

EDULAB

European Youth in Transition to
Education and Labour



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Merged Datasets and Analytical Reports on Youth Pathways and Transitions

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Purpose and scope of the deliverable

EDU-LAB is a Horizon Europe collaborative research project (Grant Agreement No. 101177428) running from 2025 to 2027. It addresses systemic challenges in the transition of young people from education into employment, examining how policies, practices and institutional arrangements across different education and training systems (particularly in general education and in professional/vocational education and training) shape outcomes for young people. Among its core concerns are early school-leaving, work-based learning, regional disparities, the policy and investment landscape in the European Education Area, and the identification and promotion of effective and inclusive practices at local, national and EU levels. The project brings together a multidisciplinary consortium of universities, research institutions and policy-oriented organisations from across Europe and aims not only to generate knowledge but to facilitate its uptake through collaborative stakeholder engagement.

D3.2 builds on the WP3A inventory and terms-of-reference work reported in D3.1. It is the quantitative counterpart to the expert-survey strand of the project (WP3B), and its findings are handed to the WP3B online survey of experts and stakeholders and to the WP4 case studies as a structured set of mechanism hypotheses.

Document history

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List of project-specific terms and abbreviations

ALMP	Active labour market policy
BRR	Balanced repeated replication (variance estimator)
Cedefop	European Centre for the Development of Vocational Training
CIL	Computer and information literacy (ICILS scale)
COVID-19	Coronavirus disease 2019
CT	Computational thinking (ICILS scale)
EEA	European Education Area
ESCS	PISA index of economic, social and cultural status
ESF+	European Social Fund Plus
ESS	European Social Survey
ETF	European Training Foundation
EU-LFS	European Union Labour Force Survey
EU-SILC	European Union Statistics on Income and Living Conditions
EUROGRADUATE	European survey of higher-education graduates
EUROSTUDENT	European survey on the social and economic conditions of student life
FDZ-DZHW	Research Data Centre of the German Centre for Higher Education Research and Science Studies
GDP	Gross domestic product
GE	General education
ICILS	International Computer and Information Literacy Study (IEA)
ICT	Information and communication technologies

IEA	International Association for the Evaluation of Educational Achievement
ISCED	International Standard Classification of Education
KIESE	Key Indicators on Education, Skills and Employment (ETF)
NEET	Not in employment, education or training
OECD	Organisation for Economic Co-operation and Development
PIAAC	Programme for the International Assessment of Adult Competencies (OECD)
PIRLS	Progress in International Reading Literacy Study (IEA)
PISA	Programme for International Student Assessment (OECD)
PPP	Purchasing power parity
PVET	Professional and vocational education and training
RQ	Research question
SD	Standard deviation
SES	Socioeconomic status
SUF	Scientific-use file (restricted-access microdata)
TIMSS	Trends in International Mathematics and Science Study (IEA)
USD	United States dollar
VET	Vocational education and training
WP	Work package

Codes for EDU-LAB target countries

FI Finland	IT Italy	UK United Kingdom
AT Austria	GR Greece	PL Poland
XK Kosovo	PT Portugal	DE Germany

About this report

This is the full report for Deliverable D3.2. It documents the construction of the merged datasets and sets out the methodology. It then presents the analytical reports for the four transition fields and the cross-cutting research-question clusters, a set of deep dives, and a triangulation with official European statistics. It closes with country profiles, a mapping of the findings to the research questions, a synthesis, the limitations and the conclusions. A detailed table of contents follows this page.

Every microdata estimate cited is recorded in the accompanying Results Register, and the official statistics used in Chapter 19 are documented in a separate macro exhibit. These files and the further materials listed below, including the codebooks of the six harmonised datasets, can be downloaded from the WP3A section of the EDU-LAB Dashboard at <https://dashboard.edu-lab-project.eu/app/wp3a-method>, which also links to the original data providers. The codebooks document how each harmonised variable was derived; the harmonised data files themselves are available upon request from office@economica.eu. The tertiary and graduate analyses draw on two further sources, EUROSTUDENT and EUROGRADUATE. These are confidential scientific-use files released only under a written data use agreement with the data provider. They could therefore not be harmonised into the partner-country files, and neither the microdata nor any derived dataset can be distributed. The Results Register contains only aggregate estimates from these sources.

Beyond the downloadable materials, the Dashboard presents the WP3A results interactively at <https://dashboard.edu-lab-project.eu/app/wp3a-overview>, and further information on the project is available at www.edu-lab-project.eu.

Accompanying materials

Item	Description	File on the EDU-LAB Dashboard
Six harmonised datasets	PISA, PIAAC, TIMSS, PIRLS, ICILS, ESS: codebooks documenting the derivation of each harmonised variable from original data; partner-country data files (CSV and Parquet) available upon request	Codebook file per programme (e.g. PISA_Codebook.xlsx)
Results Register	All microdata estimates cited in the report, with standard errors, sample sizes and inference methods	WP3A_Results_Register.xlsx
Macro exhibit	Official aggregate statistics from Eurostat, the World Bank, the OECD and the ETF, with sources and verification	WP3A_Macro_Eurostat.xlsx
Research-question coverage matrix	Coverage of all 34 sub-questions of the EDU-LAB research programme	WP3A_D32_RQ_Coverage_Matrix.xlsx
Policy-effectiveness matrix	Joint WP2–WP3A matrix of policy inputs and outcomes by country	WP3A_D32_Policy_Effectiveness_Matrix.xlsx
Targeted hypotheses	Questions handed to the WP3B expert survey and the WP4 case studies	WP3A_D32_Hypotheses_for_WP3B_WP4.docx
Country scoreboard	Key indicators by partner country, full version of Table 15	WP3A_D32_Country_Scoreboard.xlsx

Table of Contents

About this report	4
Table of Contents	5
List of Figures	8
List of Tables	10
Executive summary	11
1 Introduction	13
1.1 The EDU-LAB project and the place of WP3A	13
1.2 Goals of this deliverable	13
1.3 Relation to the transition fields and research questions	13
2 Conceptual framework and policy context	14
2.1 Intersectional determinants of pathways and transitions	14
2.2 Synthesis of the existing literature	14
2.3 The policy landscape	15
2.4 The trajectory model and the strategy for measuring determinants	15
3 Data sources and harmonisation	16
3.1 Selection of datasets	16
3.2 Harmonisation strategy	17
3.3 Validation	18
4 Methodology	18
4.1 Statistical inference	18
4.2 The analytic toolkit	18
4.3 Assumptions, robustness and validation	19
5 The choice of educational pathways	20
5.1 Achievement levels and long-run trends	20
5.2 Low performers	22
5.3 The socioeconomic gradient	23
5.4 The immigrant achievement gap	25
5.5 The gender gap	26
5.6 Mechanisms and policy relevance	27
5.7 Summary	28
6 Progress and completion of pathways	28
6.1 Grade repetition: levels, trends and the socioeconomic gradient	29
6.2 Access to and conditions of higher education	32
6.3 Completion of education	37
6.4 Summary	41
7 From general education to the labour market	42
7.1 Youth disengagement	42
7.2 The employment returns to education	44
7.3 The earnings returns to education and the tertiary threshold	47
7.4 Summary	48
8 Qualification and the labour market	49
8.1 Overqualification	49
8.2 Field mismatch	52
8.3 Summary	53
9 Education systems and cross-country differences	53
9.1 Tracking and progression	54
9.2 Vocational orientation and labour-market transitions	56

9.3	Between-school segregation	57
9.4	Robustness of the cross-country correlations	58
9.5	Summary.....	59
10	Economic crises	59
10.1	The COVID-19 achievement shock.....	60
10.2	The financial crisis: youth transitions and recovery.....	61
10.3	Summary.....	63
11	Policy programmes and investment	63
11.1	The policy landscape	63
11.2	Investment and outcomes.....	63
11.3	A reform case study: Portugal's anti-repetition policy	67
11.4	A joint WP2–WP3A policy-effectiveness matrix	67
11.5	Summary.....	68
12	Deep Dive 1 — Decompositions of gaps	68
12.1	The immigrant achievement gap	69
12.2	The gender pay gap.....	70
12.3	The socioeconomic and the NEET gaps.....	72
12.4	Beyond additive decompositions.....	73
12.5	The socioeconomic gradient by migration background	74
12.6	Socioeconomic status, achievement and grade repetition	75
12.7	Parental education, own education and labour-market outcomes.....	76
12.8	Summary.....	77
13	Deep Dive 2 — Digital skills and the digital divide	78
13.1	Levels and trends in digital literacy.....	78
13.2	Heterogeneity in digital literacy.....	79
13.3	Heterogeneity in computational thinking	80
13.4	Summary.....	81
14	Deep Dive 3 — The evolution of the socioeconomic gradient	82
14.1	The gradient over the life-course.....	82
14.2	The socioeconomic gradient in higher education.....	83
14.3	The gradient over time	84
14.4	Summary.....	85
15	Deep Dive 4 — Adult skills and lifelong learning	85
15.1	Skills and credentials in earnings	85
15.2	Participation in adult learning	86
15.3	The inheritance of skills.....	87
15.4	The labour-market value of adult skills.....	88
15.5	Summary.....	88
16	Deep Dive 5 — Subjective outcomes of education	89
16.1	Well-being and trust by education.....	89
16.2	Well-being and trust by employment status	89
16.3	Summary.....	90
17	Deep Dive 6 — Achievement gaps at school age	90
17.1	The gender gap across domains	91
17.2	The socioeconomic gradient from grade four to grade eight.....	91
17.3	The science domain.....	92
17.4	The reading domain	94
17.5	Summary.....	94
18	Deep Dive 7 — General versus vocational pathways.....	95
18.1	Employment returns to education by track	95

18.2 Earnings returns to education by track	97
18.3 Late completion and re-entry into education	99
18.4 Summary.....	100
19 Triangulation with official European statistics	100
19.1 Disengagement across the European Education Area	101
19.2 Employment returns to education	102
19.3 Earnings returns to education	103
19.4 Investment and lifelong learning	104
19.5 Summary.....	104
20 Country profiles.....	105
20.1 Comparative scoreboard	105
20.2 Austria	105
20.3 Finland	106
20.4 Germany	106
20.5 Greece	106
20.6 Italy.....	106
20.7 Kosovo	106
20.8 Poland.....	107
20.9 Portugal	107
20.10United Kingdom	107
21 Mapping the findings to the research-question programme	107
21.1 Cluster 1 — Selection of early pathways and transitions	108
21.2 Cluster 2 — Sustained participation.....	108
21.3 Cluster 3 — Progression and success	108
21.4 Cluster 4 — Qualifications and labour-market success.....	109
21.5 Cluster 5 — Education systems and cross-country differences.....	109
21.6 Cluster 6 — Regional and territorial issues	109
21.7 Cluster 7 — Economic crises.....	110
21.8 Cluster 8 — Policy programmes and investment.....	110
21.9 Cluster 9 — Subjective transition experiences	110
21.10Summary.....	110
22 Synthesis and discussion	110
22.1 The thread of socioeconomic reproduction	111
22.2 How institutions and shocks modulate the pattern.....	111
22.3 Two gaps, two policy logics	111
22.4 Contribution to the EDU-LAB model	112
22.5 Implications for policy	112
22.6 What secondary data can and cannot contribute	113
22.7 Targeted hypotheses for WP3B and WP4	113
23 Limitations	114
24 Conclusions	114
References	115
Appendix A — Technical notes.....	118
A.1 Key harmonised variables	118
A.2 Estimation and inference	118

List of Figures

Figure 1. Mathematics performance in PISA, partner countries, 2003–2025	20
Figure 2. TIMSS grade-4 mathematics, partner countries, 2003–2023	21
Figure 3. Grade-4 reading in PIRLS, partner countries, 2001–2021	22
Figure 4. Low performers in mathematics (% below baseline), 2015–2022	23
Figure 5. Socioeconomic gradient in mathematics, PISA 2022	24
Figure 6. Adjusted immigrant achievement gap in mathematics, PISA 2022	26
Figure 7. Adjusted gender gap in mathematics, PISA 2022	27
Figure 8. Grade repetition rate by country, PISA 2022	29
Figure 9. Grade repetition by socioeconomic quartile, PISA 2022	30
Figure 10. Effect of socioeconomic status on grade repetition (odds ratios), 2022	31
Figure 11. Share of students with at least one tertiary-educated parent, EUROSTUDENT 8.	32
Figure 12. Delayed entry into higher education (more than two years after school), by parental education.	33
Figure 13. Students reporting financial difficulties and working more than 20 hours a week, by parental education, EUROSTUDENT 8.	34
Figure 14. Determinants of reporting financial difficulty, EUROSTUDENT 8.	34
Figure 15. Students reporting financial difficulties and working more than 20 hours a week, by impairment status, EUROSTUDENT 8.	35
Figure 16. Share of women among students by field of study, EUROSTUDENT 8.	36
Figure 17. Tertiary attainment among 25–34 year-olds, PIAAC Cycle 1 to Cycle 2	37
Figure 18. Tertiary attainment by parental education, ages 25–34	38
Figure 19. Share of 25–34 year-olds below upper-secondary attainment, most recent PIAAC cycle	39
Figure 20. Risk of low attainment (below upper-secondary), odds ratios, PIAAC, ages 25–34	39
Figure 21. Tertiary attainment by parental education, ESS, ages 30–59	40
Figure 22. Urban–rural differences in tertiary attainment and employment, ESS, ages 30–59	41
Figure 23. Youth NEET rate (16–29) by country, PIAAC Cycle 1 and Cycle 2	42
Figure 24. NEET (ages 16–34): odds ratios from a design-based logistic model	43
Figure 25. Employment rate by education level, ages 25–64, PIAAC	44
Figure 26. Tertiary employment premium over below-upper-secondary, ages 25–64, PIAAC	45
Figure 27. Covariate balance before and after matching, PIAAC, ages 25–64	46
Figure 28. Effect of tertiary education on employment before and after matching, PIAAC, ages 25–64	47
Figure 29. Earnings returns to education: a threshold model, PIAAC, ages 25–64	48
Figure 30. Share of graduates who are overqualified for their current job, by country (EUROGRADUATE 2018).	49
Figure 31. Overqualified tertiary graduates by country (PIAAC)	50
Figure 32. Overqualification by social origin, gender and country of birth (EUROGRADUATE 2018)	51
Figure 33. Overqualification by gender, social origin and country of birth, linear probability model (EUROGRADUATE 2018)	51
Figure 34. Overqualification by broad field of study (EUROGRADUATE 2018)	52
Figure 35. Graduates working outside their field of study, by country (EUROGRADUATE 2022).	53
Figure 36. Age of first tracking versus grade repetition	54
Figure 37. Age of first tracking versus the socioeconomic gradient	55
Figure 38. Vocational share of upper-secondary education versus youth NEET	56
Figure 39. Vocational share of upper-secondary education versus the tertiary employment premium	57
Figure 40. Between-school share of variance in PISA mathematics versus the age of first tracking, 2022 ...	58
Figure 41. Cross-country correlations re-estimated with Pearson and Spearman coefficients and leave-one-out ranges	59
Figure 42. COVID-era change in PISA mathematics, 2018 to 2022	60
Figure 43. Change in PISA mathematics performance by socioeconomic quartile, 2018 to 2022	61
Figure 44. Employment gap between prime-age and young adults by PIAAC cycle	62

Figure 45. Public education expenditure versus achievement	64
Figure 46. Active-labour-market spending versus youth NEET	65
Figure 47. EU structural investment (ESF+) versus youth NEET	66
Figure 48. Robustness of the cross-country correlations of spending and investment	66
Figure 49. Grade repetition in Portugal and the other partner countries, PISA 2015–2022	67
Figure 50. Native–immigrant gap in mathematics: explained and unexplained parts, PISA 2022	69
Figure 51. Gender pay gap among employed adults: explained and unexplained parts, PIAAC Cycles 1 and 2	71
Figure 52. Gender pay gap among recent graduates: explained and unexplained parts, EUROGRADUATE 2018	72
Figure 53. Socioeconomic achievement gap and gender NEET gap: explained and unexplained parts, PISA 2022 and PIAAC Cycles 1 and 2.	73
Figure 54. Socioeconomic gradient in mathematics, native and immigrant-background students, PISA 2022.	74
Figure 55. Difference in the socioeconomic gradient between immigrant-background and native students by country, PISA 2022.....	75
Figure 56. Socioeconomic status and grade repetition: the role of mathematics achievement, PISA 2022 ..	76
Figure 57. Parental tertiary education and adults' employment and earnings: the role of own education and literacy, PIAAC Cycles 1 and 2	77
Figure 58. Computer and information literacy (CIL), ICILS 2013–2023	79
Figure 59. Socioeconomic gradient in digital literacy, ICILS 2023	80
Figure 60. Gender gap in digital literacy (girls minus boys), ICILS 2023	80
Figure 61. Gender gap in computational thinking (girls minus boys), by country, ICILS 2023.	81
Figure 62. Standardised socioeconomic gradient from grade four to adulthood, partner-country averages	82
Figure 63. The social gradient in higher education, Austria.....	83
Figure 64. Socioeconomic gradient (books at home) in grade four, TIMSS 2011–2023 and PIRLS 2011–2021	84
Figure 65. Earnings returns to years of education and literacy, PIAAC Cycles 1 and 2	86
Figure 66. Participation in non-formal adult education and training by educational attainment, PIAAC Cycles 1 and 2	87
Figure 67. Adult literacy and numeracy by parental education, PIAAC Cycles 1 and 2	87
Figure 68. Earnings returns to numeracy and literacy, PIAAC Cycles 1 and 2.....	88
Figure 69. Life satisfaction and social trust by education, ESS.....	89
Figure 70. Life satisfaction and social trust by employment status, ESS	90
Figure 71. Gender gap by domain, PISA 2022	91
Figure 72. Socioeconomic gradient in mathematics at grade four and grade eight, TIMSS 2023	92
Figure 73. Socioeconomic gradient in mathematics and science, PISA 2022	93
Figure 74. Socioeconomic gradient in science at grade four and grade eight, TIMSS 2023.	93
Figure 75. Immigrant achievement gap in mathematics and reading, PISA 2022.....	94
Figure 76. Employment rate by educational track (PIAAC).....	95
Figure 77. Vocational minus general upper-secondary employment gap, by country (PIAAC)	97
Figure 78. Mean hourly earnings by educational track (PIAAC, pooled)	98
Figure 79. Vocational relative to general upper-secondary hourly earnings, by country (PIAAC).....	99
Figure 80. NEET rate of 15- to 29-year-olds by country, 2018–2025 (Eurostat)	102
Figure 81. Share of workers earning more than the national median, by educational attainment and country (OECD).....	104

List of Tables

Table 1. Harmonised partner-country datasets and complementary restricted-access sources	17
Table 2. Socioeconomic gradient in mathematics (score points per 1 SD of ESCS), by country and PISA cycle	25
Table 3. Adjusted socioeconomic gradient and achievement gaps in mathematics, PISA 2022 (score points)	28
Table 4. Grade-repetition rate (%), by country and cycle	29
Table 5. Odds ratios of grade repetition by socioeconomic status, immigrant background and gender, by country, PISA 2022	31
Table 6. Share of students and of 25–34 year-olds with at least one tertiary-educated parent (%), by country	33
Table 7. Study conditions in the partner countries against the European average (share of students in %), EUROSTUDENT 8.....	36
Table 8. Decomposition of the gender pay gap among employed adults, PIAAC Cycles 1 and 2 (log points) 70	
Table 9. Upper-secondary employment rate by branch and the gap between them, by country (PIAAC)....	96
Table 10. Upper-secondary mean hourly earnings by branch and the gap between them, by country (PIAAC)	98
Table 11. Adults who completed their highest qualification at age 25 or older, by country and track (PIAAC)	100
Table 12. Youth disengagement indicators in the partner countries (Eurostat)	101
Table 13. General and vocational upper-secondary employment rates, by country (Eurostat, 2023)	102
Table 14. Incidence of long-term unemployment by educational attainment (OECD)	103
Table 15. Comparative scoreboard of the partner countries	105
Table 16. Key harmonised variables by programme	118

Executive summary

Work Package 3A (WP3A) of the EDU-LAB project is responsible for the targeted secondary analysis of existing quantitative data on the pathways and transitions of young people in education and training and from education and training to the labour market across the European Education Area (EEA). This deliverable, D3.2, presents the merged and agglomerated datasets that WP3A has constructed and the first full set of analytical reports, organised around the project's four transition fields: the choice of educational pathways, progress and completion within them, and the transitions from general education (GE) and from professional and vocational education and training (PVET) to the labour market and back. It also reports the cross-cutting analyses of education systems, economic crises and policy that the EDU-LAB research-question programme calls for.

The empirical base assembled for this deliverable is substantial. Six international assessment and adult-skills survey programmes were harmonised into analysis files for the nine EDU-LAB partner and case-study countries: Austria, Finland, Germany, Greece, Italy, Kosovo, Poland, Portugal and the United Kingdom. The programmes are the OECD Programme for International Student Assessment (PISA), the OECD Programme for the International Assessment of Adult Competencies (PIAAC), the IEA studies TIMSS, PIRLS and ICILS, and the European Social Survey (ESS). Together these files contain some 640,000 school-age student observations and a further 100,000 adult observations, about 744,000 records in all, spanning two decades of repeated measurement. Each harmonised file is documented by a codebook.

In addition, EUROSTUDENT (waves VII and 8) and EUROGRADUATE (2018 and 2022) are analysed for the tertiary and graduate stages of the trajectory, adding some 224,000 records. They are confidential scientific-use files released only under a written data use agreement with the data provider. They could therefore not be harmonised into the partner-country files and cannot be distributed with this deliverable. They cover only a subset of the partner countries, and their estimates are weighted and robust rather than design-based. Every analytical estimate produced from these microdata sources, harmonised and confidential alike, is recorded in a single results register with its standard error where applicable, sample size and inference method. A separate macro layer of official aggregate statistics from Eurostat, the World Bank and the OECD complements the microdata. It is used to check the microdata findings and to supply comparable European context.

Three findings recur across the whole programme. First, socioeconomic background is the strongest of the measured determinants of educational success, and its association with achievement has not weakened in the past decade. Moreover, socioeconomic differences in competence are clearly established by grade four and are of similar standardised size at every later stage, including among adults. Among fifteen-year-olds, one standard deviation of the PISA index of economic, social and cultural status (ESCS) is associated with 36 score points in mathematics in 2022, up from 33 in 2015. The difference between students one standard deviation below and one above the mean corresponds to some three school years. The same gradient reappears in grade repetition, where students in the lowest socioeconomic quartile are nearly four times as likely to have repeated a grade as those in the highest. It reappears again in completed attainment: the share of young adults holding a tertiary qualification rises from 16 per cent when neither parent completed upper-secondary education to 74 per cent when at least one parent holds a tertiary degree. Early inequality is thus not a transient feature of childhood but the first link in a chain that runs through progression and attainment into the labour market.

Second, education carries a large labour-market premium. Employment rates among adults aged 25–64 rise from about 55 per cent for those below upper-secondary education to 72 per cent at upper-secondary and 85 per cent at tertiary level. Tertiary attainment is associated with less than half the odds of being not in employment, education or training (NEET), and the earnings return to a year of education is about twice as high over the tertiary years as before them. A propensity-score-matching analysis compares tertiary and upper-secondary adults who are alike in age, gender, migration background and parental education. After matching, tertiary attainment remains associated with an 8.2 percentage-point higher probability of employment. Distinguishing the general and vocational branches of upper-secondary education shows a

small vocational employment advantage in every country where both branches can be compared, but no corresponding advantage in earnings. The match between qualification and job adds a further dimension. About one in four employed tertiary-educated adults works in a job that does not require a tertiary qualification, rising to one in three in England. Among recent graduates, EUROGRADUATE puts the share at about a fifth in Austria and Germany and three in ten in Greece.

Third, institutions and crises matter. Early tracking stands out among institutions. Grade repetition is several times more common where students are selected at age ten than where selection waits until sixteen, at broadly similar achievement, and early-tracking systems are markedly more segregated between schools. These are the only two cross-country associations that are robust to the omission of individual countries. Investment volumes show no robust association with outcomes, but in Portugal a focused reform coincided with a fall in grade repetition of about thirteen percentage points relative to the other partner countries. Among crises, the COVID-19 pandemic coincided with a fall in mathematics in every partner country between 2018 and 2022, by about 19 points on average, whereas science was far less affected. Every partner country is now above the EU target of 15 per cent low performers in mathematics.

Beyond these headline regularities, the deliverable asks how far each gap between groups is accounted for by differences in measured characteristics. Decompositions show that gaps of similar size are composed very differently. In seven of the eight countries where natives score higher, socioeconomic status, home possessions and home language account for most of the immigrant achievement gap; a significant unexplained part remains only in Finland and Kosovo. The gender pay gap among employed adults is mostly unexplained, even when job characteristics are taken into account, because women's education, literacy and age would predict slightly higher pay than men's. The gender NEET gap is likewise not accounted for by qualifications. In school, gender gaps depend on the domain: boys lead in mathematics and computational thinking, girls in reading and information literacy. The socioeconomic achievement gap is hardly associated with the other background characteristics, which account for only about a tenth of it.

