

Regional Patterns of Skill Demand in the European Labor Market:

A Spatial Analysis of Job Vacancy Data across NUTS Level 3 Regions

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Introduction

We analyze the **spatial distribution** of the European labor market transformations - **2019 vs 2023** - by examining skill demand patterns and their evolution over time.

Rather than focusing solely on national-level trends, we adopt a broader perspective and analyze **sub-national territorial units**. As different regions often exhibit **distinct labor market characteristics**, this approach allows us to capture **regional disparities** within countries and highlight **similarities** between territories across different nations.

We build upon the work of *Giambona, Kahlawi, Buzzigoli, Grassini, and Martelli (2024)* for Italian regions and extend the analysis to the European context.

We use Online Job Advertisements (OJAs) and focus on the NUTS-3 territorial level to:

- ① **Find Regional Clusters** based on occupations and skills required in OJAs
- ② **Observe Skill Change** at the regional level

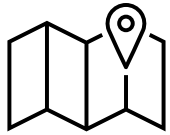
Data

Online Job Advertisements from Lightcast



Occupations and Skills

Classified according to ESCO (4 digits)

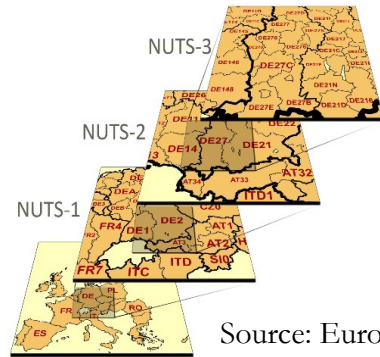


Job locations

Classified according to NUTS



1362 NUTS-3 Regions



Source: Eurostat

29

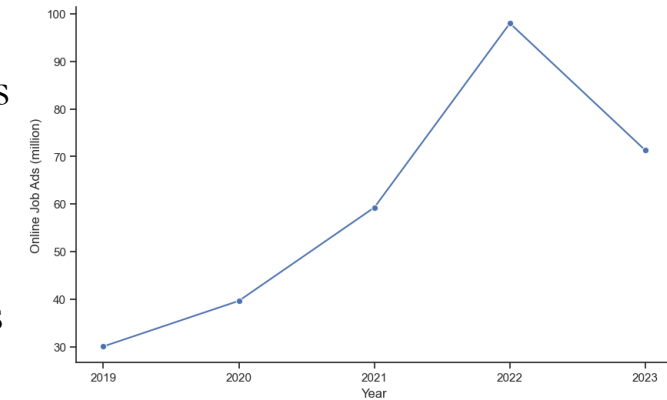
European countries

2019

20.503.001 OJAs

2023

53.304.091 OJAs



Supplementary data

GDP from the European Social Survey archive
(2019/2021)

International Socio-Economic Index of
occupational status (**ISEI**), Ganzeboom, De Graaf and Treiman (1992)

Methodology

1 Regional Clusters based on Occupations and Skills required in OJAs

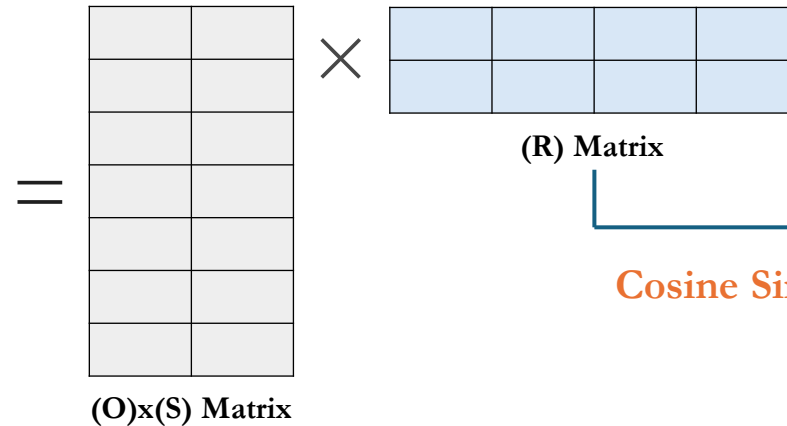
Skill profile for each region

Occupation (O) x Skill (S)	Region (R)			
	R ₁	R ₂	...	R _n
O ₁ xS ₁	0.1	0.9	0.3	0
O ₁ xS ₂	0	0	0.4	0.7
O ₂ xS ₁	0.8	0.3	0.2	0.9
O ₂ xS ₂	0.1	0	0.4	0.3
...	0	0.4	0	0
O _n xS _n	0.9	0	0.3	0

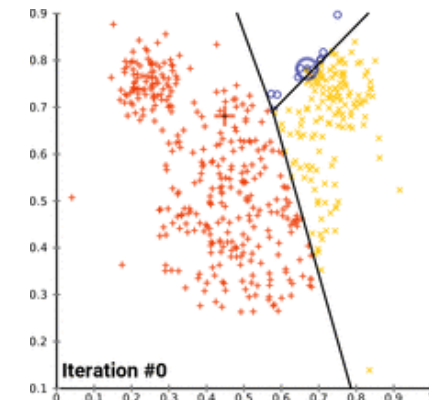
Skill importance score (0-1)

$$IS = \#ADV_{S_{ROS}} / \#ADV_{S_{RO}}$$

Matrix factorisation (ALS):
40 latent factors



K-means clustering



Cluster sorted
by **GDP**
(Anova test)

https://en.wikipedia.org/wiki/K-means_clustering#/media/File:K-means_convergence.gif

