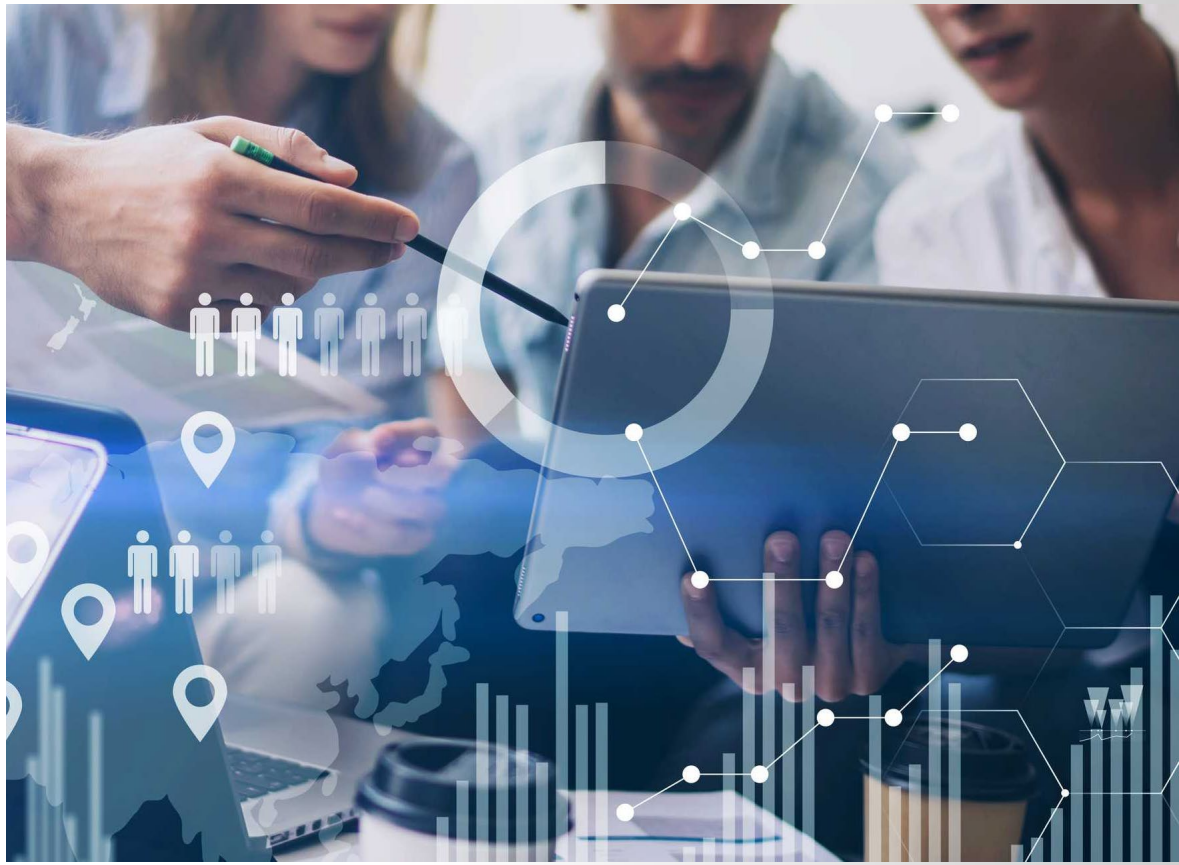




Empirical investigation of skill gaps in Europe

29 May 2025

NERI Conference – Ulster University

AUTHORS

Elisa Staffa

Seamus McGuinness



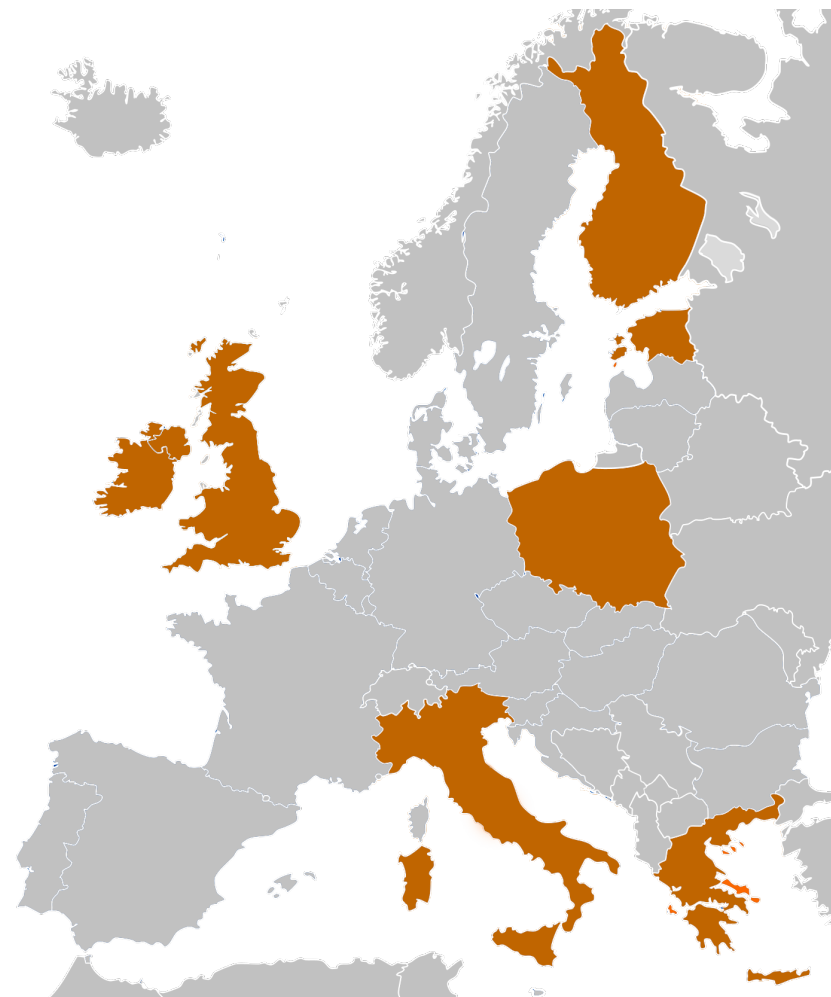


SkillsPULSE

- Skills – Predicting, Understanding, and Locating Shortages in Europe
- **Horizon Europe** project
- 3-year project (June '24 - June '27)

The project aims to provide a conceptual review of **skills shortages** and **gaps**, and devise a means of measuring their incidence and the extent to which they are likely to arise in the future as a consequence of key changes in the economy, notably digitalisation.

Coordinated by Fondazione Giacomo Brodolini:



A **skill gap** arises when existing employees lack the necessary skills for their jobs.

The existing literature on skill gaps is very thin and there is a lack of measurement consistency across the measurement approaches that do exist. McGuinness et al (2025) estimate that between 2002 and 2022 there were just 7 academic studies published on skill gaps.