The WP1 framework expects the determinants to interact rather than simply add up. Allowing for this shows that the socioeconomic gradient is flatter for immigrant-background students in all nine partner countries. Two path models trace how background reaches later outcomes. About two-fifths of the socioeconomic association with grade repetition remains among students with the same achievement. The employment advantage of a tertiary-educated parent runs almost entirely through the respondent's own education and literacy, whereas about two-fifths of the earnings advantage is not accounted for by them.

The quantitative findings are mapped question by question to the EDU-LAB research-question programme, linked to the WP2 policy mapping in a joint effectiveness matrix, and handed to the WP3B expert survey and the WP4 case studies as a structured set of questions.

All results describe associations rather than causal effects, and several limits apply. The public PIAAC files do not record exact age for Austria and Germany, which removes the two dual-system countries from the labour-market analyses, and almost all sources are cross-sectional. For D3.3, WP3A plans to apply for the PIAAC scientific-use files, the EU Labour Force Survey and EU-SILC. These would return Austria and Germany to the labour-market analyses, add regional, job-stability and income information, and allow individuals to be followed over several years.

The main results of this report can also be explored interactively in the WP3A section of the EDU-LAB Dashboard (<https://dashboard.edu-lab-project.eu/app/wp3a-overview>). The codebooks of the harmonised datasets, the Results Register and the other accompanying materials can be downloaded at <https://dashboard.edu-lab-project.eu/app/wp3a-method>, and the harmonised data files are available upon request.

1 Introduction

1.1 The EDU-LAB project and the place of WP3A

EDU-LAB ("European Youth in Transition to Education and Labour") is a Horizon Europe collaborative research project running from 2025 to 2027. Its overarching objective is to expand the knowledge base on the factors that influence young people's choices, pathways and transitions within education and training and from education and training into the labour market in Europe, with a sustained emphasis on equity and inclusion and on the role of policies and investments. The project is organised in interlocking work packages. WP1 develops a theoretical model of pathways and transitions and of the intersectional determinants that shape them. WP2 maps the policies, programmes and investments designed to support youth transitions and assesses their effectiveness and efficiency. WP3 conducts the empirical analysis of existing evidence, divided into a quantitative strand (WP3A) and an expert-survey strand (WP3B). WP4 carries out qualitative case studies.

Within this architecture WP3A has a specific and clearly bounded role: the secondary analysis of existing high-quality open-access and scientific datasets in the European Education Area. The analysis covers pathways within general education and within professional and vocational education and training, and transitions to and from the labour market. It pays particular attention to socio-cultural, individual and cognitive factors and to the role of policy measures and public or private investment. WP3A was constituted in January 2025, when the Project Management Board divided the original WP3 into a quantitative sub-package (WP3A, coordinated by the University of Bamberg in its original design and subsequently taken forward within the consortium) and an expert-survey sub-package (WP3B, the Online Survey of Experts and Stakeholders, led by ECONOMICA).

1.2 Goals of this deliverable

The terms of reference for D3.2 specify two connected outputs: merged datasets, and initial analytical reports per research theme. The targeted datasets are the international large-scale assessments. They are to be used both for international comparison and for "land-scaping" the case-study countries, that is, for establishing where each country stands and how it differs from its peers. The specification names TIMSS, PIRLS, PISA, PIAAC, EUROSTUDENT and EUROGRADUATE as the principal sources. It anticipates that information on achievement and on the individual and social factors proposed by WP1 and WP2 will be drawn from them to target the critical positions of the educational trajectory and the determinants that operate there. The analytical approach combines trend analysis, regression (including threshold models) and propensity score matching, and makes transparent those determinants, family planning being named as an example, for which adequate data are not available.

This deliverable fulfils that mandate in three steps. It first documents the construction of the merged datasets: the selection and harmonisation of six survey programmes into partner-country analysis files, validated against published statistics, together with the separate analysis of the restricted-access EUROSTUDENT and EUROGRADUATE files. It then presents the analytical reports, organised by the four transition fields and extended to cross-cutting research-question clusters and to a set of deep dives. Finally, it synthesises the findings, states the limitations with the transparency the specification requires, and sets out the next steps.

1.3 Relation to the transition fields and research questions

The analyses in this deliverable are organised, as the D3.2 specification directs, around four fields that together describe the youth trajectory:

- the **choice of educational pathways**, including the early determinants and inequalities that shape which pathway a young person enters;
- **progress and completion** within those pathways, including grade repetition, drop-out risk and the attainment that pathways ultimately yield;
- the **transition from general education to the labour market** and back; and

- the **transition from professional and vocational education and training to the labour market** and back.

These fields are nested within the wider set of research questions developed across the EDU-LAB consortium. The questions are grouped in nine clusters: the selection of early pathways, sustained participation, progression and success, qualifications and labour-market success, education systems and cross-country differences, regional and territorial issues, economic crises, policy programmes, and subjective transition experiences. WP3A's secondary-data programme addresses some of these clusters directly and others only in part. The regional cluster (Cluster 6) and the subjective-experience cluster (Cluster 9) are touched only by the ESS and fall mainly to the WP4 case studies and the WP3B expert survey. Chapter 21 maps the findings to every cluster.

The report is structured accordingly. After the conceptual framework (Chapter 2), the data (Chapter 3) and the methodology (Chapter 4), Chapters 5 to 8 cover the four transition fields. Chapters 9 to 11 treat the clusters on education systems (Cluster 5), economic crises (Cluster 7) and policy programmes (Cluster 8). Chapters 12 to 18 are deep dives into selected questions. Among them, Chapter 18 separates the general and vocational branches of upper-secondary education and so distinguishes the third and fourth transition fields. Chapter 19 checks the main patterns against official European statistics. Chapters 20 to 24 contain the country profiles, the mapping to the research questions, the synthesis, the limitations and the conclusions.

2 Conceptual framework and policy context

Chapter 1 set out the place of WP3A in EDU-LAB and the mandate of this deliverable. This chapter provides the frame within which the analyses are read. Section 2.1 summarises the WP1 model of intersectional determinants, and Section 2.2 the expectations that the existing literature derives from it. Section 2.3 outlines the policy landscape documented by WP2, including the transition regimes used to group the partner countries. Section 2.4 explains which of the determinants the international surveys can measure.

2.1 Intersectional determinants of pathways and transitions

The conceptual scaffolding for WP3A is supplied by WP1. WP1 frames young people's pathways and transitions as the product of a comprehensive set of intersectional determinants, which operate with varying force at every level of the education system. Four groups organise the determinants of pathway choice: the expectations, educational background and resources of parents; the interests, abilities, expectations and peer relations of students; institutional determinants, such as the information available about pathways, selection and admission rules and equity measures; and external contextual determinants, such as the structure of the education system, the state of the labour market, and shocks such as pandemics or migration. Six further groups govern progression and completion once a pathway has been entered: goal orientation and persistence, the quality of teaching and learning, students' competencies, the learning environment, services and support, and finances.

The working hypothesis of WP1 is that most of these determinants are generic, recurring across pathways and ISCED levels. This is what makes a secondary-data programme such as WP3A feasible. The same small set of measurable determinants, namely socioeconomic status, parental education, migration background, language, gender and measured competencies, can be followed across surveys designed for very different populations and related to outcomes at successive points of the trajectory. Because WP1 defines these determinants as intersectional, their associations need not simply add up. The analyses therefore also examine how they combine (Chapter 12).

2.2 Synthesis of the existing literature

The literature on educational participation and transitions, surveyed in the EDU-LAB research-question programme, frames several expectations against which the findings of this deliverable can be read. The most firmly established is that socioeconomic background shapes educational success even among students of similar measured ability, and that disadvantaged students face the greatest obstacles at the critical transitions, from one level of education to the next and from school to work. A closely related strand argues

that achievement gaps take root early, at the "school gate", so that early intervention matters most and early institutional sorting tends to entrench initial disadvantage (García and Weiss, 2017). A third strand concerns the institutional architecture of transitions. Comparative work on education-to-work transition regimes distinguishes systems by the age at which they sort students into tracks, by the strength and standardisation of their vocational pathways, and by the tightness of the link between education and employers. It relates these features to the smoothness of youth transitions and to the reproduction of inequality (Raffe, 2003; Roberts, 2025). A fourth strand concerns scarring: cohorts that enter the labour market in a downturn, and students whose schooling is disrupted by a shock, can carry measurable penalties for years afterwards (Schmillen and Umkehrer, 2017; von Wachter, 2020).

These expectations motivate the analyses of the field chapters and the deep dives. The synthesis in Chapter 22 returns to them and asks where the evidence for the partner countries confirms them and where it qualifies them.

2.3 The policy landscape

The policy context for these transitions is documented in detail by WP2's Deliverable D2.1, on which the policy analysis of this deliverable draws. D2.1 records that NEET rates across Europe fell over the decade in which the EU Youth Guarantee has operated, with the EU average declining from 15.2 per cent in 2015 to 11.1 per cent in 2024, while the United Kingdom and Southern Europe continued to lag. It identifies the recurring ingredients of effective youth-transition systems as integrated support structures, targeted programmes for disadvantaged youth and strong vocational pathways, and those of efficient ones as early investment, coordinated funding, robust evaluation, and work-based learning and apprenticeships.

D2.1 also groups countries into transition regimes: Nordic rights-based systems, Continental systems built on strong dual vocational education, Liberal systems with flexible labour markets, and Southern and Eastern systems facing persistent NEET challenges, in several cases despite substantial investment. Among the partner countries, Austria and Germany belong to the Continental regime, Finland to the Nordic, the United Kingdom to the Liberal, Greece, Italy and Portugal to the Southern, and Poland to the Eastern regime. Kosovo lies outside the typology and is labelled Transition in this report. The regimes build on Gallie and Paugam (2000), Walther (2006) and Raffe (2011) and combine education and training structures, labour-market regulation and welfare arrangements. In this report the regime labels serve as a shorthand for groups of countries; the report does not test whether the characteristics of a regime account for the differences in outcomes between them. The regimes and the effectiveness and efficiency factors that D2.1 identifies provide the frame for the comparative narrative of this report, and in particular for the policy analysis of Chapter 11.

2.4 The trajectory model and the strategy for measuring determinants

WP1 formalises the youth trajectory as a sequence of positions: entry into a pathway, sustained participation, progression, completion, and transition to and from employment. The determinants of Section 2.1 operate at each of them. WP3A's measurement strategy follows from this model but is bounded by what the international surveys record.

Several determinants are well measured. Socioeconomic status and parental education are captured by the PISA ESCS index and by the parental-education variables of PIAAC and the IEA studies. Students' and adults' competencies are captured by the plausible values for literacy, numeracy, mathematics, reading and science. Migration background, home language and gender are measured throughout. The type of education system, the age of tracking and the vocational share enter at country level (Chapter 9).

Other determinants are measured only partly or not at all. Financial circumstances are observed directly only for higher-education students in EUROSTUDENT, and otherwise only indirectly through socioeconomic status. The quality of teaching is covered by PISA's questionnaire scales, which have not yet been analysed. Motivation, persistence, parental expectations and ethnicity are largely absent, and family planning and fertility are available only in the ESS.

This deliverable therefore works with the most generic and most policy-relevant of the WP1 determinants and relates them to outcomes at successive positions of the trajectory. As the D3.2 specification requires, it also states explicitly where a determinant cannot be adequately measured. The result is not a full test of the WP1 model, but comparable empirical magnitudes for its measurable core across the partner countries.

3 Data sources and harmonisation

Chapter 2 set out which determinants of the WP1 model the international surveys can measure. This chapter describes the data used to measure them. Section 3.1 explains which datasets were selected and which partner countries they cover. Section 3.2 describes how they were harmonised into comparable partner-country files, and Section 3.3 how the files were validated against published statistics.

3.1 Selection of datasets

WP3A's inventory work in Deliverable D3.1 identified the international large-scale assessments as the backbone of a comparable evidence base for the partner countries, complemented by adult-skills and social-survey data for the labour-market side of the trajectory. Six programmes were selected for harmonisation, on the criteria of relevance to the four transition fields, coverage of the partner countries, availability and methodological quality. Four measure school-age students: PISA at age fifteen, TIMSS at grades four and eight, PIRLS at grade four and ICILS at grade eight. Two measure adults: PIAAC at ages sixteen to sixty-five and the ESS at ages fifteen and over. No single source spans the whole pathway from school to work, so the transition fields are assembled by combining school-age assessments with adult and labour-market data.

Two further programmes named in the D3.2 specification reach stages the assessments do not observe at all. EUROSTUDENT surveys enrolled higher-education students, and EUROGRADUATE surveys graduates about one and five years after graduation. Both are confidential scientific-use files released only under a written data use agreement with the data provider. They are therefore analysed separately, outside the harmonisation, and cannot be redistributed with this deliverable.

Two kinds of country-level data complete the evidence base. The institutional indicators of Chapter 9, namely the age of first tracking, the vocational share and the dual-system classification, are compiled from OECD Education at a Glance (OECD, 2023), Eurydice and Cedefop. The spending and policy data of Chapter 11 come from OECD and Eurostat sources (Eurostat, 2024) and from WP2's Deliverable D2.1. The macro layer of Chapter 19 adds official aggregate statistics from the Eurostat database (Eurostat, 2026), the World Development Indicators (World Bank, 2026) and the Education at a Glance database (OECD, 2025b). For Kosovo, it draws on the ETF's KIESE compilation (ETF, 2022).

The nine partner countries are Austria, Finland, Germany, Greece, Italy, Kosovo, Poland, Portugal and the United Kingdom. They are the WP4 case-study set, chosen to represent the variety of European education and labour-market systems and transition regimes. Their coverage varies by programme (Table 1). PISA covers all nine in every wave used and is therefore the spine of the cross-country comparison. PIRLS also covers all nine, although Greece and Kosovo appear in only one wave each. TIMSS, ICILS and the ESS each cover eight: Greece is absent from TIMSS, the United Kingdom from ICILS and Kosovo from the ESS. PIAAC also covers eight, as Kosovo never took part, and Greece participated only in the first cycle and Portugal only in the second.

Coverage of the two restricted-access sources is narrower, because only countries that deposited microdata appear in them. EUROSTUDENT covers Austria, Finland, Germany and Poland, not all of them in both waves. EUROGRADUATE covers Austria, Germany and Greece in the 2018 pilot, and Austria, Germany, Greece, Italy and Portugal in the 2022 wave, whose Greek file lacks the labour-market module. Kosovo and the United Kingdom are absent from both.

Table 1 summarises the collected data. The six harmonised programmes comprise about fifteen gigabytes of raw microdata across twenty-one survey waves, distilled into analysis-ready partner-country files of some 744,000 records. The two restricted-access sources add four waves and some 224,000 records, which are held and analysed separately.

Table 1. Harmonised partner-country datasets and complementary restricted-access sources

Dataset	Popula- tion	Waves	Partner countries	Rec- ords	Key harmonised content
PISA	Age 15	2015, 2018, 2022	9	205,081	Achievement (maths/reading/science), ESCS, immigrant status, grade repetition
PIAAC	Adults 16– 65	Cycle 1–2	8 (no XK)	75,244	Employment, earnings, education, liter- acy/numeracy
TIMSS	Grade 4 & 8	2003–2023 (6 waves)	8 (no GR)	237,290	Mathematics & science achievement, home SES
PIRLS	Grade 4	2001–2021 (5 waves)	9	156,244	Reading achievement, home SES
ICILS	Grade 8	2013, 2018, 2023	8 (no UK)	44,036	Computer and information literacy, com- putational thinking, SES
ESS	Adults 15+	2020, 2023	8 (no XK)	26,461	Education, parental education, employ- ment, migration, attitudes
EURO- STUDENT	Higher education students	VII, 8	4	130,839	Confidential SUF; not harmonised
EURO- GRADUATE	Higher education graduates	2018, 2022	5	93,127	Confidential SUF; not harmonised

Note: Partner countries is the number of the nine partner countries covered in at least one wave; coverage by wave is described in the text above. Records are respondents in the partner countries, summed over all waves. SUF denotes a scientific-use file released only under a written data use agreement with the data provider.

3.2 Harmonisation strategy

Each programme uses its own variable names, coding conventions and derived indices, and these change across waves and cycles. The harmonisation therefore maps each substantive construct to the internationally comparable derived variable that each programme provides, rather than rebuilding constructs from raw items.

For PISA, the harmonised file carries the ESCS index, immigrant status, gender, home language and grade repetition, the ten plausible values in mathematics, reading and science, and the final student weight with its eighty replicate weights. For PIAAC, the education, parental-education, immigrant-background and skills variables are built from the cycle-specific derived variables. The file carries the plausible values for literacy and numeracy and the final weight with the replicate weights and replication method specified for each country and cycle. For the IEA studies, the country files of each wave were combined, keeping only the main national sample and excluding the bridge and special samples of the recent digital cycles. The stable background items were harmonised: sex, age, books at home, the home-resources scale, home language and, where collected, parental education. They are held alongside the plausible values and the weights and jackknife indicators. For the ESS, the 2020 and 2023 rounds were pooled, and the harmonised file carries gender, age, own and parental education, employment status, migration background, urban–rural residence and household income, together with the analysis weight.

EUROSTUDENT and EUROGRADUATE remain outside the harmonisation. Their data use agreements permit analysis but not redistribution or derived datasets, and their instruments, such as study conditions, self-assessed qualification match and field of study, have no counterpart in the assessment programmes. They are therefore analysed wave by wave in their original structure, each with its own design weight.

3.3 Validation

Confidence in the harmonised files rests on their reproduction of published statistics. Sample sizes match the official figures, for example the German PIAAC Cycle 1 sample of 5,465 and the Polish sample of 9,366, and weighted estimates reproduce the official results to within rounding. The PISA partner-country means and their decline after 2018 match the OECD figures. TIMSS 2019 grade-four mathematics means reproduce the official IEA values (Austria 539, Finland 532, Italy 515, Kosovo 444), as do PIRLS 2021 reading means (Finland 549, Italy 537, Germany 524, Kosovo 421). PIAAC weighted literacy means fall in the expected range. These checks confirm that file selection, weighting and the handling of plausible values are correct, and they underpin the design-based estimates of the following chapters. The two restricted-access sources were checked against the published EUROSTUDENT and EUROGRADUATE indicator reports, and the weighted national figures for the indicators used here reproduce them.

4 Methodology

Chapter 3 described how the datasets were selected, harmonised and validated. This chapter explains how estimates are obtained from them. Section 4.1 sets out how their uncertainty is measured, Section 4.2 which methods are used, and Section 4.3 which assumptions limit how the results can be read.

4.1 Statistical inference

The international surveys do not draw simple random samples. They select schools or households in several stages and within strata, and each student in PISA, TIMSS, PIRLS and ICILS answers only part of the test. Standard formulas for standard errors would therefore understate the uncertainty of the estimates. Every estimate in this deliverable instead uses the final survey weight for its point estimate and a standard error that follows the sampling design of the survey concerned.

Two tools provided with the data make this possible. The first is replicate weights. The estimate is recomputed many times with slightly altered weights, and the spread of these results measures the sampling variance. PISA provides eighty such weights; TIMSS, PIRLS and ICILS form them from seventy-five sampling zones; and PIAAC specifies the method and number of replicates separately for each country and cycle. The second is plausible values. Achievement is not observed exactly, so the surveys provide several plausible values for each student. Each estimate is computed once for each plausible value, and the variation between them is added to the sampling variance. Differences, decomposition components and the matching estimate are recomputed in the same way, so that their standard errors also reflect the uncertainty of their parts. For the ESS, which has no replicate weights, standard errors are approximated from the survey's strata and primary sampling units. Appendix A.2 gives the formulas. Because the United Kingdom sample of PIAAC covers England and Northern Ireland in Cycle 1 but England only in Cycle 2, analyses that compare or pool the two cycles are restricted to England.

EUROSTUDENT and EUROGRADUATE provide a design weight but no replicate weights, primary sampling units or strata. Their estimates are therefore weighted and reported with robust standard errors. The graduate pay-gap decomposition uses bootstrapped standard errors.

Results for several countries are summarised in two ways. A partner-country average is the unweighted mean of the country estimates, so each country counts equally. A pooled model estimates one regression on the combined sample with the survey weights, so larger countries contribute more. Pooled models include country fixed effects, or country-by-cycle fixed effects where survey cycles are combined, so that they compare people within the same country. Figure and table notes state which of the two summaries is used.

4.2 The analytic toolkit

The analyses apply the toolkit specified for D3.2, extended where the research questions require it.

Levels and trends are described by weighted means and shares for each survey wave. To compare the socioeconomic gradient across surveys that use different measures and scales, Chapter 14 expresses it in standard deviations.

Weighted regressions relate outcomes to background characteristics. Linear models are used for achievement and log earnings, and logistic models for binary outcomes such as grade repetition, NEET status and low attainment, whose results are reported as odds ratios. Where binary outcomes enter decompositions, path models and interaction models, and in the analyses of EUROSTUDENT and EUROGRADUATE, they are modelled as linear probabilities, whose coefficients read as percentage-point differences. Interaction terms allow an association to differ between groups, for example the socioeconomic gradient between native and immigrant-background students, and so test the intersectional structure that the WP1 framework proposes. A threshold model allows the earnings return to a year of education to differ below and above fifteen years of education, the typical start of tertiary education.

Several methods separate or compare parts of an association. Propensity score matching compares the employment of tertiary-educated adults with that of adults who are alike in observed background but hold no tertiary qualification. A difference-in-differences comparison sets the change in grade repetition in Portugal against the change in the other partner countries. The Oaxaca–Blinder decomposition splits a gap between two groups into a part explained by differences in their measured characteristics and an unexplained remainder. It is applied to the immigrant achievement gap, the gender pay gap, the socioeconomic achievement gap and the gender NEET gap. Path models separate the part of a background association that runs through intervening variables, such as achievement or own education, from the part that remains when these are held constant.

Cross-country associations relate the country estimates to institutional and policy indicators. They are reported with the Pearson and the rank-based Spearman coefficient, and with a leave-one-out check that re-estimates each correlation with one country omitted at a time.

All point estimates, standard errors, sample sizes and inference methods are logged in the WP3A Results Register, which serves as the single source for the figures cited in this report. The analysis code is preserved so that every result can be reproduced.

4.3 Assumptions, robustness and validation

Each method rests on assumptions that limit what can be inferred from its results, and these are stated with each analysis.

The regressions describe associations net of the included controls. They do not remove the influence of unmeasured characteristics and are read as conditional gradients and gaps, not as causal effects. The threshold model fixes the bend at fifteen years of education. It shows whether returns are higher over the tertiary years as a whole, not whether they rise abruptly at a particular point.

The matching estimate identifies an effect of tertiary attainment only if, among adults alike in the matched characteristics, tertiary attainment is as good as randomly assigned. The balance checks show only that the matched groups are alike in the observed characteristics, and a sensitivity analysis indicates how strong an unobserved characteristic would have to be to overturn the result.

The split between the explained and unexplained parts of a decomposition depends on the reference coefficients and on the characteristics included. The unexplained part is therefore not a measure of discrimination or of an effect of group membership. The path models assume an ordering of the variables and that no unmeasured factor links the intervening variable to the outcome, so their direct part is not a causal effect either. The difference-in-differences comparison assumes that Portugal would otherwise have followed the same trend as the other partner countries, an assumption the stability of their average makes plausible but cannot prove. The cross-country associations rest on nine countries at most and are treated as descriptive.

These assumptions concern how the estimates can be interpreted. Whether the estimates themselves are reliable is a separate question, which rests on two features documented above: design-based inference, which accounts for complex sampling and the measurement of achievement (Section 4.1), and validation of every dataset against published statistics (Section 3.3).

