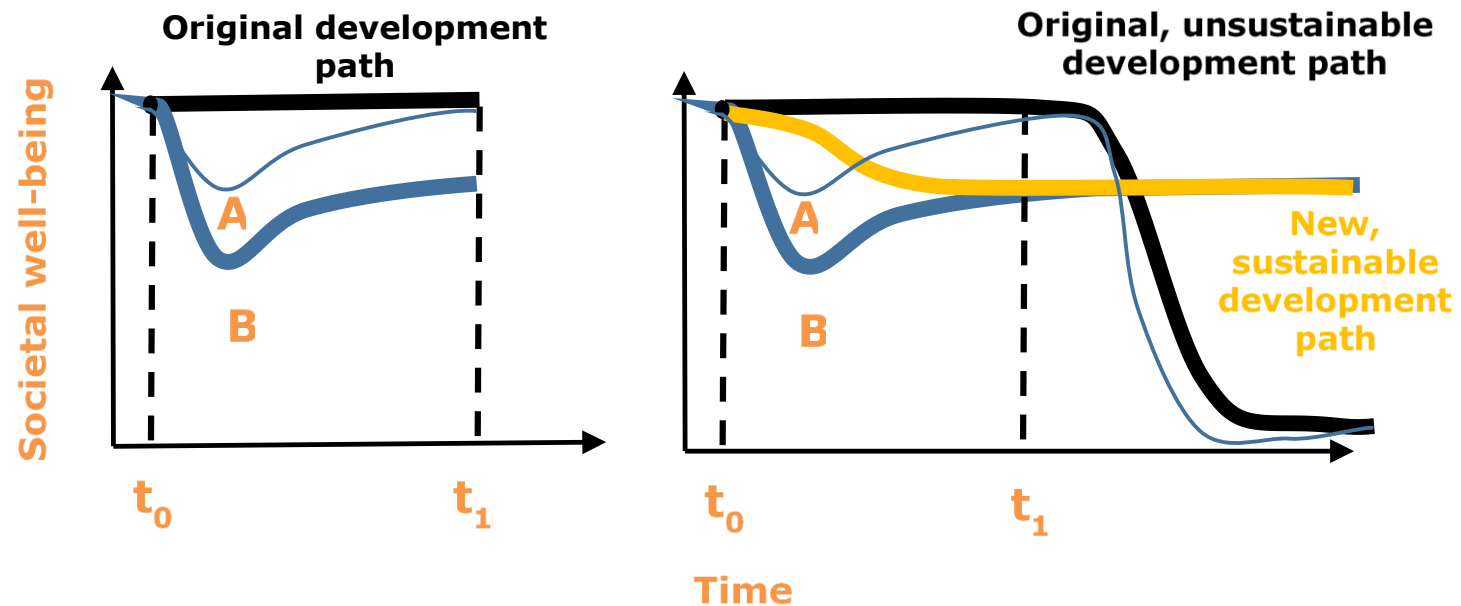
The “no shock” counterfactual?



Choosing the benchmark for evaluation

Return to the previous path if that remained sustainable
or

Switch to a new one if the previous one is no longer sustainable

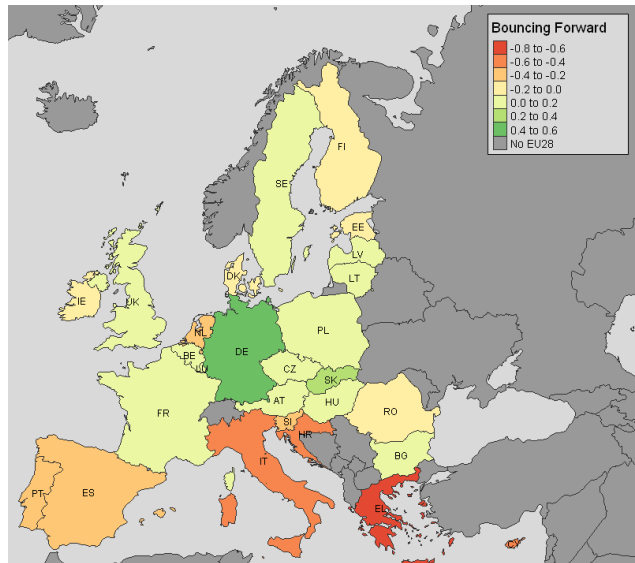
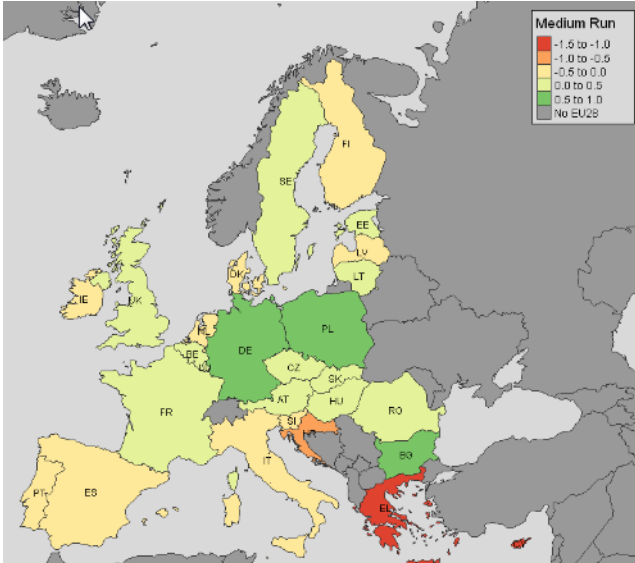
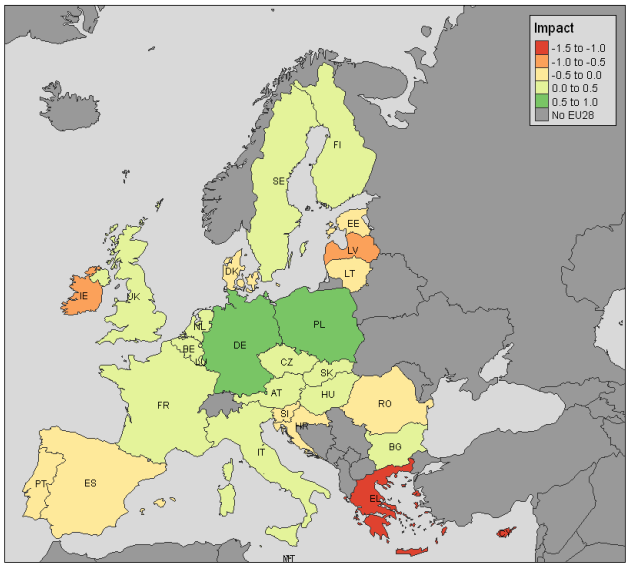


