



ALMA MATER STUDIORUM
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Industrial sustainability transition pathways in Europe: Implications for EU carbon policies

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*Shared Perspectives 2023 – How to make the green transition happen
Bertinoro, 6-7 October 2023*

Key questions

1. Which sustainability transition pathways are occurring in EU regions?
2. How to accelerate green transition?
3. Which are the socio-economic externalities of different transition pathways?

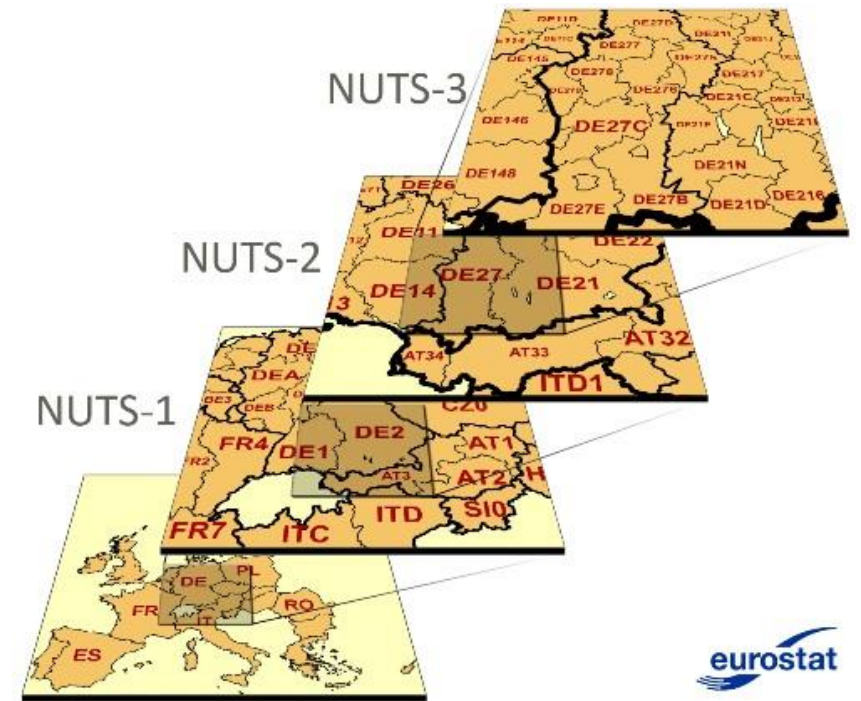


The dataset

- Re-industrialise EU project: <https://re-industrialise.climate-kic.org/>
- EU ETS: CO2eq emissions data
- Eurostat: Socio-Economic Data
 - Competences: Scientists & engineering and tertiary education
 - Investments: Intramural R&D and industry gross fixed capital formation
 - Well being: Industry employment and risk of poverty