5 The choice of educational pathways

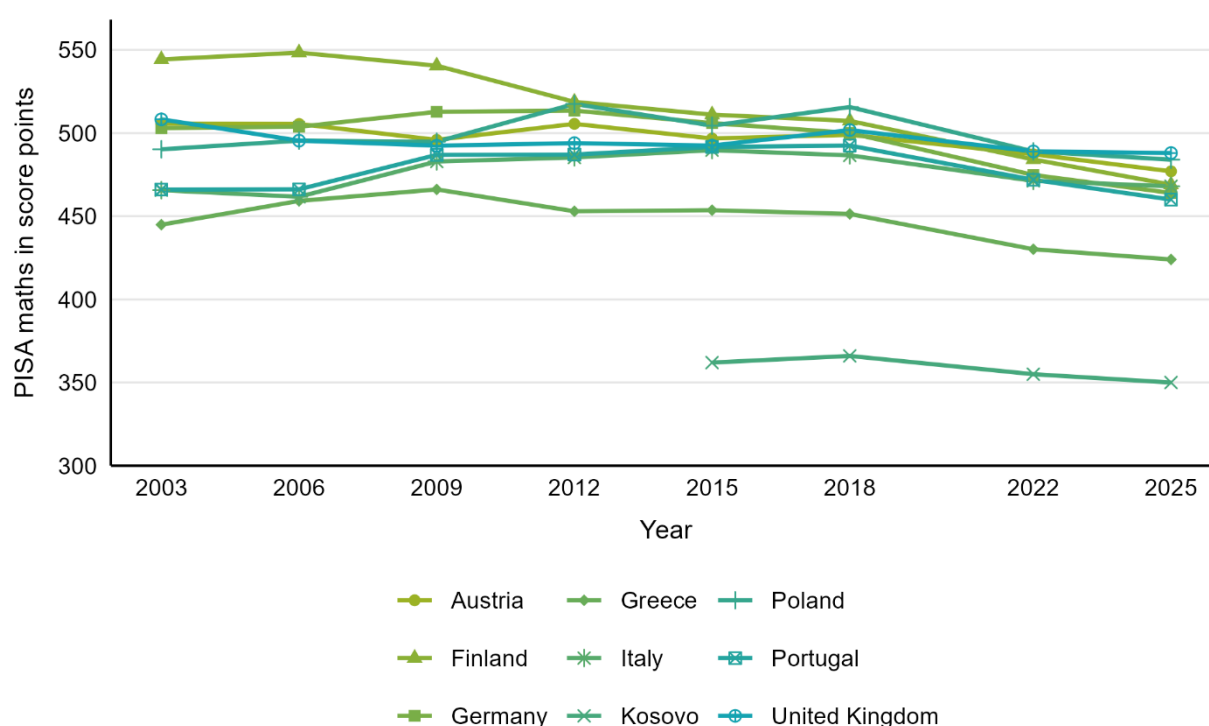
The first transition field concerns how young people come to enter a specific educational pathway and the inequalities that this sorting embodies. The data informing this field are the international achievement surveys: the achievement and background of fifteen-year-olds measured by PISA, supplemented by the primary-school series of TIMSS and PIRLS. Achievement in compulsory school is not itself a pathway choice, but it is the proximate determinant of the choices that follow — entry to academic or vocational tracks, progression to upper-secondary and tertiary education — and the socioeconomic and migration gradients in achievement are the clearest measurable expression of the intersectional determinants the WP1 framework sets out for this stage of the trajectory.

The chapter proceeds in five steps, all nine partner countries observed throughout. Section 5.1 sets out the level and long-run trend of achievement, in PISA mathematics from 2003 and, at the end of primary schooling, in TIMSS grade-4 mathematics and PIRLS grade-4 reading. Section 5.2 turns from the average to the lower tail, the share of fifteen-year-olds below the PISA baseline of competence, read against the EU-level target for 2030. Sections 5.3 to 5.5 estimate the three adjusted inequalities — the socioeconomic gradient, the immigrant achievement gap together with its disaggregation by generation, and the gender gap. All three come from a single design-based regression per country and cycle, so they are measured on the same scale and on the same sample. Section 5.6 reads them as mechanisms and identifies the margins at which policy can act, and Section 5.7 summarises.

5.1 Achievement levels and long-run trends

Since the PISA harmonised data only includes waves 2015 to 2022, the longer trend in the partner countries in Figure 1 is based on the country means published by the OECD (OECD, 2026a; OECD, 2026b).

Figure 1. Mathematics performance in PISA, partner countries, 2003–2025



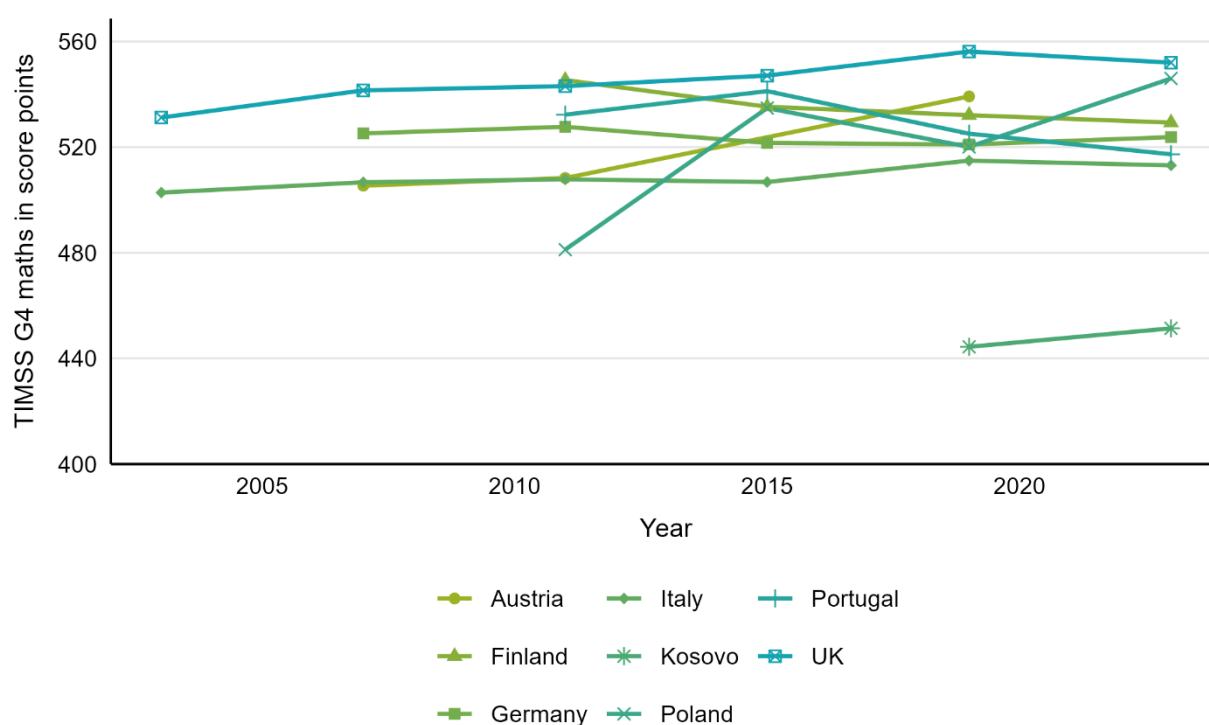
Note: Country mean scores in mathematics. Values for 2003–2022 from the PISA International Data Explorer (OECD, 2026b); values for 2025 from PISA 2025 Results (Volume I) (OECD, 2026a), Table I.B1.2a.3. Data points are shown only for the cycles in which a country participated.

At the start of the observation period Finland leads the partner countries by a wide margin, at around 545 points — some 40 points clear of the field and far above the OECD average of 500. Behind it a second group

of the United Kingdom, Austria and Germany sits just above that average, followed by Poland at around 490 and a lower-performing group formed by Portugal, Italy and Greece. In the following decade a convergence occurred, with Finland losing its commanding lead and Portugal and Italy gradually catching up. At the same time, Poland became one of the best performing countries. Kosovo participated in PISA for the first time in 2015, well below the other countries at around 360 points.

The dominant feature of the most recent period, however, is common to all of the partner countries: a marked decline between 2018 and 2022. Over that interval mathematics scores fell by 27 points in Poland, 25 in Germany, 23 in Finland, 21 in Greece and 21 in Portugal, with somewhat smaller but still substantial losses in Italy (15), the United Kingdom (13), Austria (12) and Kosovo (11); the pooled partner-country mean fell by 18 points. The drop is consistent with the disruption of schooling during the COVID-19 pandemic, a shock examined in detail in Chapter 10. The most recent PISA release saw scores stabilise in only a few countries, while in most they continued to decline.

Figure 2. TIMSS grade-4 mathematics, partner countries, 2003–2023



Note: Country mean scores in grade-4 mathematics, estimated from the TIMSS microdata using the plausible values and the study's replication weights. Data points are shown only for the cycles in which a country participated.

The IEA studies add a second vantage point: the end of primary schooling, four to five years before PISA observes the same systems. Of the partner countries only the United Kingdom (England) and Italy span the full grade-four TIMSS mathematics series, and both are stable or gently rising: the United Kingdom climbed from 531 in 2003 to 556 in 2019 and was the strongest performer in most years, while Italy moved sideways (505 to 515), as did Germany from 2007 onward. Against that backdrop the later entrants stand out. Poland improved dramatically after joining in 2011 (from 481 to 546 in 2023) while Austria rose between 2011 and 2019 (508 to 539) but has not participated at grade four since then. Math scores in Portugal and Finland, by contrast, decreased between 2011 and 2023. Kosovo ranks lowest among the partner countries, but has experienced an increase since its first participation in 2019.

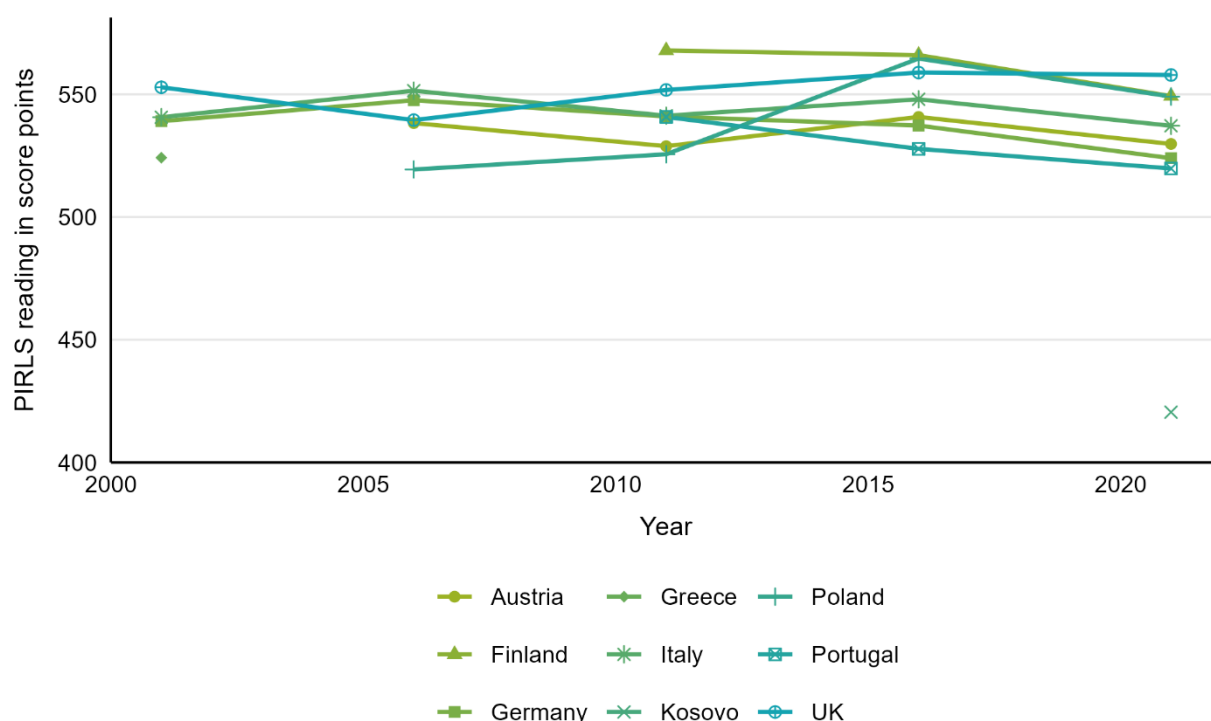
Notably, the universal 2018-to-2022 decline that dominates the PISA math scores is not mirrored at grade four: between 2019 and 2023 the TIMSS means moved in both directions (Poland +26, Kosovo +7, Germany +3, Italy –2, Finland –3, the United Kingdom –4, Portugal –8). The two series need not agree — they observe different cohorts at different ages (the 2023 fourth-graders were schooled largely after the most acute

disruption, whereas the 2022 fifteen-year-olds were hit in lower-secondary school), TIMSS 2023 was fielded a year later than PISA 2022, and the two studies scale different curricula — but the contrast cautions against reading the pandemic setback as a single, uniform shock to all ages.

While math skills did not universally decline at grade four due to the pandemic, this cannot be said for reading. PIRLS means fell between 2016 and 2021 in every partner country with data — most steeply in Finland (–17) and Poland (–16), followed by Germany (–13), Austria (–11), Italy (–11) and Portugal (–8) — with only the United Kingdom holding its level (–1). The timing is the likely reason for the contrast with TIMSS: PIRLS 2021 was fielded during the pandemic, whereas TIMSS 2023 reached a cohort schooled largely after the most acute disruption. Read together, the three series suggest a setback that was broad while it lasted and has begun to recede at grade four, but not yet among fifteen-year-olds.

Before 2021 the series show no common trend: only Poland moved substantially, gaining 45 points between 2006 and 2016, while the other countries were broadly stable. Greece and Kosovo appear once each — Greece in 2001 (524) and Kosovo in 2021 (421), the latter far below every other partner country.

Figure 3. Grade-4 reading in PIRLS, partner countries, 2001–2021



Note: Country mean scores in grade-4 reading, estimated from the PIRLS microdata using the plausible values and the study's replication weights. Data points are shown only for the cycles in which a country participated.

The summary for the pathways field is a differentiated one. The recent setback is broad but not uniform across ages: every partner country lost ground in PISA mathematics between 2018 and 2022 and in PIRLS reading between 2016 and 2021, yet at grade four in TIMSS the means moved in both directions by 2023. It also marks a break rather than a continuation. Before the pandemic the partner countries were broadly stable and Poland was improving markedly, so what the losses interrupted was stability or progress rather than decline. That makes the question of recovery, and of where within each system the losses fall, all the more pressing — the grade-four evidence suggests that recovery has begun, while among fifteen-year-olds there is as yet no sign of it.

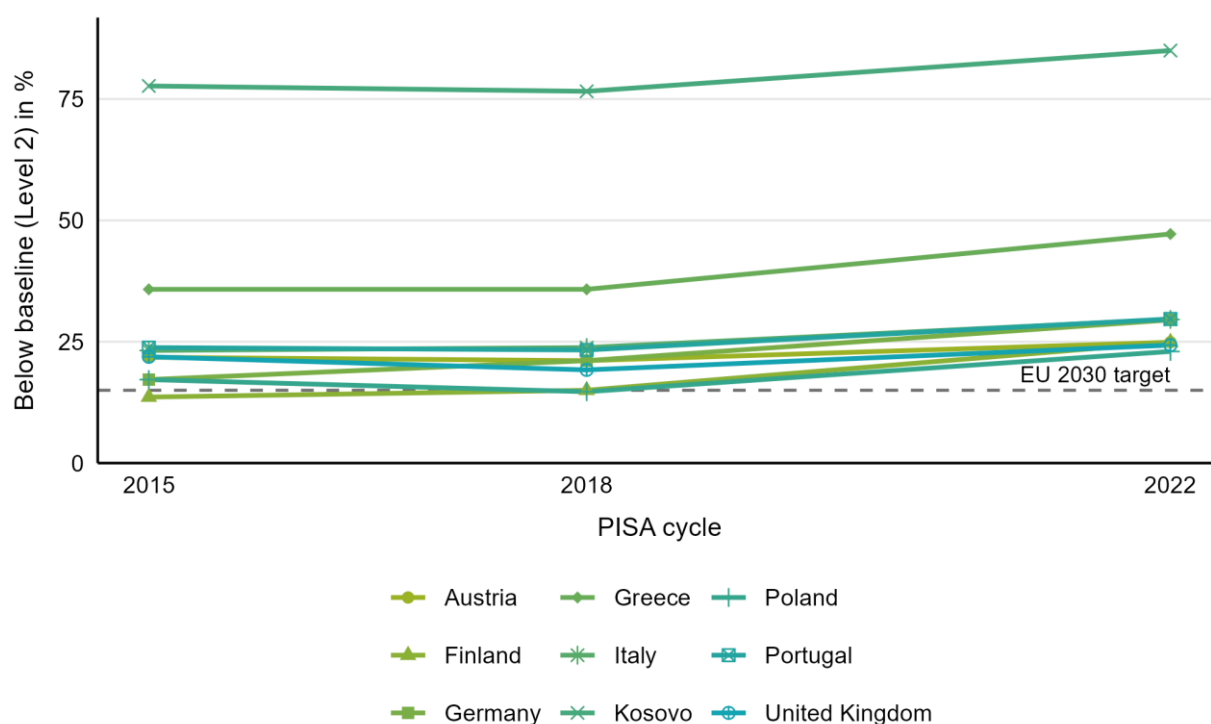
5.2 Low performers

Average scores conceal how many young people leave compulsory schooling without basic competence, and it is this group that is most exposed to difficult transitions later on. Figure 4 shows the share of fifteen-year-

olds performing below the PISA baseline (Level 2) in mathematics, the level the OECD regards as the minimum for full participation in modern society. In 2022 the share ranged from 23 per cent in Poland and 24–25 per cent in the United Kingdom, Finland and Austria to around 30 per cent in Germany, Italy and Portugal, 47 per cent in Greece and 85 per cent in Kosovo. Among the European partner countries, the three Southern systems thus have the largest shares, together with Germany.

Over time, the share changed little between 2015 and 2018 but rose in every partner country between 2018 and 2022, by between 4 points in Austria and 11 points in Greece. In Finland it grew from 15 to 25 per cent and in Germany from 21 to 30 per cent. These shares can be read against the EU-level target of the European Education Area, under which the share of low-achieving fifteen-year-olds in reading, mathematics and science should fall below 15 per cent by 2030 (Council of the European Union, 2026). The target applies to the EU as a whole rather than to individual countries, but it provides a benchmark. In mathematics, every partner country was above it in 2022. Finland in 2015 and Poland in 2018 had been below it, but the rise since 2018 has moved every partner country further away, and even Poland, the closest, is now 8 points above it.

Figure 4. Low performers in mathematics (% below baseline), 2015–2022



Note: Weighted share of fifteen-year-olds below proficiency Level 2 in mathematics, by country and PISA cycle, estimated with the final student weights and all ten plausible values. The dashed line marks the EU-level target of 15 per cent for 2030 (Council of the European Union, 2026).

5.3 The socioeconomic gradient

The socioeconomic gradient — the achievement advantage associated with one standard deviation of the PISA ESCS index — is the single most important quantity in this chapter, because it measures how strongly family background is converted into the achievement that governs subsequent pathway choices.

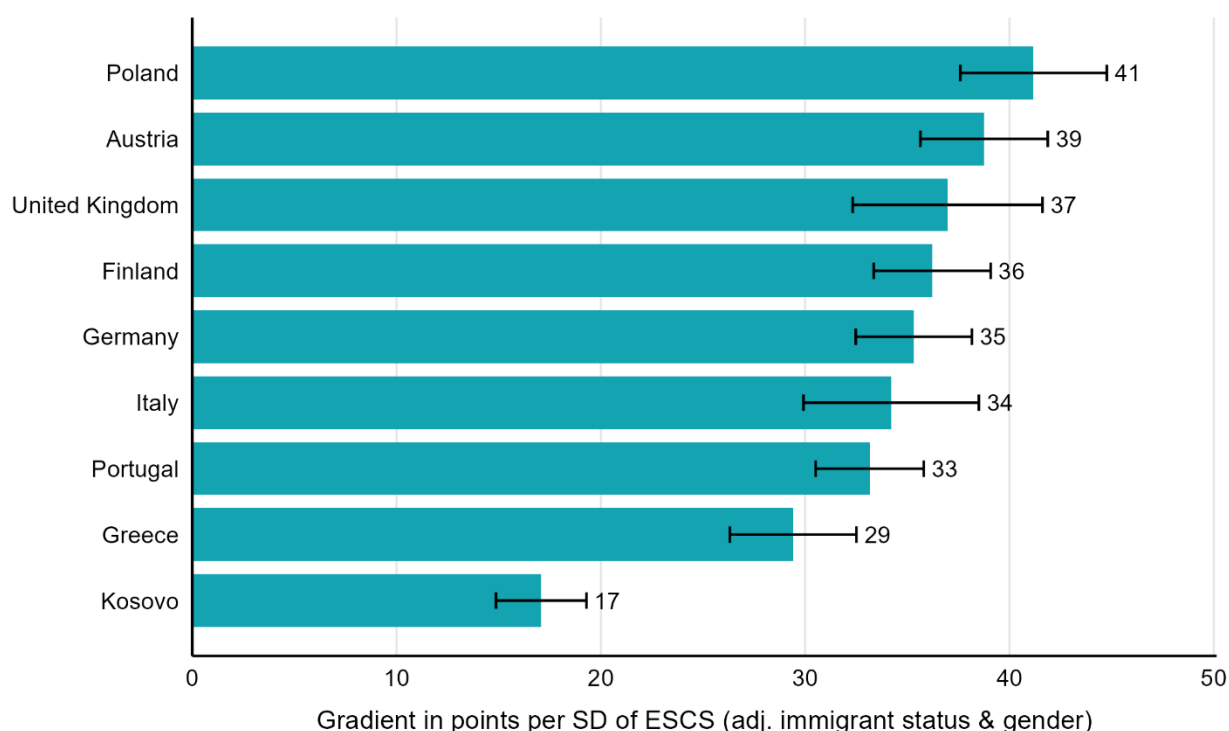
The ESCS index itself combines three student-reported components in equal weight: parents' highest occupational status, their highest educational attainment in years of schooling, and an index of household possessions including books at home. The scale is standardised across OECD countries, so zero is the average OECD student and one standard deviation the OECD-wide spread — which means partner countries differ in where their students sit on it, not only in how steeply achievement rises along it.

The gradient is estimated by design-based weighted regression of mathematics on ESCS, immigrant status and gender, pooling the nine countries within each cycle with country fixed effects. In 2022 the pooled partner-country gradient is 36.3 score points per standard deviation. A gradient of this size means that moving from one standard deviation below to one above the mean of socioeconomic status is associated with roughly seventy points — on the OECD's benchmark of about 20 score points per year of schooling, the equivalent of some three school years.

Figure 5 sets out the 2022 gradient for each partner country. Poland is steepest at 41.2 points per standard deviation, followed by Austria (38.8). A middle group is formed by the United Kingdom, Finland, Germany, Italy and Portugal (33.2–37.0). Lower gradients are observed in Greece (29.4) and Kosovo (17.1). The figures for these two should be read with care, since where overall performance in mathematics is low and compressed near the floor of the scale, the measured gradient is mechanically attenuated — a shallow gradient then signals low and undifferentiated performance rather than an equitable system.

The confidence intervals shown in Figure 5 support the broad grouping, yet not the ranking between every two countries. The distance between the steepest systems and the lower two is well established: Poland's gradient is clearly above Portugal's, Greece's and Kosovo's, and Kosovo stands apart from every other partner country. Within the middle group the intervals overlap, so the exact order there is indicative rather than firm. Read by transition regime, the three Southern systems all lie at the lower end of the distribution: Greece below the middle group, and Italy and Portugal at its lower edge. Only the Greek gradient is clearly separated from the others, and it is also the one most affected by the attenuation noted above.

Figure 5. Socioeconomic gradient in mathematics, PISA 2022



Note: Point estimates with 95% confidence intervals, from separate design-based weighted regressions of mathematics on ESCS, immigrant status and gender for each country, PISA 2022.

Table 2 gives the gradient for each country and cycle. Pooled across the nine countries it widened over the period, from 33.2 score points per standard deviation in 2015 to 34.9 in 2018 and 36.3 in 2022, which suggests that the link between background and achievement tightened rather than loosened. This drift is not uniform across countries, however. In Italy, the gradient increased the most (+4.8), followed by Poland (+4.1) and Austria (+2.8), while Kosovo is the only country where the gradient flattened (–3.7). The movements are

large enough to reorder the middle of the distribution: Italy, the second-shallowest system in 2015, had overtaken Portugal and drawn level with Germany by 2022.

Table 2. Socioeconomic gradient in mathematics (score points per 1 SD of ESCS), by country and PISA cycle

Country	2015	2018	2022	Change 2015–2022
Austria	36.0	34.5	38.8	+2.8
Finland	35.7	32.8	36.2	+0.5
Germany	32.8	35.6	35.3	+2.5
Greece	28.8	31.3	29.4	+0.6
Italy	29.4	32.4	34.2	+4.8
Kosovo	20.8	19.0	17.1	–3.7
Poland	37.1	40.4	41.2	+4.1
Portugal	31.0	33.5	33.2	+2.2
United Kingdom	35.3	33.9	37.0	+1.7
Pooled	33.2	34.9	36.3	+3.1

Note: The pooled estimate comes from a single regression per cycle that stacks all nine countries and includes country fixed effects, so it describes the within-country association. PISA's final student weights scale to each country's population of fifteen-year-olds, so larger systems carry more weight; the pooled value is therefore higher than the unweighted mean of the nine country gradients.