- **Employer-reported** skill deficiencies: direct employer assessments of their workforce's competency shortfalls
- **Employee surveys:** direct questions to employees on areas of skill misalignment.
- **Linked employee/employer datasets**

Forth and Mason (2006). UK businesses. *‘Do your employees have sufficient understanding of the ICTs available in your company to enable them to maximise the competitive advantage that these technologies bring?’.*

Jackson and Chapman (2012) measure skill gaps by comparing the perceptions of employers and academics regarding the performance levels of Australian business graduates across a comprehensive framework of 20 non-technical skills.

Malik et al. (2019). HR directors in US businesses were asked to rate the extent to which specific skills were ‘in short supply’ at their organisation.

Cedefop's European Skills and Jobs Survey (Wave 1) asks employees: '*How would you best describe your skills in relation to what is required to do your job?*'.

'Over-skilled' if they respond that their skills are higher than required;

'under-skilled' if they respond that their skills are lower than what is required for their job and need to be further developed.

Questions on the highest level of literacy/numeracy skills required for doing the job. "*How would you describe your basic literacy (numeracy) skills?*". Range from 0 ('my level of skill is a lot lower than required') to 5 ('my level of skill is matched to what is required') and 10 ('my level of skill level is a lot higher than required').

The principal difficulty is that the questions used to measure skill gaps may vary both across and within survey approaches.

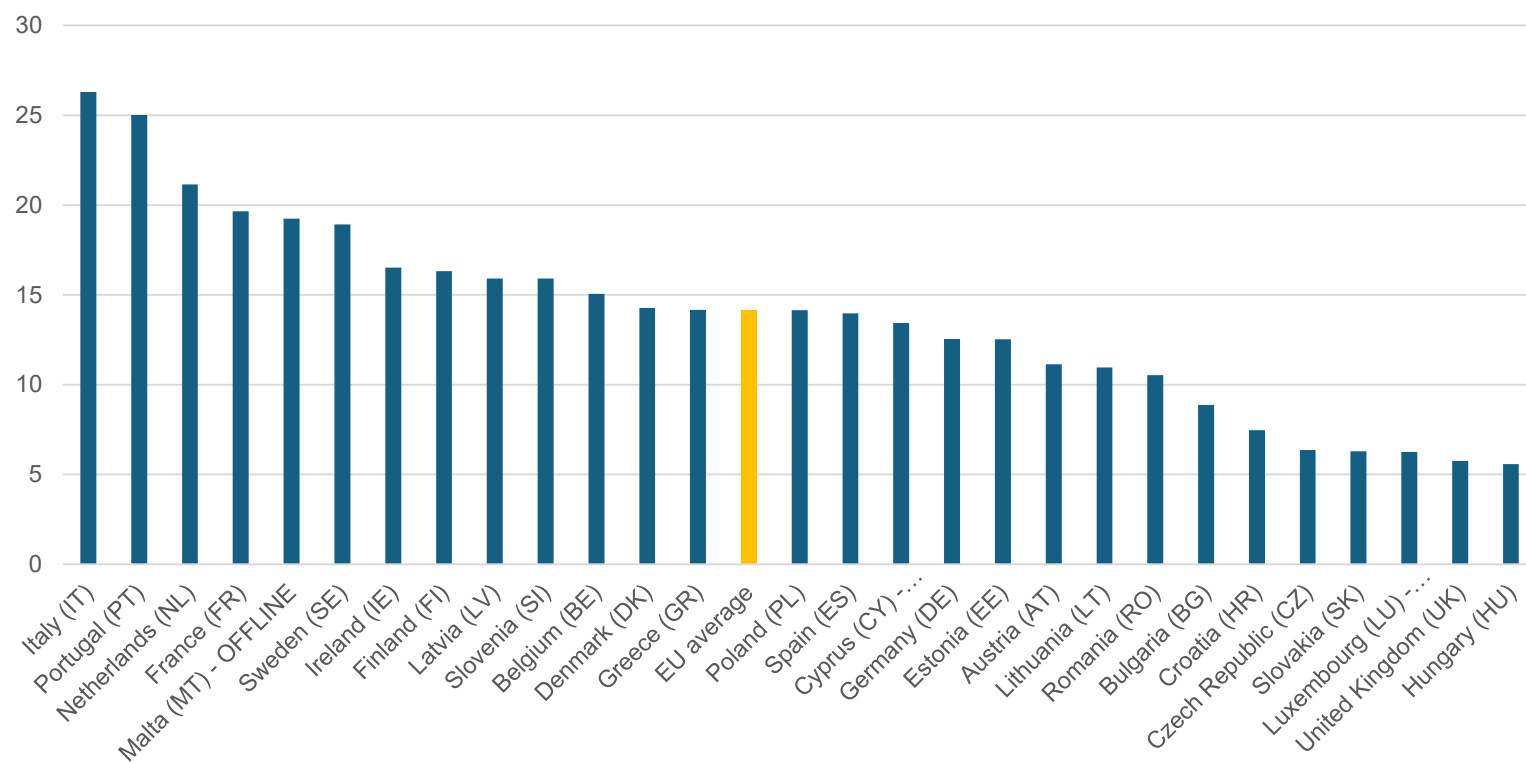
- ***‘Is there a skills problem in Europe?’*** (McGuinness, S., Staffa, E., Redmond, P., 2024). Aim to assess the extent to which Europe is facing a skills problem. This study used the ESJS1 and concluded that underskilling was not a significant problem in Europe.
- **6 per cent** of workers stating that their skills and abilities did not meet current job requirements (‘underskilled’).
- The EU incidence of **basic numeracy gaps was 2.7 per cent** and **basic literacy gaps was 1.8 per cent**; with variation across countries.
- No evidence of any wage effect associated with general underskilling, but basic literacy gaps are associated with a 10 per cent pay penalty.