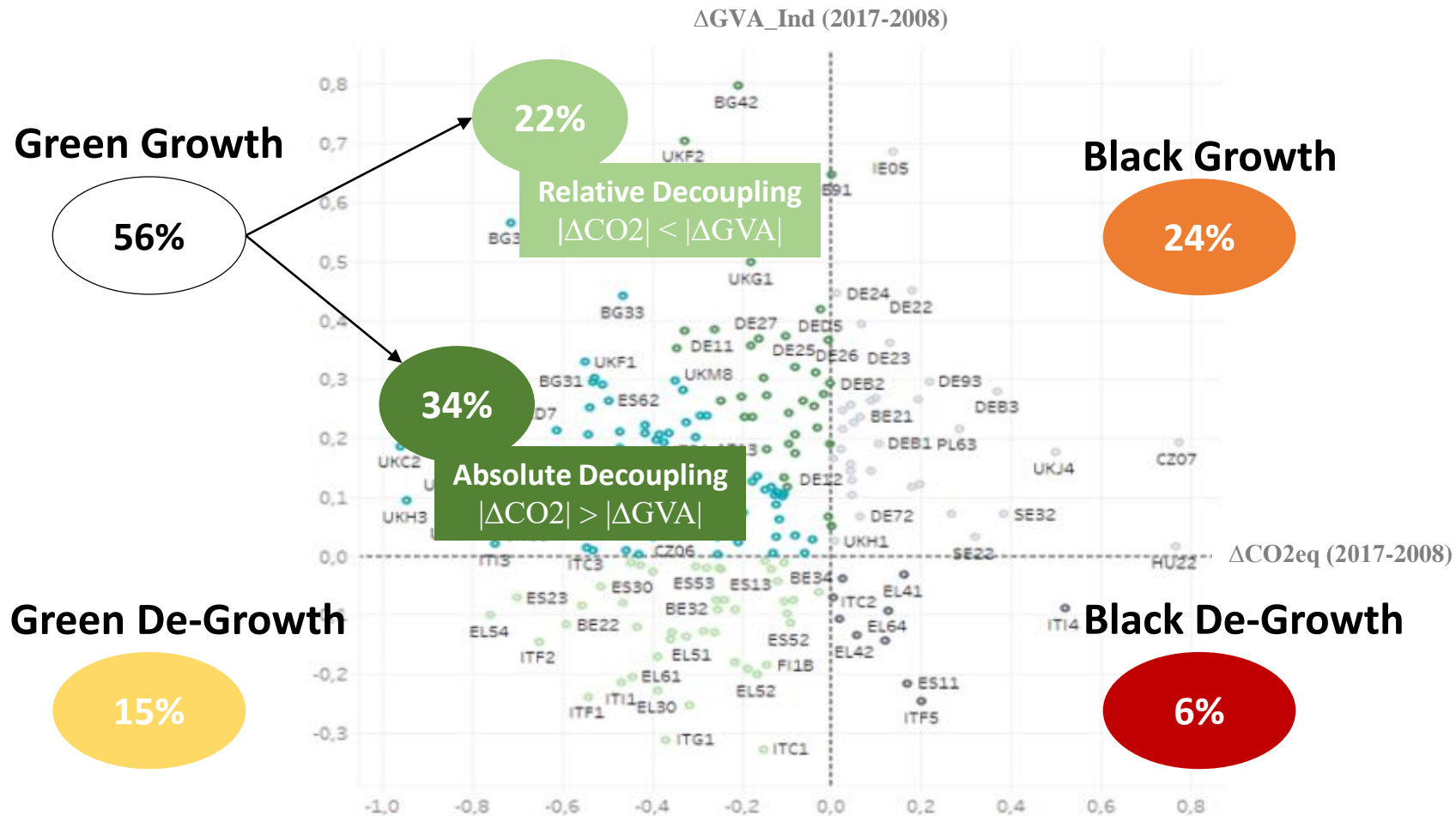
Key characteristics:

- Different scales of analysis:
 - NUTS 0: **28** | NUTS 1: **103** | NUTS 2: **279** | NUTS 3: **1,195**
- 10 years covered (2008-2017) ~ 17,000 data points



