Labour and skill shortages: Overview of the literature, datasets and methods used to compute the EU indicators

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Abstract

Labour and skill shortages across Europe have been steadily increasing and are projected to worsen in the coming decades. SkiLMeeT's primary objective is to generate data and indicators that quantify the extent of labour and skill shortages and mismatches in Europe. This deliverable presents a thorough overview of the relevant literature, available datasets, and methods employed in calculating the EU indicators central to the project. By synthesizing this information, SkiLMeeT lays the groundwork for developing targeted strategies to mitigate the impact of labour and skill shortages on the European workforce.

Keywords: Labour shortage, skill shortage, skill mismatch, EU indicators.

1. Introduction

Labour and skill shortages have been increasing and are expected to continue rising over the coming decades, becoming a critical issue in the European Union and prompting significant actions from the European Commission. On 20 March 2024, the Commission unveiled a comprehensive action plan[1] developed in collaboration with social partners to address these challenges. This plan stands as a key deliverable of the European Year of Skills[2] and builds upon the discussions held at the Val Duchesse Social Partners Summit on 31 January 2024.

The urgency to address these challenges was further emphasized when Employment and Social Affairs Ministers convened at the EPSCO Council in July 2024 to engage in a policy debate on labour and skill shortages within the framework of the European Semester[3]. This high-level discussion underscores the EU's commitment to tackle these shortages, which are crucial for maintaining EU competitiveness, fostering sustainable growth, and facilitating the green and digital transitions.

The current deliverable proposes an overview of the literature, datasets and methods used to compute the EU indicators that are provided as Stata files.

2. Existing approaches to measure labour and skills shortages and skills mismatch in the literature

2.1. Labour shortage

There are two approaches to the definition of accurate measures of labour shortage that make use of publicly available data.

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[1] The text of the action plan is available here: https://data.consilium.europa.eu/doc/document/ST-8153-2024-INIT/en/pdf.

[2] Information on the European Year of Skills are available here: https://year-of-skills.europa.eu/index_en.

[3] The Council Conclusions are available here: https://data.consilium.europa.eu/doc/document/ST-15463-2024-INIT/en/pdf.

1. The McGrath approach

McGrath & Behan (2017); McGrath (2019, 2020, 2021) (also later used by Bachmann et al. (2023)) propose a calculation of a shortage/surplus ratio suited for the Labour Force Survey (LFS). The calculation is as follows: *(number of recruits to the occupation in the year under review) / (number of inactive persons in the year under review with previous work experience in this occupation).* McGrath's (2021) most recent report on EU25 combines the data of the LFS with the EURES National Coordination Offices from the latter half of 2020 and the first quarter of 2021. The report estimates that 28 occupations, employing 14% in the EU workforce in 2020 (27 million of workers) are classified as shortages, with 19 occupations classified as shortages of high magnitude. Additionally, the most prominent occupations in shortage were healthcare and STEM (science, technology, engineering, and mathematics) occupations at all levels.

2. The labour as a factor limiting production approach.

The European Commission (2021) use another measure of labour shortage proxied by the variable "factors limiting production: labour", which is asked in the European Business and Consumer Survey (BCS) from DG ECFIN. This measure is applied in various reports such as The European Commission's Winter forecast for 2024[4], where the report analyses inflation trends in the EU area including this metric as part of its assessment of labour market conditions and its impact on inflation.

Additional approaches exist but rely on data that is not yet publicly available. For instance, Cedefop (2025) recently published the Cedefop's Labour and Skills Shortage Index (LSSI) which proposes a forecast for 2035 on data provided by Cedefop's skills forecast using estimates of the employment growth, replacement needs and supply-demand imbalances over the period 2021 to 2035. The estimation revealed that the high-skilled occupations expected to be in shortage in 2035 will include legal, social and cultural professionals, as well as various associate professionals.

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[4] The report is available here: https://www.consilium.europa.eu/media/qeyjzlz2/inflation-note_march24_eeurogroup.pdf.