2.2: Constructing the resilience (composite) indicators from metrics: Impact

Country	ASSET						ENGINE														OUTCOME											Avg. score				
	DWELLINGS	EXP. EDUCATION	EXP. HEALTH	FAIRNESS	TRUST PEOPLE	INVESTMENT	SOCIAL ACTIVITY	GOV. DEFICIT	GOV. DEBT	HH LOANS	HOUSE PRICES	TRUST EP	TRUST LEGAL	INFLATION	ACTIVE LM	PASSIVE LM	LABOUR PROD.	CORP. LOANS	PRIVATE DEBT	EXP. R&D	STOCK PRICES	TEMPORARY WORK	WAGES	EMPLOYMENT	GDP	HAPPINESS	HEALTH	HH CONSUMPTION	INEQUALITY	NEET	SOCIAL EXCLUSION		HH INCOME	SATISFACTION	UNEMPLOYMENT	
PL	0.2	0.8	0.3	0.0	0.0	1.4	0.0	0.4	0.9	0.5	0.0	0.0	0.3	0.2	1.0	-2.1	1.1	1.4	-0.1	1.0	0.4	0.4	0.8	1.4	1.4	0.8	0.1	1.4	1.7	0.7	1.5	1.0	0.8	0.9	0.61	
DE	0.7	0.5	0.1	0.7	-0.2	0.9	1.0	0.5	0.7	1.6	1.2	0.6	0.0	0.5	-1.0	-1.4	0.1	0.7	0.9	0.7	0.7	0.6	0.5	1.2	0.3	1.1	1.5	0.7	0.7	1.4	0.5	0.8	0.8	1.2	0.61	
BE	1.0	0.6	0.3	-0.4	0.1	1.0	0.2	0.3	0.6	1.0	1.3	0.5	0.2	0.0	0.8	0.5	0.5	-0.1	-1.1	0.6	0.3	0.5	0.5	0.8	0.7	-0.1	0.0	0.8	0.6	0.8	0.5	0.7	0.1	0.9	0.45	
AT	0.7	0.6	0.3	0.3	0.1	0.9	-2.0	0.6	0.5	1.2	1.2	0.6	-0.1	0.7	0.6	0.2	0.6	0.8	0.6	0.6	0.1	0.3	0.4	1.1	0.6	1.1	-0.7	0.7	-0.3	1.0	-0.5	0.2	0.8	0.9	0.44	
BG		0.8	0.8	-0.2	-0.2	0.3	-0.6	0.2	0.9	0.1	-0.3	0.3	0.4	-1.5	-2.2	0.1	1.2	1.0	0.5	1.0	-0.9	0.5	1.3	-0.3	1.2	1.1	0.4	0.5	1.0	0.4	3.4	1.3	0.8	-0.1	0.41	
LU	0.9	0.8	0.1			1.1		0.5	0.7	-0.5	1.2			0.7	0.6	0.6	-1.7	0.5	2.7	-1.5	0.2	-0.5	0.0	0.8	0.2	0.9	-0.8	0.7	-0.5	1.1	-0.3		0.6	0.6	0.35	
SK	1.1	0.3	0.3	-0.1	0.3	0.5	0.7	0.3	0.4	0.8	0.4	-1.7	-1.0	0.0	0.4	1.5	0.7	0.1	0.1	0.6	0.2	-1.4	1.2	0.4	0.9	-1.4	2.0	1.1	-0.1	0.7	0.7	1.3	-1.4	0.5	0.30	
FR	0.7	0.2	0.0	0.4	0.2	0.9	0.4	0.5	0.0	0.8	0.9	0.1	0.2	0.6	0.5	0.2	0.4	0.7	-0.1	0.4	0.6	0.3	0.1	0.8	0.5	-0.6	-0.8	0.7	-0.9	0.6	0.4	0.6	-0.9	0.6	0.30	
SE	0.3	0.3	0.2	-0.1	-1.3	0.7	1.3	0.5	1.2	1.1	1.1	1.5	1.3	0.6	-0.2	-1.8	-0.4	0.6	-0.4	0.1	0.7	0.8	-0.7	0.5	0.1	0.3	0.5	0.7	-0.9	0.6	-0.3	0.4	0.2	0.6	0.29	
FI	0.4	0.6	0.1	0.9	1.1	0.5	0.0	-0.1	0.1	0.9	1.1	0.0	-0.6	0.4	0.6	0.0	-1.0	-0.1	-0.2	-1.6	0.3	0.9	0.3	0.5	-0.1	0.7	-0.7	0.5	0.9	0.0	0.4	0.7	0.5	0.6	0.25	
NL	0.0	0.6	0.2	1.0	0.6	0.5	1.0	0.3	0.3	0.0	0.1	-0.1	0.1	0.6	0.1	-0.5	0.1	0.0	0.4	0.0	0.4	-0.2	-0.3	0.4	0.6	0.0	0.0	0.3	1.2	0.6	0.3	-0.3	-0.5	0.5	0.25	
HU	-0.3	-2.8	-1.2	0.2	1.1	0.4	-0.6	1.2	0.8	-0.2	-0.5	0.9	1.6	3.1	0.8	-0.5	0.7	0.0	0.1	0.5	0.4	-1.0	0.7	0.4	0.1	0.9	2.5	-0.7	-0.7	-0.1	-0.9	-0.2	0.8	0.4	0.23	
MT	0.6	0.2	-0.8			0.4		1.0	1.1	1.0	1.0			0.7	-0.9	0.0	0.1	-0.8	0.1	-0.2	0.7	-0.2	-0.3	1.1	1.0	-0.6	-1.5	0.6	0.0	1.6	-0.6		-0.3	1.0	0.21	
CZ	0.3	0.6	0.4	-1.7	-1.6	0.8	-1.1	0.5	0.7	0.5	1.0	1.2	0.7	-0.8	0.6	0.4	0.1	-0.8	0.3	0.0	0.4	0.0	0.2	0.6	0.6	-1.5	-0.2	0.9	1.2	0.5	0.6	0.7	-0.2	0.7	0.19	
UK	-0.8	0.1	0.2	-0.2	0.2	0.3	-0.4	0.0	-0.6	0.0	0.3	0.6	0.5	0.1	0.8	0.2	0.1	-0.9	0.4	0.1	0.9	0.6	-1.4	0.6	0.2	0.7	-1.8	0.2	0.5	0.5	0.0	-0.6	0.8	0.6	0.09	
IT	0.8	-1.8	-0.2			-0.1		0.6	0.0	0.7	0.1			0.2	-0.2	0.4	0.0	0.1	0.3	0.3	0.1	0.2	0.2	0.3	-0.3	0.2	0.3	-0.2	0.3	-0.9	-0.5	-0.7	0.8	-0.1	0.03	
PT	-0.9	-1.4	-1.1	-0.4	0.5	-0.5	2.2	-0.1	-1.3	-0.6	0.5	-0.6	-0.4	-0.1	0.3	0.0	1.0	0.8	0.0	0.6	0.0	0.1	-1.0	-0.7	-0.1	1.1	0.3	-0.4	1.8	0.3	-0.1	-0.2	0.8	-0.3	0.00	
RO		-2.6	2.6			-0.1		0.1	0.3	-0.4	-2.1			-0.5	-2.4	-1.8	1.8	0.6	0.3	-1.7	-0.3	0.8	1.0	0.8	0.9	-1.2	0.4	0.2	0.9	-0.4	1.2	0.0	0.2	0.9	-0.01	
DK	-0.3	-0.1	0.4	0.5	0.1	0.4	0.1	-0.2	0.6	-0.6	-0.1	0.6	0.8	0.5	0.2	-1.1	0.1	-4.1	0.0	0.9	0.5	-1.1	0.8	0.1	0.2	0.3	-0.9	0.3	-1.5	0.5	0.1	0.7	0.0	0.4	-0.03	
SI	0.6	0.2	0.0	-0.7	-0.6	-0.6	0.7	-1.3	-1.2	0.4	-0.2	-1.1	-1.1	0.5	-0.6	-0.5	-1.3	0.3	0.2	1.5	-0.6	0.9	-0.4	-0.2	0.0	-0.3	0.5	0.4	-0.2	0.3	-0.3	-0.3	-0.9	0.1	-0.16	
HR		-0.5	0.2	2.6	1.5	0.0	-1.5	0.4	-0.7	0.2	-0.3	0.6	0.5	-0.5	-1.4	0.7	-1.3	0.0	0.0	-1.0	-0.1	-3.2	-0.6	-0.6	-0.6	0.5		-0.9	-0.2	-1.1		0.6	0.9	-0.3	-0.20	
ES		0.2	0.4	-0.4	0.6	-0.6	-0.1	-0.9	-1.4	-0.9	-1.0	-0.1	-0.2	0.4	-0.3	0.9	1.0	0.1	0.6	-0.3	0.5	1.7	0.1	-1.6	-0.2	-0.2	1.1	-0.8	-1.6	-1.0	-1.0	-0.6	-1.2	-2.2	-0.28	
EE	-0.2	0.1	0.7	0.1	0.4	-1.2	-1.0	0.4	1.1	-0.2	-1.5	0.7	0.6	-1.1	-0.9	2.0	-0.3	-1.0	-0.2	0.6	0.0	-0.2	1.6	-1.4	-1.9	-0.5	-0.2	-2.0	-0.9	-0.7	-0.5	0.1	-1.1	-1.2	-0.29	
LT	-0.4	1.4	0.6			-0.8		-0.1	0.3	-0.6	-0.9			-2.1	0.7	0.8	0.2	0.0	0.6	-0.9	0.0	1.2	-0.3	-1.0	-0.8	0.1	-1.3	-1.4	-1.8	-0.9	-0.8	-0.3	0.8	-1.4	-0.32	
IE	-2.2	0.7	0.7	-1.1	-0.7	-0.6	-1.2	-4.3	-2.7	-1.9	-1.7	-0.6	0.5		-0.3	0.9	1.3	0.2	-0.1	-2.9	0.8	-0.1	-0.1	0.8	-1.4	-0.2	0.5	-0.3	0.0	0.9	-1.7	-1.3	0.4	0.2	-0.8	-0.54
LV	-3.1	-0.2	-1.4			-1.6		-0.2	-0.3	-1.8	-1.5			-2.1	-1.2	0.5	-2.0	-0.1	-0.3	-2.9	0.3	-0.5	-0.6	-1.6	-2.1	-0.1	0.6	-2.2	-0.6	-0.8	-0.8	-1.1	0.8	-1.4	-0.97	
CY	0.5	0.1	-0.7	-2.3	-3.0	-1.8	0.8	-0.8	-0.9	-2.7	0.0	-2.5	-3.2	-0.7	1.8	-1.0	0.3	0.7	-2.6	0.2	-4.4	-1.7	-2.7	-1.3	0.0	-0.8	-0.4	0.2	-1.3	-2.2	-0.4	-2.2	-1.4	-1.2	-1.10	
EL	-0.7	-0.4	-3.4	1.0	0.7	-2.9	0.1	-0.2	-1.9	-0.5	-1.2	-1.5	-1.2	0.0	0.6	0.3	-2.4	-0.2	-0.2	-0.4	-1.5	0.3	-2.2	-2.0	-3.1	-3.2	-0.5	-2.4	0.0	-1.9	-1.5	-3.0	-3.2	-2.4	-1.21	

Medium-run and bounce forward available as supplementary slides

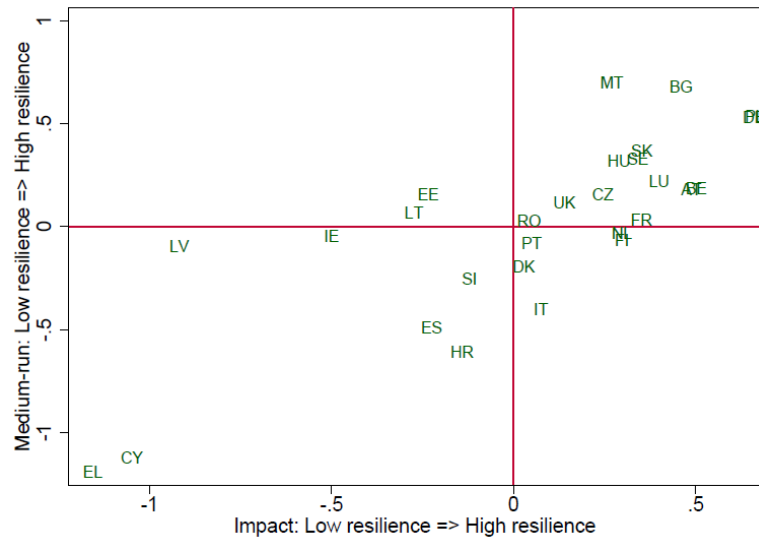
Visualizing the three main resilience indicators



IMPACT

MEDIUM RUN

BOUNCE FORWARD



Good absorption does not necessarily imply good adaptation and vice-versa

Measurement strategy: a three-step-approach towards a dashboard



System variables



Indicators of resilience



Resilience characteristics

Step 3: Characteristics of resilience

Resilience characteristics are features of countries that influence their resilience.

They cover broad aspects of the society, institutions and policies.

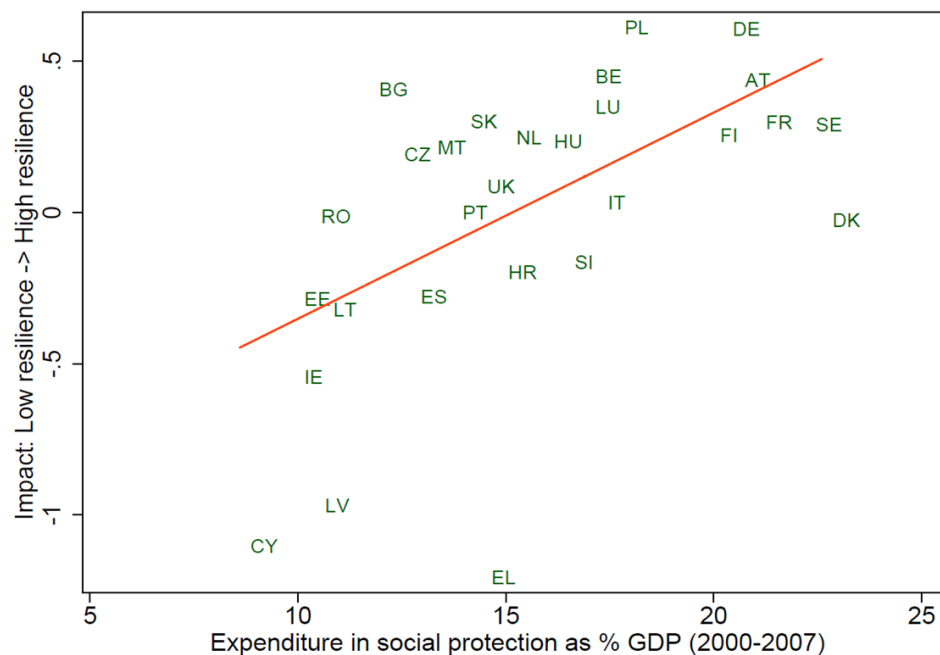
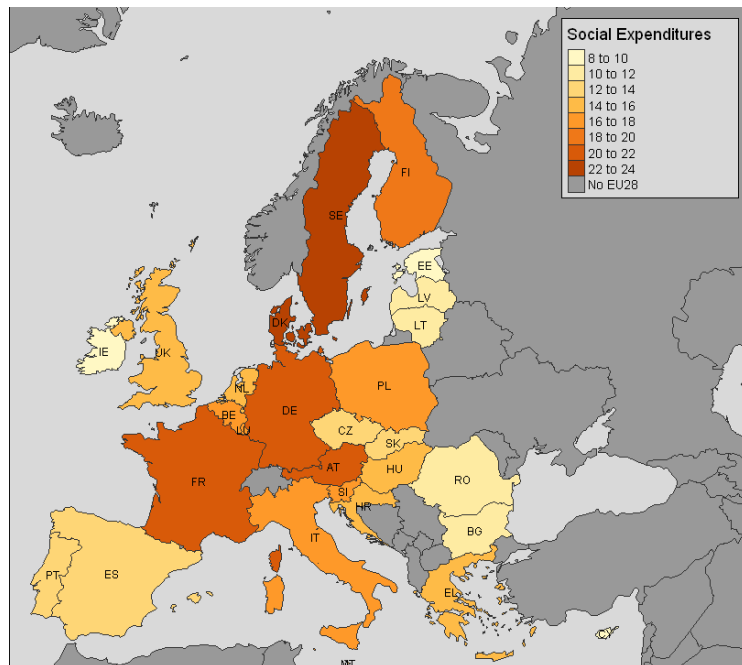
Pre-determined, multi-year averages, that can be monitored continuously, even in the absence of a shock.