2 Skill Change at the Regional Level (SCI_R)

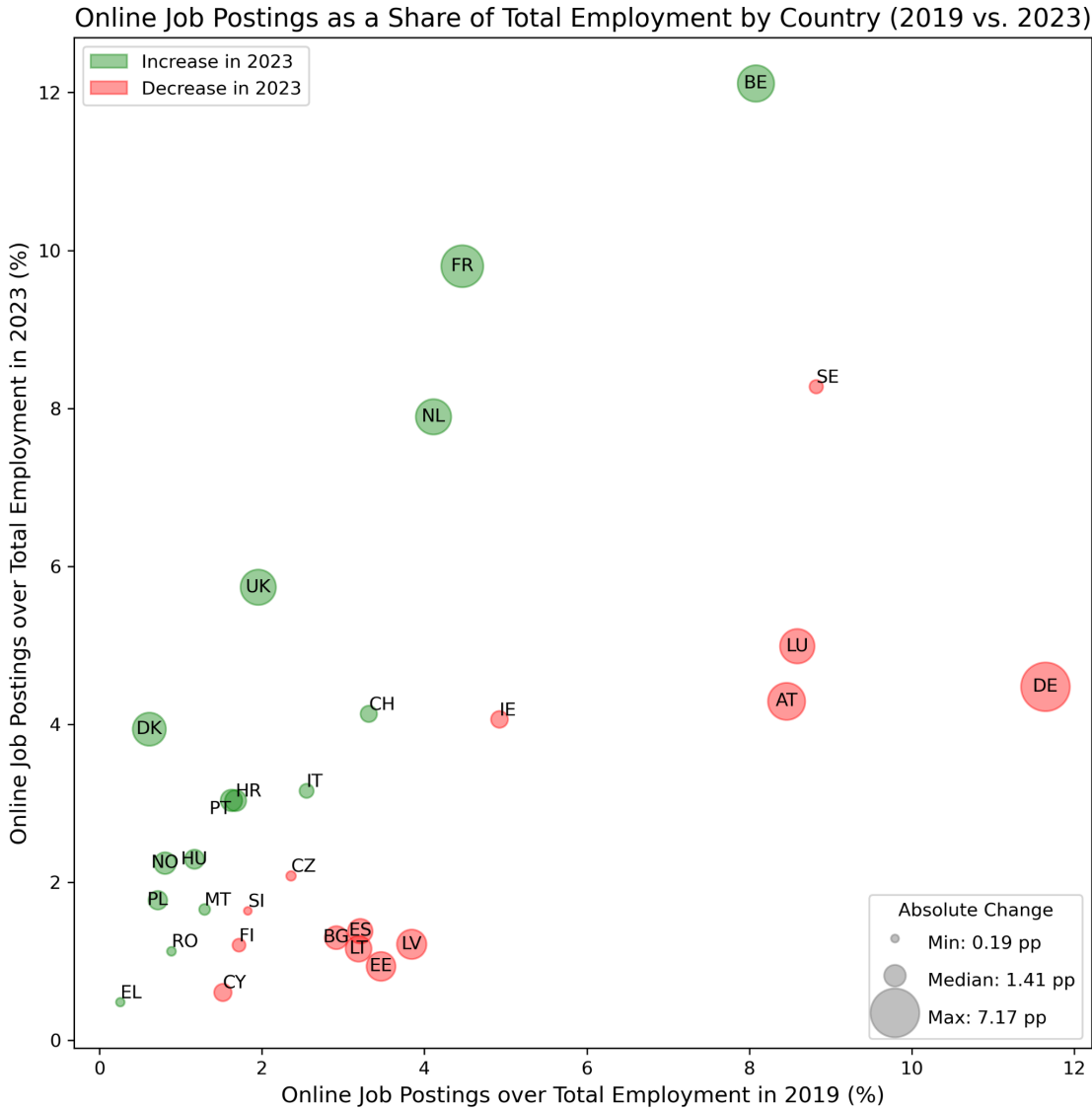
$$SCI_R = \sum_S |\Delta_{RS}| \quad \text{with} \quad |\Delta_{RS}| = \left(\frac{\#ADV_{S_{RS}}}{\#ADV_{S_R}} \right)_{2023} - \left(\frac{\#ADV_{S_{RS}}}{\#ADV_{S_R}} \right)_{2019}$$

Spatial autocorrelation
Global Moran's I

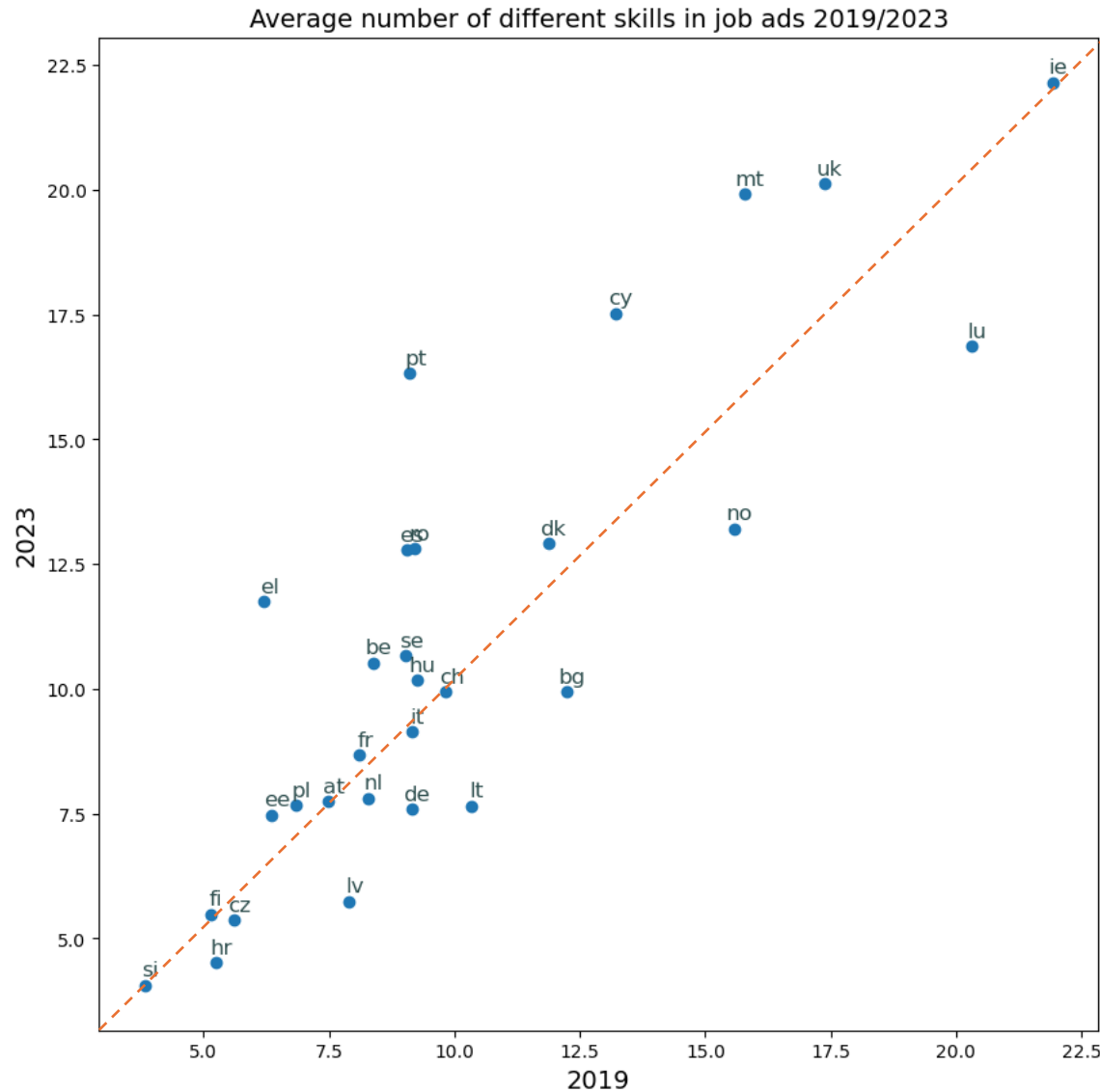
Occupations: average numbers of skills over time