1. Which sustainability transition pathways are occurring in EU regions?

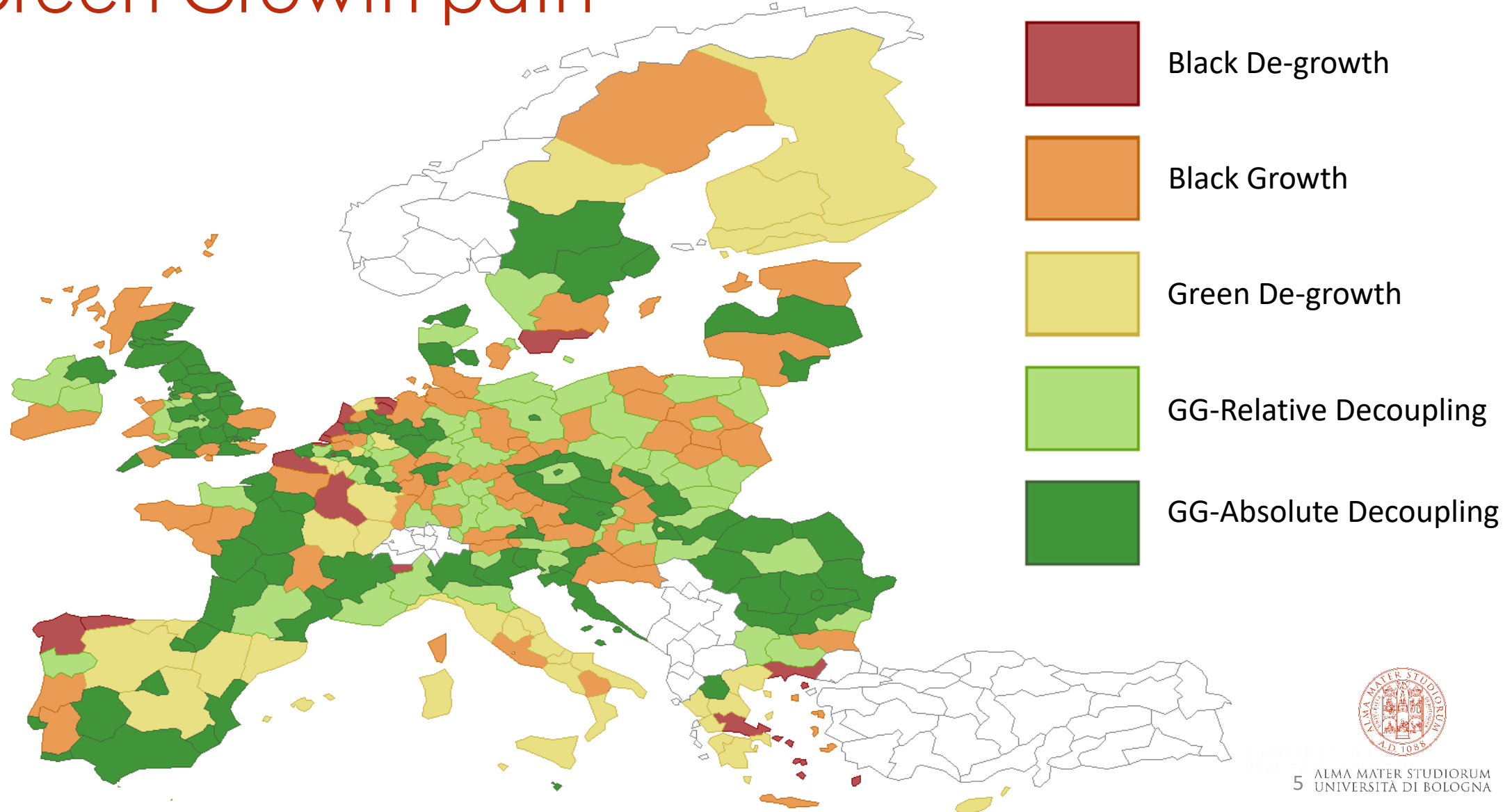
FOUR TRANSITION PATHWAYS: Most NUTS 2 are on a Green Growth path



Mura, M., Longo, M., Toschi, L., Zanni, S., 2023. Exploring socio-economic externalities of development scenarios. An analysis of EU regions from 2008 to 2016. J of Environmental Management, 332, p. 117327.