Over 200 tested, mostly from the WEF Competitiveness Index

Broad aggregation	Example of variables
Government expenses	<ul style="list-style-type: none">- Social expenditure- Expenditure on education- R&D expenditure- Exp. on labour market programmes
Education	<ul style="list-style-type: none">- PISA results- Population with tertiary education
Quality of Government	<ul style="list-style-type: none">- Ease of doing business- Government effectiveness- Political stability- Regulatory quality- Rule of law- Trade openness- Voice and accountability
Digital development	<ul style="list-style-type: none">- Connectivity- Digital skills- Integration of digital technology
Health status	<ul style="list-style-type: none">- Chronic illness- Fertility rate
Innovation and R&D	<ul style="list-style-type: none">- Eco-innovation index
Economic performance	<ul style="list-style-type: none">- GDP growth- Investment share- Government indebtedness
Gender equality	<ul style="list-style-type: none">- Gender equality index
Labour market	<ul style="list-style-type: none">- Employment rate- Unemployment rate- Share of routine
Social cohesion	<ul style="list-style-type: none">- Trust towards institutions- Trust towards your neighbour- Perception of fairness- Poverty

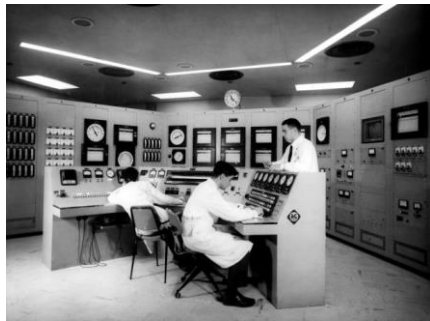
Characteristics for the three resilience indicators

Expenditures in social protection as prime resilience characteristic



A purely illustrative dashboard

	IMPACT										MEDIUM RUN							BOUNCING FORWARD					
	Expenditure in social protection			Gender Equality Index			Non routine manual workers				Political stability			Openess to trade				Ease of doing business			Voince and accountability		
	2000-2007	2013-2015	Change	2005	2015	Change	2000-2007	2014-2016	Change		2008-2010	2013-2015	Change	2008-2010	2014-2016	Change		2010	2017	Change	2008-2010	2013-2015	Change
A	16.9	18.9	2.0	64.4	69.0	4.59	21.3	19.0	-2.334	A	1.5	1.4	-0.090	318.6	400.0	81.399	A	65.7	68.8	3.140	1.5	1.6	0.013
B	13.7	18.8	5.1	49.9	56.0	6.15	29.6	29.8	0.187	B	0.8	0.8	-0.007	66.8	79.7	12.926	B	70.3	77.4	7.130	1.1	1.1	-0.045
C	8.6	12.0	3.4	45.9	55.1	9.15	33.2	35.5	2.316	C	0.5	0.5	0.062	107.8	127.5	19.653	C	66.6	72.7	6.100	1.1	1.0	-0.045
D	17.2	21.3	4.1	49.2	62.1	12.90	23.1	29.2	6.098	D	0.4	0.4	-0.012	50.9	56.3	5.427	D	66.1	72.3	6.130	1.0	1.0	-0.016
E	15.0	16.8	1.8	67.8	72.9	5.07	22.1	28.4	6.310	E	0.9	1.0	0.132	129.7	154.8	25.097	E	75.2	76.4	1.180	1.5	1.6	0.075
F	16.4	18.0	1.6	60.8	68.4	7.64	18.8	21.9	3.060	F	1.0	0.9	-0.039	124.6	145.3	20.625	F	62.8	76.1	13.390	1.0	1.0	-0.072
G	15.9	15.6	-0.2	49.5	50.8	1.38	22.9	26.5	3.583	G	0.6	0.7	0.095	153.8	169.8	16.047	G	65.4	73.1	7.680	0.9	0.6	-0.324
H	12.3	13.1	0.8	53.6	53.6	0.05	18.4	20.9	2.457	H	0.9	1.0	0.043	122.2	155.5	33.226	H	63.2	76.7	13.520	1.0	1.0	-0.005
I	22.6	24.0	1.4	74.6	76.8	2.21	27.5	31.7	4.249	I	1.0	0.9	-0.091	96.2	101.7	5.479	I	84.2	84.9	0.630	1.6	1.6	0.020
J	10.6	11.3	0.7	55.8	56.8	1.01	26.0	23.7	-2.242	J	0.7	0.8	0.123	121.3	153.3	31.974	J	73.4	80.6	7.260	0.9	1.0	0.085
K	17.6	16.1	-1.5	52.4	56.8	4.41	22.8	22.6	-0.214	K	0.9	0.9	-0.021	79.4	96.7	17.355	K	63.0	77.8	14.850	1.0	1.0	0.056
L	10.3	11.5	1.2	49.9	52.4	2.55	24.8	30.3	5.480	L	0.3	0.1	-0.119	66.3	83.1	16.722	L	64.1	74.3	10.200	0.5	0.4	-0.084
M	13.9	15.1	1.2	52.5	52.4	-0.18	23.4	27.5	4.098	M	1.0	1.0	0.035	151.2	183.5	32.203	M	68.7	75.6	6.880	0.9	1.0	0.067
N	10.4	11.5	1.2	53.4	57.9	4.42	28.8	28.3	-0.502	N	0.4	0.5	0.159	95.9	121.0	25.106	N	73.4	78.8	5.420	0.8	0.8	0.011
O	20.5	21.6	1.1	59.5	63.3	3.84	24.9	26.8	1.944	O	1.2	1.3	0.057	96.1	102.3	6.225	O	76.4	78.9	2.560	1.4	1.4	0.002
P	9.9	12.3	2.4	52.2	56.7	4.52	23.6	21.5	-2.195	P	0.6	0.7	0.149	132.7	156.5	23.885	P	76.0	81.1	5.080	1.1	1.1	0.063
Q	12.7	17.6	4.9	62.2	68.3	6.18	30.7	36.3	5.553	Q	-0.4	0.2	0.579	51.5	63.2	11.628	Q	68.2	75.7	7.550	1.2	1.0	-0.163
R	14.4	20.1	5.7	46.8	50.0	3.12	23.3	34.3	10.951	R	0.0	-0.2	-0.147	53.3	64.1	10.760	R	62.4	68.7	6.230	0.9	0.6	-0.274
S	11.7	13.4	1.7	56.0	58.0	1.96	27.8	32.4	4.586	S	0.3	0.1	-0.252	107.0	127.6	20.562	S	68.3	73.5	5.260	0.5	0.4	-0.193
T	20.2	18.9	-1.3	60.0	65.5	5.43	20.1	22.4	2.207	T	0.8	0.9	0.008	77.0	84.8	7.865	T	79.5	79.9	0.380	1.3	1.4	0.100



It offers entry points for monitoring resilience and for policy interventions.

But would be important to extend to multiple „big decline episodes“

From countries to regions (NUTS2)

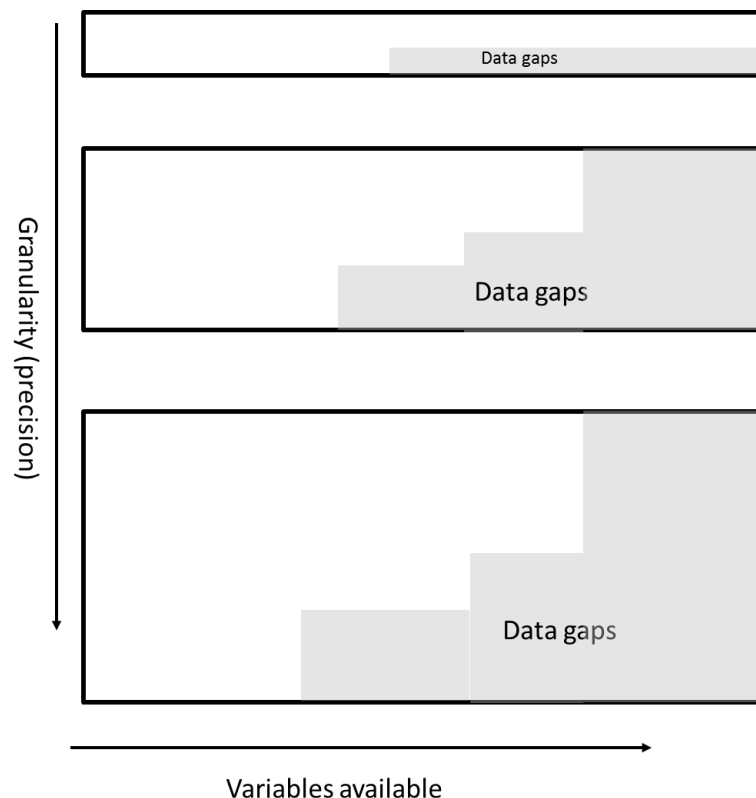
On the data collection effort

- Official data sources
- Time series coverage (points before, during, after and well after the crisis) – in at least 60% of the units
- A bit less demanding for characteristics

NUTS0

NUTS1

NUTS2



- Variables has been selected according to their dynamic response to the

We check if the pre-crisis linear trend was broken in at least 50 (or 40) % of the NUTS1 regions

System variables obtained

Country-level analysis – 34 system variables

- Investment
- Government deficit
- Government debt
- Household loans
- Household consumption
- House prices
- Dwellings
- Inflation
- Corporate loans
- Private debt
- Stock prices
- Expenditures on education
- Expenditures on health
- Expend. on active/passive LMP
- Social exclusion
- Happiness

- Fairness
- Labor productivity
- Expenditures on R&D
- Social activity
- Wages
- Employment rate
- Permanent/temporary employment
- GDP
- Health
- Household income
- Trust in people
- Trust in European Parliament
- Trust in legal system
- Income inequality
- Life satisfaction
- Youth inactivity (NEET)
- Unemployment rate

- Educated labour
- Education level
- Female employment
- Long-term unemployment
- Migration rate
- Stress disease
- Suicide