Postings over total employment

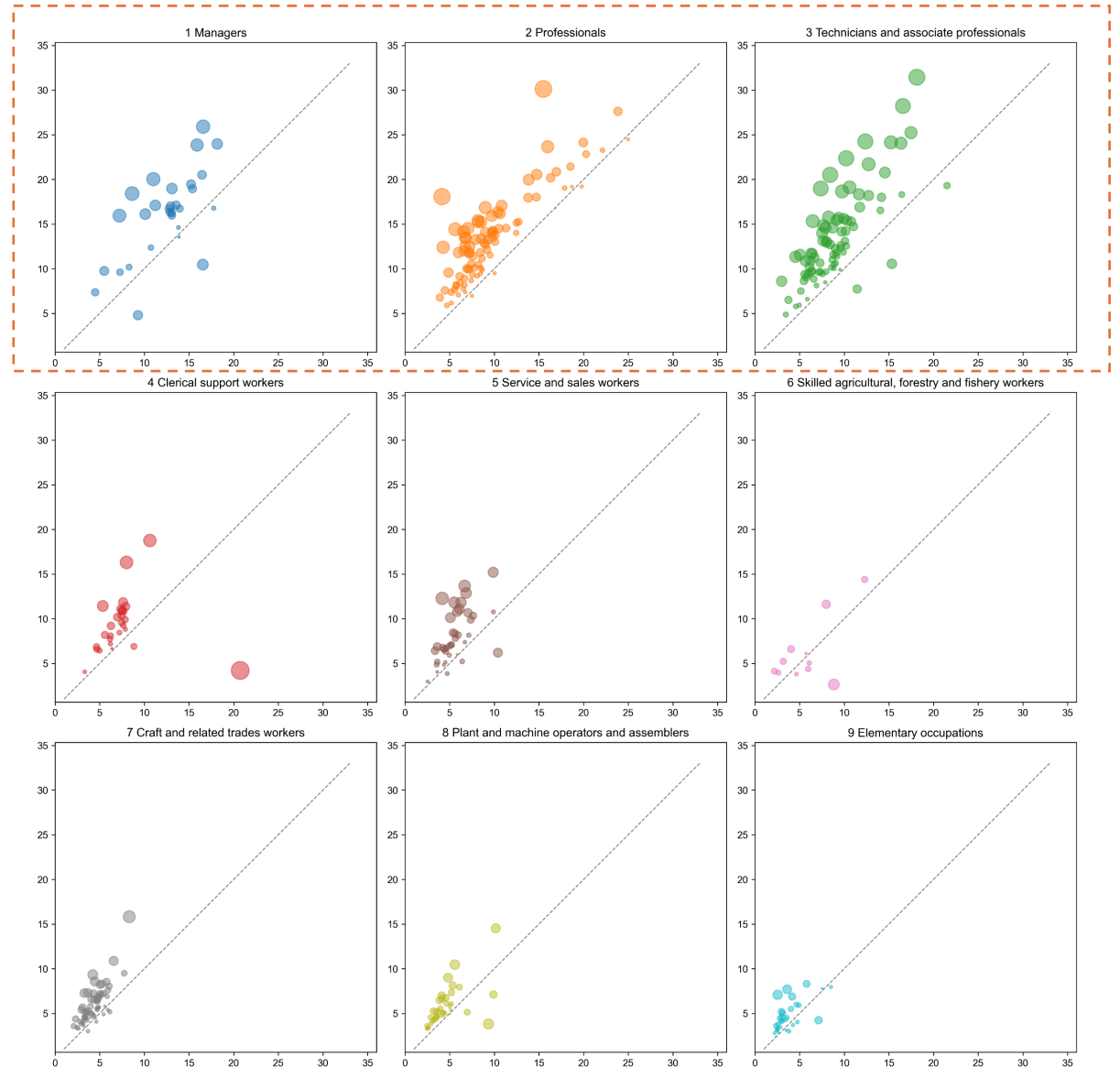
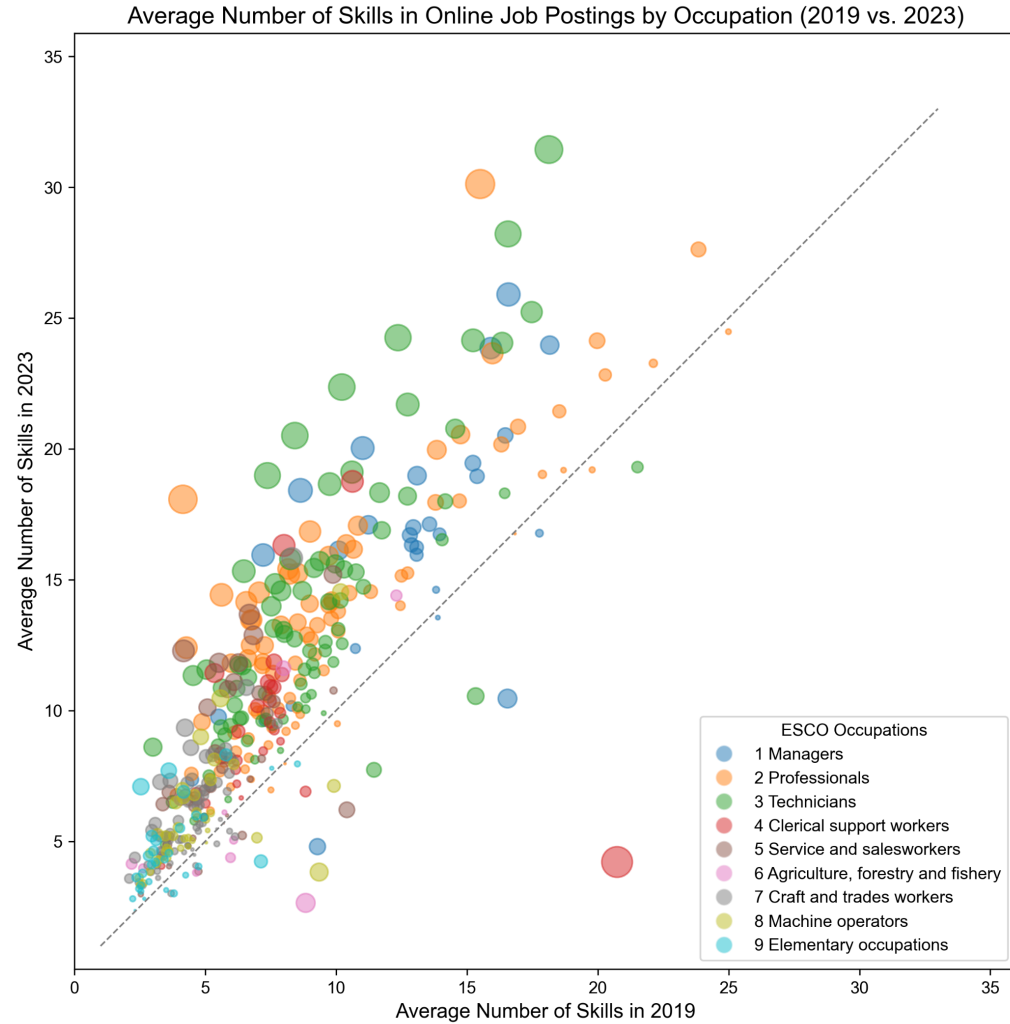