ELA & EURES (2024) published a report on occupations in shortage across EU27 countries, based on data from the EURES National Coordination Offices (NCOs). The report includes a data triangulation comparison with Cedefop skills forecasts, job vacancy rates (JVR), and Eurobarometer data to enhance the robustness and plausibility of the findings. They also used LFS data. The results projected that the four business sectors most affected by labour shortages are construction, engineering, healthcare, and ICT, and the specific occupations that suffer the most are heavy truck drivers, nursing professionals (including specialists), doctors, electricians, roofers, waiters, construction labourers, and and software developers. Nevertheles, about 67% of the total available 4-digit ISCO08 occupations in 24 countries are identified to be in surplus, which is an average of 29 occupations for each country. The main drivers identified are unattractive working conditions and mismatches between jobseekers' preferences and employers' offerings, which contribute to the challenge.

Bossler & Popp (2023) propose a measure of labour market tightness that equals the ratio of vacancies to job seekers in an occupation, within a region, and over a year, using data from the German Federal Employment Agency (FEA). The researchers estimate that a 10 percent increase in labour market tightness reduces firms' employment by 0.5 percent. When accounting for search externalities, the report further highlight that the individual-firm wage elasticity of labour demand reduces from -0.7 to -0.5 at the aggregate level.

It should be noted that Eurostat and the European Commission provide additional data that can complement the indicators presented above. For instance, Eurostat have published companies' job vacancy rates (JVR) and the European Commission have proposed the 'labour hoarding'. The 'labour hoarding' dataset is based on a survey question capturing managers' employment expectations and a question on their output expectations. The formulation of the question is identical across all of the surveys: "How do you expect your firm's total employment to change over the next 3 months? With the repsonces being options of increase, remain unchanged, decrease.

2.2. Skill shortage

The approach using employer survey data is the most widely used across literature.

1. The employer survey approach

Green et al. (1998) explored the notion of 'skills shortage'. They underline that the definition used by the British Government's Training Agency is that 'skills shortage' exists 'when there are not enough people available with the skills needed to do the jobs which need to be done' (Training Agency, 1990,

page 29). They highlight that the typical question used in employer surveys to quantify the skill shortage is 'Would you say that this establishment has experienced a 'skill shortage' in the last 12 months, or not?'. Green & Owen (2003) use another but similar measure that is about 'hard-to-fill vacancies': 'What are the main causes of having a hard-to-fill vacancy?', which is related to subset reasons: a low number of applicants with the required skills; a lack of work experience the company demands; or a lack of qualifications the company demands. Statistics from the UK employer survey (ESS: Employers Skills Survey – 1999) were used in this research. The incidence of skill shortages at a local level were examined and revealed both broad regional and intra-regional variations. Bennett & McGuinness (2009) use data collected by the Economic Research Institute of Northern Ireland (ERINI) with a question on hard-to-fill vacancy similar to UK Employers Skills Survey used by Green & Owen (2003). They also account for the number of unfilled vacancies occurring in the 12 months preceding the surveys. They underline that both hard-to-fill and unfilled vacancies reduce output per worker by 65% and 75% in affected firms. Morris et al. (2020) used the ESS data from 2008 to 2014 to measure the skill shortages using the hard-to-fill vacancies measure from Green and Owen (2003). However, they restricted it to cases where skill-shortage vacancies are hard-to-fill vacancies due to skill-related reasons only. The research highlighted a direct negative effect of skill shortages on firm productivity, and identified negative spillover effects for skill shortages and skill gaps in related industries and nearby regions.

 Brunello & Wruuck (2021) advise following Quintini's (2011b) definition, which states that skill shortages arise when employers are unable to recruit staff with the required skills in the accessible labour market. However, they suggest adding the ongoing rate of pay to this definition. Nevertheless, Quintini (2011a) underscores that 'wage related skill-shortage measures require good hourly wage data or good data on monthly/weekly wages and on hours worked and these are often unavailable' (page 11).

2.3. Skill mismatch

Another notion that exists in the literature is skill mismatch, which complements efforts to measure labour and skill shortages

Brunello & Wruuck (2021) provide advise on how to measure skill mismatch at the macro level 'by comparing the composition of vacancies by qualification or education with that of the working age population (as a proxy of labour supply). Instead of vacancies, one can compare the composition of employment as a proxy of labour demand with that of the population at working age, or the composition

of unemployment with that of the labour force' (page 1147). Additional literature reviews on skill mismatch by McGuinness et al. (2018) and Somers et al. (2019) are also referred to.