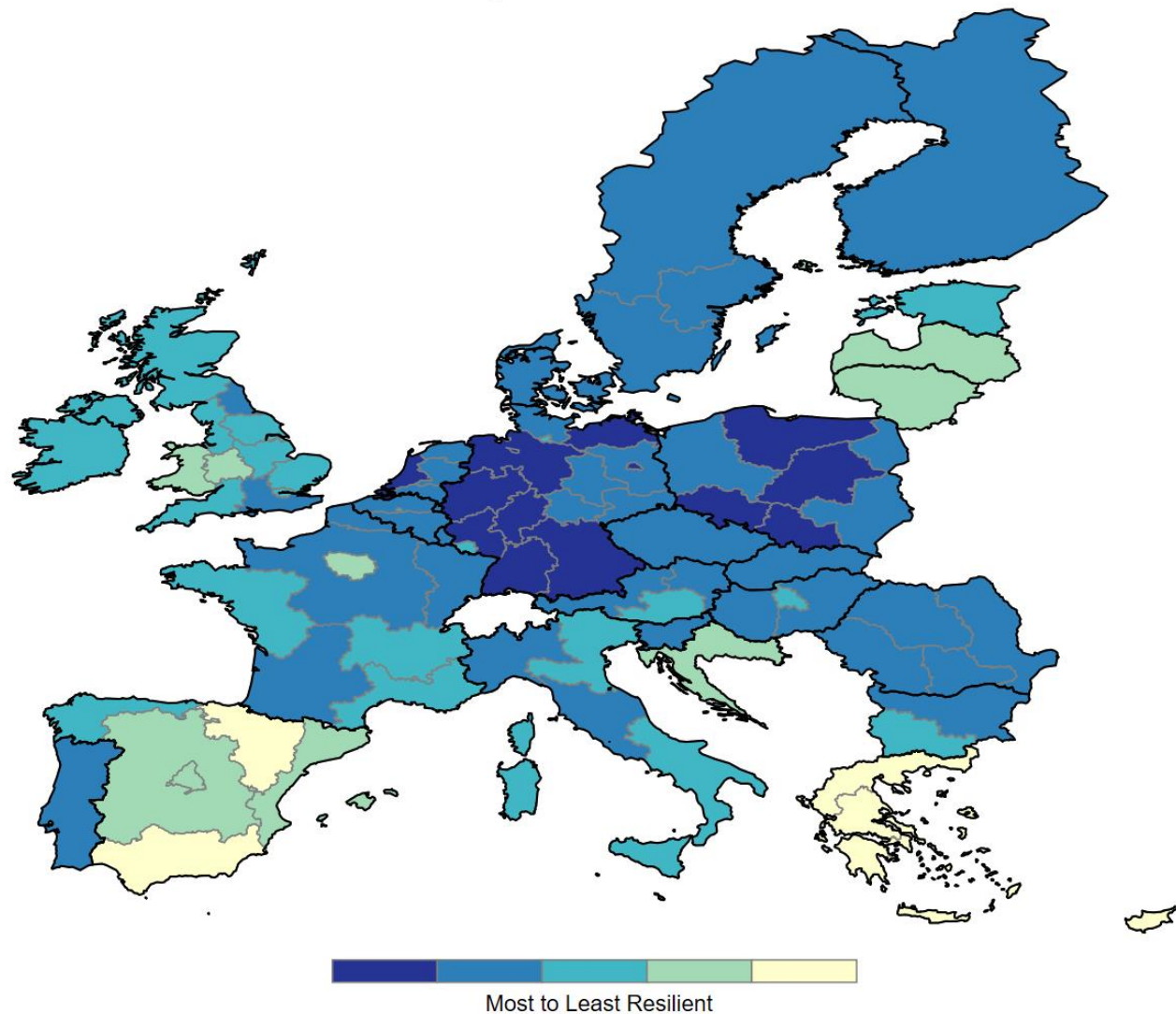
Regional analysis – 24 system variables

System variables obtained

Variable	source	NUTS2	NUTS1 regions available	flatness at NUTS1	NUTS2 available regions (without imputation)		Variable	source	NUTS2	NUTS1 regions available	flatness at NUTS1	NUTS2 available regions (without imputation)
educated_labour	Eurostat (28/03/2018)	1	100%	86%	95%		wages	Eurostat (07/08/2018)	1	82%	87%	93%
education_level	Eurostat (26/04/2018)	1	99%	73%	97%		employment	Eurostat (06/03/2018)	1	100%	84%	95%
fairness	ESS	0	72%	38%	41%		gdp	Eurostat (08/08/2018)	1	100%	97%	97%
migration_rate	Eurostat (01/03/2018)	1	100%	72%	96%		health	SILC/ GSOEP(for DE)/ BHPS (for UK)	1	66%	73%	26%
trust_people	ESS	1	72%	40%	41%		hh_income	Eurostat (15/03/2018)	1	98%	84%	97%
female_employment	Eurostat (06/03/2018)	1	100%	82%	95%		inequality_s80s20	SILC/ GSOEP(for DE)/ BHPS (for UK)	1	66%	46%	26%
lprod	eurostat elaboration (08/08/2018)	1	91%	92%	93%		lifesat	ESS	0	72%	62%	41%
permanent	LFS	1	95%	62%	65%		neet	Eurostat (21/12/2017)	1	99%	84%	95%
rd_gdp	Eurostat (27/02/2018)	1	63%	82%	89%		stress_disease	Eurostat (26/09/2016// 01/03/2018)	1	100%	62%	91%
social_weekly	ESS	0	72%	56%	41%		suicide	Eurostat (26/09/2016// 01/03/2018)	1	100%	56%	91%
trust_ep	ESS	1	72%	41%	41%		unemployed_12m	Eurostat (07/08/2018)	1	99%	72%	90%
trust_legal	ESS	1	72%	50%	41%		unemployment	Eurostat (07/08/2018)	1	99%	91%	95%