Average number of skills per postinting



2019 vs 2023

Average number of skills by ESCO group - 4 digits



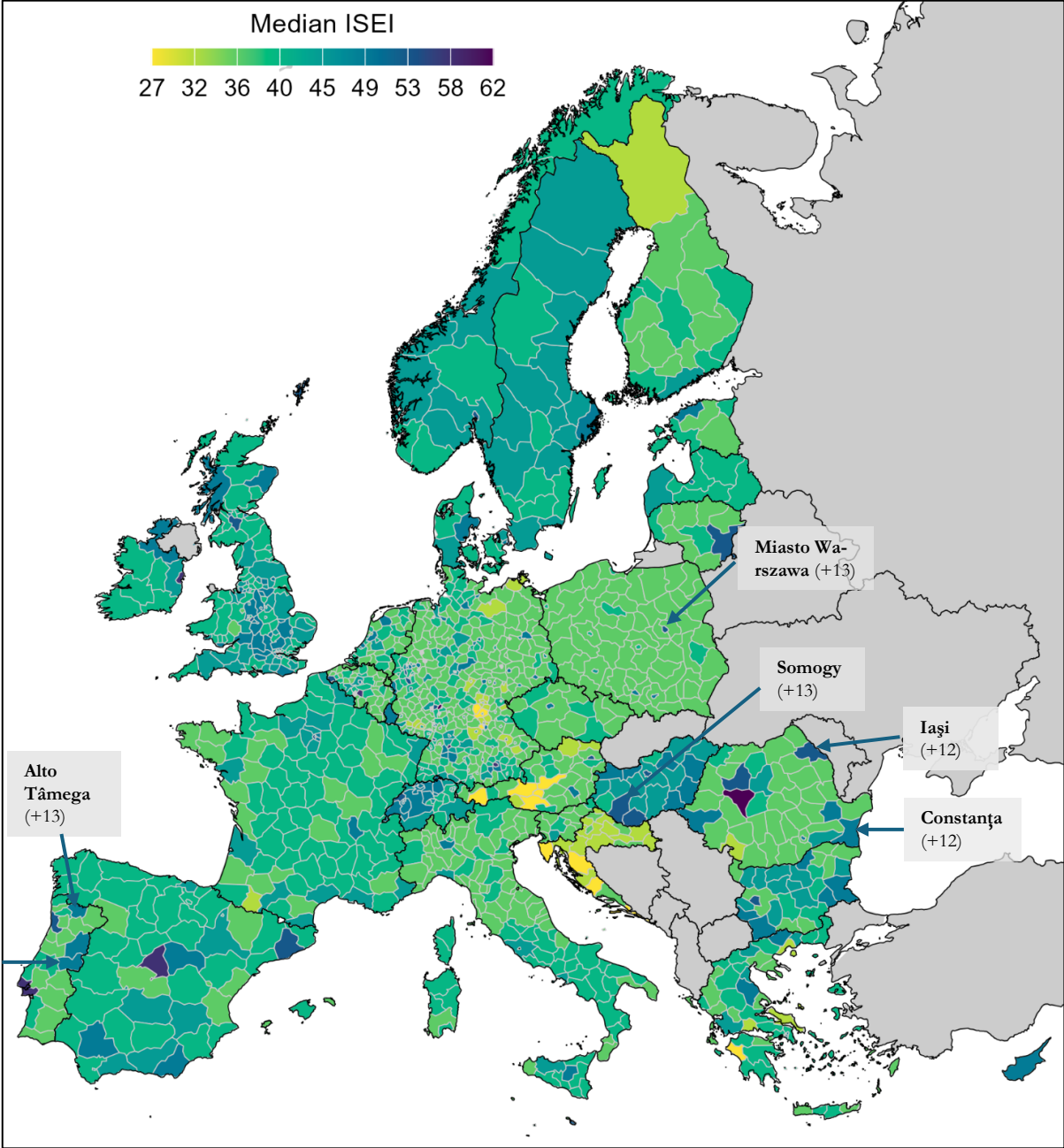
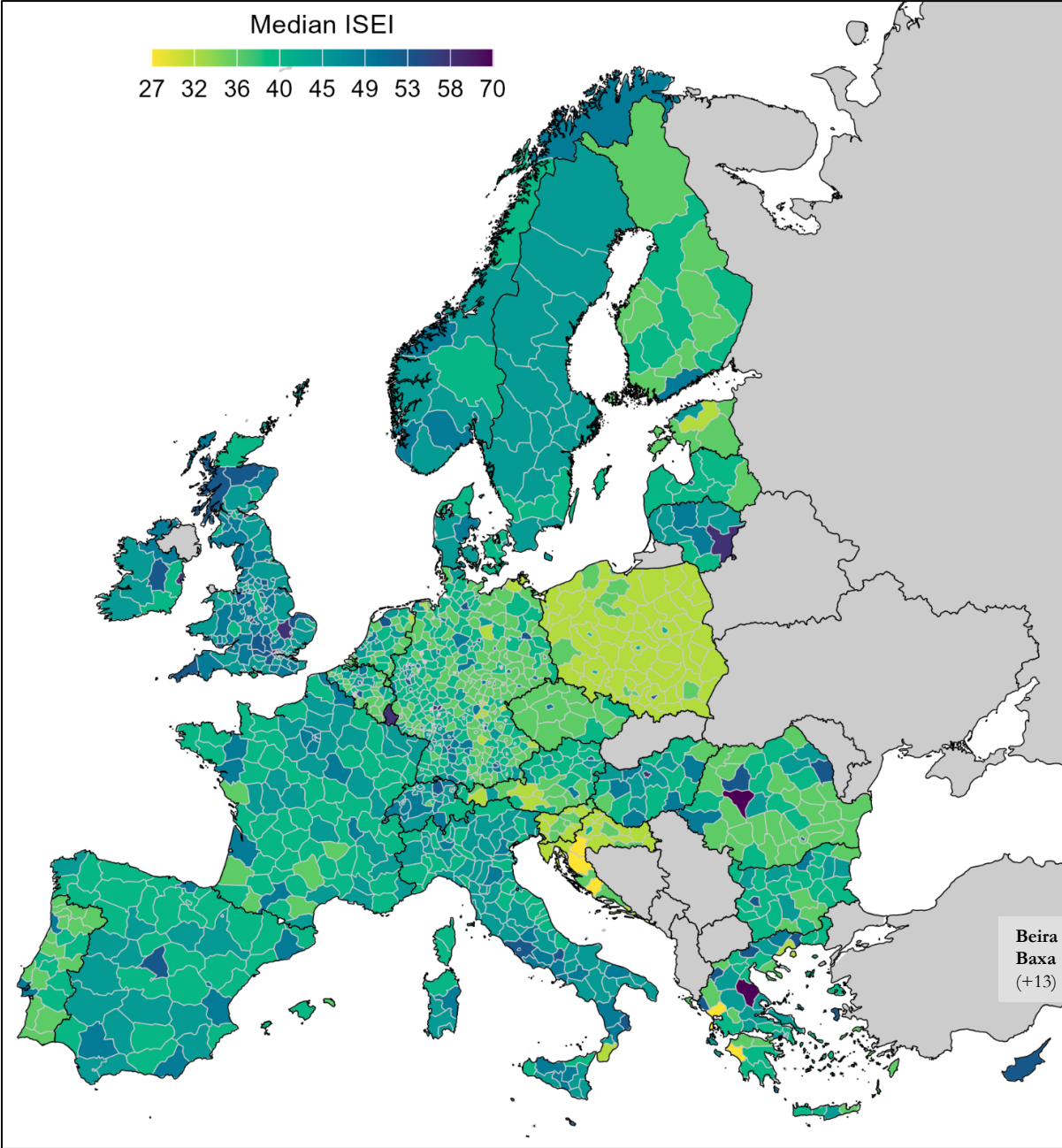
Occupations: median ISEI score over time