Using existing available data, two main approaches in terms of skills mismatch exist.

1. The employer survey approach

Morris et al., (2020) use the ESS and measure the skill gaps based on 'How many of your existing staff would you regard as fully proficient at their job? (a proficient employee is someone who is able to do the job to the required level)'. They find negative spillover effects for skill gaps (and also skill shortages) in related industries and proximate regions.

2. The employee survey approach

Cedefop (2018) propose to use the European skills and jobs survey (ESJS) that asks individuals directly about their skills and whether it matches with what is required in their job.

3. Data and methods used to calculate the European indicators

3.1. Labour shortage

1. The McGrath approach

The McGrath approach uses the Labour Force Survey (data available from EUROSTAT MICRODATA). Using the McGrath approach, the country specific Labour Force Surveys are used to calculate the shortage/surplus ratio as the following = (number of recruits to the occupation ISCO 3D in the year under review) / (number of inactive persons in the year under review with previous work experience in this occupation ISCO 3D). The reference population covered is the population aged 15-64 with no missing values in their occupation codes. The weight 'coeffy' is used for the calculation.

All EU27 countries except Malta are covered:

Table 1. Labour Force Survey – Countries covered for labour shortage

Code	Name	Code	Name
AT	Austria	IT	Italy
BE	Belgium	LV	Latvia
BG	Bulgaria	LT	Lithuania
CZ	Czechia	LU	Luxembourg

CY	Cyprus	HU	Hungary
DK	Denmark	NL	Netherlands
DE	Germany	PL	Poland
EE	Estonia	PT	Portugal
IE	Ireland	RO	Romania
EL	Greece	SI	Slovenia – Almost ISCO 2D
ES	Spain	SK	Slovak Republic
FR	France	FI	Finland
HR	Croatia	SE	Sweden

The LFS2023_labour_shortage table contains the country code (AT, BE, etc.), the ISCO 3-digit codes and label (isco_label and isco_lable_name), and the labour shortage indicator appears below the country code.

2. The labour as a factor limiting production approach

The European Business and Consumer Surveys (BCS) survey (seasonally adjusted statistics) question: 'What main factors are currently limiting your business? Shortage of labour force' (available from DG ECFIN) is used.

Three group of sectors are covered (manufacturing, services, construction), while consumers and retail trade are not included. The data provides quarterly figures since 1985 for some countries.

The following table (Table 2) includes the list of countries covered:

Table 2.   Business and Consumer Surveys – Countries covered for labour shortage

Code	Name	Code	Name
EU	European Union (current composition)	HU	Hungary
BE	Belgium	MT	Malta
BG	Bulgaria	NL	Netherlands
CZ	Czechia	AT	Austria
DK	Denmark	PL	Poland
DE	Germany	PT	Portugal
EE	Estonia	RO	Romania
IE	Ireland	SI	Slovenia
EL	Greece	SK	Slovak Republic
ES	Spain	FI	Finland
FR	France	SE	Sweden

HR	Croatia	UK	United Kingdom
IT	Italy	ME	Montenegro
CY	Cyprus	MK	North Macedonia
LV	Latvia	AL	Albania
LT	Lithuania	RS	Serbia
LU	Luxembourg	TR	Türkiye

The BCS2025_labour_shortage table contains the time (year and quarter), sector (NACE 1-digit) and the country code (AT, BE, etc.), and the labour shortage indicator appears below the country code.

3.2. Skill shortage

1. The employer survey approach

The 2019 European Company Survey – management survey (ECS_mm from Eurofound, available on UK data Archive) is used. The following question is applied to measure skill shortages: How difficult is it for this establishment to find employees with the required skills? The values are recoded to obtain: 1 "Not at all difficult" 2 "Not very difficult" 3 "Fairly difficult" 4 "Very difficult".

The skill shortage indicator is calculated using the weighted mean command on STATA (egen wmean using the weight wgt_EU_final) at the country and a strata level. The strata is crossing NACE 1-digit and size as defined below.