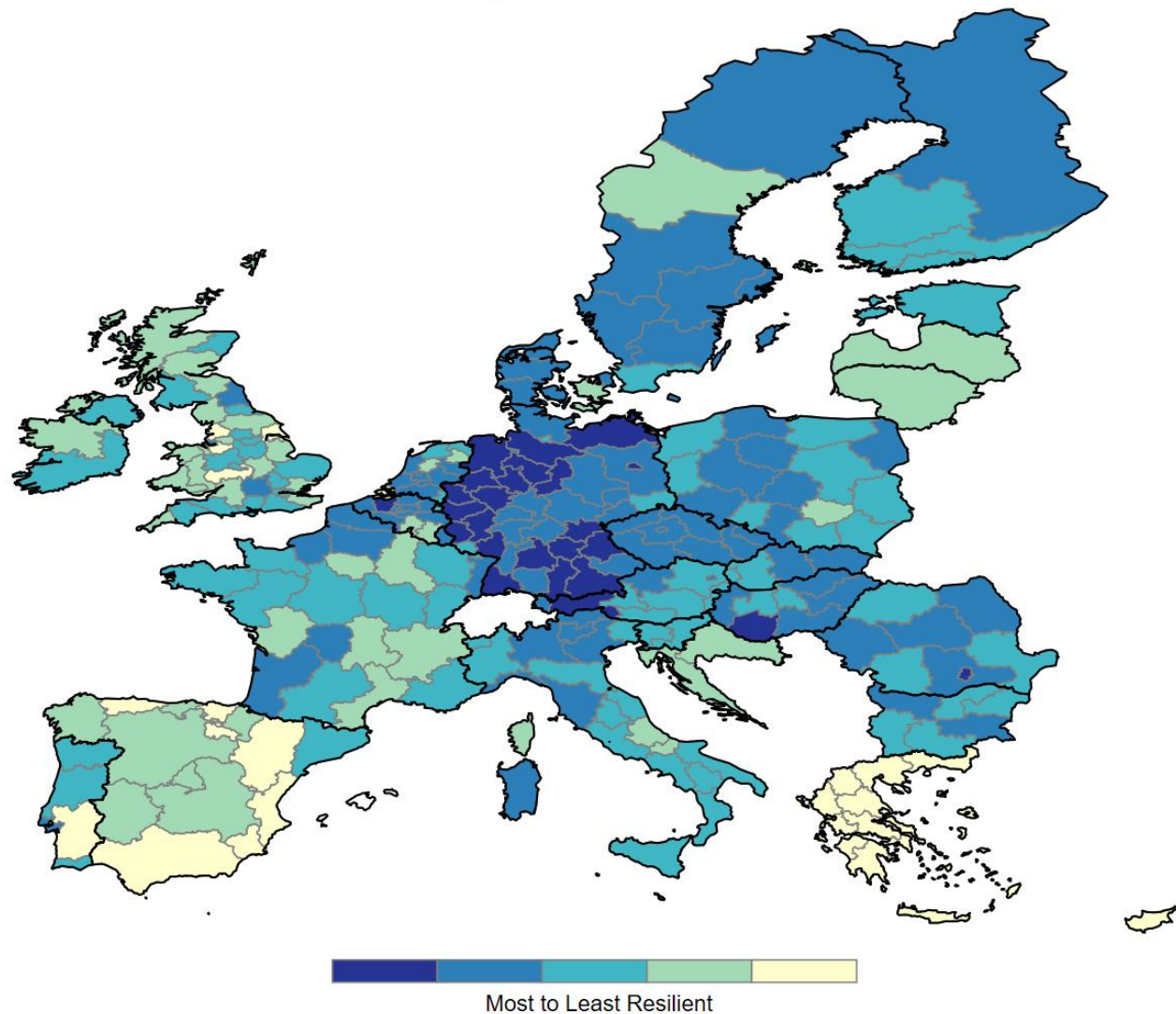
Indicator maps: impact

Impact - NUTS1



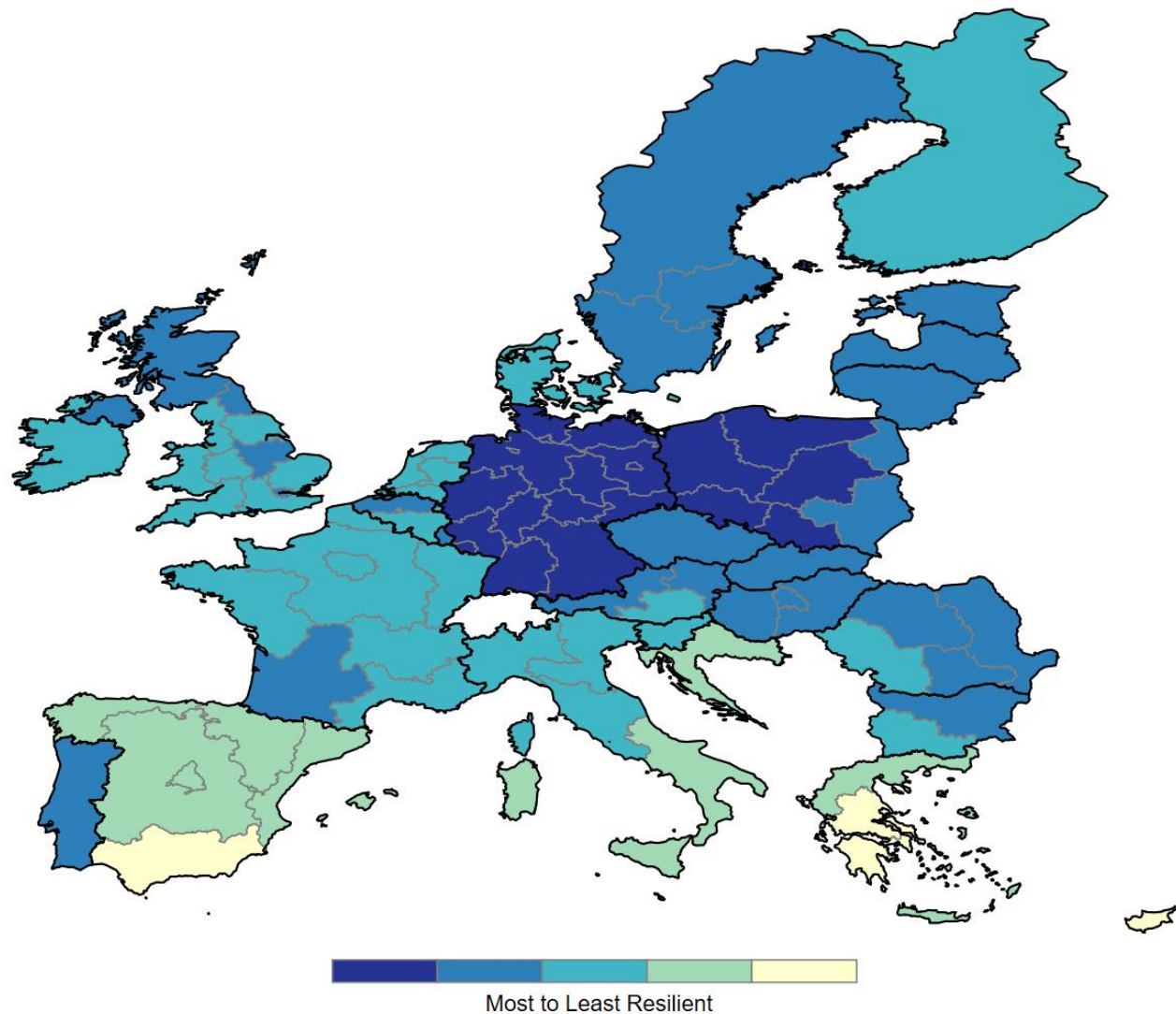
Indicator maps: impact

Impact - NUTS2



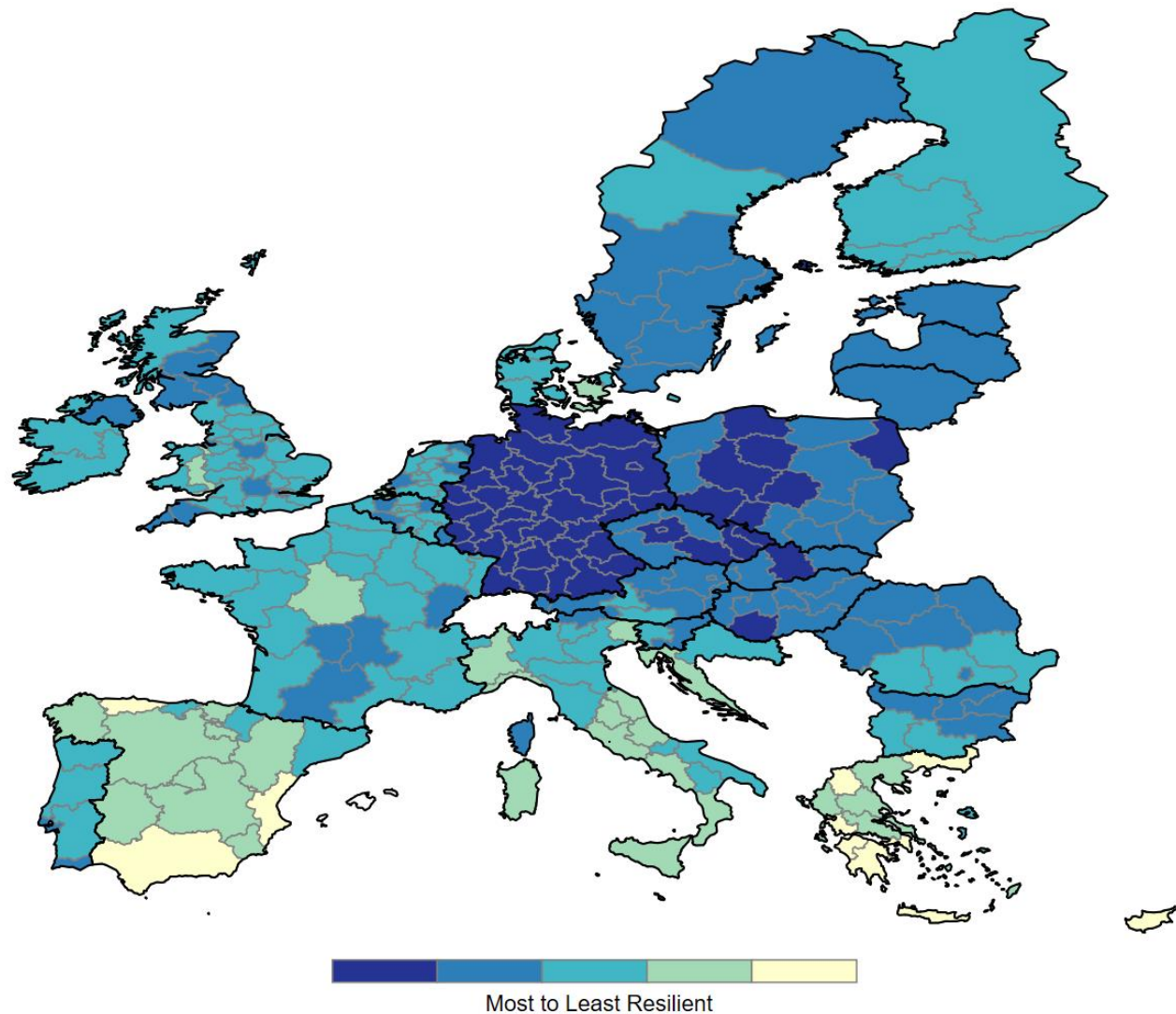
The medium-run

Medium Run - NUTS1



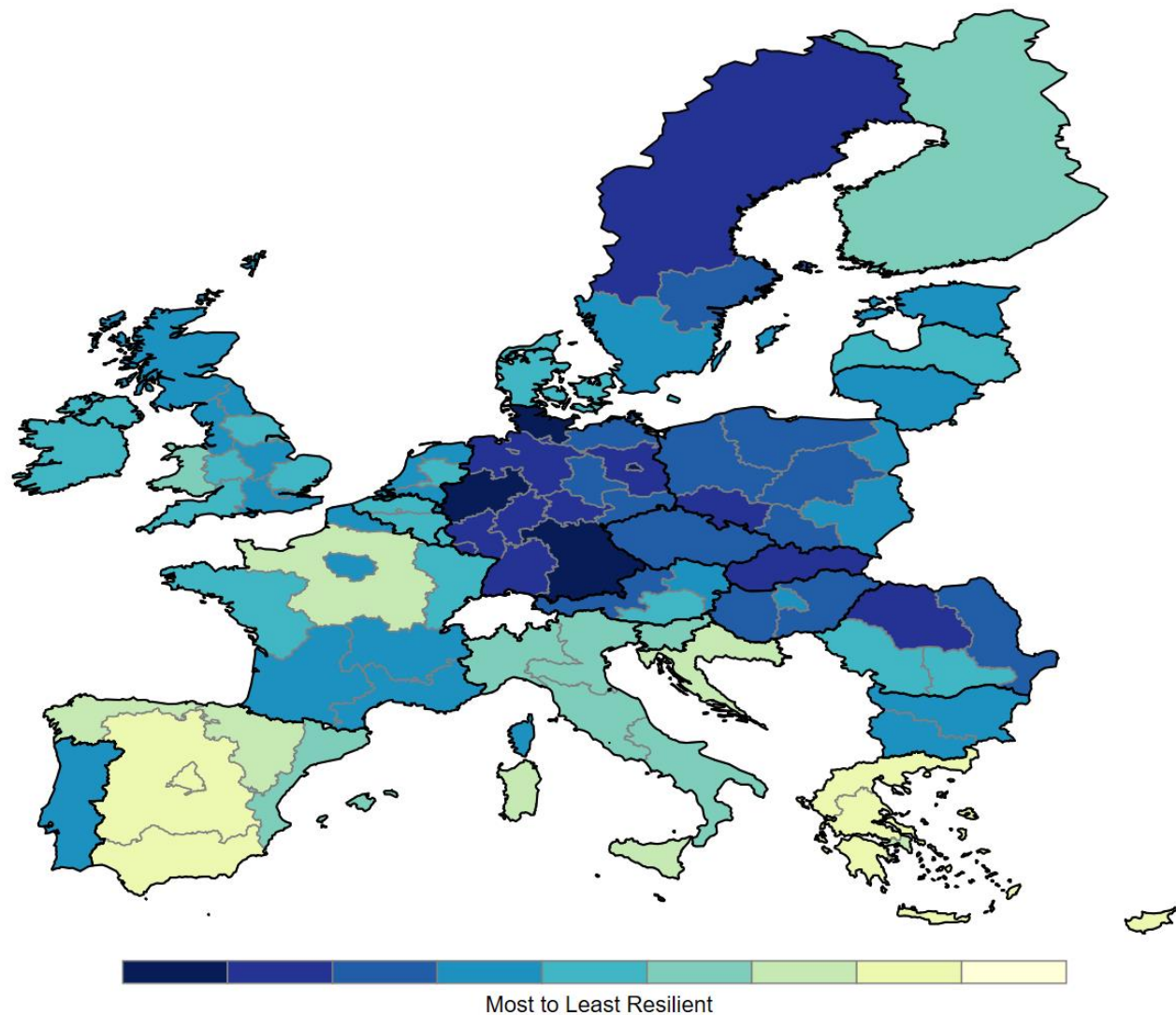
The medium-run

Medium Run - NUTS2



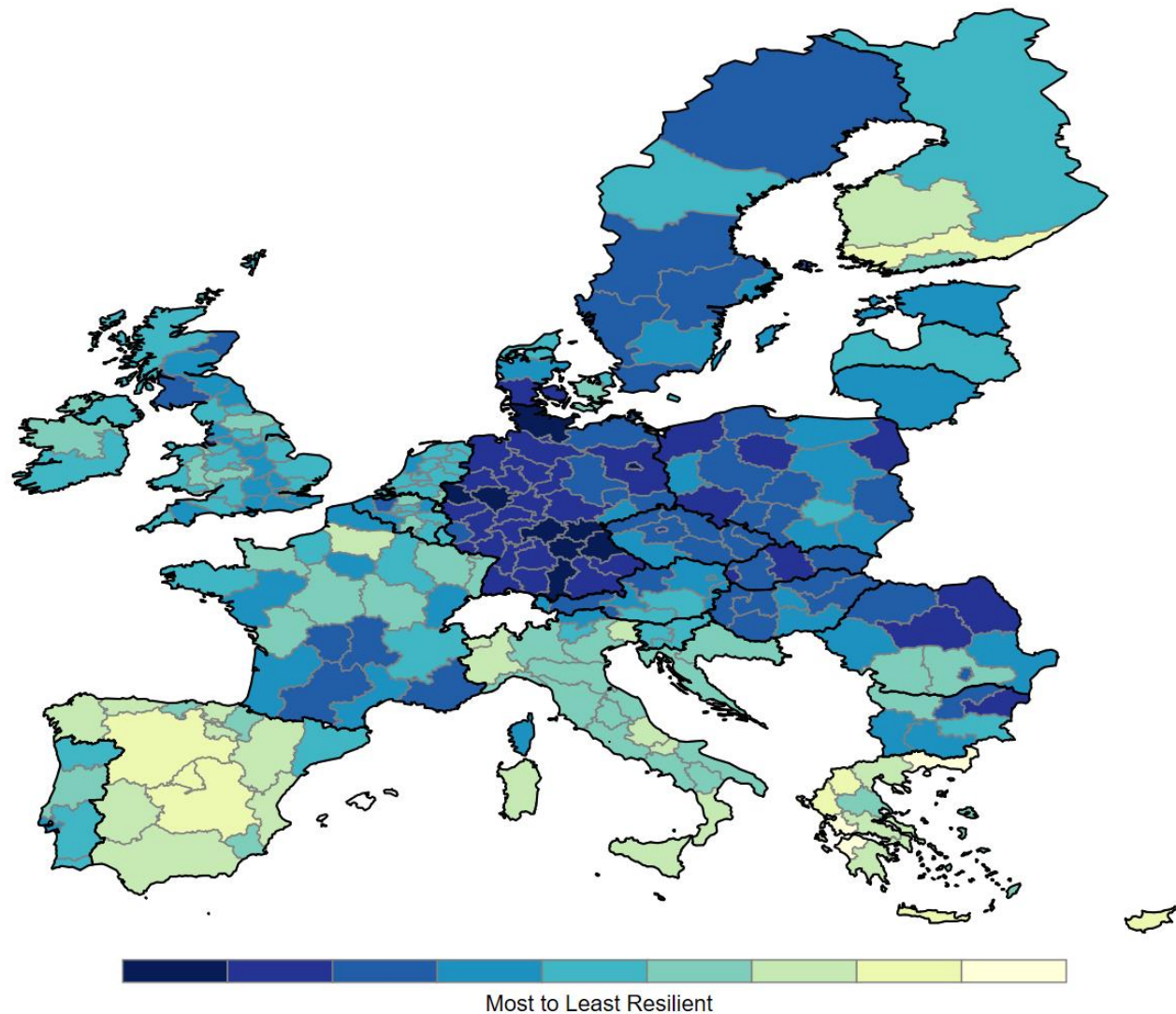
Bouncing forward

Bounce Forward - NUTS1

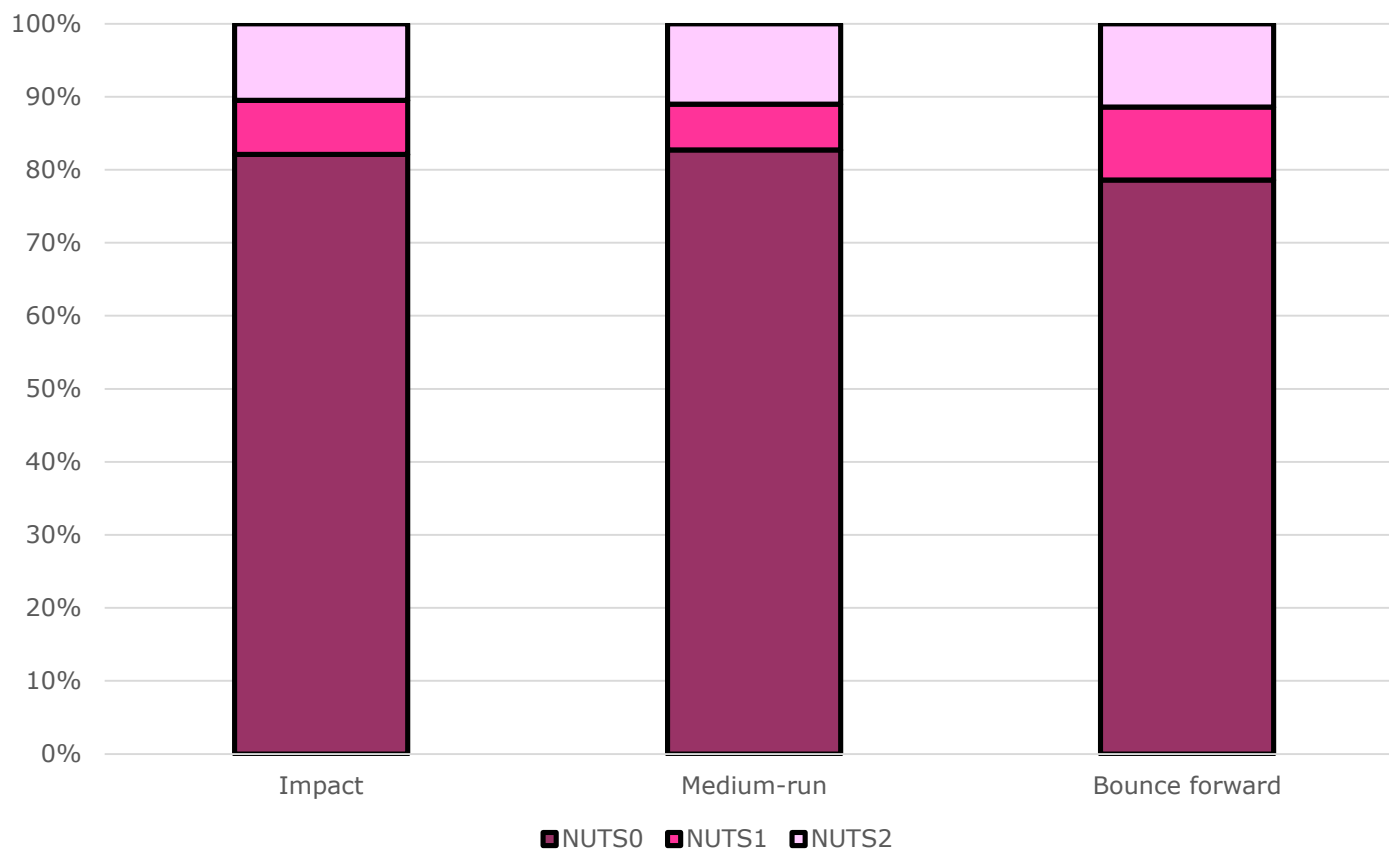


Bouncing forward

Bounce Forward - NUTS2

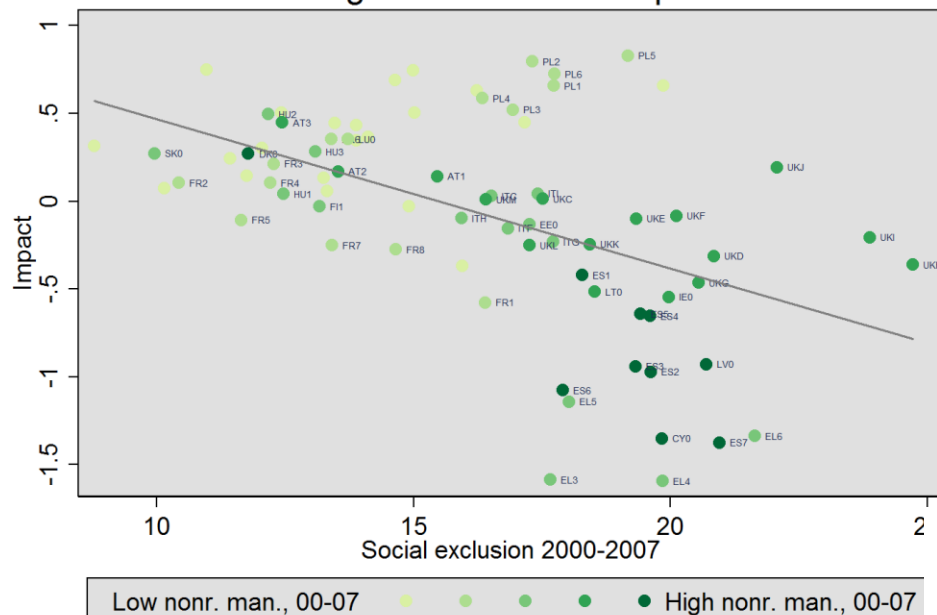


Variance decomposition: NUTS0, 1 and 2

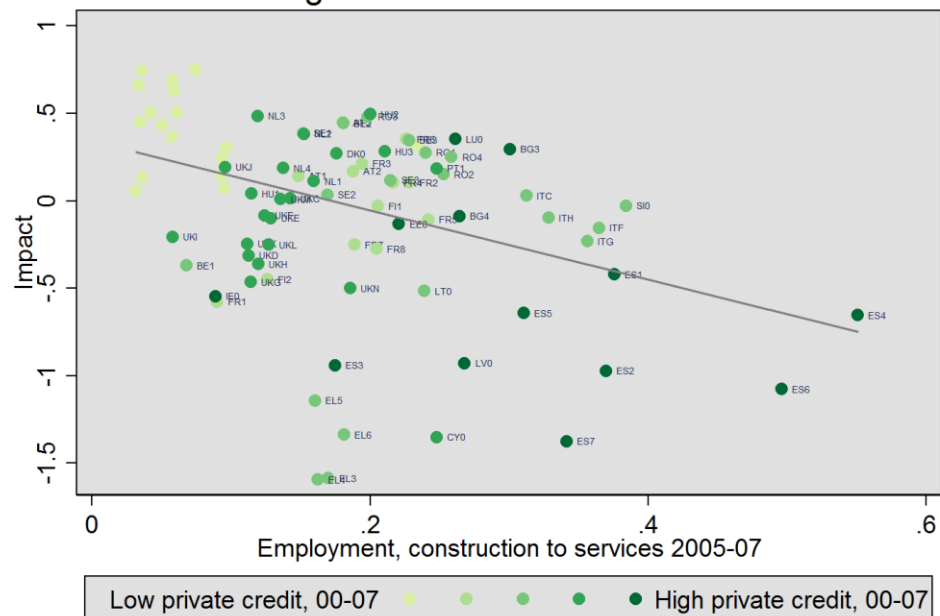


Some indicative regression results at NUTS1 level

Regional resilience: impact

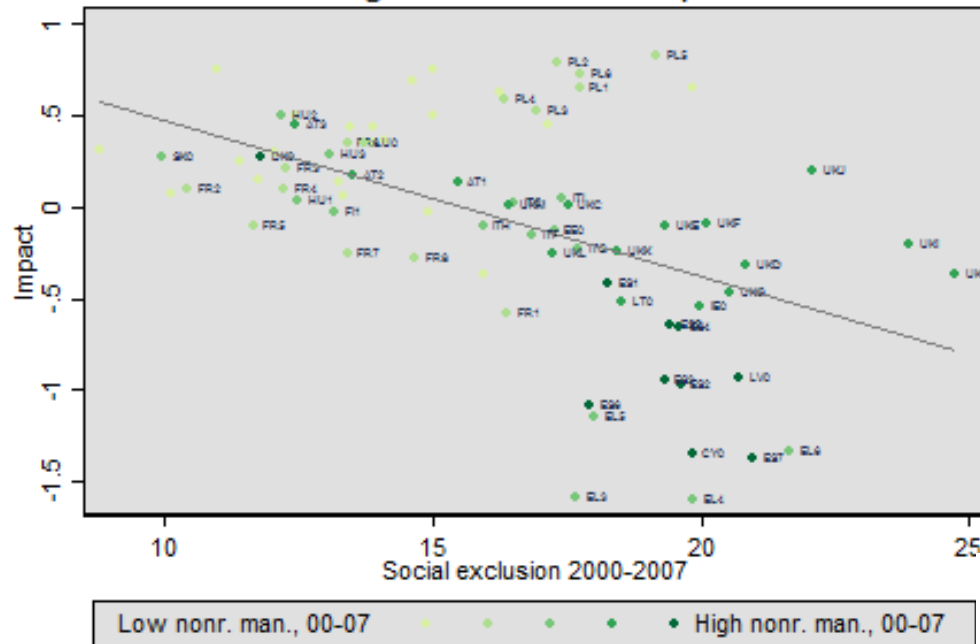


Regional resilience: medium run