Median Occupational ISEI score 2019 vs 2023

2019

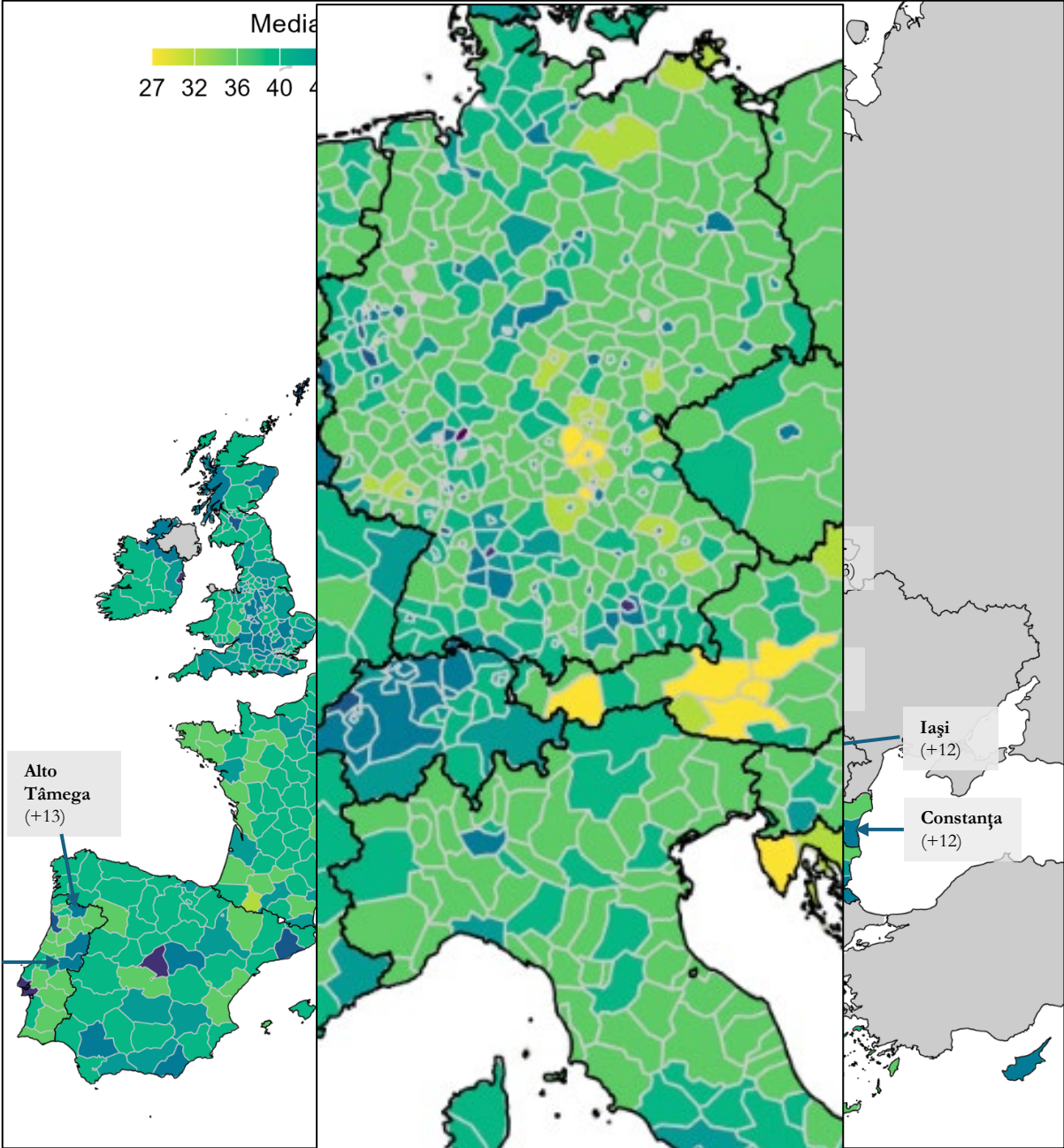
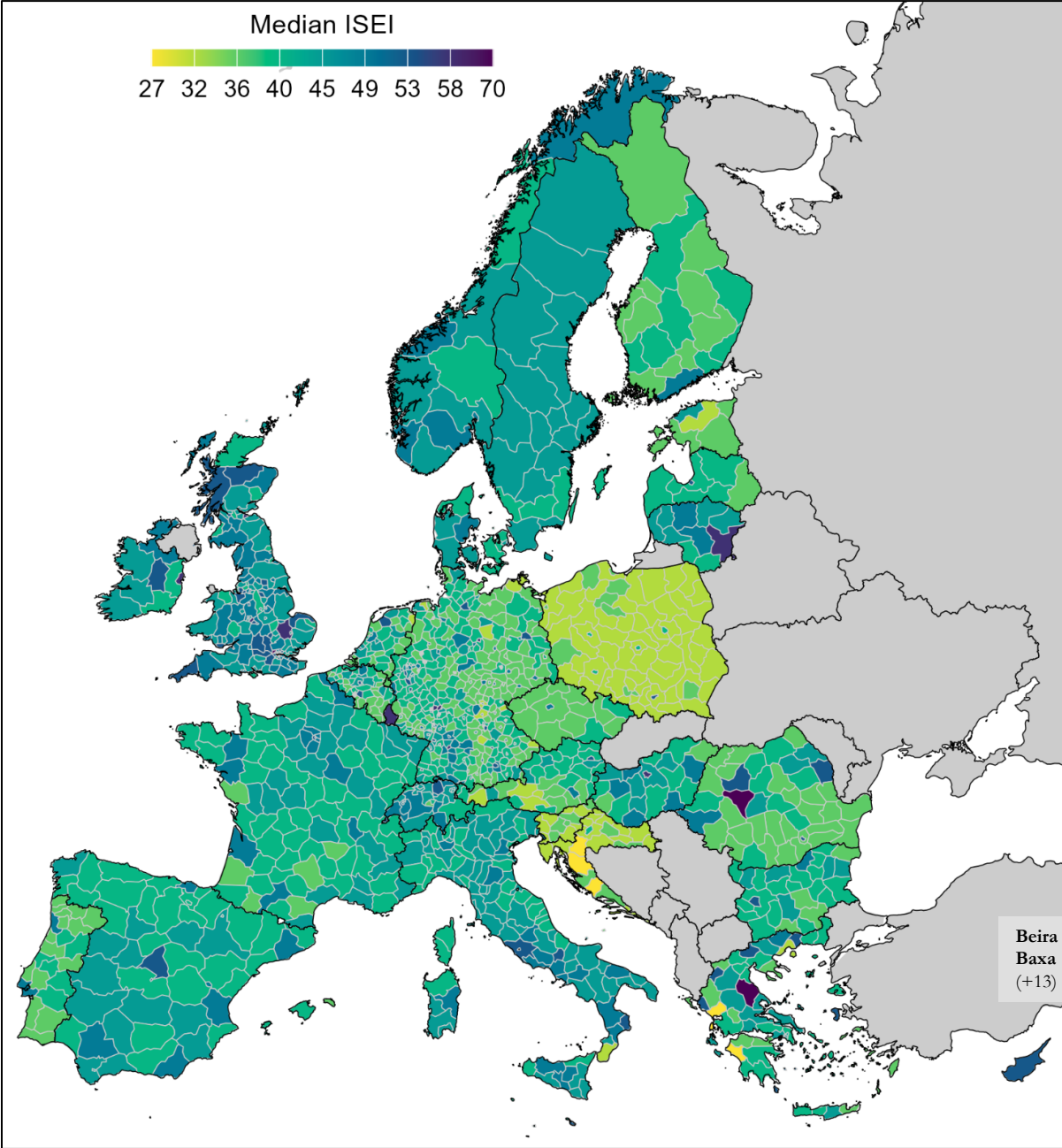
2023