- In this paper, we investigate the extent of skill gaps among the European workforce and examine the relationship between skill gaps and workers characteristics.
- We use European Skills and Jobs Survey data, administered by CEDEFOP (wave 1 in 2014; wave 2 in 2021). Change of questions in Wave 2, some challenges for inconsistencies in the approach.
- We examine the incidence of:
 - Undereducation (wave 1 and 2)
 - General skill gaps ('underskilling') (wave 2)
 - Specific skills gaps (wave 2)
- We model:
 - General characteristics associated with underskilling
 - Determinants of wages, controlling for different mismatch measures

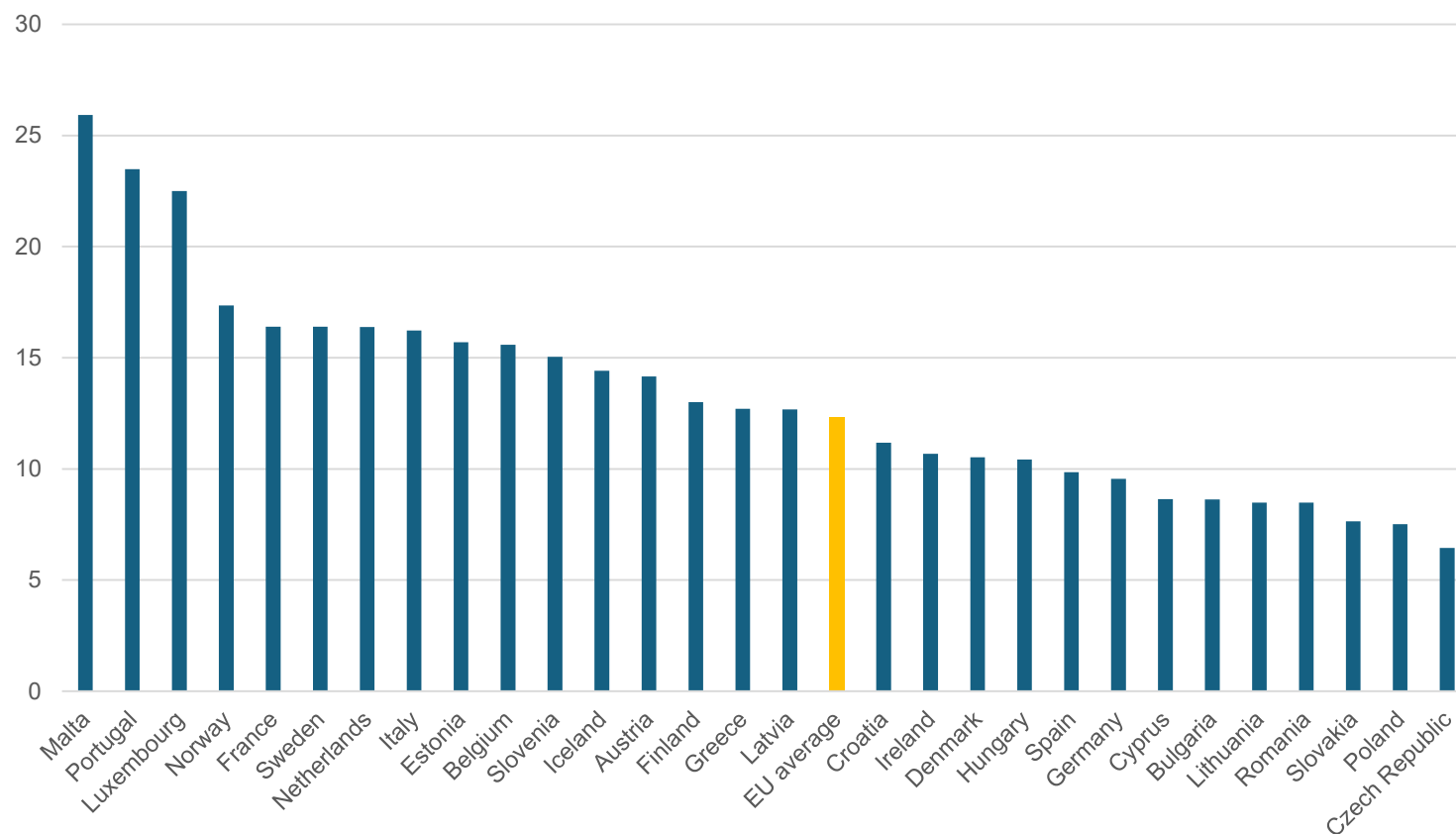
- Undereducation is an objective proxy measure of skill gap (deficit in human capital accumulation).
- European Skills and Jobs Survey data: wave 1 2014, wave 2 2021.
- In both waves, we compare: *the highest level of education completed by the employee to the education level required by the job (according to ISCED classification).*