5.4 The immigrant achievement gap

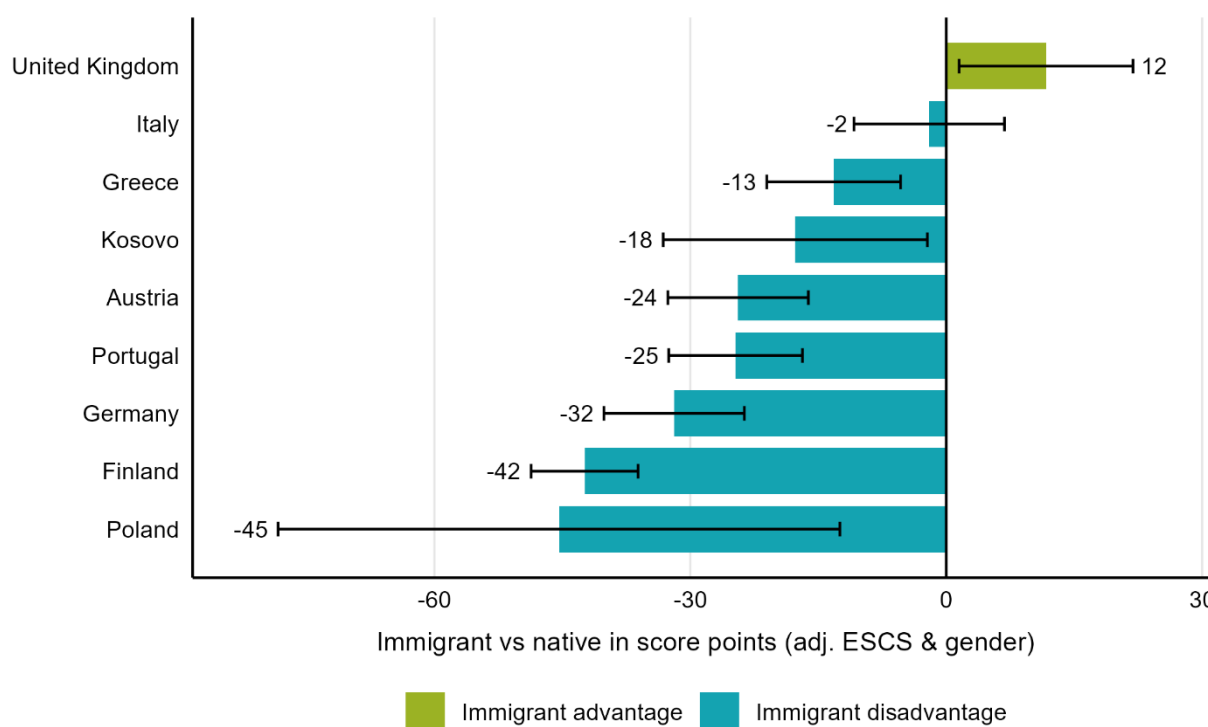
The immigrant gap comes from the same regressions as the gradient above: mathematics is regressed on ESCS, immigrant status and gender separately for each country and cycle, with design-based weights, and the gap is the coefficient on immigrant status. It therefore compares immigrant-background and native-born students of the same gender and the same socioeconomic standing.

As shown in Figure 6, the immigrant achievement gap varies enormously across the partner countries. In 2022 the gap exceeded 40 score points in Poland and Finland and stood at about 32 in Germany, while Austria and Portugal sat near 25 and Greece and Kosovo lower still. In Italy it was negligible. The United Kingdom is the clear exception: there immigrant-background students out-perform comparable native peers by about 12 points, a pattern that is consistent with a positively selected migration stream, though this estimate cannot separate selection from schooling effects.

The Polish and Kosovan estimates are based on small immigrant samples, so that their confidence intervals are correspondingly wide — Poland's spans –78 to –12 — and their position in the ranking should be read with caution. The remaining seven estimates are precise enough to distinguish the countries at either end, though the order within the middle of the country distribution is less certain.

This cross-country pattern — large gaps in the Nordic, Continental and Eastern systems, smaller ones in the Southern systems other than Portugal, and a reversed gap in the Liberal system — is one of the more policy-relevant findings of the chapter. Chapter 12 complements it from a different angle: it decomposes the raw (unadjusted) native–immigrant gap into a component attributable to composition — socioeconomic status, home resources and language — and a residual. The adjusted gap shown here already holds socioeconomic status and gender constant, so the two analyses answer related but distinct questions.

Figure 6. Adjusted immigrant achievement gap in mathematics, PISA 2022



Note: Point estimates with 95% confidence intervals, from the same regressions as Figure 5, PISA 2022.

Disaggregating the immigrant gap by generation sharpens the picture considerably. In a pooled, design-based model for 2022, using the same variables as above, yet distinguishing immigrant status into first- and second-generation students, the adjusted gap relative to native peers is large for the first generation (–32.3 points) but small and statistically indistinguishable from zero for the second generation (+0.2 points). In other words, the immigrant achievement penalty is overwhelmingly a first-generation phenomenon and has effectively closed by the second generation once socioeconomic status is taken into account. This is an encouraging signal that integration works across generations. What lies behind the first-generation gap — length of residence, language or interrupted schooling — cannot be established from these estimates; the composition of the raw gap is decomposed in Section 12.1.

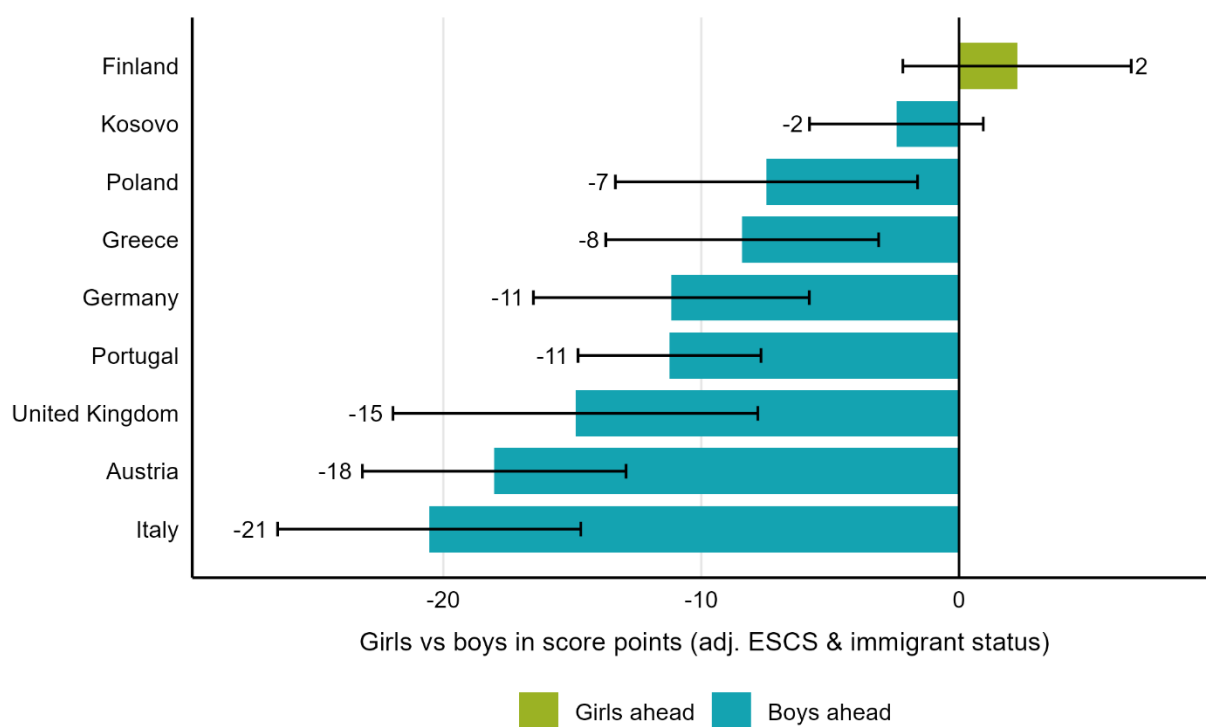
5.5 The gender gap

The gender gap comes from the same regressions as the socioeconomic gradient and the immigrant gap: it is the coefficient on gender, so it compares girls and boys of the same socioeconomic standing and the same immigrant background. A negative value means boys score higher.

Figure 7 shows the adjusted difference in 2022. It favours boys in every partner country but one, most strongly in Italy (–20.6 points), Austria (–18.0) and the United Kingdom (–14.9), and more modestly in Portugal, Germany, Greece and Poland, which range from –11.2 to –7.5. Finland is the exception, where girls hold a small nominal advantage of +2.3. In Finland and Kosovo the confidence interval spans zero, so in these two systems the data do not establish any gender difference at all. Elsewhere the male advantage is clearly established.

Averaged across the nine countries the gap is about 10 score points, roughly a third of the socioeconomic gradient and well below the typical immigrant gap, and small against country means of roughly 355 to 490 points. The cross-country pattern — the largest male advantage in Italy and Austria, parity in the Nordic system and in Kosovo — is consistent with the literature linking gender gaps in mathematics to broader societal and institutional differences in gender norms rather than to differences in underlying ability.

Figure 7. Adjusted gender gap in mathematics, PISA 2022



Note: Point estimates with 95% confidence intervals, from the same regressions as Figure 5, PISA 2022.

5.6 Mechanisms and policy relevance

The gradients documented in this chapter are not merely descriptive; they point to the mechanisms through which inequality is produced and to the margins at which policy can act:

- The socioeconomic gradient reflects the cumulative advantage that better-resourced families confer through home learning environments, cultural capital, school choice and the capacity to navigate selection — mechanisms that operate before and alongside schooling and that early-tracking systems tend to lock in, a question examined in Chapter 9.
- The immigrant gap, by contrast, operates substantially through socioeconomic and linguistic channels — a point established formally in Section 12.1 — which is why language support and socioeconomic targeting, rather than measures defined by migration status, are the indicated levers.
- And the comparatively modest gender gap in mathematics, set against the well established gender pay gap among adults (Section 12.2), signals that the decisive gender inequalities in the trajectory arise primarily after schooling.

Table 3 brings the three adjusted associations together for 2022. Because all three are coefficients from the same country-level regression, they are measured on the same scale and estimated on the same sample. What the comparison shows is that they do not travel together. Italy has the smallest immigrant gap in the partner set and the largest gender gap; Finland has one of the largest immigrant gaps and no gender gap at all; Kosovo combines the shallowest socioeconomic gradient with a middling immigrant gap. Across the nine countries none of the three associations predicts either of the others. There is therefore no such thing as a uniformly equitable or inequitable system here, and no single policy lever addresses the three at once: a system that performs well on one dimension is not thereby relieved on the others.

Reading the gradients as mechanisms in this way is what allows the descriptive evidence of this chapter to inform the policy discussion of Chapter 11 and the synthesis of Chapter 22.

Table 3. Adjusted socioeconomic gradient and achievement gaps in mathematics, PISA 2022 (score points)

Country	SES gradient (per 1 SD of ESCS)	Immigrant gap (immigrant – native)	Gender gap (girls – boys)
Austria	38.8	–24.4	–18.0
Finland	36.2	–42.4	+2.3
Germany	35.3	–31.9	–11.2
Greece	29.4	–13.2	–8.4
Italy	34.2	–2.0	–20.6
Kosovo	17.1	–17.7	–2.4
Poland	41.2	–45.4	–7.5
Portugal	33.2	–24.7	–11.2
United Kingdom	37.0	+11.7	–14.9

Note: All three coefficients come from the same country-level regression of mathematics on ESCS, immigrant status and gender, PISA 2022. The gradient is measured per standard deviation of ESCS; the two gaps are differences in score points between the groups named. The Polish and Kosovan immigrant-gap estimates rest on small immigrant samples and are imprecisely estimated.

5.7 Summary

Achievement in the partner countries was broadly stable before the pandemic, with Poland the one system improving markedly. PISA mathematics then fell in every partner country between 2018 and 2022, and the decline was not confined to the average: the share of fifteen-year-olds below the mathematics baseline rose everywhere over the same interval, leaving every partner country above the EU-level target of 15 per cent for 2030. At the end of primary schooling the picture differs by domain — PIRLS reading fell in every partner country with data between 2016 and 2021, whereas TIMSS grade-4 mathematics moved in both directions to 2023.

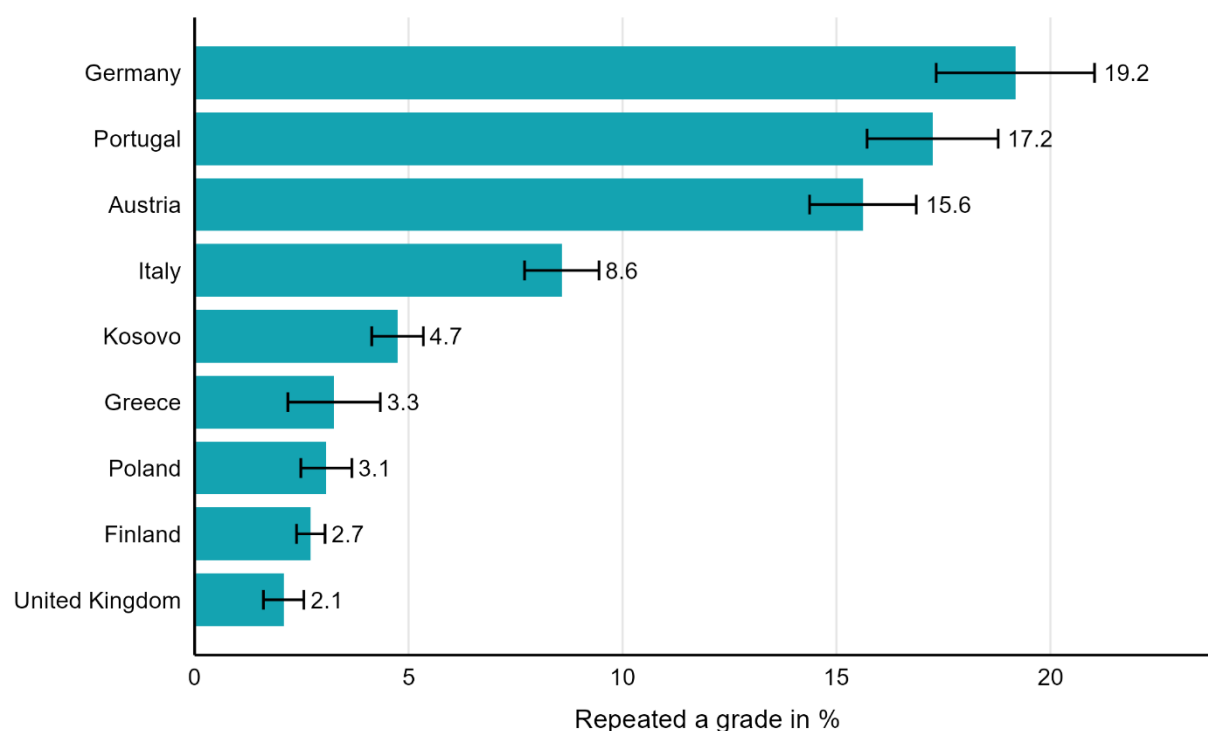
Of the three adjusted inequalities the socioeconomic gradient is the largest and the most uniform: 36.3 score points per standard deviation of ESCS pooled in 2022, against 33.2 in 2015, and present in every system. The immigrant gap varies far more, from over 40 points in Poland and Finland to a reversed gap in the United Kingdom, and it is concentrated in the first generation; the second-generation gap is not distinguishable from zero once socioeconomic status and gender are held constant. The gender gap is modest, about 10 score points on average, and favours boys in every partner country except Finland. The three do not travel together: across the nine countries none of them predicts either of the others, so no system is uniformly equitable and no single lever addresses all three at once. These early gradients are the starting point of the progression, completion and labour-market inequalities documented in the chapters that follow.

6 Progress and completion of pathways

The second transition field concerns how far young people progress through the pathways they enter and complete them, and how unequally. The chapter follows the trajectory in three stages, each observed in a different data source. Section 6.1 uses PISA to examine grade repetition, the earliest visible sign that a student has fallen behind, in all nine partner countries. Section 6.2 turns to access to higher education and the conditions of study, which only EUROSTUDENT observes, for the four partner countries covered by its most recent wave: Austria, Finland, Germany and Poland. Section 6.3 examines completed attainment among young adults in PIAAC, which can be analysed for six partner countries, and complements it with the ESS, which extends the analysis of intergenerational persistence to eight. Throughout, the chapter asks how progression and completion depend on social origin, gender, migration background and, among students, health impairment. Together, the three stages trace educational pathways from their earliest visible break in school, through access to and conditions of study, to their final result in completed attainment.

6.1 Grade repetition: levels, trends and the socioeconomic gradient

Figure 8. Grade repetition rate by country, PISA 2022



Note: Share of fifteen-year-old students who report having repeated at least one grade, with 95% confidence intervals, estimated from the PISA microdata using the study's replication weights, PISA 2022.

Figure 8 shows that grade repetition varies enormously across the partner countries. In 2022 the rate was highest in Germany with 19.2 per cent, followed by Portugal and Austria with still over 15 per cent. By contrast, five countries had repetition rates below 5 per cent, with the lowest rates observed in the United Kingdom (2.1 per cent) and Finland (2.7 per cent). The estimates are precise enough to separate three distinct groups — the three high-repetition countries, the five low-repetition countries, and Italy in between — as their confidence intervals do not overlap. Within each group, however, the intervals of neighbouring countries overlap, so the ranking should not be over-interpreted.

Table 4. Grade-repetition rate (%), by country and cycle

Country	2015	2018	2022	Change 2015–2022
Austria	15.2	14.4	15.6	+0.4
Finland	3.0	3.3	2.7	–0.2
Germany	18.1	19.6	19.2	+1.1
Greece	5.0	4.0	3.3	–1.7
Italy	15.1	13.2	8.6	–6.5
Kosovo	3.8	4.5	4.7	+0.9
Poland	5.3	3.3	3.1	–2.2
Portugal	31.2	26.6	17.2	–14.0
United Kingdom	2.8	2.5	2.1	–0.7
Average	11.0	10.2	8.5	–2.5

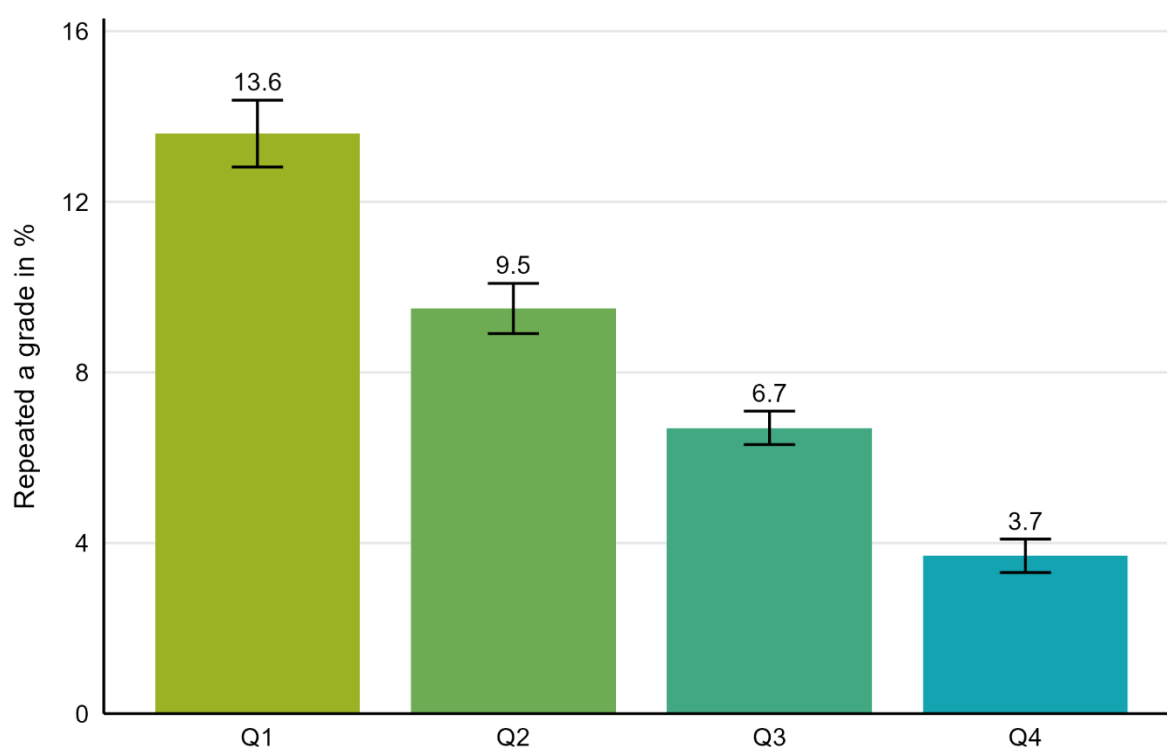
Note: Share of fifteen-year-old students who report having repeated at least one grade, PISA. The average is the unweighted mean of the nine country rates; changes are computed from unrounded estimates.

Table 4 shows that between 2015 and 2022 the rates changed little in most countries but fell strongly in Italy and Portugal and, from a low base, in Poland and Greece. The fall in Portugal was particularly pronounced — from 31.2 per cent in 2015 to 17.2 per cent in 2022 — and is examined as a policy case study in Chapter 11. That repetition can fall by more than forty per cent in seven years in some systems, while in Germany, Portugal and Austria it remains six to nine times more common than in the United Kingdom and Finland without a corresponding difference in achievement, underlines that it is an institutional practice as much as a response to learning difficulty, a point developed in Chapter 9.

The role of social background

Grade repetition falls disproportionately on socioeconomically disadvantaged students. On average across the partner countries in 2022, 13.6 per cent of students in the lowest quarter of their country's ESCS distribution had repeated a grade, against only 3.7 per cent in the highest — a near four-fold difference.

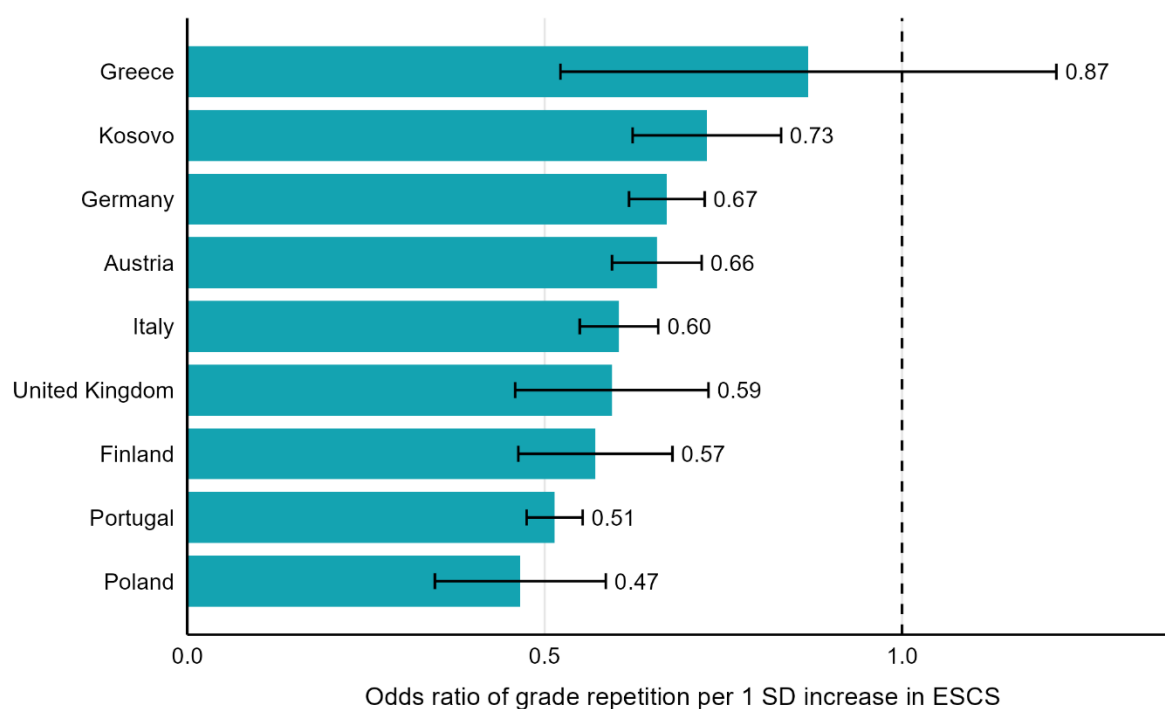
Figure 9. Grade repetition by socioeconomic quartile, PISA 2022



Note: Share of students who report having repeated at least one grade, by quartile of the PISA index of economic, social and cultural status (ESCS), with 95% confidence intervals based on the study's replication weights. Quartiles are defined within each country; values are averages of the nine country estimates.

A design-based logistic model, estimated separately for each country with repetition regressed on ESCS, gender and immigrant background, points in the same direction in every partner country. Figure 10 plots the resulting ESCS odds ratios with their design-based confidence intervals: all nine point estimates lie below one, and only in Greece does the interval reach it. A one-standard-deviation increase in ESCS reduces the odds of repetition by between about an eighth and a half, with the strongest socioeconomic protection in Poland and Portugal (odds ratios 0.47 and 0.51) and the weakest in Kosovo and Greece (0.73 and 0.87).