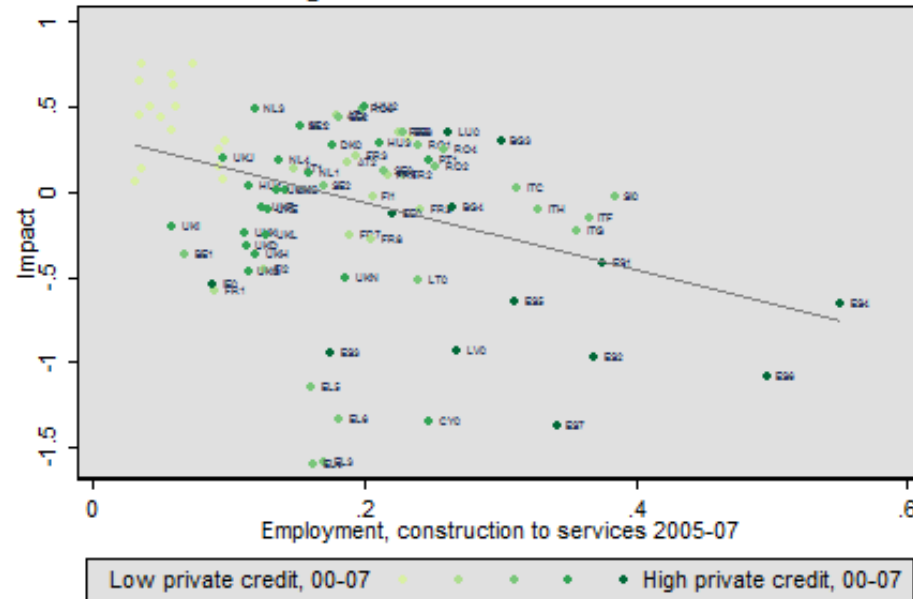


Some indicative regression results at NUTS2 level

Regional resilience: impact



Regional resilience: medium run



Takeaway messages

- Resilience as a general and normative concept
- Perceived versus revealed resilience indicators
- Using characteristics for monitoring
- Implementing the system view at sub-national level

Thank you and stay tuned for our forthcoming Resilience Report



EU Science Hub: [*ec.europa.eu/jrc*](https://ec.europa.eu/jrc)



Twitter: [*@EU_ScienceHub*](https://twitter.com/EU_ScienceHub)



Facebook: [*EU Science Hub - Joint Research Centre*](https://www.facebook.com/EU_Science_Hub_-_Joint_Research_Centre)



LinkedIn: [*Joint Research Centre*](https://www.linkedin.com/company/joint-research-centre)