Table 3.   European Company Survey – NACE covered for skill shortage and mismatch

mm_NACE	NACE identifiant	NACE 1-digit
2	B	Mining and quarrying
3	C	Manufacturing
4	D	Electricity, gas, steam and air conditioning supply
5	E	Water supply; sewerage, waste management and remediation activities
6	F	Construction
7	G	Wholesale and retail trade; repair of motor vehicles and motorcycles
8	H	Transportation and storage
9	I	Accommodation and food service activities
10	J	Information and communication
11	K	Financial and insurance activities
12	L	Real estate activities

13	M	Professional, scientific and technical activities
14	N	Administrative and support service activities
18	R	Arts, entertainment and recreation
19	S	Other service activities

Table 4.   European Company Survey – Companies size covered for skill shortage and mismatch

scr_size_grp	Size groups
1	Small (10-49)
2	Medium (50-99, 50-199 or 50-249)
3	Large (100+, 200+ or 250+)

Table 5.   European Company Survey – Countries covered for skill shortage and mismatch

Name	Name	Name
Austria	Germany	Poland
Belgium	Greece	Portugal
Bulgaria	Hungary	Romania
Croatia	Ireland	Slovakia
Cyprus	Italy	Slovenia
Czechia	Latvia	Spain
Denmark	Lithuania	Sweden
Estonia	Luxembourg	United Kingdom
Finland	Malta	
France	Netherlands	

The ECS2019_skill_shortage_mismatch table contains the country name (country), the NACE 1-digit (mm_NACE), the size group (scr_size_grp), the skill shortage indicator: findskill_indicator_w and three skill mismatch indicators: skillsmatch_indicator_w underskill_indicator_w overskill_indicator_w.

3.3. Skill mismatch

1.   The employer survey approach

The 2019 European Company Survey – management survey (ECS_mm from Eurofound, available on UK data Archive) is used.

-   [skillsmatch] What percentage of employees have the skills that are about right to do the job?

- [underskill] What percentage of employees have a lower level of skills than is needed in their job?
- [overskill] What percentage of employees have a higher level of skills than is needed in their job?

The skill mismatch indicators are calculated using the weighted mean command on STATA (egen wmean using the weight wgt_EU_final) at the country and the strata (NACE*Size) level as defined above.

The ECS2019_skill_shortage_mismatch table contains the country name (country), the NACE 1-digit (mm_NACE), the size group (scr_size_grp), three skill mismatch indicators: skillsmatch_indicator_w underskill_indicator_w overskill_indicator_w, and the skill shortage indicator: findskill_indicator_w.

2. The employee survey approach

The a) European Skills and Job Survey 2021 (ESJS, available from Cedefop). Two questions are used to measure skill mismatches:

- On a scale from 0 to 10, where 0 is completely dissatisfied, 5 moderately satisfied and 10 is completely satisfied, how satisfied are you with the following aspects of your job? Job's match with your qualifications and skills.

-To what extent do you need to further develop your overall level of knowledge and skills to do your main job even better? The values are recoded to obtain: 1 "Not at all", 2 "Small extent", 3 "Moderate extent", 4 "Great extent".

The indicators are computed using the weighted mean command on STATA (egen wmean using Pan_Country_weight_CAWI as weight) at the country and ISCO 4 digit level.

The ESJS2_skill_match_ISCO table contains the country name (COUNTRYCODE), the ISCO 4 digit code (ISCO4d), ISCO 4-digit name (B_ISCOD4), and the two skill mismatch indicators at the occupational level: satmatch_indicator_isco4_w skilldef_indicator_isco4_w.

The ESJS2_skill_match_NACE table contains the country name (COUNTRYCODE), the NACE 2 digit code (NACE2d), NACE 2-digit name (B_NACE2), and the two skill mismatch indicators at the sectoral level: satmatch_indicator_nace2_w skilldef_indicator_nace2_w.

4. The datasets produced at a glance

Table 6 provides an overview of the datasets created.

Table 6.   Labour and skill shortage and mismatch datasets

Name of the dataset	Level of analysis	Indicators types
BCS2025_labour_shortage	NACE 1-digit and countries	Labour shortage
LFS2023_labour_shortage	ISCO 3-digit and countries	Labour shortage
ECS2019_skill_shortage_mismatch	NACE 1-digit, size groups and countries	Skill shortage and skill mismatch
ESJS2_skill_match_ISCO	ISCO 4-digit and countries	Skill mismatch
ESJS2_skill_match_NACE	NACE 2-digit and countries	Skill mismatch

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