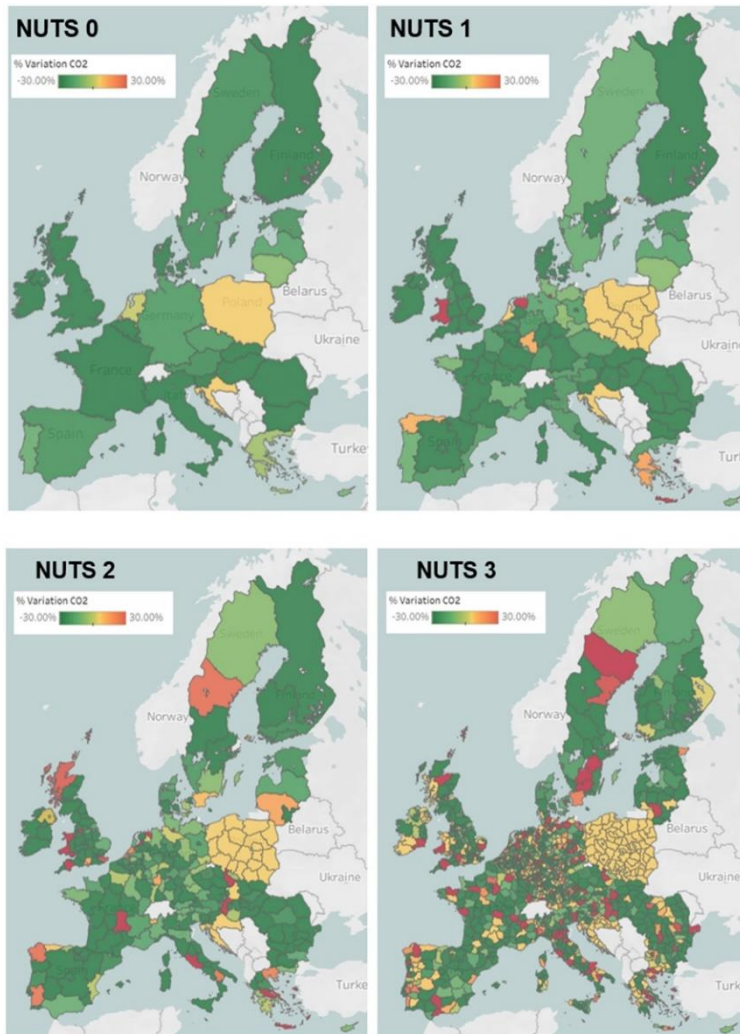
1. Which sustainability transition pathways are occurring in EU regions?

FOUR TRANSITION PATHWAYS: Most NUTS 2 are on a Green Growth path



2. How to accelerate green transition?

ONE SIZE POLICY DOES NOT FIT ALL: Different transition paths at different levels of analysis



State	NUTS 1			NUTS 2			NUTS 3		
	Obs.	Intercept	Slope	Obs.	Intercept	Slope	Obs.	Intercept	Slope
Germany	16	*	N.S.	38	N.S.	N.S.	361	***	***
Poland	7	N.S.	N.S.	17	N.S.	N.S.	73	***	***
Italy	5	N.S.	N.S.	21	N.S.	N.S.	105	***	***
Spain	7	§	§	19	N.S.	N.S.	59	***	***
UK	12	N.S.	N.S.	41	N.S.	N.S.	158	***	***
France	14	N.S.	N.S.	27	***	N.S.	192	n.a.	n.a.
The Netherlands	4	N.S.	N.S.	12	***	N.S.	78	n.a.	n.a.
Czech Republic	0	n.a.	n.a.	8	**	N.S.	14	***	***
Greece	0	n.a.	n.a.	12	***	***	40	**	**
Belgium	3	N.S.	N.S.	11	N.S.	N.S.	44	***	***