Figure 10. Effect of socioeconomic status on grade repetition (odds ratios), 2022



Note: Odds ratios with 95% confidence intervals, from separate design-based logistic regressions of grade repetition on ESCS, immigrant status and gender for each country, PISA 2022. An odds ratio below one means that a one-standard-deviation increase in ESCS lowers the odds of having repeated a grade.

The role of gender and migration

Table 5 sets the ESCS estimates alongside those for gender and immigrant background from the same models. Girls repeat less often than boys in eight of the nine countries, although the intervals for Poland and Kosovo include one. In the United Kingdom the estimate lies above one, but its interval also includes one, so the data do not establish a gender difference there. Students with an immigrant background repeat more often in eight of the nine countries, most markedly in Poland, Finland and Greece. The Polish and Greek estimates rest on small immigrant samples and are imprecise. In the United Kingdom the estimate is close to one and its confidence interval includes it, so no immigrant excess can be established.

Table 5. Odds ratios of grade repetition by socioeconomic status, immigrant background and gender, by country, PISA 2022

Country	ESCS (per 1 SD)	Immigrant (vs. native)	Girls (vs. boys)
Austria	0.66	1.94	0.76
Finland	0.57	6.74	0.46
Germany	0.67	1.33	0.67
Greece	0.87	5.58	0.45
Italy	0.60	3.18	0.63
Kosovo	0.73	3.76	0.78
Poland	0.47	9.44	0.71
Portugal	0.51	1.95	0.61
United Kingdom	0.59	1.11	1.13

Note: All three odds ratios come from the same country-level logistic regression of grade repetition on ESCS, immigrant status and gender, PISA 2022. Values below one indicate lower odds of repetition. The Polish, Greek and Kosovan immigrant estimates rest on small immigrant samples and are imprecisely estimated.

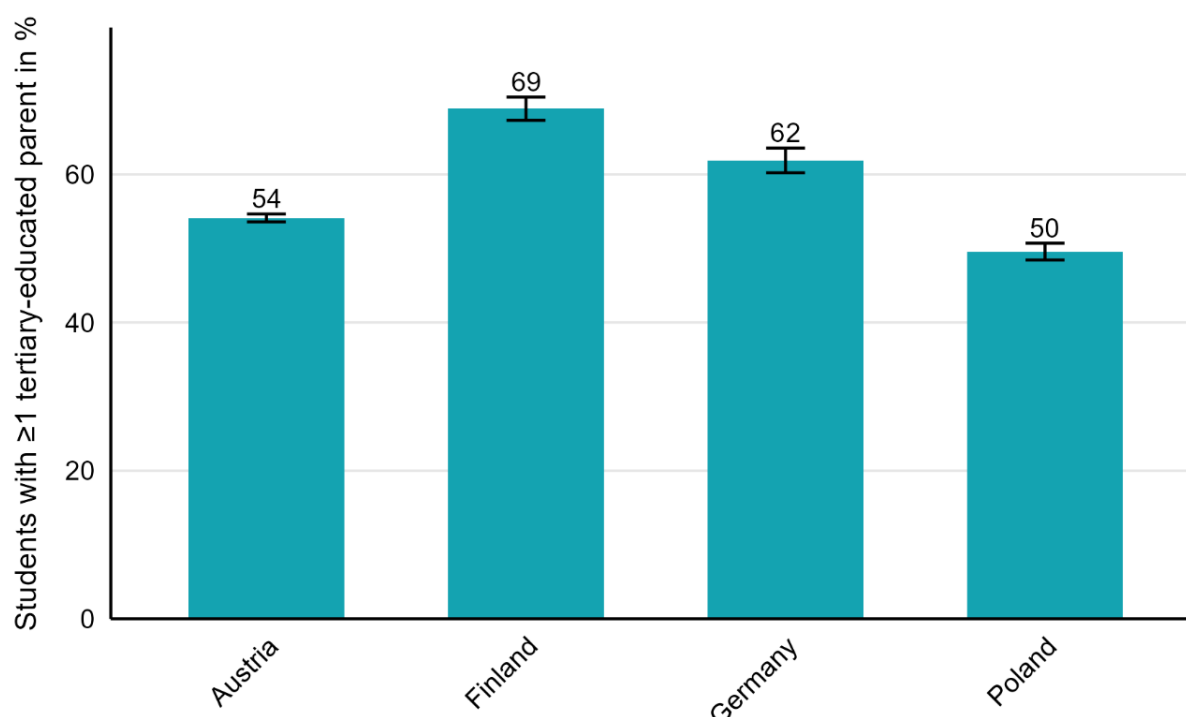
6.2 Access to and conditions of higher education

Section 6.1 followed students through compulsory schooling, where grade repetition marks the first visible break in educational pathways. This section turns to the next stage, the transition into higher education, and asks who has entered it and under what conditions they study. The evidence comes from EUROSTUDENT, the European survey of the social and economic conditions of student life, whose scientific-use files are confidential and available only under a written data use agreement. The analysis uses wave 8 (fieldwork 2021–2024) rather than wave VII (around 2019), because it is both more recent and covers more partner countries: Austria, Finland, Germany and Poland, whereas wave VII lacks Germany. Because the scientific-use files carry a single design weight but no replicate weights or design variables, the estimates in this section are accompanied by robust rather than design-based standard errors.

Access to higher education by social origin

Higher education recruits heavily from tertiary-educated families. The share of students with at least one tertiary-educated parent is 54 per cent in Austria, 62 per cent in Germany, 50 per cent in Poland and 69 per cent in Finland (Figure 11). How far this reflects selective access rather than the educational composition of the parent generation cannot be established from EUROSTUDENT alone.

Figure 11. Share of students with at least one tertiary-educated parent, EUROSTUDENT 8.



Note: Share of students with at least one parent holding a tertiary qualification, with 95% confidence intervals based on robust standard errors, estimated from the EUROSTUDENT 8 microdata using the survey weight.

An approximate benchmark to assess selectivity is to compare these figures with the share of all 25–34 year-olds with at least one tertiary-educated parent from PIAAC 2023. Against this benchmark, students from tertiary-educated families are over-represented in every partner country, but to very different degrees: by a factor of about 1.5 in Germany, 1.9 in Austria, 2.3 in Finland and 5.0 in Poland. Finland's high intake share therefore does not simply reflect a highly educated parent generation, and Poland's comparatively low share conceals the strongest over-representation of the four. Because the benchmark cohort is somewhat older than today's students, whose parents are on average more highly educated, the factors are upper bounds; the ranking of the countries is the more robust result.

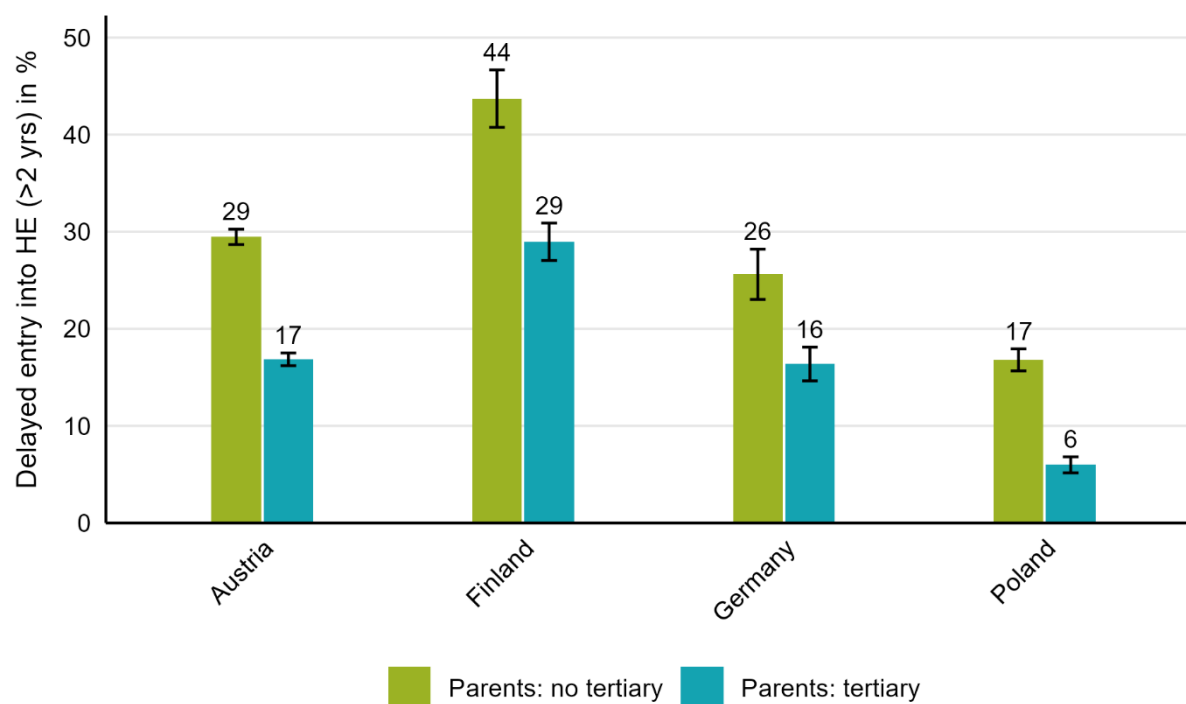
Table 6. Share of students and of 25–34 year-olds with at least one tertiary-educated parent (%), by country

Country	Students (EUROSTUDENT 8)	25–34 year-olds (OECD 2025)	Ratio
Austria	54	28	1.9
Finland	69	30	2.3
Germany	62	40	1.5
Poland	50	10	5.0

Note: Share with at least one parent holding a tertiary qualification (ISCED 5–8). Values for 25–34 year-olds from Education at a Glance 2025 (OECD, <https://stat.link/vur4y1>), Table A1.4, based on PIAAC 2023. The ratio divides the student share by the cohort share.

Social origin also shapes how students reach higher education (Figure 12). In every partner country, students from non-tertiary families are more likely than those from tertiary families to have entered higher education more than two years after leaving school. The gap is widest in Finland (44 against 29 per cent) and Austria (29 against 17 per cent), and smallest in Germany (26 against 16 per cent). Poland has the lowest levels, but there delayed entry is almost three times as common among students from non-tertiary families (17 against 6 per cent). First-in-family students thus arrive later and by less direct routes.

Figure 12. Delayed entry into higher education (more than two years after school), by parental education.



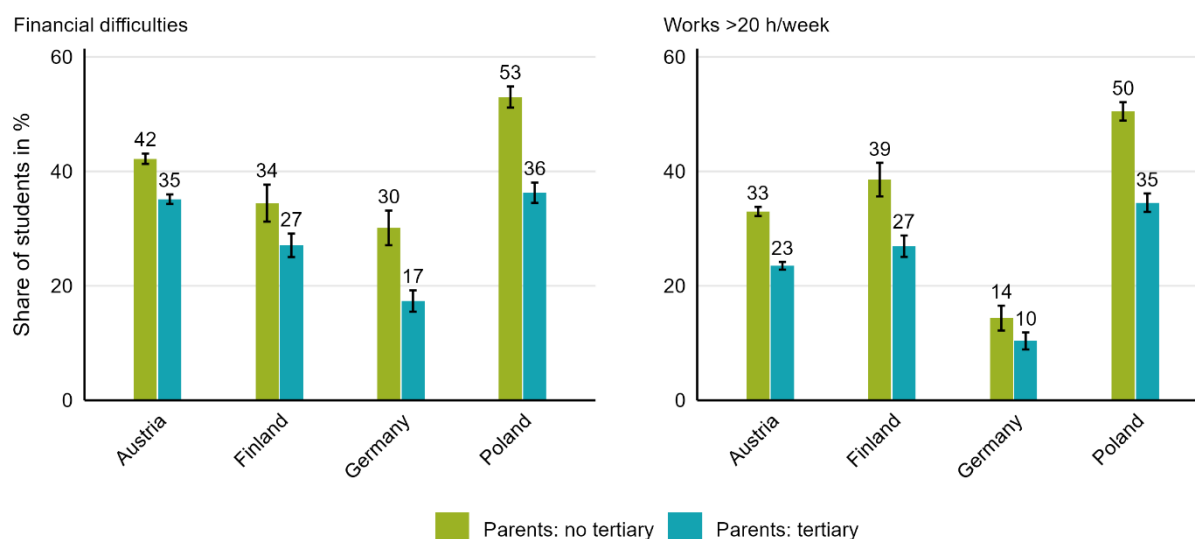
Note: Share of students who entered higher education more than two years after leaving school, with 95% confidence intervals based on robust standard errors, estimated using the survey weight.

Material conditions of study

Students from non-tertiary families also carry a heavier material load throughout their studies (Figure 13). In every partner country they report financial difficulties more often than students with tertiary-educated parents. The gap is widest in Poland (53 against 36 per cent) and Germany (30 against 17 per cent), and narrowest in Austria (42 against 35 per cent) and Finland (34 against 27 per cent).

Students from non-tertiary families also more often work more than twenty hours a week alongside their studies. This gap, too, is widest in Poland (50 against 35 per cent) but smallest in Germany (14 against 10 per cent), where few students in either group work long hours; Finland (39 against 27 per cent) and Austria (33 against 23 per cent) lie in between.

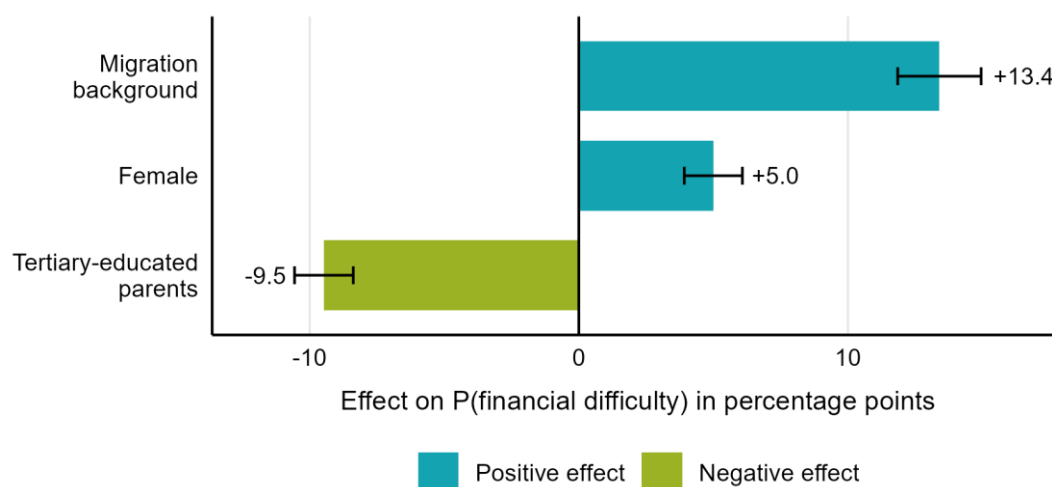
Figure 13. Students reporting financial difficulties and working more than 20 hours a week, by parental education, EUROSTUDENT 8.



Note: Shares of students with 95% confidence intervals based on robust standard errors, estimated using the survey weight. Financial difficulties refer to students giving a clear yes or no answer.

Who reports financial difficulty, though, is not a matter of social origin alone: students also differ in age, gender and migration background, and the four countries differ in their student populations and support systems. To identify which of these characteristics are associated with financial difficulty, and whether social origin still matters once the others are taken into account, Figure 14 shows the results of a linear probability model that includes all of them together with country fixed effects, so that the estimates compare students within the same country. Even at equal values of the other characteristics, having tertiary-educated parents lowers the probability of reporting financial difficulty by 9.5 percentage points. Being female is associated with a 5.0-point higher probability and, most strongly, having a migration background with a 13.4-point higher probability. Taken together, a female student with a migration background and non-tertiary parents is thus predicted to be about 28 percentage points more likely to report financial difficulty than a native male student with tertiary-educated parents.

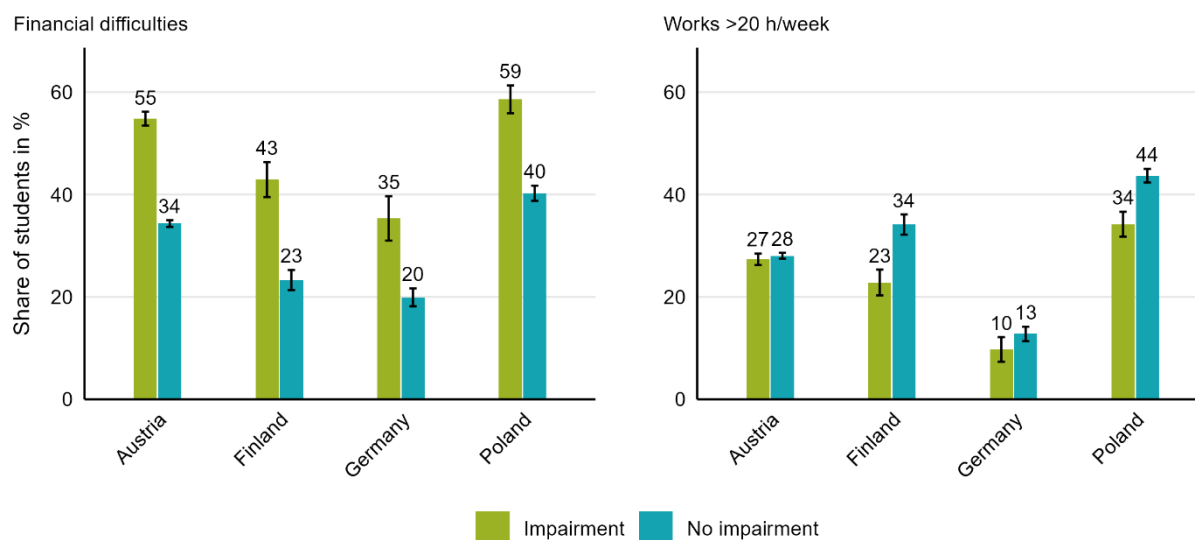
Figure 14. Determinants of reporting financial difficulty, EUROSTUDENT 8.



Note: Coefficients of a weighted linear probability model of reporting financial difficulty on parental education, gender, migration background, age group and country fixed effects, with 95% confidence intervals based on robust standard errors. Age enters as a linear term across the survey's age groups.

A further dimension of disadvantage is health. Between 18 per cent of students in Germany and 31 per cent in Finland report a health impairment that limits them in their studies; these differences may partly reflect national differences in reporting. Figure 15 compares their study conditions with those of their peers. In every partner country, students with an impairment report financial difficulties considerably more often, by between 15 and 21 percentage points. Yet they do not compensate by working more: in Finland and Poland they are markedly less likely to work more than twenty hours a week, in Germany slightly less likely, and in Austria the two groups hardly differ. Higher need thus goes together with an equal or lower capacity to earn alongside their studies.

Figure 15. Students reporting financial difficulties and working more than 20 hours a week, by impairment status, EUROSTUDENT 8.



Note: Shares of students with and without a self-reported impairment limiting their studies, with 95% confidence intervals, estimated using the survey weight. Financial difficulties refer to students giving a clear yes or no answer.

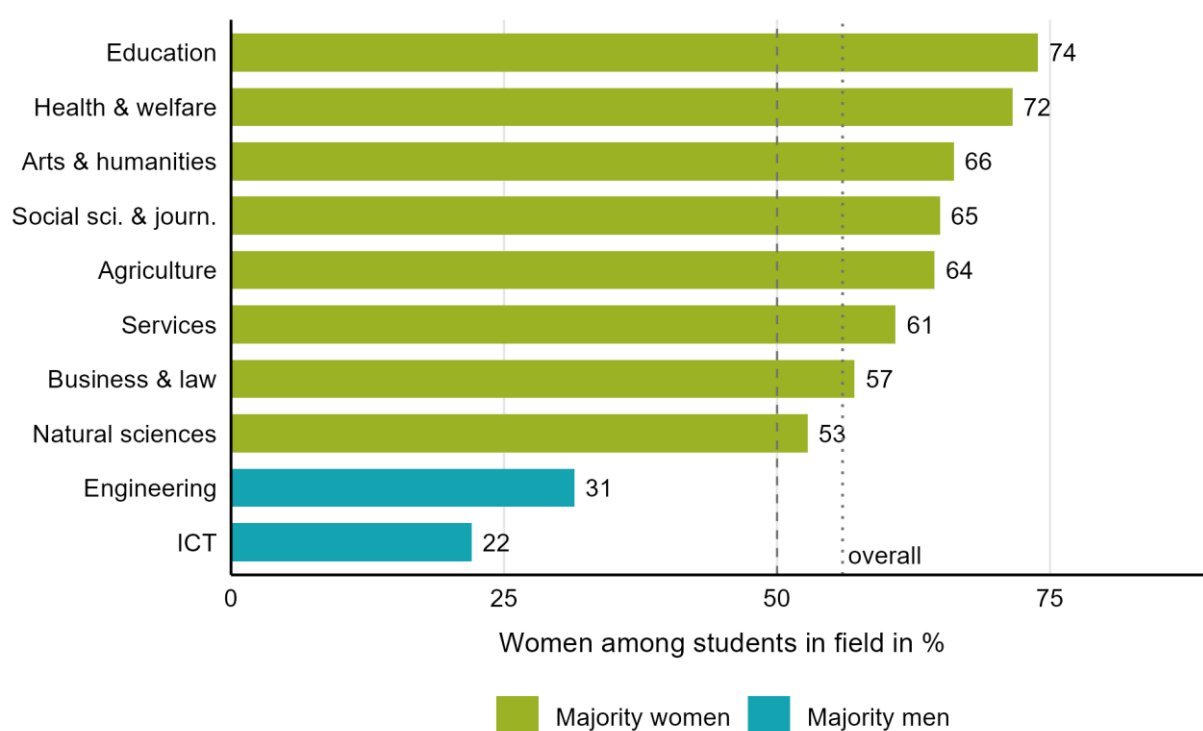
Impairment and social origin add up. Across all students in the four countries taken together, students from non-tertiary families report financial difficulties about 10 percentage points more often than those with tertiary-educated parents, whether or not they have an impairment. Neither disadvantage therefore amplifies the other; they accumulate additively, from 28 per cent among non-impaired students with tertiary-educated parents to 58 per cent among impaired students from non-tertiary families.

Field of study by gender and social origin

The student body is segregated not only by social origin but also, and strongly, by gender (Figure 16). Women make up 56 per cent of all students in the four partner countries, but only about a fifth of ICT and less than a third of engineering students, while they account for around three quarters of students in education and in health and welfare. This matters for later earnings: in the graduate data of Section 12.2 (Austria, Germany and Greece), differences in composition, mainly field of study, account for more than half of the early-career gender pay gap. Horizontal sorting within higher education thus pre-structures a pay gap that becomes visible only at labour-market entry.

Social origin, by contrast, varies little across fields: eight of the ten fields draw between 53 and 60 per cent of their students from tertiary-educated families. The least socially selective fields are education (48 per cent) and services (50 per cent), so teaching remains a comparatively open route for first-in-family students.

Figure 16. Share of women among students by field of study, EUROSTUDENT 8.



Note: Share of women among students in each field of study, pooled over the four partner countries and estimated using the survey weight. The dashed line marks parity, the dotted line the overall share of women (56 per cent).

Partner countries in European perspective

EUROSTUDENT 8 also makes it possible to place the four partner countries within a wider European field. Table 7 compares them with the average of the 19 countries covered by the survey on three indicators of the social and economic conditions of study, and the partner countries occupy quite different positions.

Table 7. Study conditions in the partner countries against the European average (share of students in %), EUROSTUDENT 8.

Indicator	European average	Austria	Finland	Germany	Poland
Tertiary-educated parents	60%	54%	69%	62%	50%
Works >20 h/week	28%	28%	31%	12%	42%
Financial difficulties	37%	39%	29%	23%	44%

Note: The European average is the unweighted mean of the 19 EUROSTUDENT 8 countries with data, the partner countries included. Financial difficulties refer to students giving a clear yes or no answer.

Austria and Poland draw fewer of their students from tertiary-educated families than the European average, Finland more. This is not by itself a measure of social selectivity; relative to the parental composition of their age cohort, students from tertiary-educated families are most over-represented in Poland and least in Germany (Table 6).

The material conditions of study diverge even more sharply. German students work far less alongside their studies than the European average and report less financial difficulty than students in any other of the 19 countries. Polish students, by contrast, work the most and report the most financial strain of the four partner countries. Austria and Finland lie close to the European average on working hours, with Austria above and Finland below it on financial difficulty. Higher education is thus pursued under very different material conditions across the partner countries.