Median Occupational ISEI score 2019 vs 2023

2019

2023

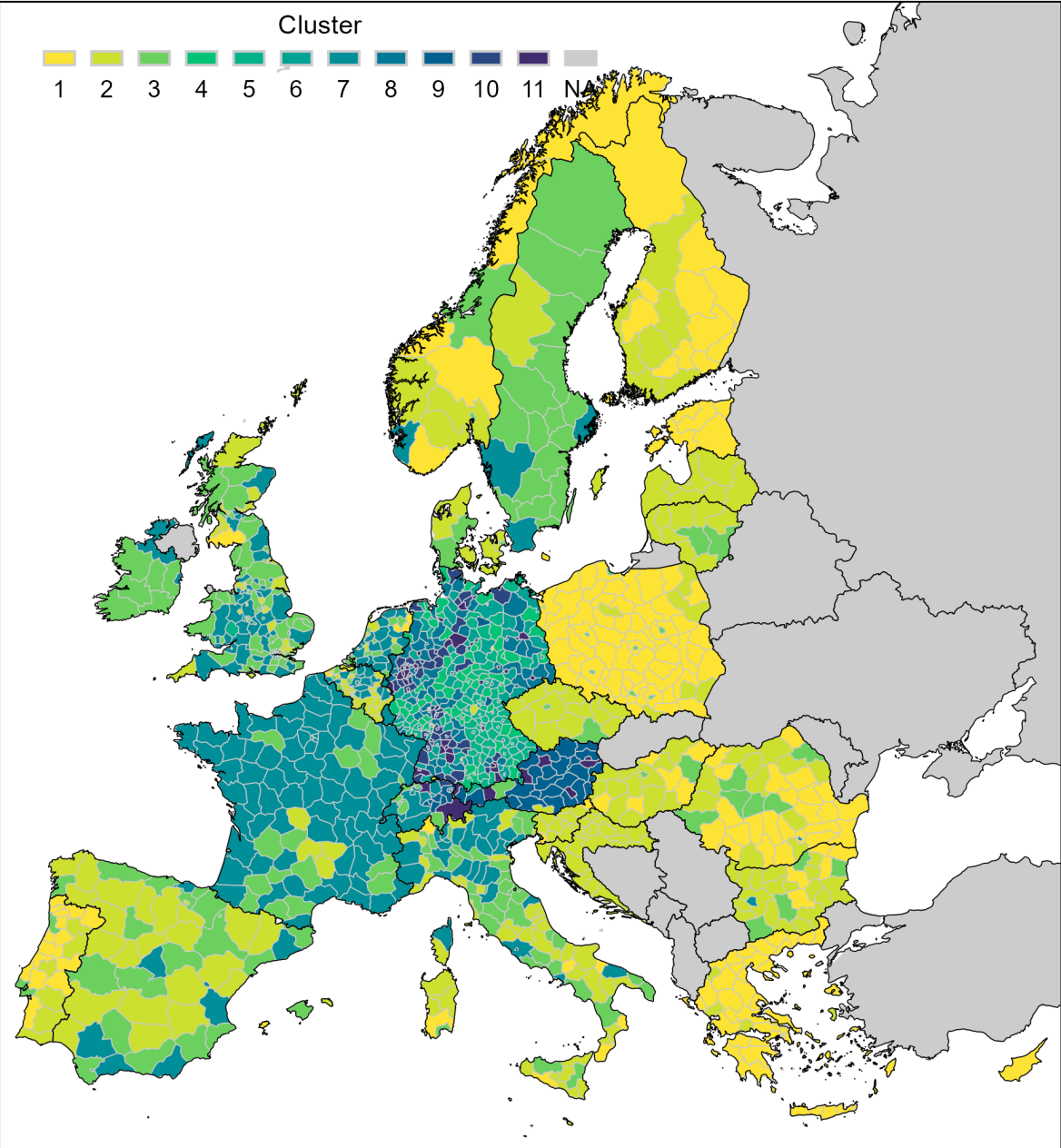


Regional Clusters and Skill Change

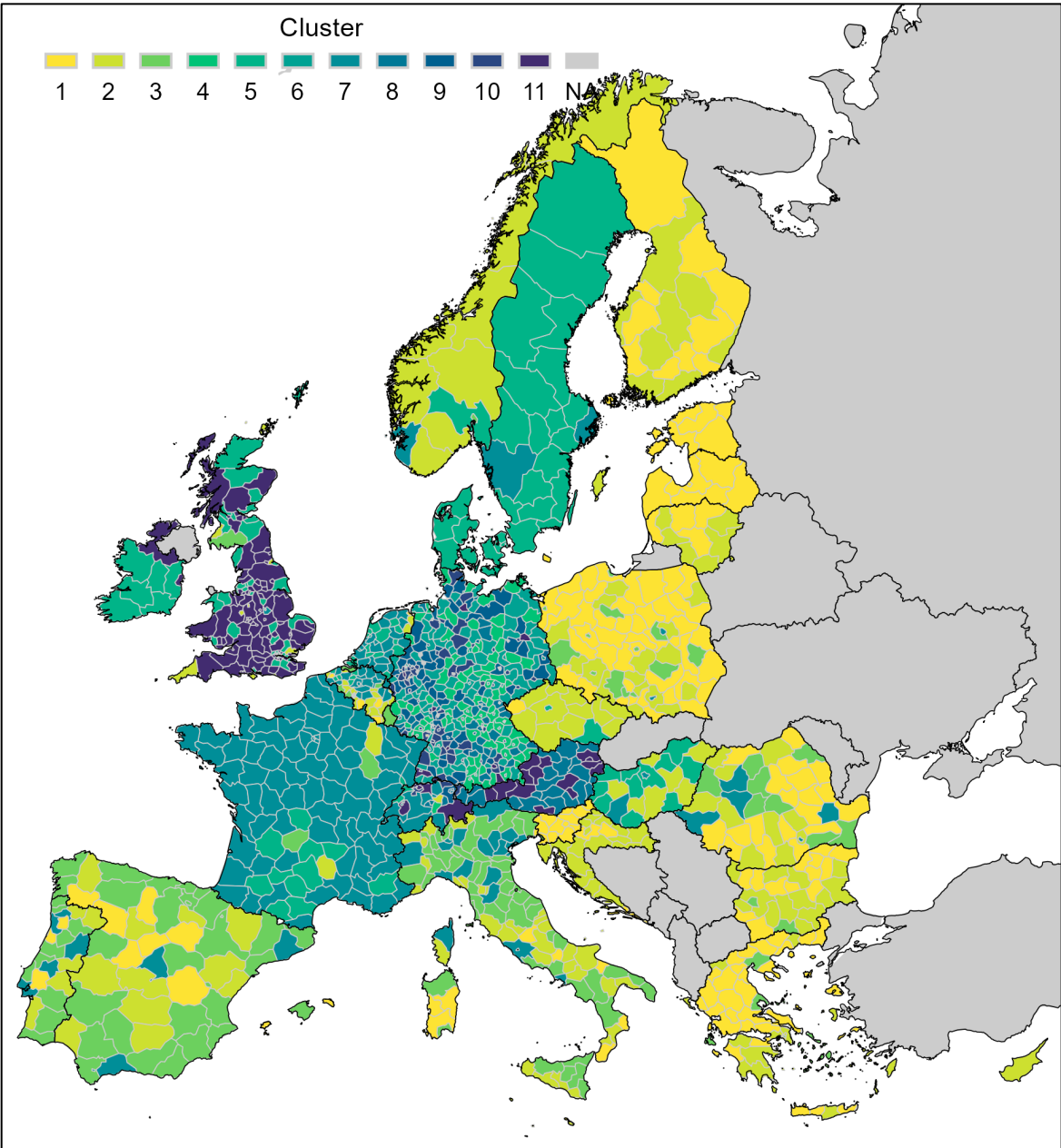


Territorial cohesion and differentiation. *Order and color of 11 clusters by average GDP*