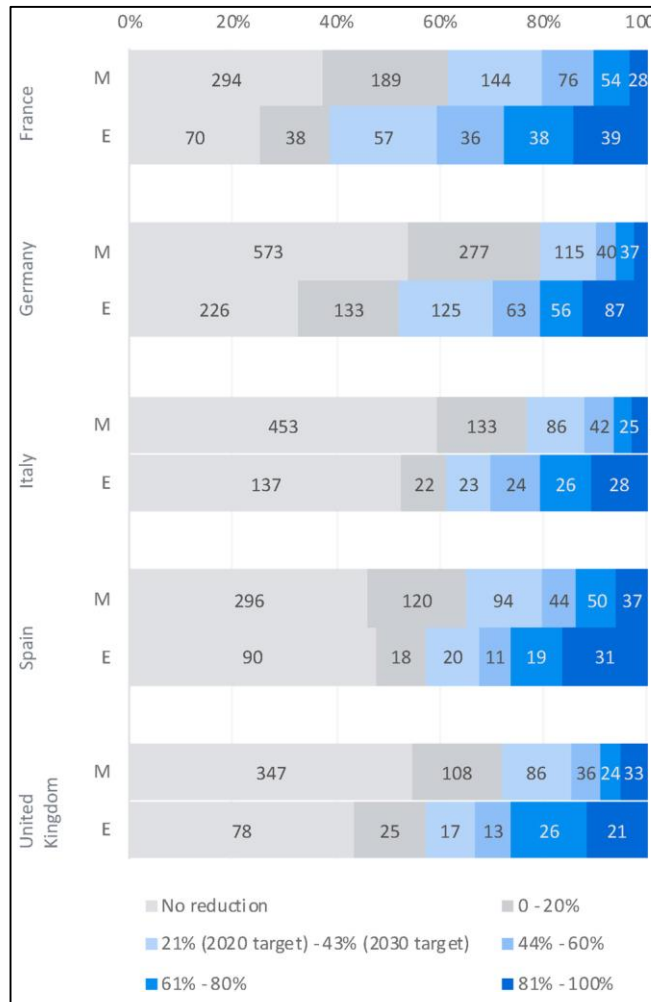
- The use of different scales is necessary to identify critical areas.
- EU Policies, in particular EU ETS Phase III, were instrumental in triggering a reduction of CEI in EU regions.
- Those reductions might be a product of incremental actions, that are insufficient to achieve the Net-zero goal.

Fig. 1. Variation of Carbon Emission Intensity (tons of CO₂e/million €) between 2008 and 2016 for NUTS 0-1-2-3.



2. How to accelerate green transition?

HETEROGENEITY IN EMISSION LEVELS can give a misleading impression of progress



- Many installations have not started their decarbonisation journey.
- Policies that take into account those differences are required to:
 - ✓ Avoid a false sense of collective progress.
 - ✓ Avoid the perpetuation of lock-ins.
 - ✓ Ensure the decarbonisation of super polluters while avoiding negative socio-economic impacts.

Fig 2. Installations decarbonisation performance (2005–2017): M – manufacturing; E – energy.



2. How to accelerate green transition?

Focus on «SUPER-POLLUTERS»: Few installations are responsible for the majority of emissions

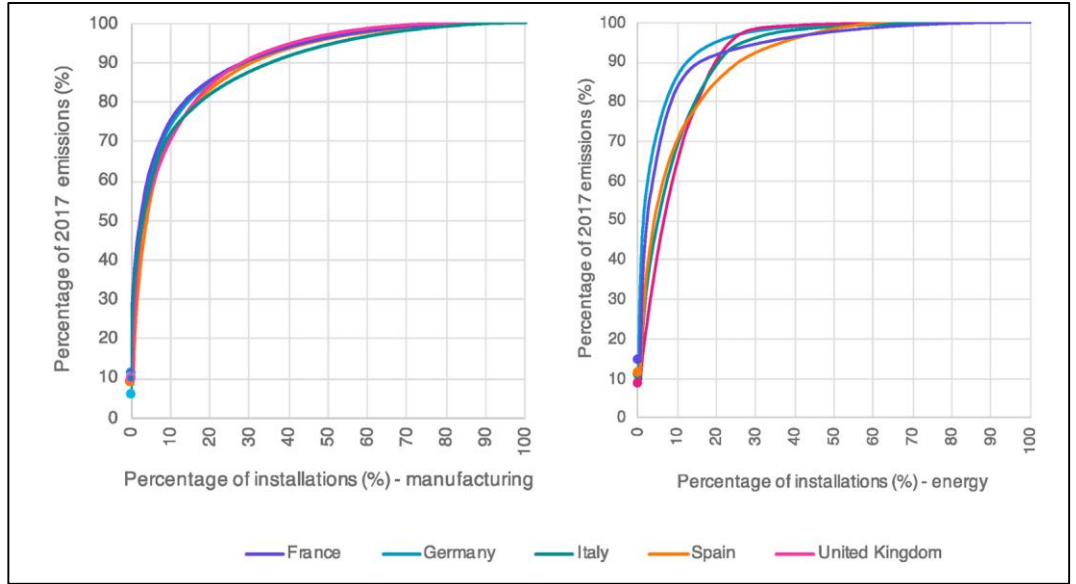
Level of pollution	France		Germany		Italy		Spain		United Kingdom	
	N ^a	PE ^b	N	PE	N	PE	N	PE	N	PE
Super ($x > \bar{x} + 2\sigma$)	11 (1,4%)	41,2%	26 (2,4%)	45%	11 (1,4%)	38,5%	16 (2,5%)	41,8%	12 (1,9%)	43,4%
Very high ($x > \bar{x} + \sigma$)	14 (1,8%)	12,8%	28 (2,6%)	15,5%	14 (1,8%)	12,2%	17 (2,6%)	15,9%	8 (1,3%)	7,9%
High ($x > \bar{x}$)	91 (11,6%)	27,1%	91 (8,5%)	20,4%	80 (10,5%)	25,7%	75 (11,7%)	22,7%	100 (15,8%)	31,9%
Low ($x < \bar{x}$)	669 (85,2%)	19%	902 (84,4%)	19%	658 (86,2%)	23,6%	533 (83,1%)	19,5%	514 (81%)	16,7%