Undereducation = level education completed < education level required by the job

EU average: **14.16** per cent

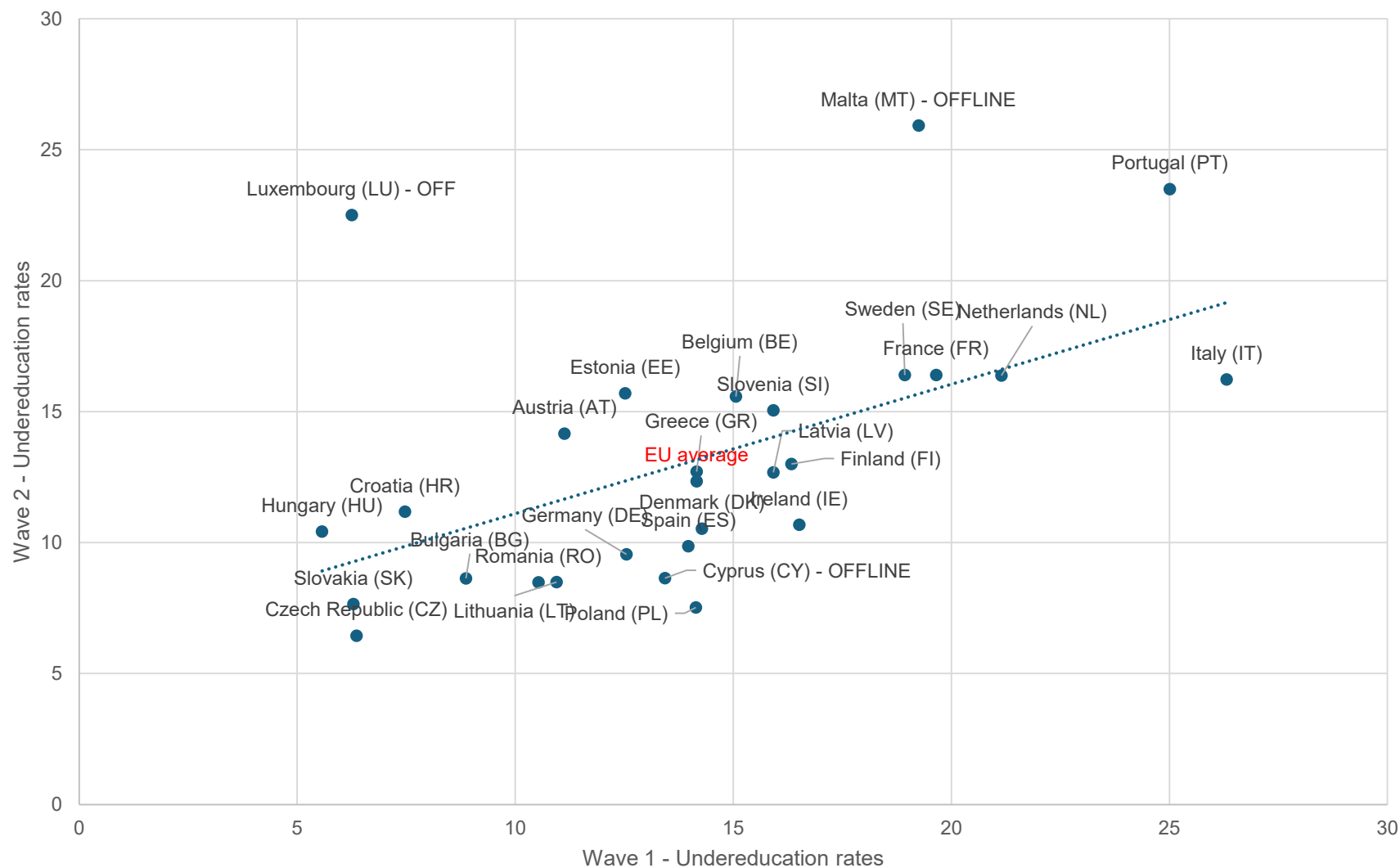


EU average: **12.34** per cent



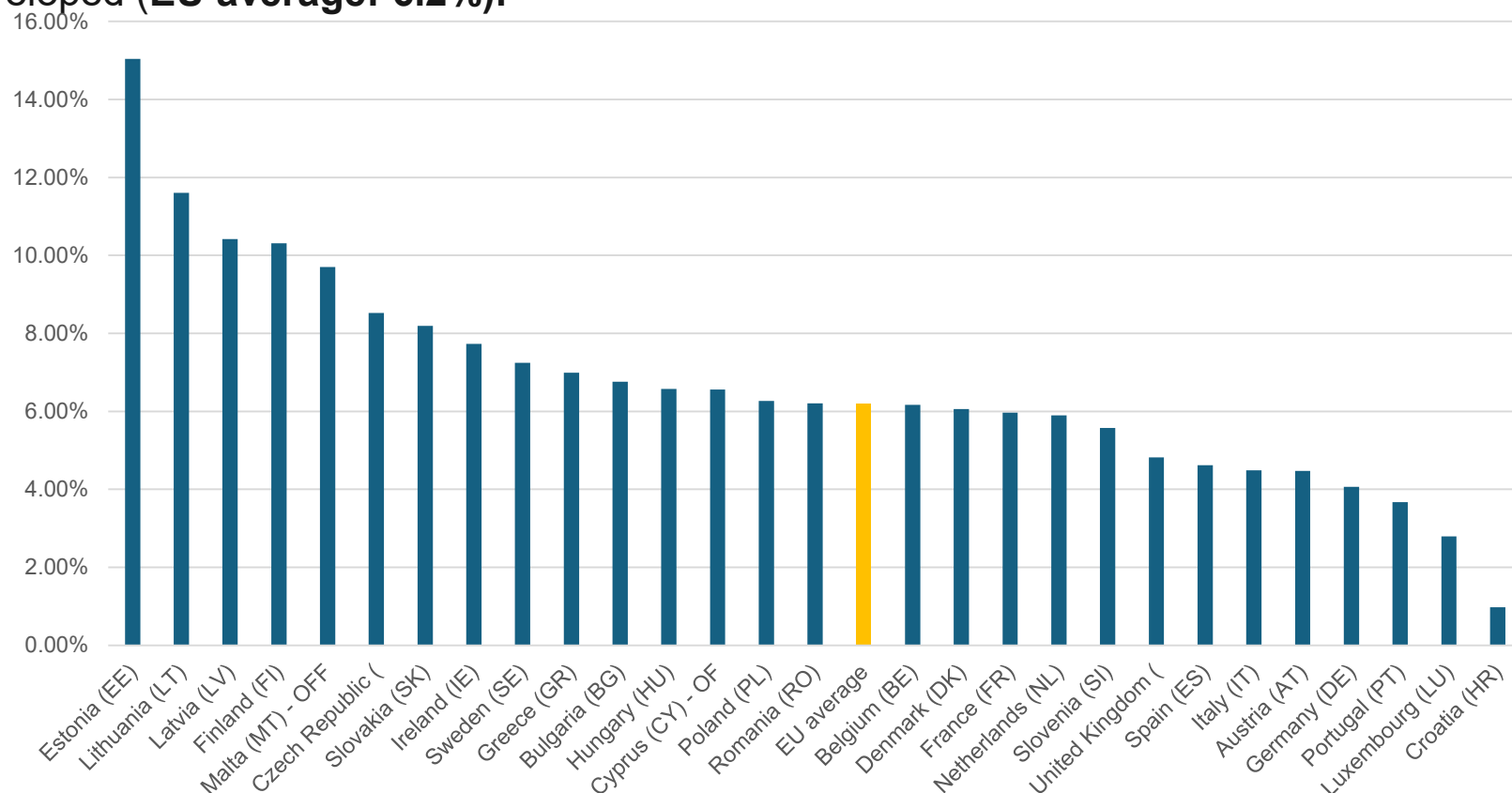
Undereducation by Country- Wave 1 against Wave 2

High correlation.



“How would you best describe your skills in relation to what is required to do your job?”

‘Under-skilled’: share of people responding that **their skills are lower than what is required** for their job and need to be further developed (**EU average: 6.2%**).