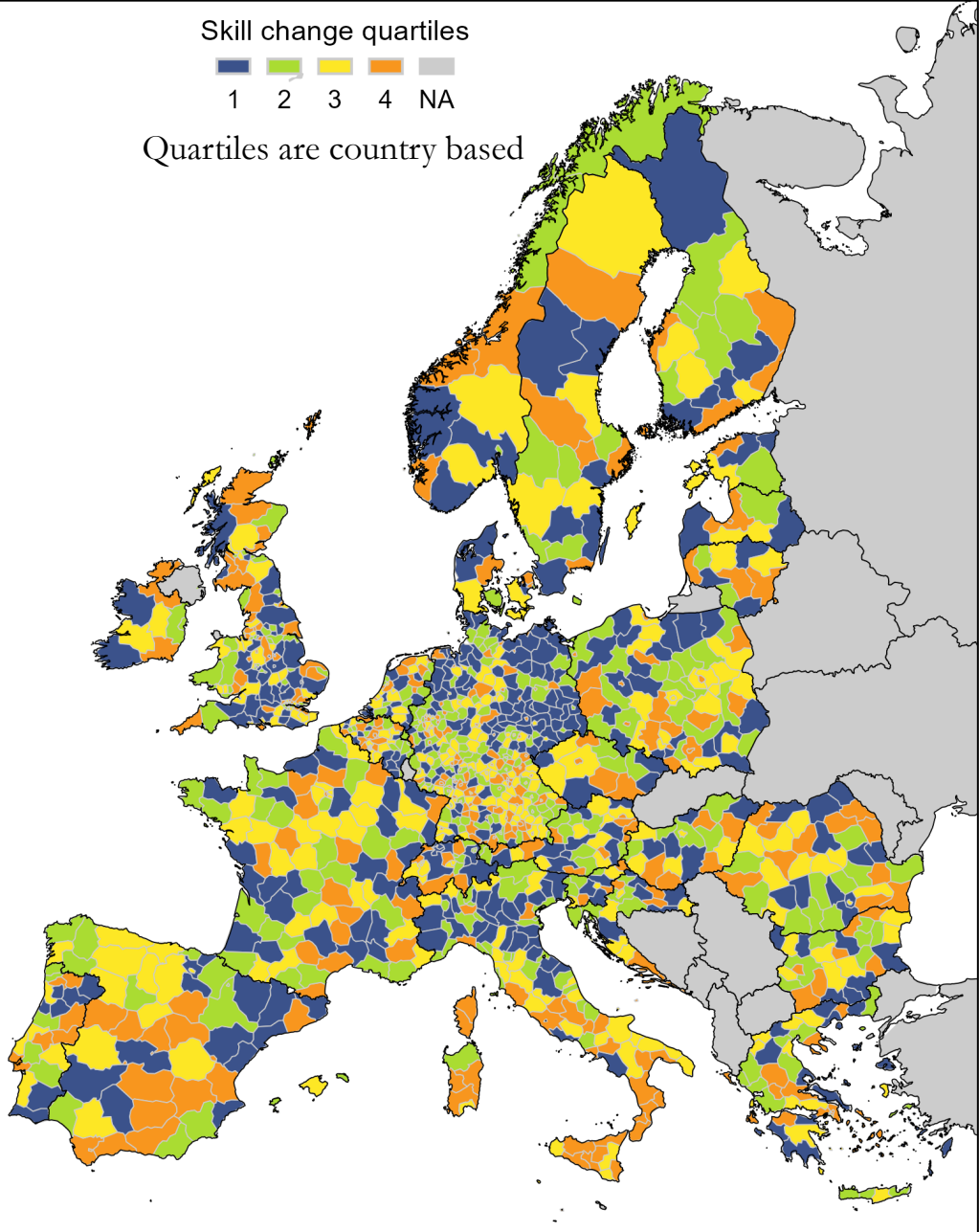
2019



2023



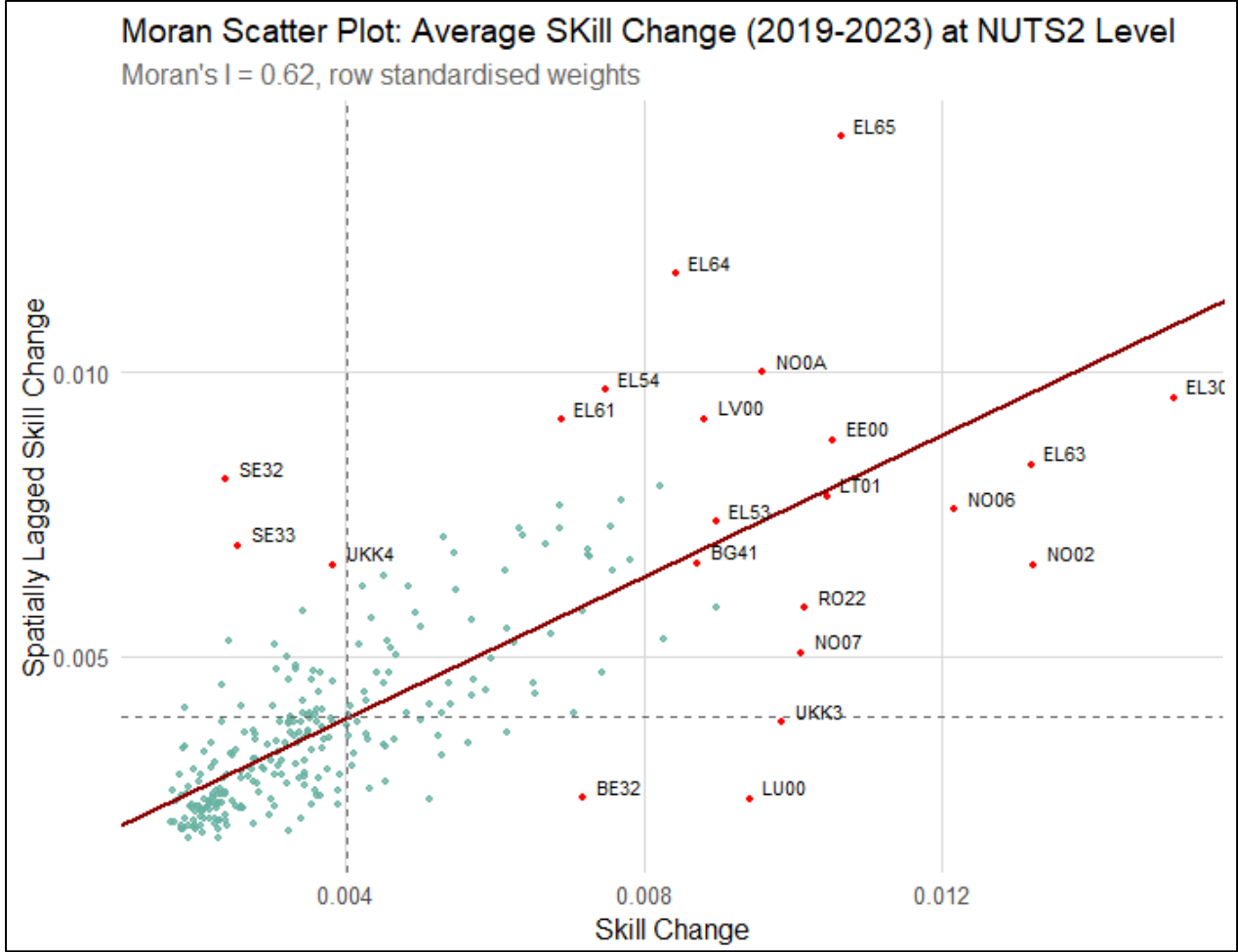
Skill Change between 2019 and 2023



Average Skill Change **Global Moran's I:**

NUTS-3 = **0.38**

NUTS-2 = **0.62**



Conclusion



Conclusion

Online Job Advertisements have various **methodological challenges**, including missing values, data sparsity, and biases due to internet penetration and the use of online platforms.

Despite these constraints, they offer valuable opportunities to capture granular labor market signals.