6.3 Completion of education

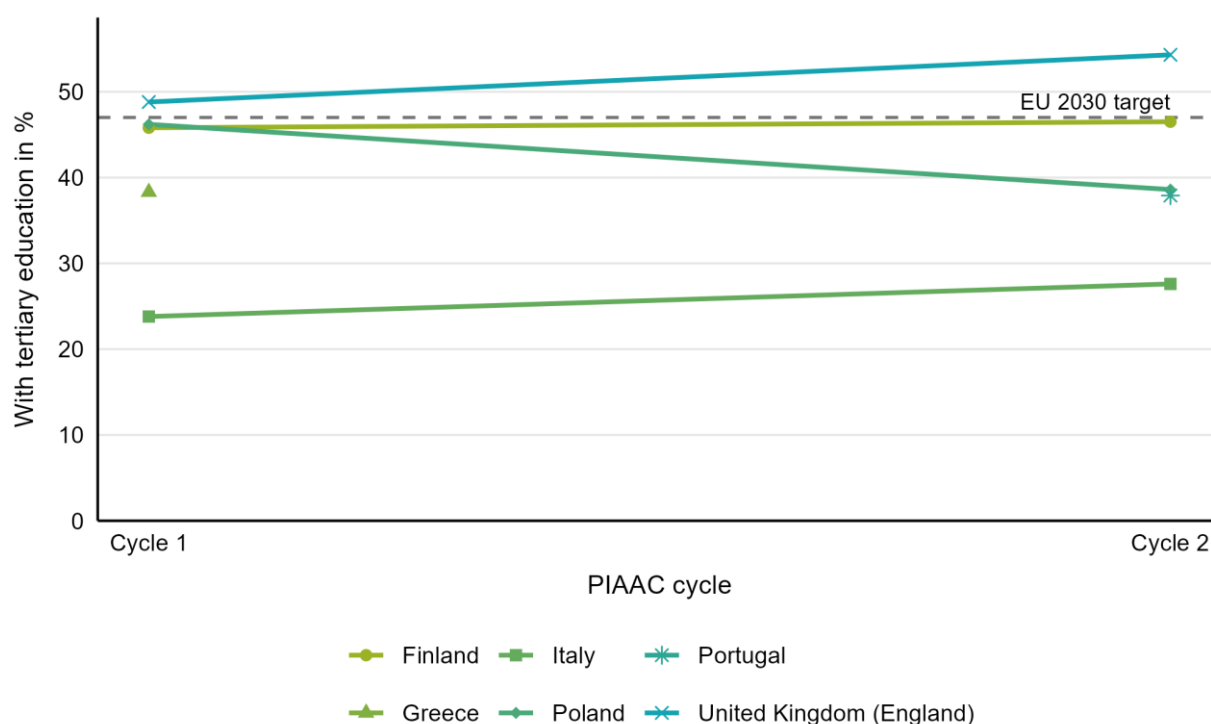
Sections 6.1 and 6.2 followed students through school and into higher education; this section turns to the education that young adults have completed. It first describes tertiary attainment in PIAAC, then its dependence on parental education, and finally checks the pattern in the ESS, which also covers Austria and Germany.

Aggregate trends

Figure 17 shows tertiary attainment among 25 to 34 year olds in the two PIAAC cycles. In the most recent cycle, attainment is highest in the United Kingdom (England; 54.3 per cent) and Finland (46.5) and lowest in Italy (27.6), with Poland and Portugal in between. Greece and Portugal are observed in one cycle only and appear as single points in the figure. Between the two cycles there is no uniform trend: tertiary attainment rose in the United Kingdom (from 48.8 per cent) and in Italy (from 23.8), remained essentially unchanged in Finland (from 45.8) and fell in Poland (from 46.2 to 38.6).

Measured against the EU-level target of at least 47 per cent of 25- to 34-year-olds with tertiary attainment by 2030 (Council of the European Union, 2026), only the United Kingdom (England) was above it in Cycle 2, at 54 per cent, and Finland was just below it. Poland and Portugal were about 8 to 9 points below, and Italy about 19 points. In Poland the share was close to the target in Cycle 1 and has since fallen. The target applies to the EU as a whole rather than to individual countries, but it provides a benchmark for the partner countries' position.

Figure 17. Tertiary attainment among 25–34 year-olds, PIAAC Cycle 1 to Cycle 2

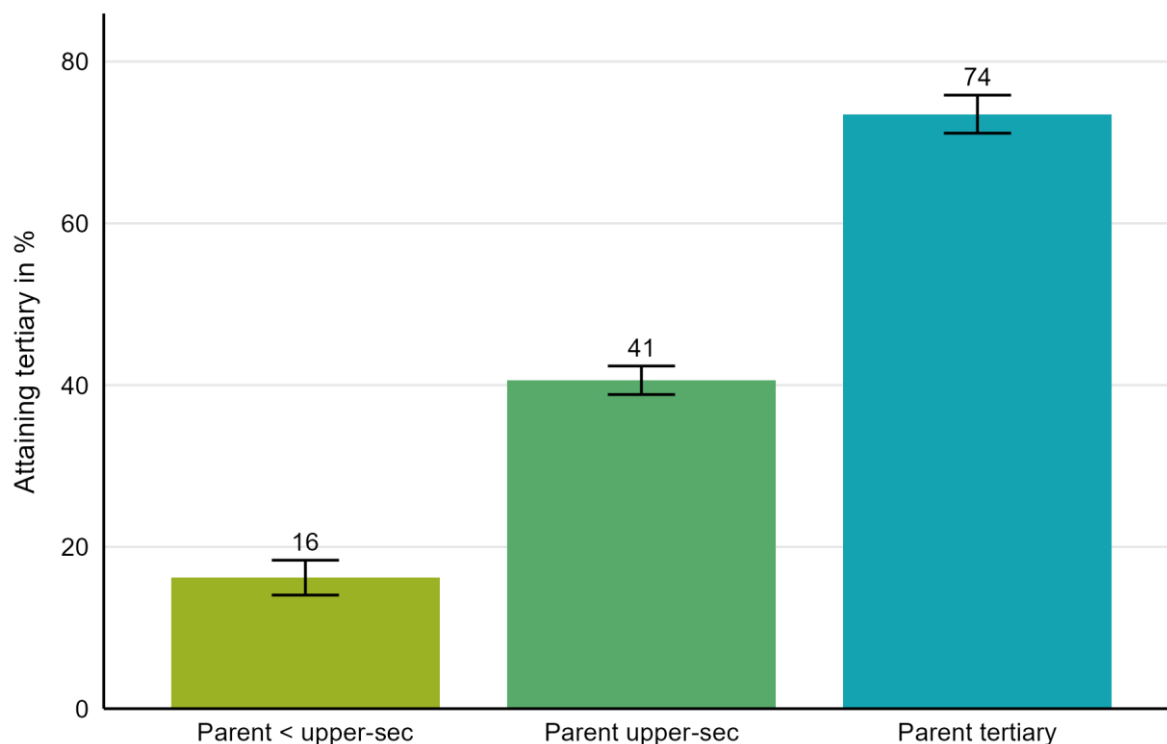


Note: Share of 25–34 year-olds with tertiary attainment, estimated from the PIAAC microdata using the study's replication weights. Cycle 1 fieldwork took place in 2011–12 in Finland, Italy, Poland and the United Kingdom and in 2014–15 in Greece; Cycle 2 fieldwork took place in 2022–23 in all participating countries. Values for the United Kingdom refer to England in both cycles. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age. The dashed line marks the EU-level target of at least 47 per cent of 25- to 34-year-olds with tertiary attainment by 2030 (Council of the European Union, 2026).

Individual Determinants

The most striking feature of completion is how strongly it is inherited (Figure 18). Among young adults, the share holding a tertiary qualification rises from 16 per cent when neither parent completed upper-secondary education, to 41 per cent when at least one parent holds an upper-secondary qualification, to 74 per cent when at least one parent holds a tertiary degree — a more than four-fold difference across the range of parental education.

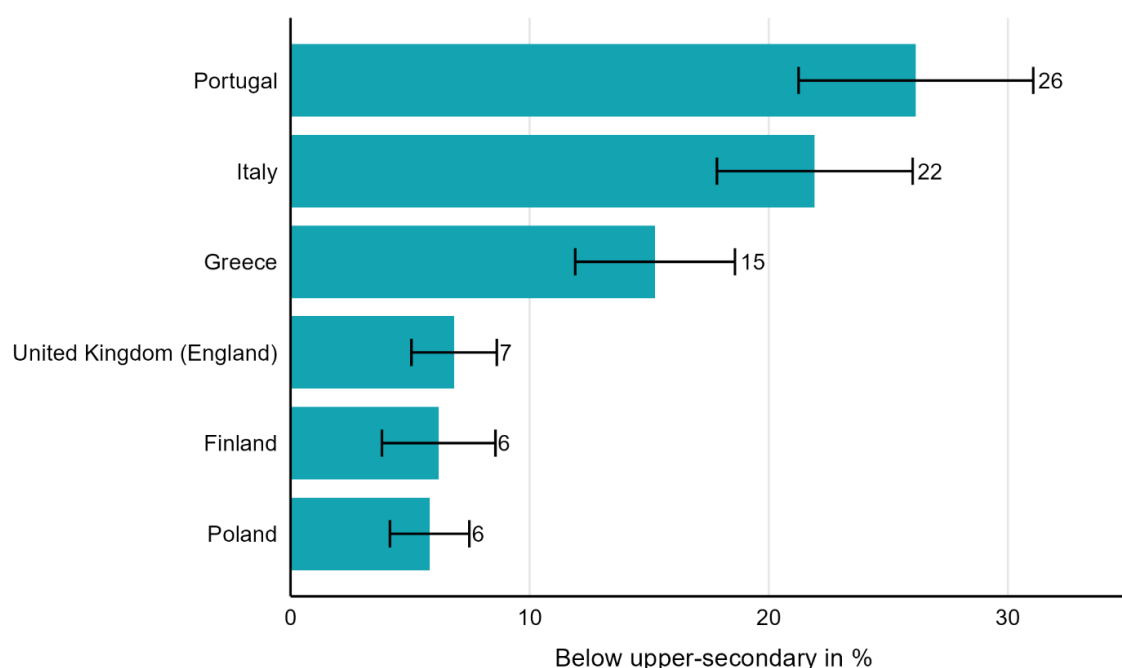
Figure 18. Tertiary attainment by parental education, ages 25–34



Note: Share of 25–34 year-olds with tertiary attainment, by the highest educational attainment of either parent, with 95% confidence intervals, pooled over the six partner countries and both PIAAC cycles and estimated using the study's replication weights. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age.

The same inheritance is visible at the other end of the distribution, among young adults who have not completed upper-secondary education. Figure 19 shows how common such low attainment is in each country's most recent cycle: it remains widespread in Portugal and Italy, where around a quarter and a fifth of 25 to 34 year olds lack an upper-secondary qualification, and to a lesser extent in Greece, while in Finland, Poland and the United Kingdom it affects fewer than 7 per cent.

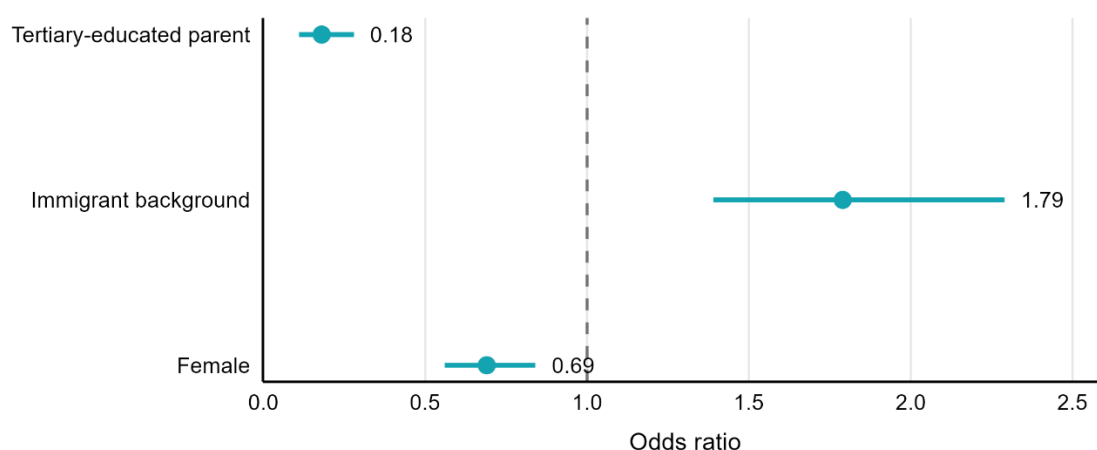
Figure 19. Share of 25–34 year-olds below upper-secondary attainment, most recent PIAAC cycle



Note: Share of 25–34 year-olds without an upper-secondary qualification, with 95% confidence intervals, estimated from the PIAAC microdata using the study's replication weights. Values refer to Cycle 2 (2022–23) except for Greece (Cycle 1, 2014–15). Values for the United Kingdom refer to England. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age.

Which individual characteristics are associated with low attainment is examined with a design-based logistic model that compares young adults within the same country and survey cycle (Figure 20). Having a tertiary-educated parent cuts the odds of not completing upper-secondary education to less than a fifth. For young adults with an immigrant background the odds are about 80 per cent higher than for those without, whereas young women have odds about 30 per cent lower than young men. The intergenerational gradient in completion mirrors the socioeconomic gradient in achievement documented in Chapter 5: the inequality visible at the school gate compounds into unequal completion of the educational trajectory.

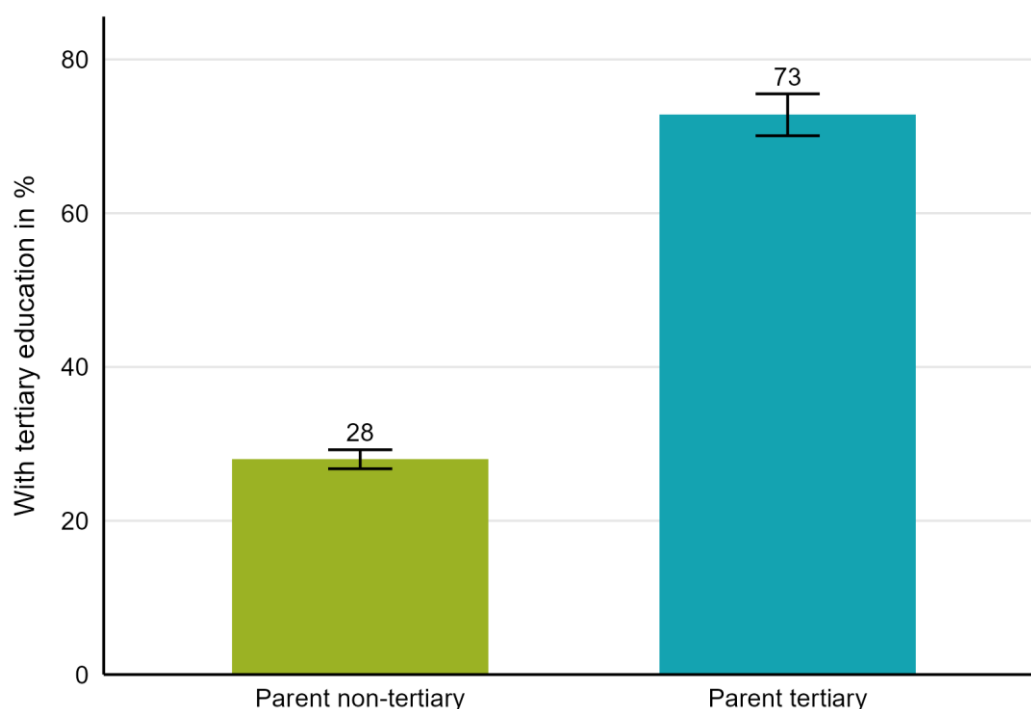
Figure 20. Risk of low attainment (below upper-secondary), odds ratios, PIAAC, ages 25–34



Note: Odds ratios with 95% confidence intervals from a design-based logistic regression of below upper-secondary attainment on parental education, immigrant background and gender, with country-by-cycle fixed effects, pooled over six partner countries with PIAAC data. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age. An odds ratio below one indicates lower odds of low attainment.

The European Social Survey (ESS) corroborates the strong intergenerational persistence found in PIAAC from an independent source. The ESS is a biennial cross-national survey of the adult population living in private households, which records respondents' own education together with that of their parents. It covers eight of the nine partner countries, all except Kosovo, and thus also includes Austria and Germany, for which PIAAC cannot be used here. Among adults aged 30–59, 73 per cent of those with at least one tertiary-educated parent had themselves attained tertiary education, against 28 per cent of those without (Figure 21) — a gap of 45 percentage points that confirms the durability of educational advantage across generations.

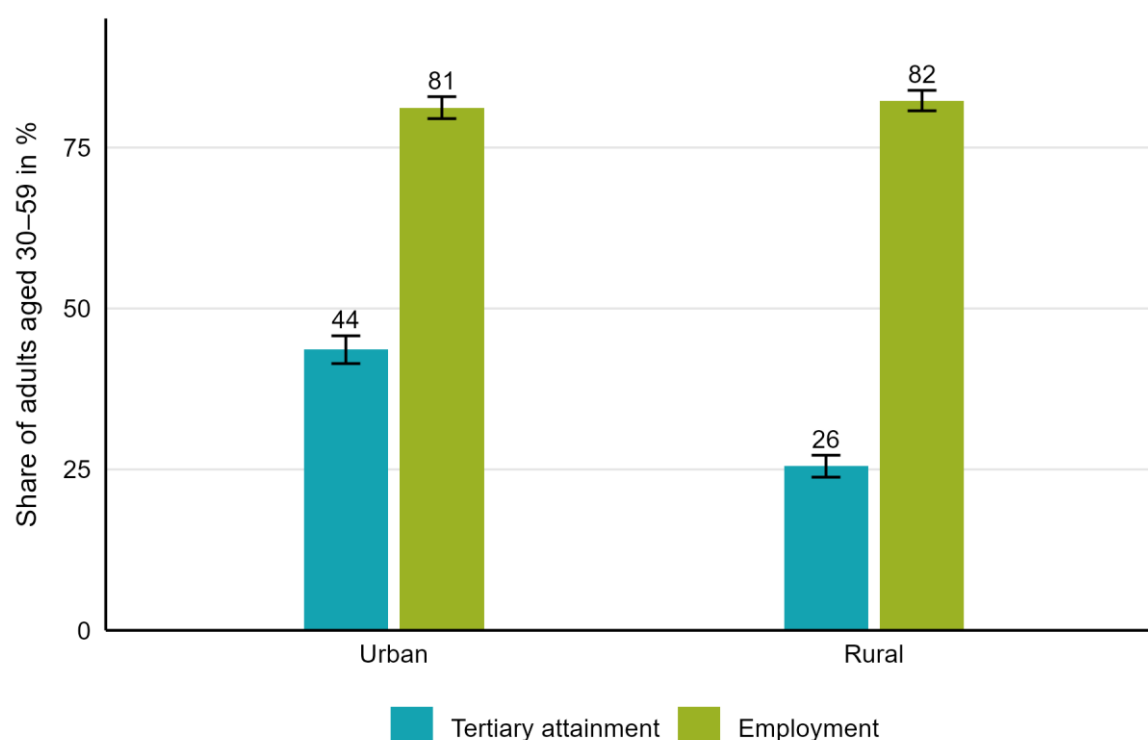
Figure 21. Tertiary attainment by parental education, ESS, ages 30–59



Note: Share of adults aged 30–59 with tertiary attainment, by whether at least one parent attained tertiary education, with 95% confidence intervals based on the ESS design variables (Taylor linearisation). Values are unweighted averages of the eight partner countries covered by the ESS (2020 and 2023 rounds pooled), each estimated using the ESS analysis weight.

The urban–rural dimension, which the cross-national assessment data cannot address, shows a clear spatial inequality in education that does not carry through to employment (Figure 22). Tertiary attainment is far higher among adults in urban areas (44 per cent) than in rural ones (26 per cent), yet employment rates are essentially identical (81 and 82 per cent). The lower attainment of rural residents plausibly reflects the location of universities, the out-migration of graduates and the scarcity of jobs that require higher education. These descriptive data cannot establish which of these channels dominates, although the distinction matters for regional and higher-education policy.

Figure 22. Urban–rural differences in tertiary attainment and employment, ESS, ages 30–59



Note: Share of adults aged 30–59 with tertiary attainment and share in paid work, by place of residence, with 95% confidence intervals based on the ESS design variables (Taylor linearisation). Urban comprises big cities and their suburbs, rural comprises country villages and farms or homes in the countryside; residents of towns and small cities are not shown. Values are unweighted averages of the eight partner countries covered by the ESS (2020 and 2023 rounds pooled), each estimated using the ESS analysis weight.

6.4 Summary

Progression and completion are strongly socially structured at every stage the data observe. Grade repetition varies enormously across the partner systems and, within them, falls disproportionately on socioeconomically disadvantaged students, on boys and, in most countries, on students with an immigrant background. Access to higher education is socially selective in all four EUROSTUDENT countries: students from tertiary-educated families are over-represented relative to their age cohort, most strongly in Poland and least in Germany, and first-in-family students more often enter higher education later. Once enrolled, students from non-tertiary families, women, students with a migration background and students with a health impairment more often report financial difficulties, and impairment and non-tertiary origin add up. Students with an impairment face higher financial need while their capacity to earn alongside their studies is no greater, and in some countries lower. Field choice is only weakly related to social origin, but strongly segregated by gender, which contributes to the later gender pay gap. Consistent with the selectivity of the student body, educational attainment is powerfully transmitted across generations. In PIAAC, young adults with a tertiary-educated parent are more than four times as likely to hold a tertiary qualification as those whose parents did not complete upper-secondary education. They also have much lower odds of not completing upper-secondary education than young adults whose parents have no tertiary degree. Read together with Chapter 5, the evidence shows a single thread of socioeconomic reproduction running from early achievement through progression into final attainment — the platform on which the labour-market outcomes of the next two chapters are built.

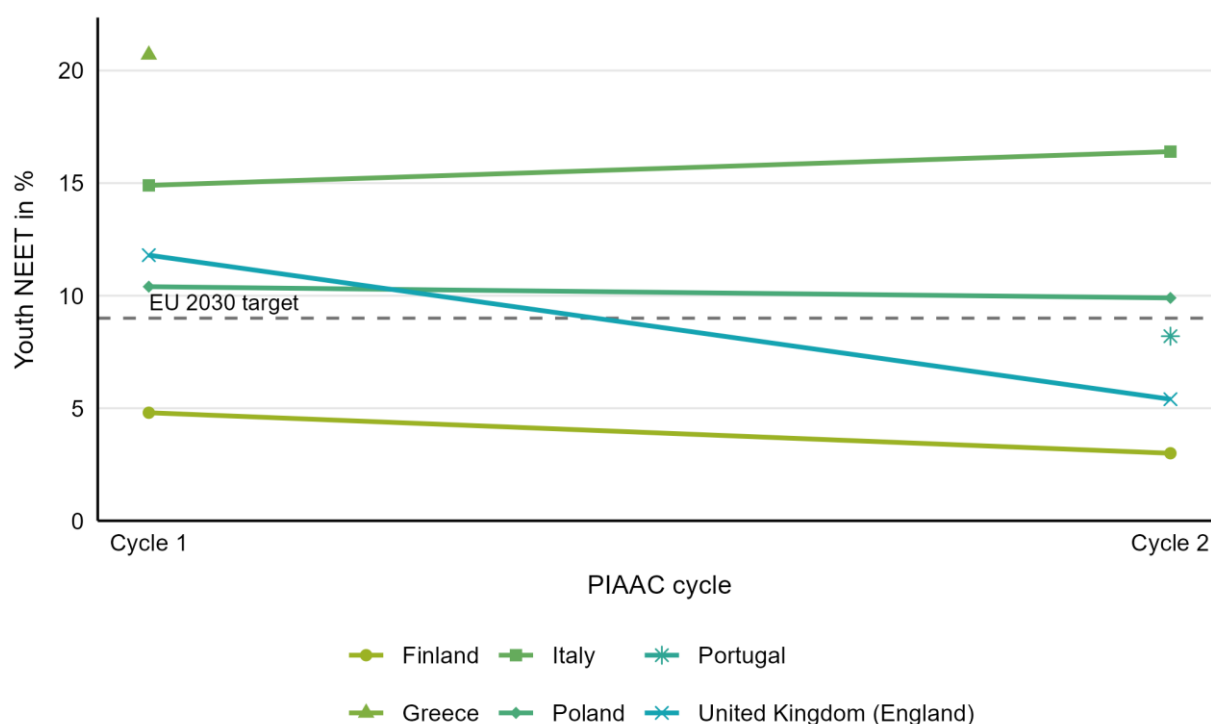
7 From general education to the labour market

The third transition field concerns the move from education into the labour market: whether young people enter employment, how strongly their chances of work depend on the education they have obtained, and what that education is worth in earnings. The natural data source is PIAAC, the only programme in the harmonised holdings that measures adults' employment status, earnings and qualifications together with their measured skills. Because PIAAC suppresses respondents' exact age in the Austrian and German public-use files, the age-restricted analyses of this chapter rest on the six partner countries with usable age — Finland, Greece, Italy, Poland, Portugal and the United Kingdom — a limitation that recurs in Chapters 8, 9 and 18 and is discussed fully in Chapter 23. The chapter proceeds in three steps. It first examines youth disengagement from education and work and the characteristics associated with it; it then turns to the employment return to education, both descriptively and with a matching approach that compares otherwise similar adults; and it finally examines the earnings return to schooling, including whether that return differs below and above the start of tertiary education.