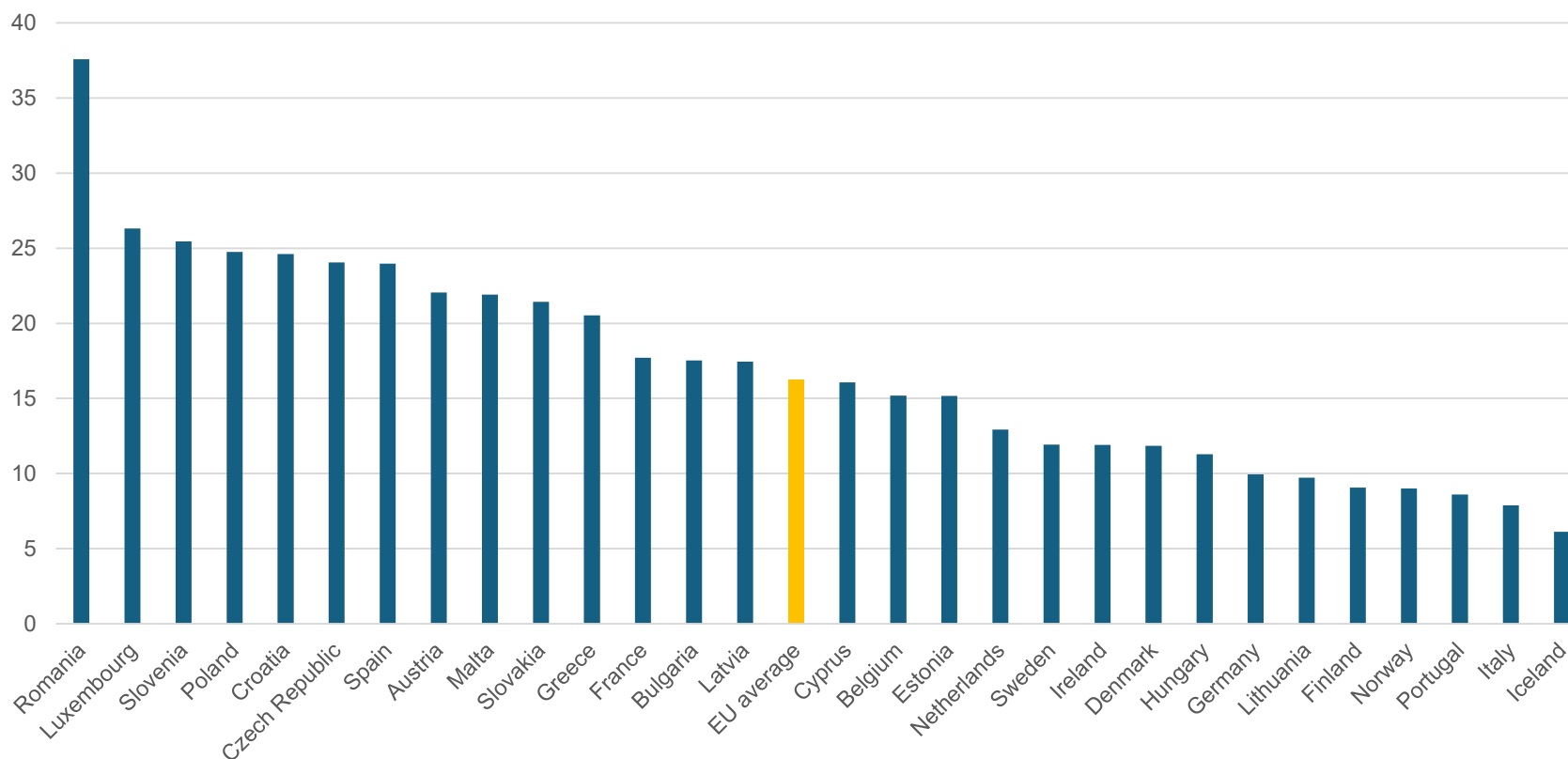


“To what extent do you need to further develop your overall level of knowledge and skills to do your main job even better?”

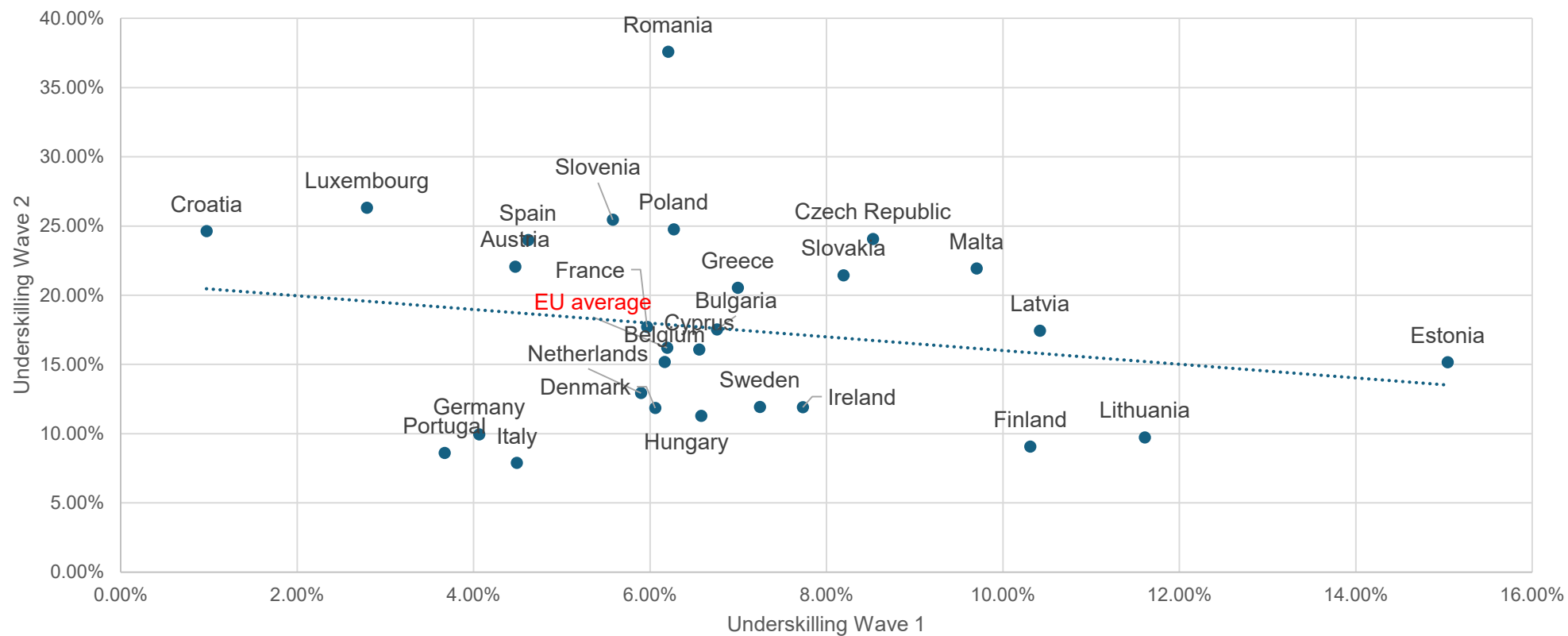
1 Great extent, 2 Moderate extent, 3 Small extent, 4 Not at all.

- Underskilling at great extent: **16.2 per cent**
- Underskilling at great and moderate extent: 63.6 per cent

‘Under-skilled’: share of those responding *at great extent* (EU average: 16.2 %).