By focusing on sub-national levels, we can uncover local labor market dynamics that remain hidden in aggregated analyses.

Analyses show **regional disparities** within countries and **similarities** between territories across different nations.

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Thanks!

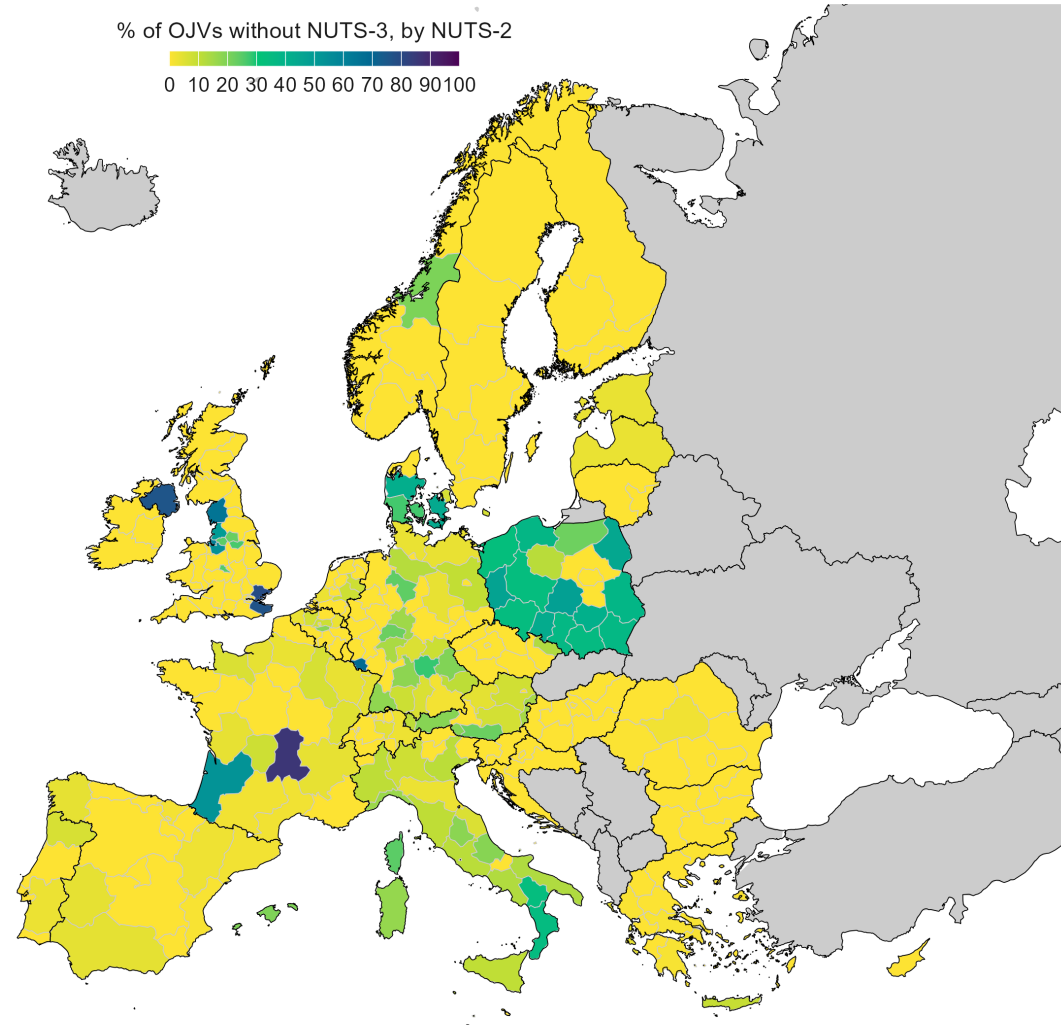


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Percentage of Online Job Vacancies without NUTS-3 classifications, by NUTS-2 regions (2019)



Percentage of Online Job Vacancies without NUTS-3 classifications, by NUTS-2 regions (2023)