7.1 Youth disengagement

The first question in the transition to the labour market is whether young people make it into work or further education at all. The standard indicator for this is the NEET rate: the share of young people who are neither in employment nor in education or training. Unlike the unemployment rate, it covers not only young people who are looking for work but also those who have withdrawn from the labour market altogether, and so captures disengagement from both education and work; it is also the headline youth indicator in European policy monitoring, whose official figures Chapter 19 sets alongside the microdata.

Figure 23. Youth NEET rate (16–29) by country, PIAAC Cycle 1 and Cycle 2



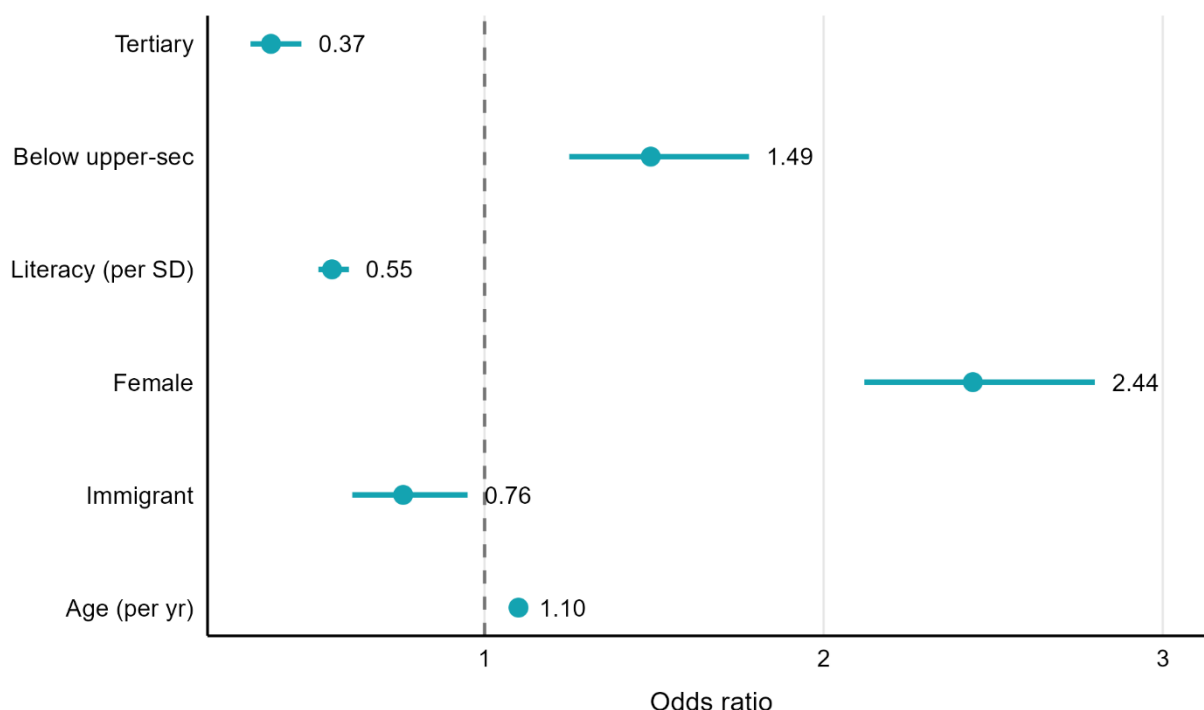
Note: Share of 16–29 year-olds not in employment, education or training, estimated from the PIAAC microdata using the study's replication weights. Cycle 1 fieldwork took place in 2011–12 in Finland, Italy, Poland and the United Kingdom and in 2014–15 in Greece; Cycle 2 fieldwork took place in 2022–23. Greece is observed in Cycle 1 only and Portugal in Cycle 2 only. Values for the United Kingdom refer to England in both cycles. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age. The dashed line marks the EU-level target of at most 9 per cent NEET by 2030, which refers to 15- to 29-year-olds.

Figure 23 shows the NEET rate among 16–29 year-olds in the two PIAAC cycles. In the most recent cycle it is highest in Italy (16.4 per cent), followed by Poland (9.9) and Portugal (8.2), and lowest in the United Kingdom (England; 5.4) and Finland (3.0). Greece, observed in the first cycle only, then had the highest rate of all partner countries at 20.7 per cent. Between the cycles, the rate fell markedly in the United Kingdom (from 11.8 per cent) and in Finland (from 4.8), barely moved in Poland (from 10.4) and slightly increased in Italy (from 14.9), a change within the range of sampling error.

Measured against the EU-level target of at most 9 per cent NEET among 15- to 29-year-olds by 2030 (European Commission, 2021), three of the five countries observed in Cycle 2, Finland, the United Kingdom (England) and Portugal, are below it, Poland is just above, and Italy exceeds it clearly. The comparison is approximate, because PIAAC covers 16- to 29-year-olds. Since almost all 15-year-olds are still in school, the PIAAC rates are, if anything, slightly higher than those the target refers to.

Country rates do not show who becomes NEET within a country. To identify the individual characteristics associated with NEET status, a design-based logistic model of 16–34 year-olds, pooled across the partner countries with country and cycle fixed effects, relates it to education, literacy, gender, immigrant background and age (Figure 24; Rahmani and Groot, 2023). Tertiary education is strongly protective, reducing the odds of NEET status to 37 per cent of those of the upper-secondary reference group, while having less than upper-secondary education raises the odds by about one half. Measured literacy is protective independently of formal qualification: each additional standard deviation lowers the odds by about 45 per cent. The most striking demographic result is the gender pattern: the odds of NEET status are more than twice as high for young women as for young men. An immigrant background (first or second generation) is associated with odds about a quarter lower. Net of education and literacy, migration background therefore does not appear as a separate risk factor for disengagement; if anything, it is associated with lower odds. As with the other coefficients, this is an association from a pooled model, not a causal estimate; selection into PIAAC participation or country-specific integration policies could still play a role.

Figure 24. NEET (ages 16–34): odds ratios from a design-based logistic model



Note: The determinants model pools ages 16–34 (vs. 16–29 in the trend chart above) to gain statistical power across countries and education categories. Bars show the 95% confidence interval of each odds ratio, computed from PIAAC's replicate weights; a bar not crossing the dashed line at 1 is statistically significant at the 5% level.

The gender pattern deserves separate emphasis, because it qualifies the otherwise education-centred story of this field. It is not a matter of young women being less qualified or less skilled: Chapter 6 shows that they are less likely than young men to leave education without an upper-secondary qualification, and Chapter 12 that their measured characteristics would predict higher, not lower, pay. The pattern is consistent with a withdrawal from the labour market associated with caregiving and family formation in the years in which young adults form households.

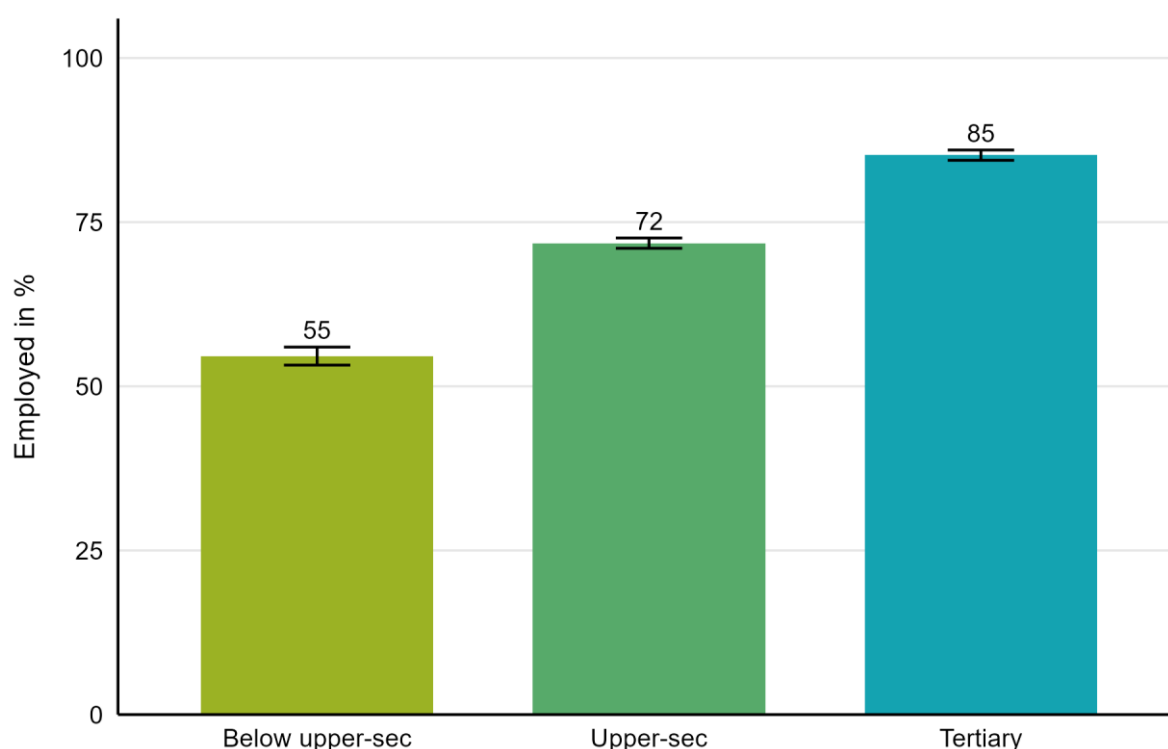
The NEET gap should not be confused with the gender pay gap discussed in Chapter 12. The pay gap is measured only among people in work, so women who are NEET do not enter it at all. The two could still be linked, for example if time out of work lowers women's pay once they return, but tracing this would require data that follow the same people over time. What the two gaps have in common is that neither is explained by women's qualifications or skills. For policy, this points less to education and training for women and more to childcare, parental leave and the availability of part-time and flexible work.

7.2 The employment returns to education

Descriptive analysis

Beyond the margin of disengagement captured by NEET status, the central labour-market outcome for adults is whether they are in work, and how strongly this depends on their education. Figure 25 shows employment rates by level of education among adults aged 25–64. The employment rate rises from 54.6 per cent for those with less than upper-secondary education, to 71.8 per cent at upper-secondary level and 85.2 per cent at tertiary level, a span of about thirty percentage points.

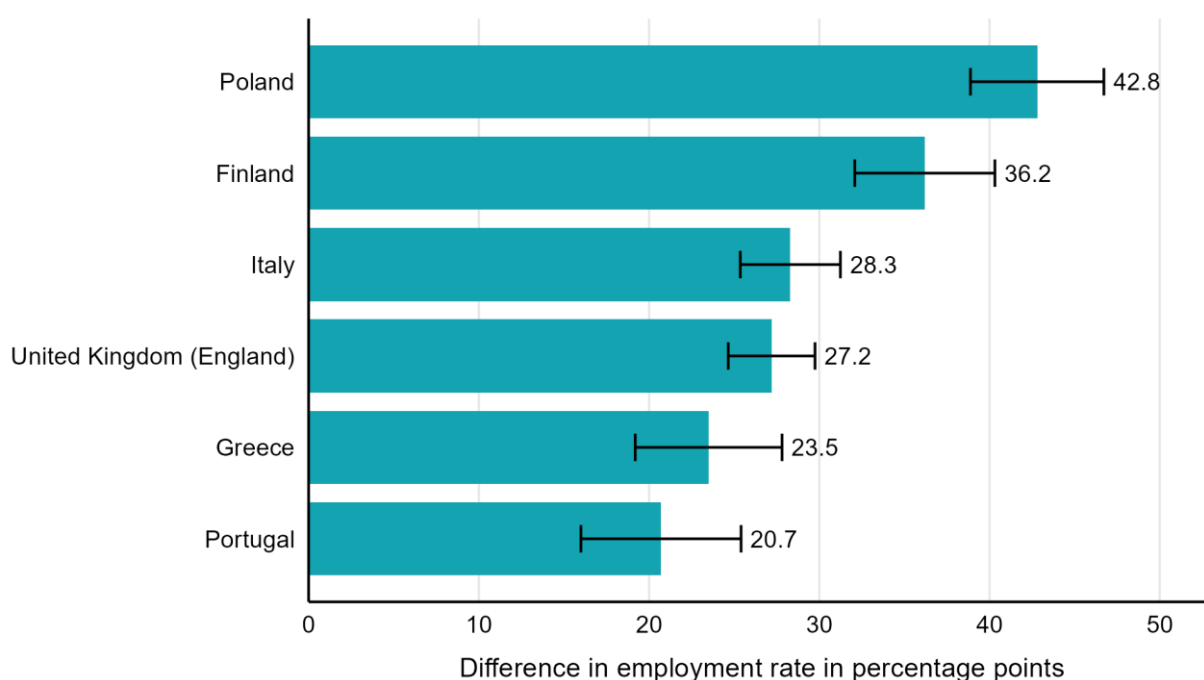
Figure 25. Employment rate by education level, ages 25–64, PIAAC



Note: Share of 25–64 year-olds in employment by highest educational attainment, with 95% confidence intervals, pooled over the six partner countries with PIAAC data and both cycles and estimated using the study's replication weights. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age.

Figure 26 shows the tertiary employment premium — the difference in the employment rate between tertiary-educated and below-upper-secondary adults — for each country. It is largest in Poland (43 percentage points) and Finland (36) and smallest in Greece (24) and Portugal (21), with Italy and the United Kingdom in between. These country-level premia feed into the systems analysis of Chapter 9.

Figure 26. Tertiary employment premium over below-upper-secondary, ages 25–64, PIAAC



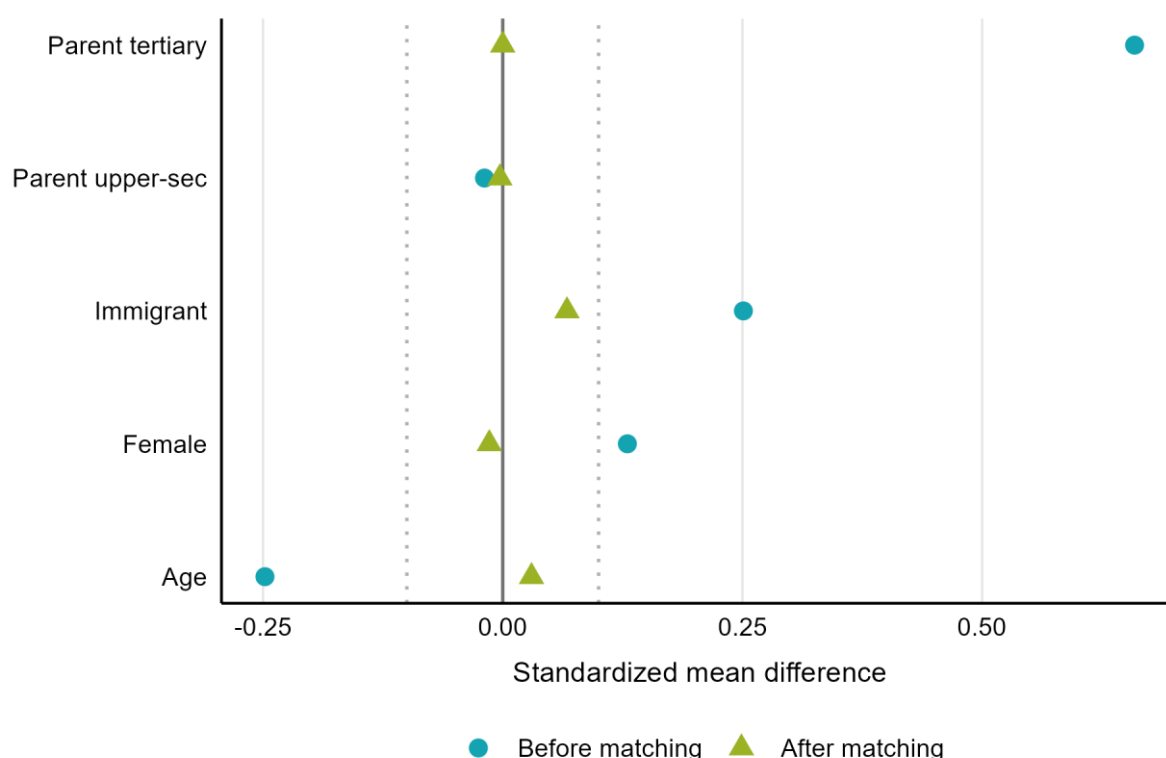
Note: Difference in the employment rate between tertiary-educated and below-upper-secondary adults aged 25–64, in percentage points, with 95% confidence intervals from the replication weights; both PIAAC cycles pooled. Values for the United Kingdom refer to England. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age.

Regression analysis

The descriptive premia do not show whether tertiary education itself raises employment, or whether those who obtain it would have fared better anyway: the people who reach tertiary education differ from those who do not in family background, prior ability and other ways that themselves affect employment. To move from association toward a causal statement under transparent assumptions, this section estimates the effect of tertiary attainment on the probability of employment using propensity score matching. The method mimics a controlled comparison within observational data: for every tertiary-educated adult (the treated group) it finds upper-secondary or post-secondary adults (the comparison group) with a near-identical estimated probability of having obtained tertiary education — the propensity score, here a function of age, gender, migration background, parental education, country and cycle — and compares employment only between these matched counterparts.

Figure 27 reports, for each covariate, the standardised mean difference between the treated and comparison groups before and after matching, with values below about 0.1 conventionally taken to indicate balance. Before matching, the groups differ substantially on several covariates, most notably parental tertiary education (0.66). Each tertiary-educated adult is then matched to the comparison adult with the closest propensity score, provided the two differ by no more than a maximum distance, the caliper, here set at 0.2 standard deviations of the propensity score. Matches that would be further apart are not accepted, which prevents treated adults from being paired with comparison adults who are dissimilar. After matching, every standardised mean difference falls below 0.07, and all treated adults found a match within the caliper. The matched comparison is therefore between tertiary and non-tertiary adults who are alike in age, sex, migration background and family educational background.

Figure 27. Covariate balance before and after matching, PIAAC, ages 25–64



Note: Standardised mean differences between tertiary-educated and upper-secondary adults before and after propensity score matching. Values below 0.1 are conventionally taken to indicate balance. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age.

Figure 28 compares the employment gap before and after matching. Before matching, the gap between tertiary and upper-secondary adults is 13.5 percentage points (design-based standard error 3.0). After matching, the average treatment effect on the treated falls to 8.2 percentage points (standard error 2.8): holding observed background constant, tertiary attainment raises the probability of employment by about eight percentage points. Selection on the observed characteristics thus accounts for about two-fifths of the raw gap (5.3 percentage points), while the larger part remains associated with the qualification itself.

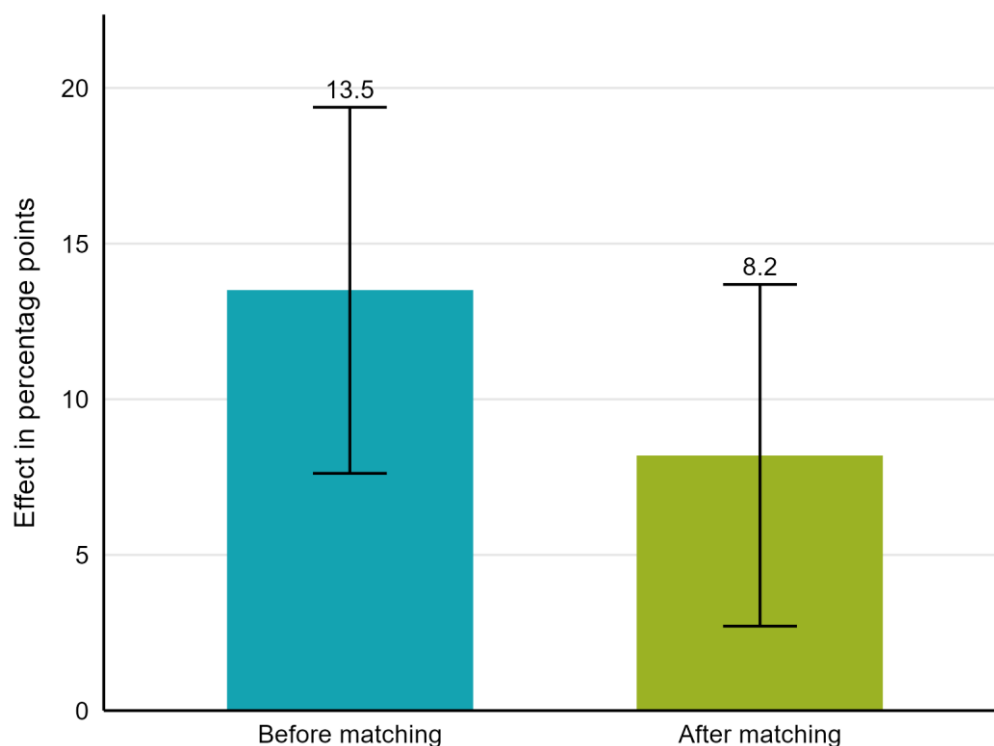
The matching estimate is identified under the assumption that, conditional on the matched covariates, tertiary attainment is as good as randomly assigned. It cannot rule out selection on unobserved characteristics such as motivation or unmeasured ability, and the absence of Austria and Germany means that it cannot speak to the systems in which the vocational alternative to tertiary education is strongest. A sensitivity analysis suggests that the result is moderately robust: an unobserved characteristic would have to increase the odds of attaining tertiary education by about 85 per cent, over and above the matched characteristics, before the employment effect would lose statistical significance.¹

A further caveat concerns the matching itself. Because the propensity score is built from largely discrete covariates, many treated adults have several comparison adults at the same distance, so the choice among these tied matches is arbitrary. Matching is also done with replacement, and some comparison adults are used for many treated adults. The point estimate and its standard error should therefore be read as a good approximation rather than as reproducible to the last decimal.

¹ Rosenbaum sensitivity analysis based on one-to-one matching without replacement within countries: of 9,543 matched pairs, 2,974 differ in employment status; in 1,974 of these the tertiary-educated partner is employed, in 1,000 the comparison partner. The effect remains statistically significant up to a sensitivity parameter of about $\Gamma = 1.85$.

Within these limits, the matching analysis confirms the central message of Field 3: tertiary education carries a substantial employment premium, and because access to it is socially graded, that premium is a channel through which early inequality is converted into unequal adult outcomes.

Figure 28. Effect of tertiary education on employment before and after matching, PIAAC, ages 25–64



Note: Difference in employment rates between tertiary-educated and upper-secondary adults before matching and after matching (average treatment effect on the treated), in percentage points, with 95% confidence intervals from the replication weights. Matching is exact by country, with a propensity score based on age, gender, migration background, parental education and cycle. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age.

7.3 The earnings returns to education and the tertiary threshold

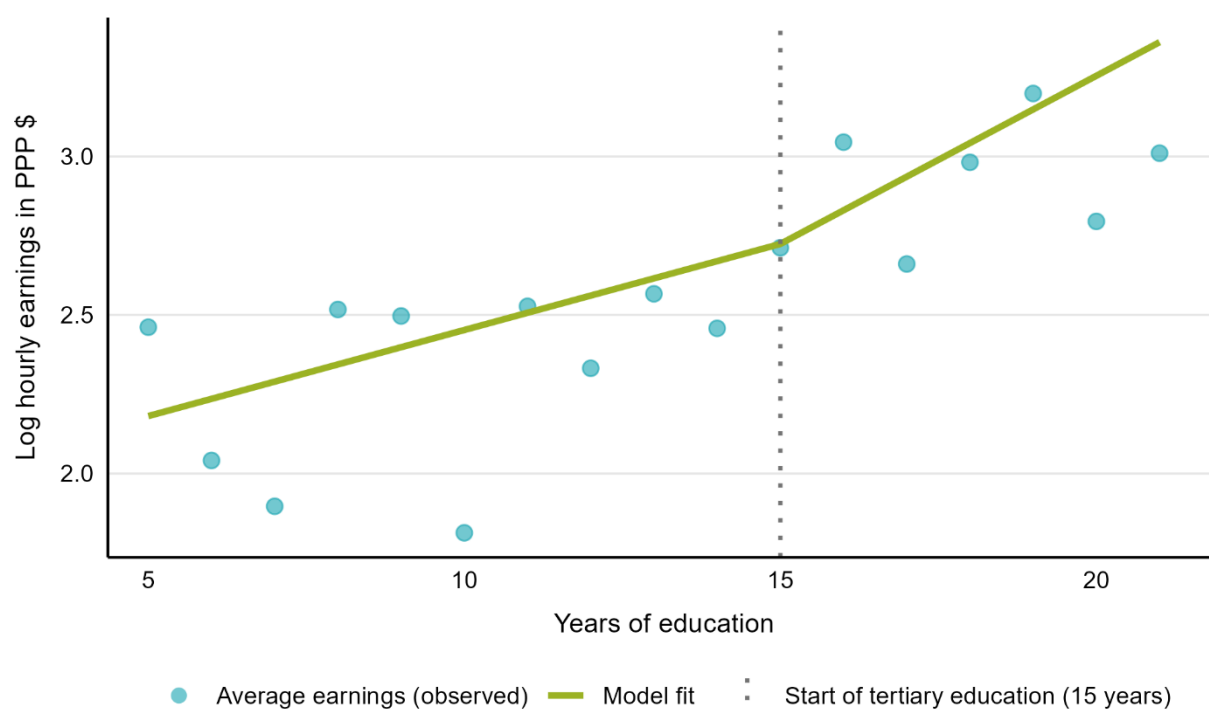
Employment is one side of the return to education; the other is what those in work earn. Figure 29 shows, for employed adults, the average of hourly earnings by years of education, on a logarithmic scale, so that a difference of 0.1 corresponds to roughly 10 per cent higher earnings. Earnings rise with education, and the rise appears steeper beyond about 15 years of schooling, the point at which tertiary education typically begins. The averages for the lowest years of schooling scatter widely because few adults in the partner countries have so little education.