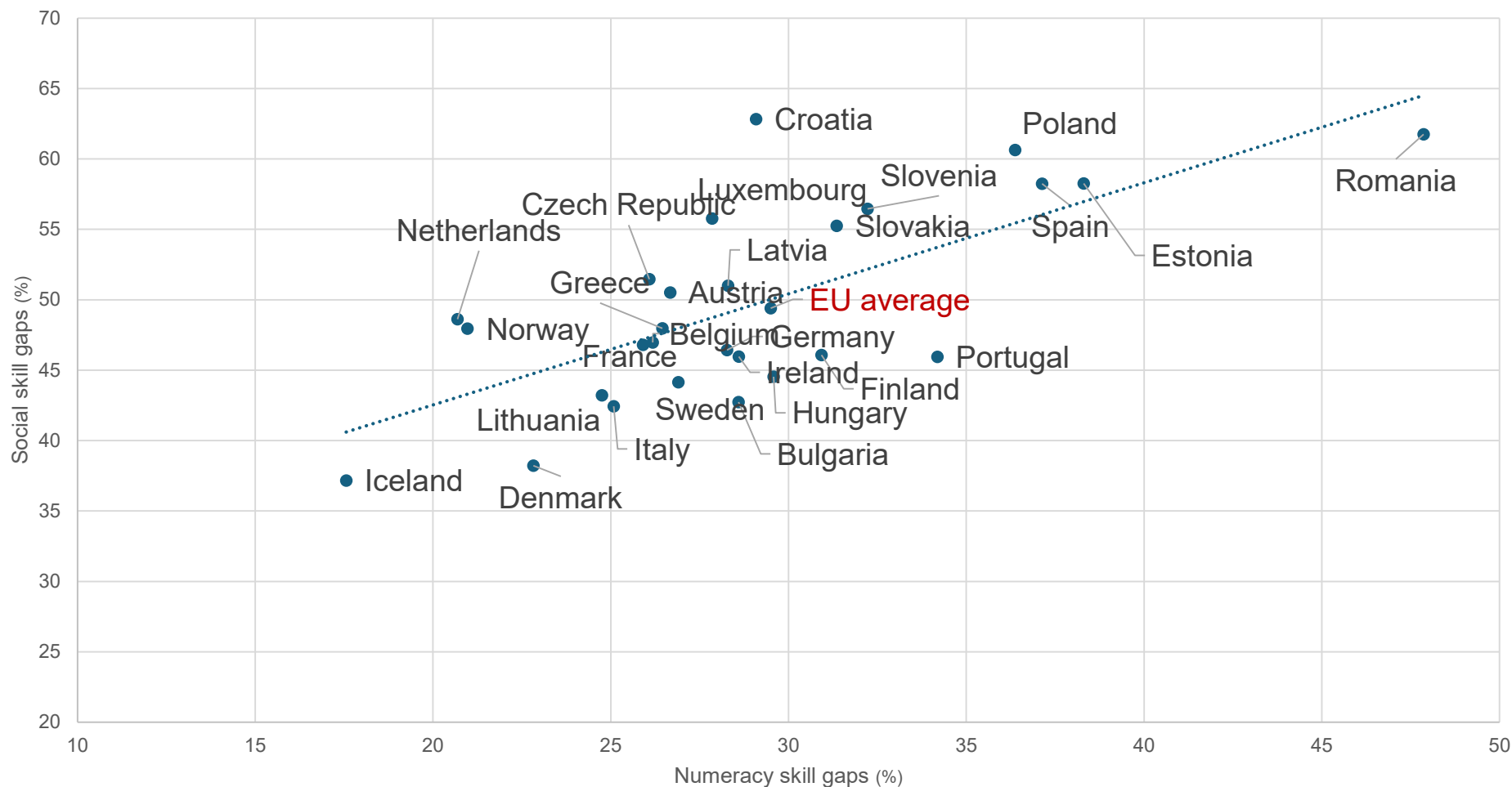
No correlation: change in question from Wave 1 and Wave 2, there is no consistent measure.



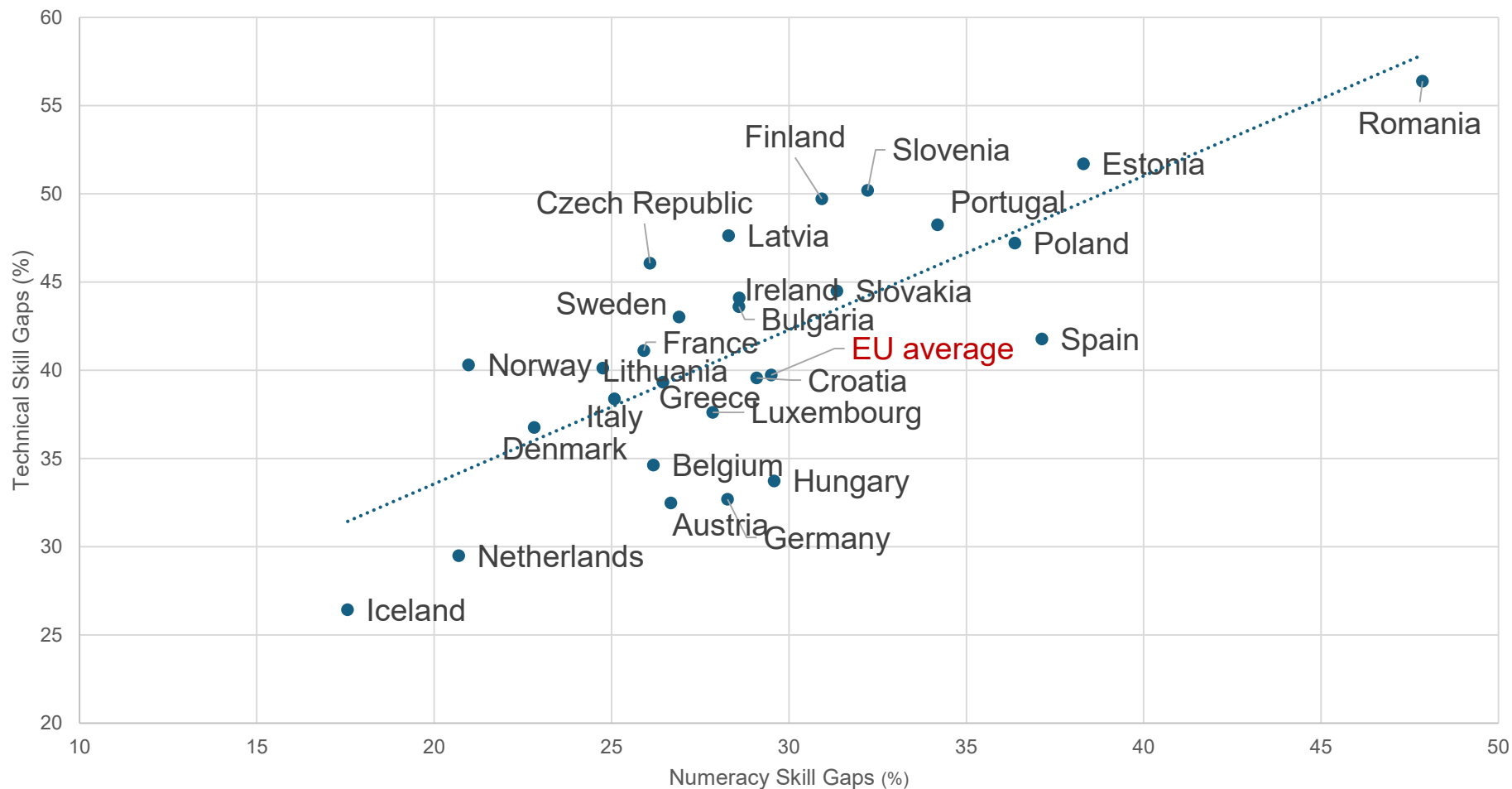
“Do you feel the need to further develop any of the following skills to do your main job even better?” Yes.