N= number of installations; PE% of 2017 emissions

Level of pollution	France		Germany		Italy		Spain		United Kingdom	
	N ^a	PE ^b	N	PE	N	PE	N	PE	N	PE
Super ($x > \bar{x} + 2\sigma$)	6 (2,2%)	50,3%	11 (1,6%)	52,4%	7 (2,7%)	37,6%	7 (3,7%)	47,3%	10 (5,6%)	44,4%
Very high ($x > \bar{x} + \sigma$)	8 (2,9%)	17,3%	10 (1,4%)	10,9%	12 (4,6%)	22,6%	5 (2,6%)	12,3%	11 (6,1%)	26,1%
High ($x > \bar{x}$)	22 (7,9%)	20,3%	68 (9,8%)	27%	39 (15%)	32%	25 (13,2%)	25%	21 (11,7%)	24,2%
Low ($x < \bar{x}$)	242 (87%)	12,1%	601 (87%)	9,7%	202 (77,7%)	7,8%	152 (80,4%)	16,3%	138 (76,7%)	5,2%

N= number of installations; PE% of 2017 emissions

ETS MANUFACTURING
1,9% of companies account for 42,5% of emissions.



ETS ENERGY PRODUCTION
2,6% of power plants account for 48,3% of emissions



Vieira, L.C., Longo, M. and Mura, M., 2021. Are the European manufacturing and energy sectors on track for achieving net-zero emissions in 2050? An empirical analysis. Energy Policy, 156, p.112464.

SOCIO-ECONOMIC EXTERNALITIES.

Competences – Investments – Well being

- Accordingly to different transition pathways we explored: **Employees' competences; Investments in R&D and machineries; Individuals' well being**
- **Relative decoupling**: industrial employment and risk of poverty show the best results compared to all the other transition scenarios. This scenario shows the highest results for investments in R&D and gross fixed capital formation. Focus on fostering incremental innovations to make production processes more efficient
- **Absolute decoupling: worst values in well being** (industrial employment and the risk of poverty). Investments in R&D and gross fixed capital formation are lower than relative decoupling and black growth, but comparable to the green de-growth scenario. **Highest level of competences.**
 - Two means of transitions:
 - 1) Moving productions offshore (e.g. Midlands in the UK)
 - 2) New service-oriented business models (Outer London, Berkshire, Oxfordshire)



Key Takeaways

- Most EU regions are reducing CO2e emissions, which suggests they are in a pathway towards decarbonization. However **different transition pathways** emerge.
- Different policies to accelerate the low-carbon transition:
 - **Scales matter:** Design different actions accordingly to different **units of analysis** (country, region, province)
 - Focus on **“super-polluters”**
- Socio-economic externalities: Absolute decoupling shows negative externalities in terms of **industrial employment** and the **risk of poverty**.



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