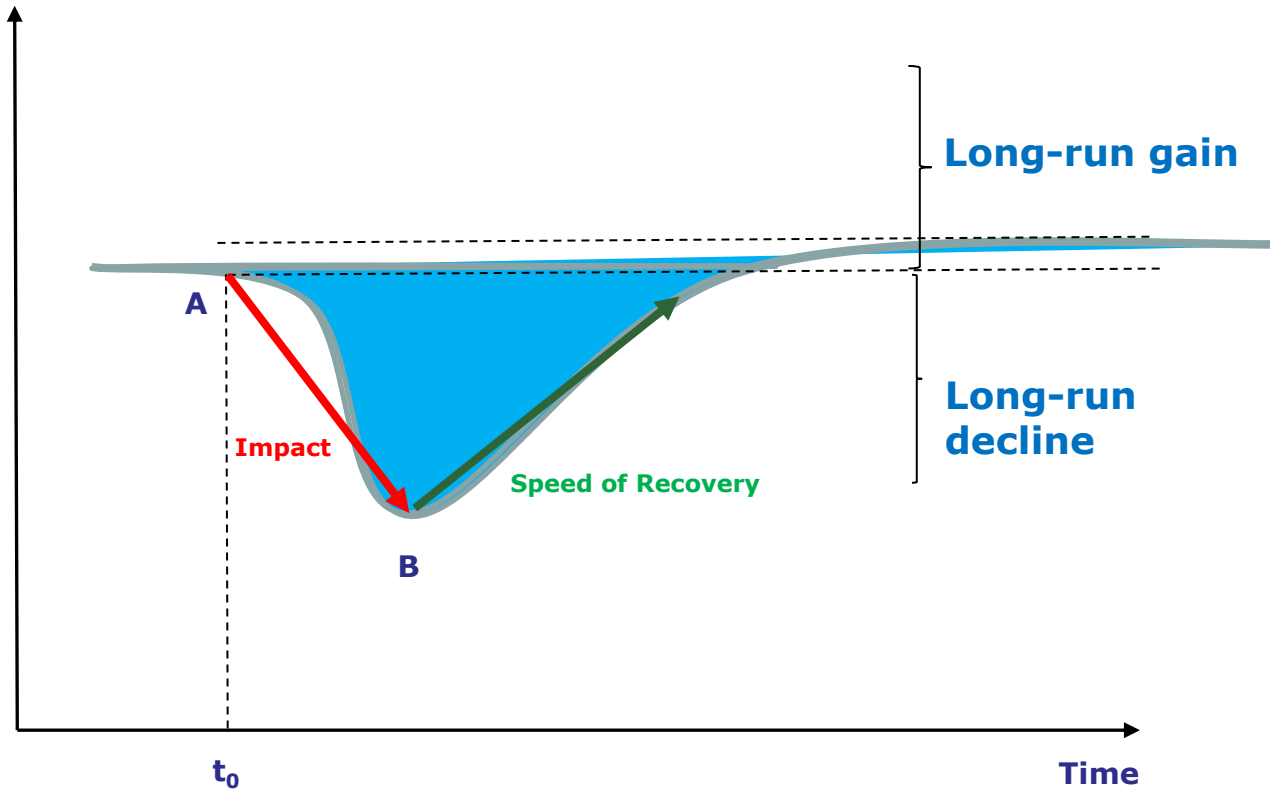


YouTube: [*EU Science Hub*](https://www.youtube.com/EU_Science_Hub)

Supplementary slides

A model based alternative for resilience metrics

Impulse
response from
the model



Impact
Absorption

**Speed of
Recovery**
Absorption/
Adaptation

Welfare loss

Long-run
Adaptation/
Transformation

A subjective (direct) approach to resilience indicators

Use a direct, subjective measure of resilience:

- Using surveys for individual resilience
- Using expert opinions for countries, cities

Impact
Absorption

Recovery
Absorption/
Adaptation

Medium-Run
Adaptation

Bounce-Forward
Adaptation/
Transformation

2.2: Constructing the resilience (composite) indicators from metrics: Medium run

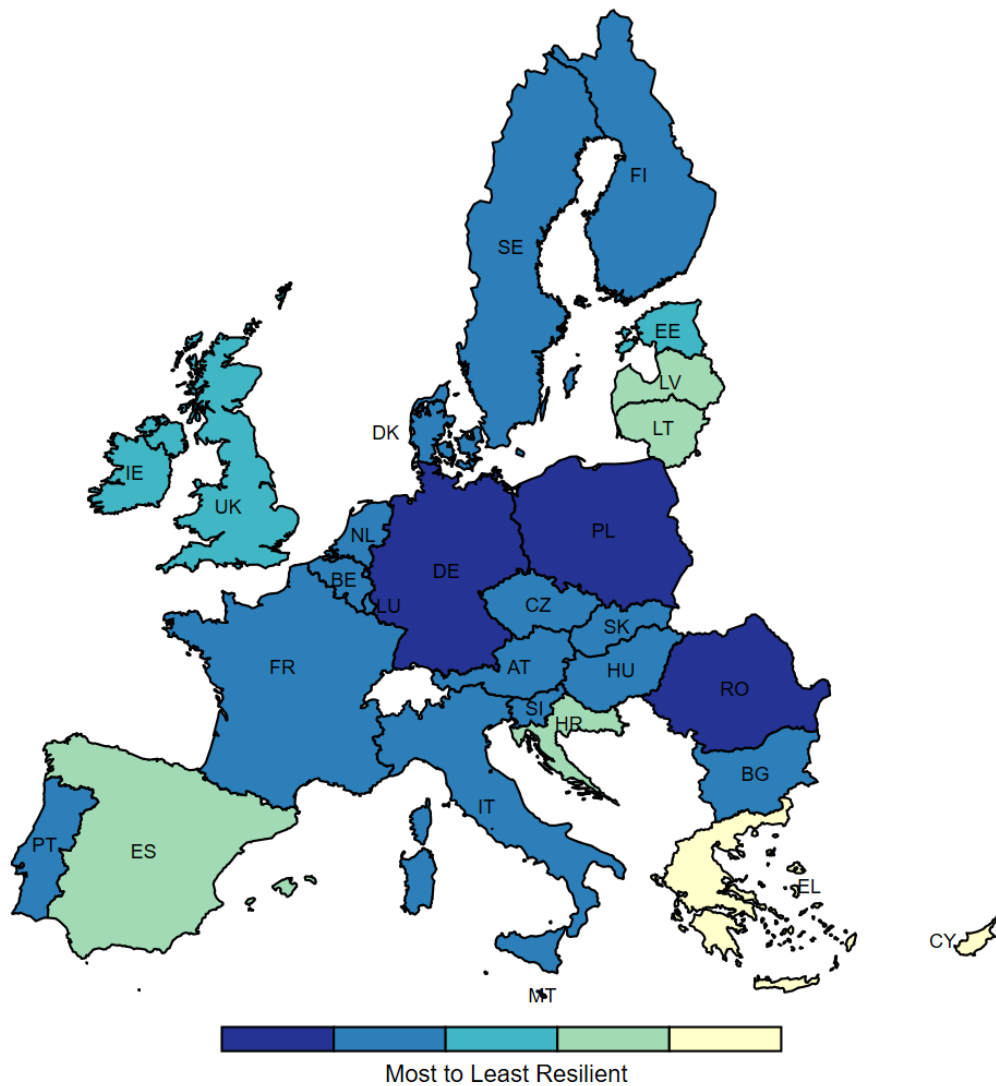
Country	ASSET						ENGINE														OUTCOME											Avg. score			
	Dwellings	Exp. Education	Exp. Health	Fairness	Trust People	Investment	Social Activity	Gov. Deficit	Gov. Debt	HH Loans	House Prices	Trust EP	Trust Legal	Inflation	Active LM	Passive LM	Labour Prod.	Corp. Loans	Private Debt	Exp. R&D	Stock Prices	Temporary Work	Wages	Employment	GDP	Happiness	Health	HH Consumption	Inequality	NEET	Social Exclusion		HH Income	Satisfaction	Unemployment
MT	0.2	1.4	0.3			1.4		1.3	1.5	0.8	0.9			0.2	0.8	-0.4	0.3	3.3	0.6	0.8	0.4	-0.4	-0.3	2.3	1.9	0.2	-0.9	1.2	-0.3	1.7	-0.6		0.0	0.9	0.70
BG		1.5	1.8	-0.7	-0.5	-0.2	-0.8	-0.1	0.7	-0.1	-0.4	0.1	0.0	1.2	-1.1	1.6	1.2	-0.2	0.6	2.0	-0.7	0.8	2.9	-0.2	0.6	2.4	0.6	0.6	0.4	0.8	3.5	1.7	1.9	0.3	0.68
PL	0.4	0.8	0.7	-0.5	-0.3	1.0	0.0	0.1	0.8	0.2	-0.3	-0.2	0.0	-0.6	0.4	-1.6	1.3	0.4	-0.6	2.3	0.4	0.3	1.0	1.4	1.6	0.3	0.0	2.1	1.5	0.5	1.9	1.4	0.2	1.3	0.54
DE	0.7	0.5	0.3	1.0	1.0	0.7	0.7	0.4	1.1	1.9	1.2	0.8	0.2	-0.5	-1.6	-1.4	-0.3	0.8	0.6	0.2	0.8	0.7	0.0	1.2	0.2	0.6	0.8	0.4	0.8	1.4	0.0	0.6	0.5	1.5	0.53
SK	0.8	1.6	0.8	-0.4	0.3	0.3	1.2	0.3	0.3	0.8	0.4	-1.6	-1.2	-1.0	0.4	0.1	0.7	1.5	-0.4	2.1	0.1	-1.4	1.0	0.5	1.0	-1.3	2.6	0.5	0.6	0.5	0.5	1.3	-1.2	0.9	0.36
SE	1.5	0.2	0.2	1.2	-0.4	0.9	1.4	-0.6	1.2	1.4	2.1	1.1	0.9	-0.1	0.1	-1.3	-0.4	-0.1	-0.3	-0.3	0.8	0.6	-0.6	0.2	0.5	0.2	0.3	1.1	-1.1	0.9	-0.5	0.1	-0.1	0.3	0.33
HU	-0.9	-1.4	-1.3	-0.3	0.7	-0.2	-0.8	1.3	0.9	0.1	0.1	2.1	1.3	2.2	1.7	-1.0	0.3	-0.8	0.7	0.3	0.7	-0.6	0.2	1.9	-0.1	0.4	1.9	-0.6	-1.2	0.6	0.1	-0.4	1.7	1.0	0.31
LU	1.5	1.7	0.4			1.1		-0.7	0.7	-0.9	1.5			-0.5	0.5	0.4	-1.2	-0.2	2.0	-1.1	0.1	-0.3	-0.4	0.2	0.9	0.6	-1.0	1.0	-0.3	0.6	-0.6		0.1	0.0	0.22
BE	1.1	1.0	0.7	-0.8	-0.2	0.6	0.4	-0.7	0.4	1.0	0.8	0.3	0.4	0.1	0.1	-0.5	-0.6	0.6	-1.3	0.6	0.3	0.2	-0.3	-0.1	0.0	-0.3	-0.1	0.4	0.9	1.0	0.0	0.1	-0.4	0.4	0.18
AT	1.0	0.4	0.0	-0.3	-0.2	0.6	-2.1	0.2	0.4	1.2	1.7	0.3	-0.4	-0.2	0.1	-0.2	-0.4	0.3	0.1	0.4	-0.1	0.0	0.2	0.4	0.0	2.0	-0.7	0.0	0.0	0.3	-0.4	-0.5	2.0	0.2	0.18
CZ	-0.2	0.4	0.4	-1.9	-1.6	0.4	-1.3	0.7	0.9	0.6	0.8	1.1	1.3	-0.1	1.1	-0.2	-0.1	0.5	-0.2	0.5	-0.2	-0.2	0.0	1.0	0.3	-1.4	-0.2	0.7	0.6	0.4	0.2	0.7	-0.6	0.8	0.16
EE	-0.3	-0.5	0.6	0.0	0.3	-0.8	-1.1	-0.6	1.0	0.3	-0.4	0.4	0.4	1.8	1.0	2.8	0.1	0.6	0.4	-0.1	0.9	-0.1	1.2	-0.1	-0.6	-0.1	-0.6	-0.5	-0.8	0.3	-0.5	0.4	-0.2	0.0	0.15
UK	-0.4	-0.5	0.4	1.0	0.3	0.4	-0.6	0.1	-0.9	0.3	0.4	0.6	1.3	-0.3	1.0	0.5	-0.8	-0.4	0.5	-0.3	0.6	0.4	-1.1	0.4	0.1	0.5	-1.8	0.2	0.8	0.9	-0.3	-0.8	0.6	0.6	0.12
LT	-0.3	0.6	0.2			-0.2		0.6	0.2	-0.5	-0.8			1.3	-0.1	0.7	0.6	0.0	0.8	-0.8	0.6	1.2	0.7	0.5	0.1	-0.1	-1.5	0.2	-2.2	-0.6	-0.2	0.8	0.5	-0.3	0.07
FR	0.8	-0.1	0.0	1.1	1.1	0.4	0.6	-0.1	-0.2	0.8	0.3	-0.1	0.5	-0.5	-0.1	-0.1	-0.4	0.1	-0.6	-0.3	0.3	0.0	0.0	0.0	-0.1	-0.7	-0.9	0.2	-0.6	-0.1	0.1	0.3	-0.9	0.0	0.03
RO		-1.6	1.9			-0.4		0.2	0.1	-0.7	-2.2			0.1	-2.7	-1.7	2.0	-0.3	0.3	-0.5	0.1	0.5	1.4	0.3	0.8	-1.1	0.0	1.3	0.3	-1.4	1.7	1.9	-0.4	0.6	0.03
NL	-0.6	0.1	0.5	0.3	0.3	0.4	0.7	0.3	0.4	0.2	-0.2	-0.3	0.3	-0.6	-0.7	0.3	-0.6	-0.4	0.0	0.1	0.4	-0.1	-0.7	-0.2	-0.1	-0.2	-0.2	-0.4	1.2	-0.1	-0.2	-0.7	-0.2	0.1	-0.03
IE	-2.6	0.6	0.5	-0.3	-0.5	2.1	-1.1	-0.1	-1.1	-2.0	-0.9	0.2	0.5	-0.5	0.6	1.4	3.2	-0.9	-2.7	0.3	0.4	0.3	0.3	-0.8	2.0	0.1	-0.5	-0.2	1.3	-0.5	-0.6	0.0	0.3	-0.3	-0.05
FI	0.6	0.0	0.3	0.8	2.0	0.1	0.0	-2.1	-0.1	0.8	0.5	-0.2	-0.8	-0.4	0.1	-0.3	-0.9	-0.4	-0.6	-1.7	0.3	0.5	-0.4	-0.4	-0.8	0.3	0.1	0.4	0.9	-0.8	0.0	0.0	-0.2	0.1	-0.07
PT	-1.3	-1.6	-1.4	1.2	0.4	-0.8	1.9	0.6	-1.6	-0.7	0.4	0.2	0.0	-0.3	0.0	-0.3	-0.3	-0.3	0.6	-0.5	-0.6	-0.2	-1.0	-0.5	-0.8	1.6	-0.1	-0.7	1.5	0.7	-0.4	-0.4	2.1	0.0	-0.08
LV	-1.3	-0.2	-1.4			-1.4		0.4	-0.2	-1.7	-1.1			3.0	-0.6	0.1	0.3	-0.2	0.6	-1.8	0.7	0.6	1.4	-0.5	-0.8	0.1	0.6	-0.9	0.4	0.7	0.7	0.0	-0.1	-0.3	-0.10
DK	-0.1	0.6	0.2	0.9	0.6	0.3	-0.1	-1.8	0.8	-1.0	0.0	0.5	0.4	-0.7	0.1	-0.9	-0.3	-3.1	0.1	-0.2	1.1	-1.4	0.2	-0.4	-0.2	0.0	-1.0	-0.1	-0.6	-0.2	-0.3	0.3	-0.5	-0.1	-0.20
SI	0.2	-0.6	-0.3	-0.9	-0.8	-1.0	0.7	-0.4	-1.3	0.4	-0.5	-1.1	-0.8	0.0	0.6	0.6	-0.7	-0.4	0.7	0.5	-0.8	0.7	-0.5	-0.6	-0.4	-0.5	1.3	-0.2	-0.4	-0.1	-0.5	-0.4	-0.9	-0.2	-0.26
IT	0.6	-1.8	-0.8			-0.6		-0.1	-0.2	0.6	-0.4			-0.8	-1.0	1.1	-0.9	-0.2	0.0	-0.6	-0.3	-0.1	-0.6	-0.3	-1.1	-0.1	0.3	-1.0	-0.2	-1.2	-0.6	-0.9	0.3	-0.8	-0.40
ES		-0.5	-0.4	0.6	0.2	-0.7	-0.3	-1.9	-1.7	-0.9	-1.2	-0.3	0.0	-0.6	-0.9	0.6	0.2	-0.3	1.5	-1.0	0.0	2.2	-0.6	-1.4	-0.6	-0.4	0.9	-1.0	-2.1	-0.7	-1.1	-0.6	-1.1	-2.2	-0.49
HR		-1.0	-0.3			-0.3		0.8	-0.9	0.0	-0.7			-0.7	-1.7	-0.2	-0.1	-0.3	-0.2	-0.8	-0.5	-3.4	-0.7	-0.6	-1.0	0.1		-1.5	0.1	-1.3		-0.3	0.0	-0.3	-0.61
CY	0.0	-0.6	-1.1	-2.4	-2.9	-1.0	0.9	-0.7	-1.2	-2.0	-0.5	-2.3	-2.9	-1.3	1.4	0.3	-0.4	0.5	-2.4	0.0	-4.0	-1.2	-1.7	-1.8	-0.7	-0.9	0.6	-0.3	-1.4	-2.6	-0.8	-2.0	-1.2	-1.7	-1.12
EL	-1.3	-1.0	-3.0	0.3	0.3	-3.0	-0.1	2.7	-2.2	-1.0	-1.6	-1.5	-1.4	-0.3	0.6	-0.3	-1.8	-0.3	-0.5	0.0	-1.7	0.3	-1.6	-2.2	-2.8	-2.6	-0.6	-3.0	-0.3	-1.5	-1.5	-2.5	-2.1	-3.1	-1.19