- **Numeracy skills** (working with numbers and quantities and doing calculations using maths): **29.50 per cent.**
- **Social skills** (working with and dealing with co-workers and other people): **49.39 per cent.**
- **Technical skills** or job-specific skills (engine repair if you are a mechanic, applying accountancy rules if accountant, using design software): **39.73 per cent.**

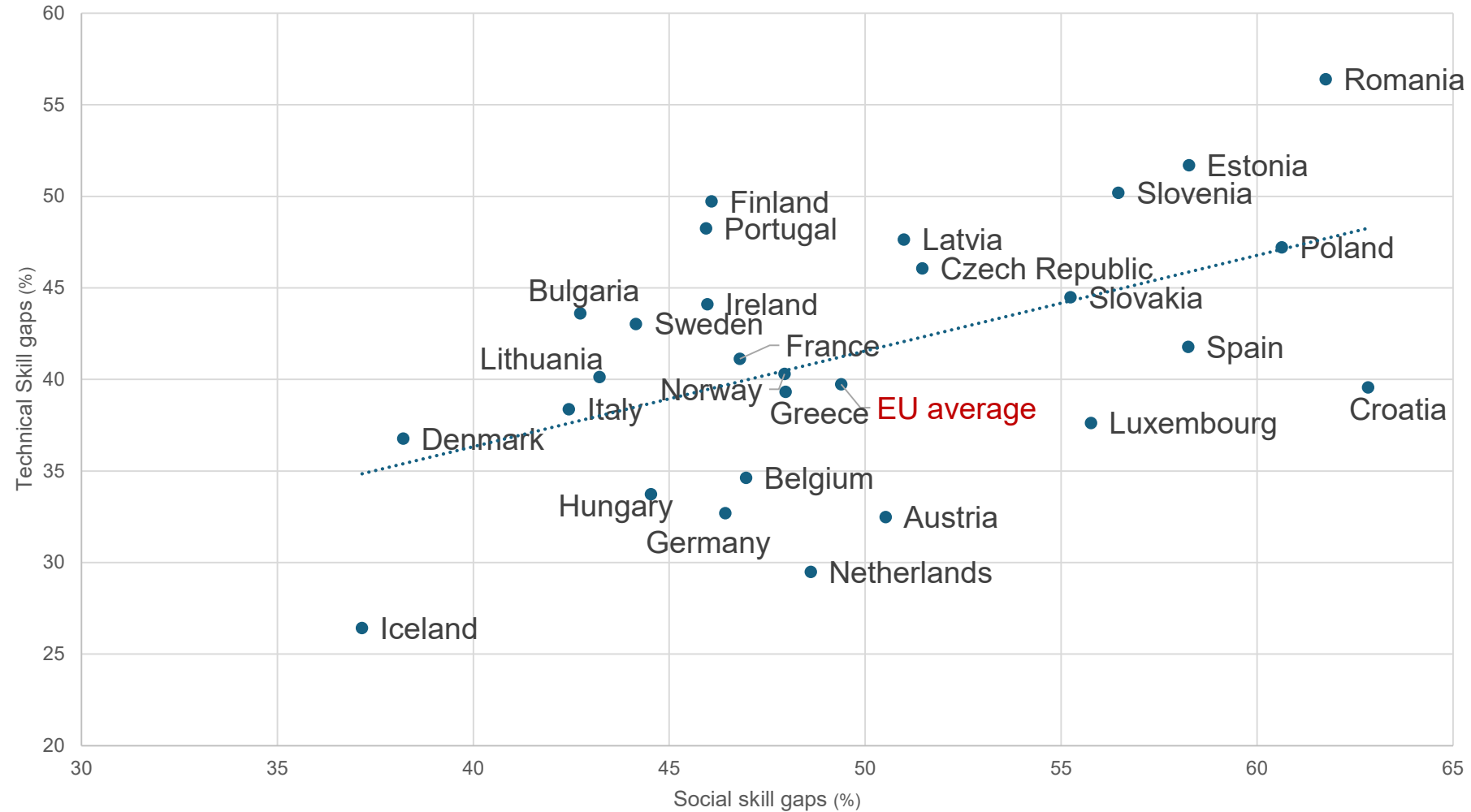
Wave 2- Numeracy skill gaps against Social skill gaps by Country



Wave 2- Numeracy skill gaps against Technical skill gaps by Country



Wave 2- Social skill gaps against Technical skill gaps by Country



	Underskilling	Numeracy	Social	Technical
Primary education or below (ISCED 0-1)	1.0	1.9	1.5	1.36
Lower secondary (ISCED 2)	8.6	9.6	9.41	8.4
Upper secondary/post upper (ISCED 3-4)	40.6	43.4	43.25	44.12
Tertiary (ISCED 5 and above)	49.8	45.2	45.83	46.12

Multivariate Estimates

Probit model for general skill gaps

$$U_{ic} = a + \beta_1 Num_{ic} + \beta_2 Soc_{ic} + \beta_3 Tech_{ic} + X_{ic}' \beta_4 + \delta_c + e_{ic}$$

Determinants of Wages

$$\ln(W)_{ic} = a + \beta_1 U_{ic} + \beta_2 Num_{ic} + \beta_3 Soc_{ic} + \beta_4 Tech_{ic} + X_{ic}' \beta_5 + \delta_c + e_i$$

- **Lower probability of underskilling:** males, older workers, overeducated workers and at a small extent workers with experience of previous unemployment.
- **Higher probability of underskilling:** undereducated workers, workers with a tertiary level of education and those on temporary contracts.
- **Underskilling is positively correlated with the three skill gaps measures**, with people declaring the need to develop numeracy, social and technical skills having a higher probability of underskilling.

Determinants of Underskilling- basic model II

VARIABLES	(1) Being Underskilled (only controls)	(2) Being Underskilled (only numeracy gap)	(3) Being Underskilled (only social gap)	(4) Being Underskilled (only technical gap)	(5) Being Underskilled (all skill gaps)
Undereducated	0.13*** (0.028)	0.12*** (0.028)	0.12*** (0.028)	0.11*** (0.029)	0.11*** (0.028)
Overeducated	-0.21*** (0.021)	-0.15*** (0.020)	-0.19*** (0.021)	-0.17*** (0.020)	-0.14*** (0.019)
Numeracy Skill Gap		0.63*** (0.031)			0.39*** (0.032)
Social Skill Gap			0.60*** (0.032)		0.42*** (0.029)
Technical Skill Gap				0.59*** (0.019)	0.40*** (0.014)
Controls	Yes	Yes	Yes	Yes	Yes
Constant	-0.31*** (0.100)	-0.72*** (0.093)	-0.77*** (0.103)	-0.62*** (0.096)	-1.09*** (0.097)
Observations	30,697	30,692	30,692	30,669	30,668
R2	0.0628	0.105	0.0996	0.0995	0.138

Source:
European
Skills and
Jobs Survey
2021 (authors'
elaboration).
Includes
country level
fixed effects.
Robust
standard
errors in
parentheses;
*** p<0.01,
** p<0.05,
* p<0.1.

- We also control for a **job complexity measure** (composite index with intermediate and high level of foundational skills-reading, writing and math).
- The measure is positively and statistically significant. **The more complex the job, the higher the probability for workers to report their need of developing their skills and knowledge.**
- Underskilling is positively correlated with the three skill gaps measures.
- All other controls lose significance.

Determinants of Underskilling- wt job complexity II

VARIABLES	(1) Being Underskilled (only controls)	(2) Being Underskilled (only numeracy gap)	(3) Being Underskilled (only social gap)	(4) Being Underskilled (only technical gap)	(5) Being Underskilled (all skill gaps)
Undereducated	0.04 (0.046)	0.05 (0.045)	0.05 (0.044)	0.05 (0.047)	0.06 (0.044)
Overeducated	-0.08 (0.050)	-0.05 (0.051)	-0.08 (0.050)	-0.07 (0.048)	-0.05 (0.049)
Foundational index	0.21*** (0.023)	0.15*** (0.020)	0.17*** (0.023)	0.17*** (0.022)	0.12*** (0.021)
Numeracy Skill Gap		0.62*** (0.041)			0.39*** (0.038)
Social Skill Gap			0.66*** (0.045)		0.46*** (0.044)
Technical Skill Gap				0.54*** (0.039)	0.34*** (0.035)
Controls	Yes	Yes	Yes	Yes	Yes
Constant	-0.81*** (0.185)	-1.03*** (0.200)	-1.14*** (0.191)	-0.97*** (0.194)	-1.26*** (0.207)
Observations	6,703	6,701	6,702	6,696	6,696
R2	0.0839	0.119	0.122	0.109	0.147

Source: European Skills and Jobs Survey 2021 (authors' elaboration). Includes country level fixed effects. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Determinants of Wages: Mismatch general model I

VARIABLES	Wage (only controls)	Wage (only underskilling)	Wage (only numeracy gaps)	Wage (only social gaps)	Wage (only technical gaps)	Wage (all skill gaps)
Underskilling		0.07*** (0.017)				0.06*** (0.017)
Undereducated	0.10*** (0.016)	0.10*** (0.016)	0.10*** (0.016)	0.10*** (0.016)	0.10*** (0.016)	0.09*** (0.016)
Overeducated	-0.14*** (0.013)	-0.14*** (0.012)	-0.14*** (0.012)	-0.14*** (0.013)	-0.14*** (0.013)	-0.13*** (0.012)
Numeracy Skill Gap			0.04*** (0.010)			0.02* (0.012)
Social Skill Gap				0.03*** (0.007)		0.01 (0.008)
Technical Skill Gap					0.04*** (0.007)	0.03*** (0.009)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.39*** (0.112)	5.37*** (0.108)	5.38*** (0.109)	5.38*** (0.110)	5.38*** (0.112)	5.35*** (0.107)
Observations	22,661	22,661	22,658	22,659	22,648	22,648
R-squared	0.496	0.497	0.496	0.496	0.496	0.497

Source:
European
Skills and
Jobs Survey
2021
(authors'
elaboration).
Includes
country level
fixed effects.
Robust
standard
errors in
parentheses;
*** p<0.01, **
p<0.05, *
p<0.1.

Determinants of Wages:

Mismatch general model with job complexity

VARIABLES	Wage (only controls)	Wage (only underskilling)	Wage (only numeracy gaps)	Wage (only social gaps)	Wage (only technical gaps)	Wage (all skill gaps)
Underskilling		0.04 (0.027)				0.03 (0.027)
Foundational Index	0.04*** (0.010)	0.04*** (0.010)	0.04*** (0.010)	0.04*** (0.010)	0.04*** (0.010)	0.04*** (0.009)
Undereducated	0.11*** (0.018)	0.11*** (0.017)	0.11*** (0.018)	0.11*** (0.018)	0.11*** (0.017)	0.11*** (0.017)
Overeducated	-0.09*** (0.023)	-0.08*** (0.023)	-0.09*** (0.023)	-0.09*** (0.023)	-0.09*** (0.023)	-0.08*** (0.024)
Numeracy Skill Gap			0.00 (0.018)			-0.01 (0.020)
Social Skill Gap				0.01 (0.011)		0.01 (0.017)
Technical Skill Gap					0.01 (0.010)	0.01 (0.010)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.14*** (0.271)	5.12*** (0.271)	5.14*** (0.274)	5.13*** (0.273)	5.14*** (0.271)	5.13*** (0.274)
Observations	5,072	5,072	5,070	5,071	5,066	5,066
R-squared	0.555	0.556	0.555	0.555	0.555	0.556

Source:
European
Skills and Jobs
Survey 2021
(authors'
elaboration).
Includes
country level
fixed effects.
Robust
standard errors
in
parentheses;
*** p<0.01, **
p<0.05, *
p<0.1.

Note: the controls are gender, age, education, pt, temporary, previous unemployment.

- We investigated the extent of skill gaps among the European workforce, using employee survey data.
- **Undereducation has been declining** slightly at both an EU and a member state level between 2014 and 2021.
- We find relatively **high rates of general and specific underskilling** (based on the questions in the ESJS2).
- Measures of underskilling were found to be highly correlated with each other at member state level and within the models estimated at worker level.

- We find that, **where skill gaps exist, they are likely to be driven by workers motivated to keep pace with evolving requirements in more demanding/complex jobs.** In this context, the skill gaps observed here, which are likely to be overwhelmingly non-essential, can be viewed as a positive outcome that reflects employees' desire to undertake their job in a more optimal way. This is very different from a deficiency that prevents workers from meeting the basic requirements of their role, which is the traditional perception of skill gaps.
- When estimating a basic wage model, **underskilling was associated with a wage premium. However, these premia disappeared when job complexity was introduced in the model.**
- Consequently, **we find no evidence that skill gaps (as measured in the ESJS2) are associated with negative productivity impacts (proxied by wages).**
- The research highlights the importance of adopting consistent survey tools for the measurement of skill gaps both within and across countries.

Thank you for the attention!

SkillsPULSE

SKILLS - PREDICTING, UNDERSTANDING, AND LOCATING SHORTAGES IN EUROPE



www.skillspulse.eu



@SkillsPulse



@skillspulse



@Skills-Pulse

elisa.staffa@esri.ie