2.2: Constructing the resilience (composite) indicators from metrics: Bounce forward

Country	ASSET						ENGINE														OUTCOME												Avg. score	% FWD Bounces	
	DWELLINGS	EXP. EDUCATION	EXP. HEALTH	FAIRNESS	TRUST PEOPLE	INVESTMENT	SOCIAL ACTIVITY	GOV. DEFICIT	GOV. DEBT	HH LOANS	HOUSE PRICES	TRUST BP	TRUST LEGAL	INFLATION	ACTIVE LM	PASSIVE LM	LABOUR PROD.	PRIVATE DEBT	EXP. R&D	STOCK PRICES	TEMPORARY WORK	WAGES	EMPLOYMENT	GDP	HAPPINESS	HEALTH	HH CONSUMPTION	INEQUALITY	NET	SOCIAL EXCLUSION	HH INCOME	SATISFACTION			UNEMPLOYMENT
DE	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.52	0.64
MT	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.33	0.52
SK	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.21	0.42
BG	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.19	0.50
SE	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.18	0.48
LT	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.14	0.43
CZ	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.12	0.45
PL	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.12	0.42
AT	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.09	0.48
FR	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.06	0.45
HU	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.06	0.45
BE	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.00	0.33
LU	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.00	0.44
LV	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.00	0.25
UK	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	0.00	0.30
IE	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.03	0.33
RO	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.04	0.33
EE	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.06	0.27
DK	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.15	0.36
FI	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.15	0.30
PT	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.21	0.33
NL	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.24	0.21
SI	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.30	0.24
ES	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.38	0.25
CY	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.48	0.21
IT	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.55	0.17
HR	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.60	0.16
EL	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	-0.61	0.12
Avg. score	0.13	0.36	0.54	0.00	-0.14	-0.21	-0.38	-0.18	-0.89	-0.86	-0.39	-0.48	0.00	-0.39	0.46	0.46	0.71	-0.11	0.61	-0.25	-0.43	0.11	0.11	0.43	-0.46	0.15	0.39	-0.36	-0.32	-0.26	-0.04	-0.07	-0.39	-0.06	
% FWD Bounces	0.38	0.57	0.75	0.38	0.24	0.29	0.19	0.14	0.04	0.04	0.21	0.14	0.36	0.18	0.71	0.68	0.79	0.36	0.71	0.14	0.11	0.50	0.46	0.64	0.14	0.52	0.57	0.11	0.11	0.30	0.38	0.29	0.18	0.35	

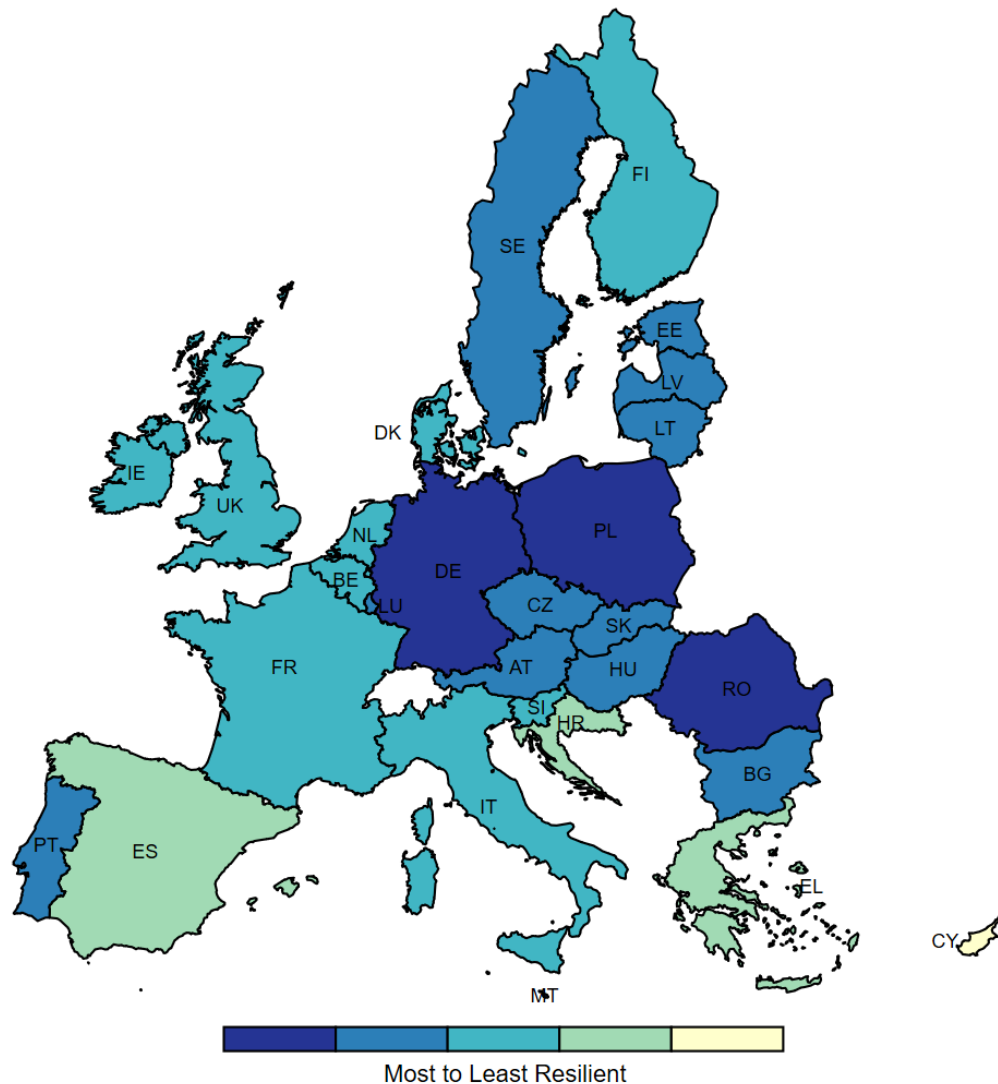
Indicator maps: impact, NUTS0

Impact - NUTS0



Medium-run, NUTS0

Medium Run - NUTS0



Bounce forward, NUTS0

Bounce Forward - NUTS0