To quantify this pattern, a regression model relates log hourly earnings to years of education, allowing the return to an additional year to differ below and above 15 years, the start of tertiary education. The model controls for age and its square, gender and migration background, and includes fixed effects for each combination of country and survey cycle, so that earnings differences between countries and between the two PIAAC cycles do not affect the estimates. It does not control for parental education, measured skills, occupation, working hours or field of study, so the estimated returns include any part of the education effect that operates through these channels. Because the model covers only adults in work, it describes the earnings return among the employed, not the total return that would include the employment effects shown above.

Below the bend, each additional year of education is associated with about 5.4 per cent higher hourly earnings; above it, with about 10.6 per cent. A year of tertiary education is thus associated with roughly twice the earnings gain of a year of schooling before it, and the difference of 5.2 percentage points is precisely

estimated (standard error 0.9; 95 per cent confidence interval about 3.4 to 7.0). Because the bend is set at 15 years of education, the model shows that returns are higher over the tertiary years as a whole. It cannot show whether they rise abruptly at a particular point, such as the completion of a degree, which would point to a 'sheepskin effect', a pay premium for holding the degree itself. Since access to tertiary education is itself strongly socially graded (Chapter 6), a labour market that pays its largest per-year gains at the tertiary level amplifies the inequalities accumulated earlier in the trajectory.

Figure 29. Earnings returns to education: a threshold model, PIAAC, ages 25–64



Note: The dots show the average log hourly earnings (PPP-adjusted) of employed adults aged 25–64 at each year of education, without adjustment. The line shows the earnings predicted by the model for an adult of average age, gender, migration background, country and cycle, so that it varies only with years of education; the dotted line marks the bend at 15 years. Both PIAAC cycles pooled. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age.

7.4 Summary

The chapter followed the transition into the labour market in three steps. The first concerned young people who make no transition at all. Disengagement from education and work is most widespread in Italy and, in the first PIAAC cycle, Greece, and it fell markedly between the cycles in the United Kingdom and Finland. Within countries, the risk is highest for young people with low qualifications or low measured literacy and for young women, whereas an immigrant background carries no additional risk once education and literacy are taken into account. The second step turned to those who enter the labour market, and showed that their chances of employment rise steeply with education, most of all at the tertiary level. This tertiary advantage is not merely a matter of who obtains a degree: when tertiary-educated adults are compared with otherwise similar adults without one, it shrinks by about two-fifths, but most of it remains. The third step showed that education also pays in earnings, and again most strongly at the tertiary level, where a year of education is associated with roughly twice the earnings gain of a year of schooling before it. Taken together, education — and tertiary education in particular — protects against disengagement, improves the chances of work and raises pay once in work. Clearing the transition into employment is not, however, the same as clearing it into work that matches the qualification obtained, and that is the subject of the next chapter.

8 Qualification and the labour market

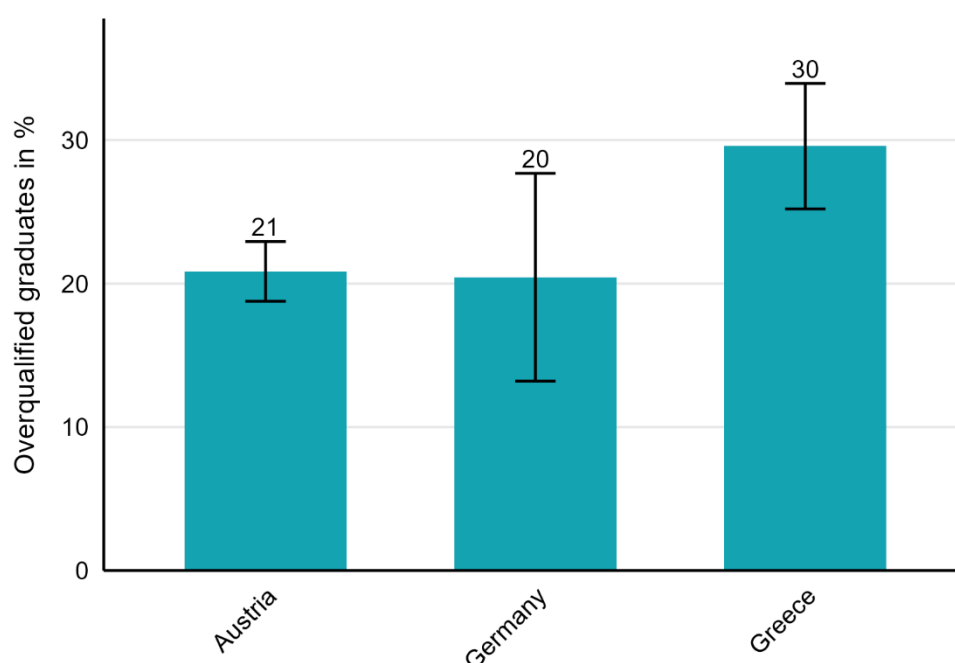
Chapter 7 followed the transition into employment; this chapter asks whether the job obtained matches the qualification held. Section 8.1 examines overqualification, meaning work that requires a lower level of education than the one held. It draws first on EUROGRADUATE for recent higher-education graduates and then on PIAAC for a wider set of partner countries, and shows how overqualification varies by social origin, gender, migration background and field of study. Section 8.2 turns to a second form of mismatch: working in a job unrelated to one's field of study.

8.1 Overqualification

EUROGRADUATE is the European survey of higher-education graduates, interviewed about one and five years after graduation (Section 3.1). It is a confidential scientific-use file, available only under a written data use agreement with the data provider, so neither the microdata nor any derived file is distributed with this deliverable. Among the partner countries, the 2018 pilot covers Austria, Germany and Greece. Overqualification is measured from graduates' own assessment of the level of education their current job requires: a graduate counts as overqualified when that level is below the one held. The file carries a design weight but no replicate weights, so the estimates are weighted and use robust rather than design-based standard errors (Section 4.1).

Figure 30 shows the share of overqualified graduates by country. It is highest in Greece, at 30 per cent, and about a fifth in Austria (21 per cent) and Germany (20 per cent). The German estimate is less precise than the others because the employed sample is small. Greece, the only Southern system in the 2018 pilot, thus lies well above the two Continental systems.

Figure 30. Share of graduates who are overqualified for their current job, by country (EUROGRADUATE 2018).



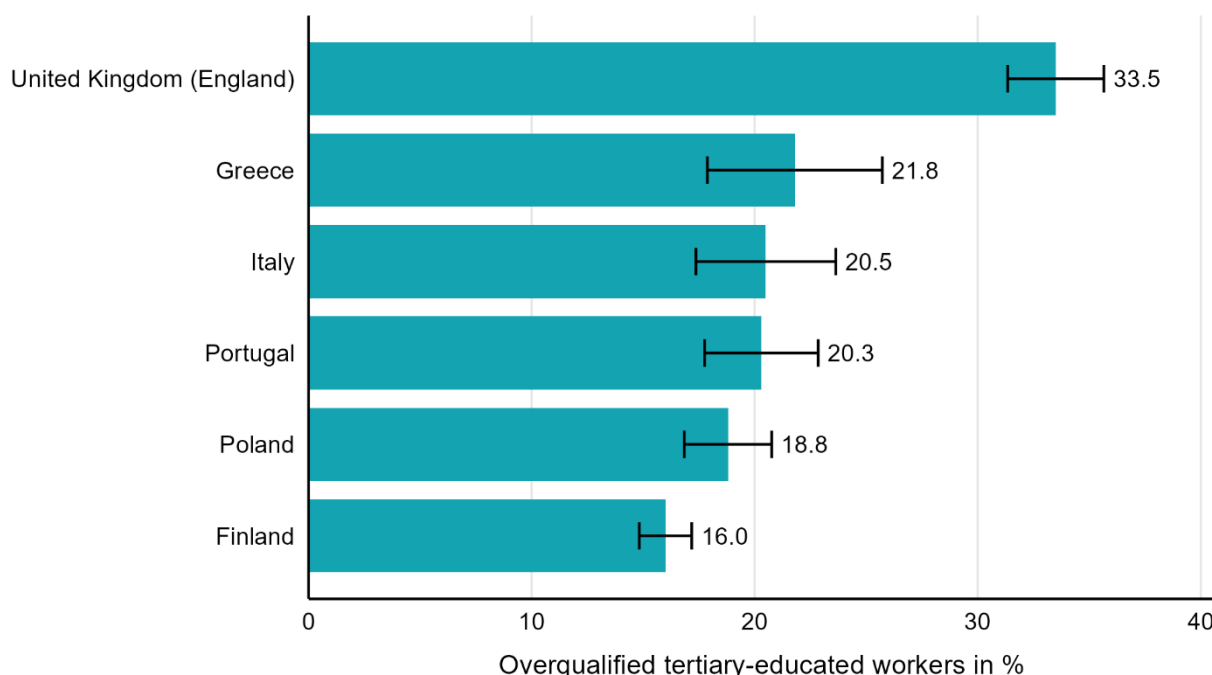
Note: Weighted shares of employed graduates who report that their job requires a lower level of education than the one they hold, with 95% confidence intervals from robust standard errors. Among the partner countries, only Austria, Germany and Greece took part in the 2018 pilot.

PIAAC allows a similar measure for a wider set of partner countries, with design-based inference. Employed respondents report the qualification someone would need today to get their job, and a tertiary graduate is counted as overqualified when that qualification lies below the tertiary level (Quintini, 2011). Like the EUROGRADUATE measure, it rests on the respondent's own assessment. It covers all employed tertiary-

educated adults aged 25–64 rather than recent graduates, however, so the two sources are read side by side rather than compared directly.

Figure 31 shows the shares by country. The United Kingdom (England) has by far the highest share, at 33.5 per cent: about one in three tertiary-educated workers is in a job that does not require a tertiary qualification. Finland has the lowest share, at 16.0 per cent, and Poland, Portugal, Italy and Greece lie close together between 19 and 22 per cent. By transition regime, the Liberal system has by far the highest share and the Nordic system the lowest, while the three Southern systems and the Eastern system lie close together in between.

Figure 31. Overqualified tertiary graduates by country (PIAAC).



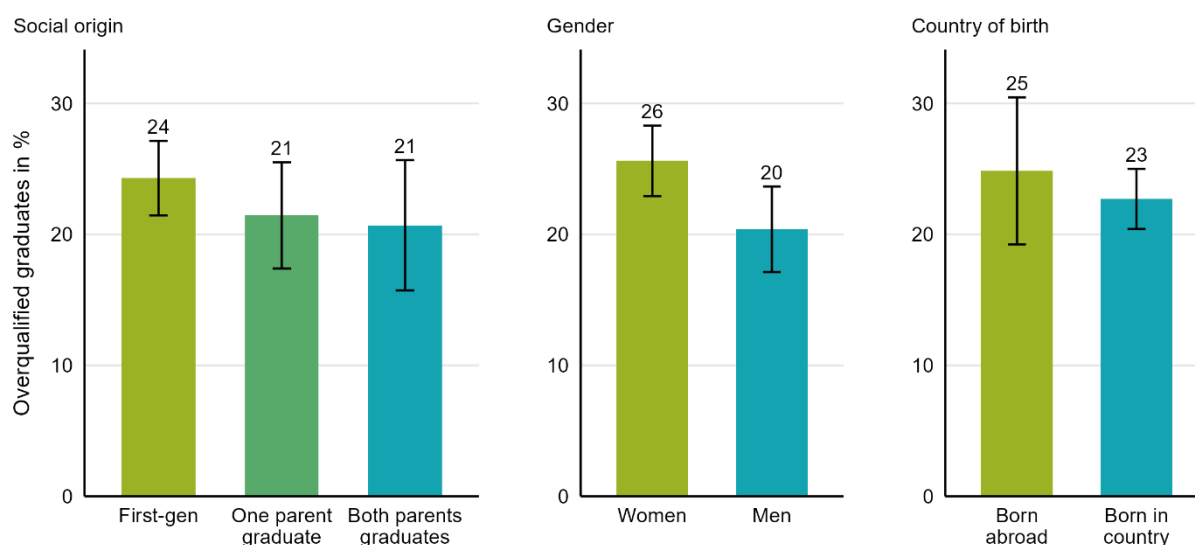
Note: Weighted shares of employed tertiary graduates aged 25–64 who report that their job requires less than a tertiary qualification, with 95% confidence intervals from replicate weights; Cycles 1 and 2 pooled. United Kingdom estimates refer to England only. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age; Kosovo did not take part in PIAAC.

In all six countries, then, a sizeable minority of tertiary-educated workers are employed in jobs that do not require their level of education. The employment rates and earnings returns of Chapter 7 compare levels of education and cannot show this.

Heterogeneity by demographic characteristics

Overqualification also differs between groups of graduates. Figure 32 shows it by social origin, gender and country of birth, pooled across Austria, Germany and Greece. Women are overqualified more often than men (26 against 20 per cent). First-generation graduates, whose parents hold no bachelor's degree or higher, are overqualified somewhat more often than graduates with one or two graduate parents (24 against 21 per cent in both groups). Graduates born abroad are overqualified slightly more often than those born in the country (25 against 23 per cent). The origin and country-of-birth differences are small relative to their sampling uncertainty.

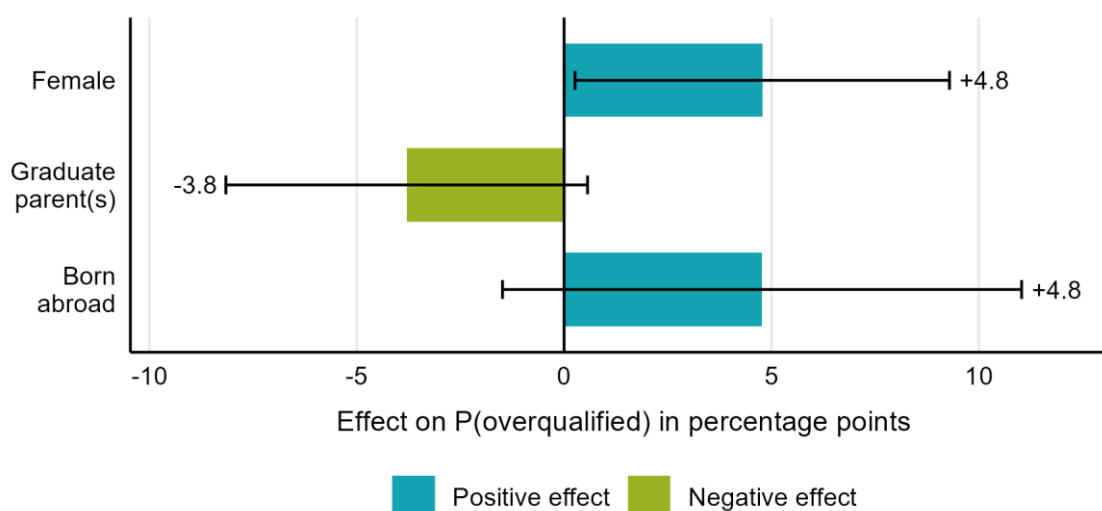
Figure 32. Overqualification by social origin, gender and country of birth (EUROGRADUATE 2018)



Note: Weighted shares of employed graduates, pooled across Austria, Germany and Greece, with 95% confidence intervals from robust standard errors.

A linear probability model shows whether these differences persist once field of study, country and age at graduation are held constant. The model includes gender, having at least one graduate parent and being born abroad. Figure 33 shows, in percentage points, how much more or less likely each group is to be overqualified than its comparison group. Women are about 5 percentage points more likely than men to be overqualified. Having a graduate parent is associated with a probability about 4 points lower, although the interval includes zero. The coefficient for graduates born abroad, also about 5 points, is as high as the gender difference, but too imprecisely estimated to support a conclusion, because few graduates in the sample were born abroad.

Figure 33. Overqualification by gender, social origin and country of birth, linear probability model (EUROGRADUATE 2018)

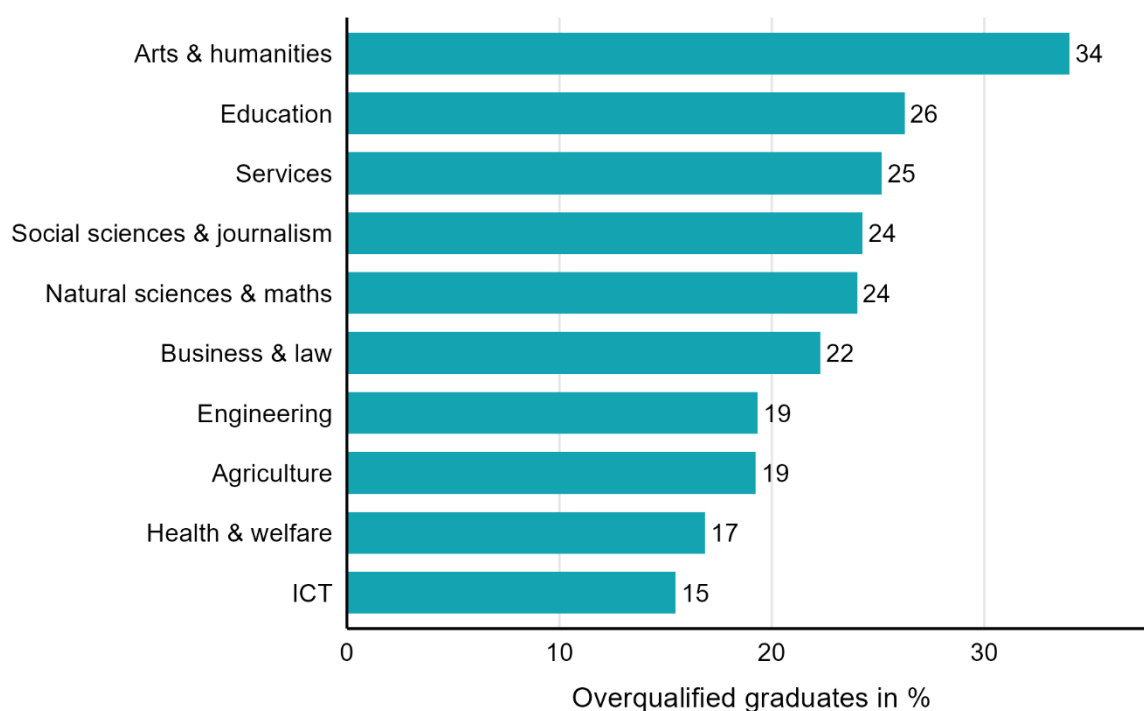


Note: Differences in the probability of being overqualified in percentage points, with 95% confidence intervals from robust standard errors; the model holds country, field of study and age group at graduation constant. Employed graduates in Austria, Germany and Greece, weighted.

Heterogeneity by field of study

Overqualification also differs by field of study (Figure 34). It is highest in arts and humanities, where about a third of graduates (34 per cent) are overqualified, and lowest in ICT and in health and welfare (15 and 17 per cent). Many fields have few graduates in the sample, however, so most differences between neighbouring fields are small relative to their sampling uncertainty. Only the gap between arts and humanities and the fields at the lower end, including engineering and business and law, is clearly larger; the value for services rests on very few cases.

Figure 34. Overqualification by broad field of study (EUROGRADUATE 2018)



Note: Weighted shares of employed graduates, pooled across Austria, Germany and Greece. Confidence intervals are not shown because they are wide for most fields; see the text.

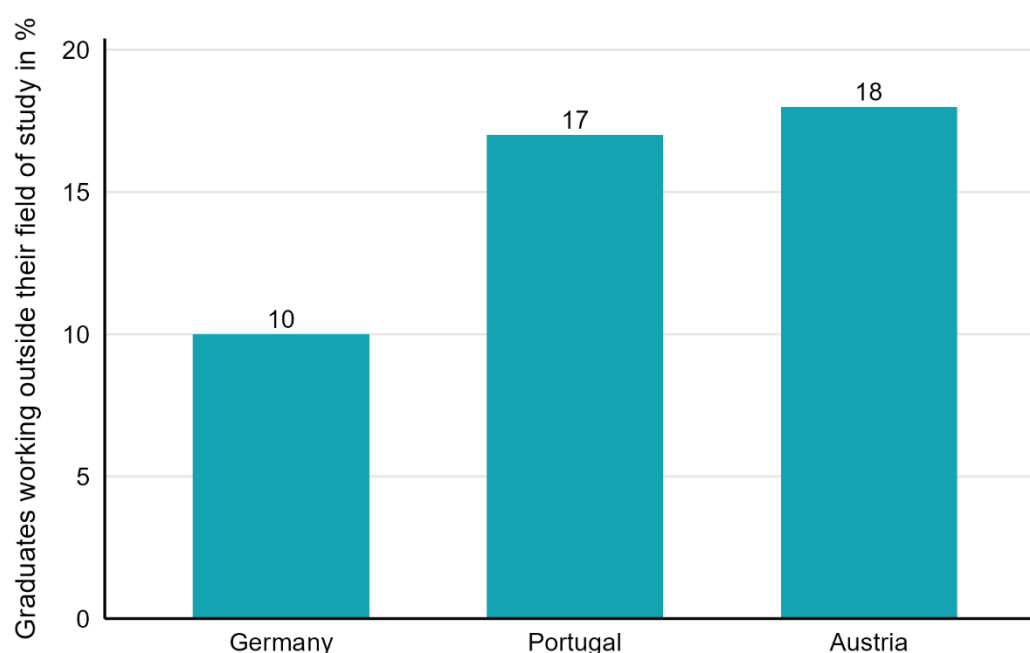
The subjects men and women study do not account for the gender difference in overqualification: in the model of Figure 33, which holds field of study constant along with country and age at graduation, the difference remains about 5 percentage points, as large as the raw difference in Figure 32.

8.2 Field mismatch

Overqualification concerns the level of a job, but a graduate can also work at the appropriate level and still outside the field of study. The EUROGRADUATE 2022 wave records this horizontal mismatch as whether the current job is related to the field studied. Among the partner countries, it covers Austria, Germany and Portugal: the Greek file lacks the labour-market module, and the item is not recorded for Italy.

Figure 35 shows the share of graduates whose job is unrelated to their field of study. It is lowest in Germany, at 10 per cent, and 17 to 18 per cent in Austria and Portugal.

Figure 35. Graduates working outside their field of study, by country (EUROGRADUATE 2022).



Note: Weighted shares of employed graduates who report that their job is unrelated to their field of study. Greece is not included because its file lacks the labour-market module, and Italy because the item is not recorded.

8.3 Summary

The chapter asked whether entering employment also means entering work that matches the qualification held. For a sizeable minority it does not. Between 20 and 30 per cent of recent graduates, and between 16 and 34 per cent of employed tertiary-educated adults, work in jobs below their level of education. Women are overqualified more often than men, also at equal field of study, and overqualification is most common with a degree in arts and humanities. Moreover, 10 to 18 per cent of recent graduates work outside their field of study. The next chapter relates these and the findings of earlier chapters to the institutional features of the partner countries' education systems.

9 Education systems and cross-country differences

The fifth research-question cluster asks how transitions differ across education-and-training systems, and in particular how the institutional features of those systems — the age at which they sort students into tracks, the strength of their vocational pathways, and the presence of a strong dual (apprenticeship) system — relate to the outcomes documented in the preceding chapters. The harmonised microdata do not contain these institutional features; they were therefore compiled from standard sources (OECD Education at a Glance, Eurydice and Cedefop) as country-level indicators and merged with the per-country outcome estimates from the Results Register. Because there are only nine partner countries — and, depending on the outcome, either six or eight with usable labour-market data — the analysis in this chapter is explicitly descriptive: it reports cross-country associations together with the number of countries they rest on and treats them as indicative patterns rather than as causal effects.

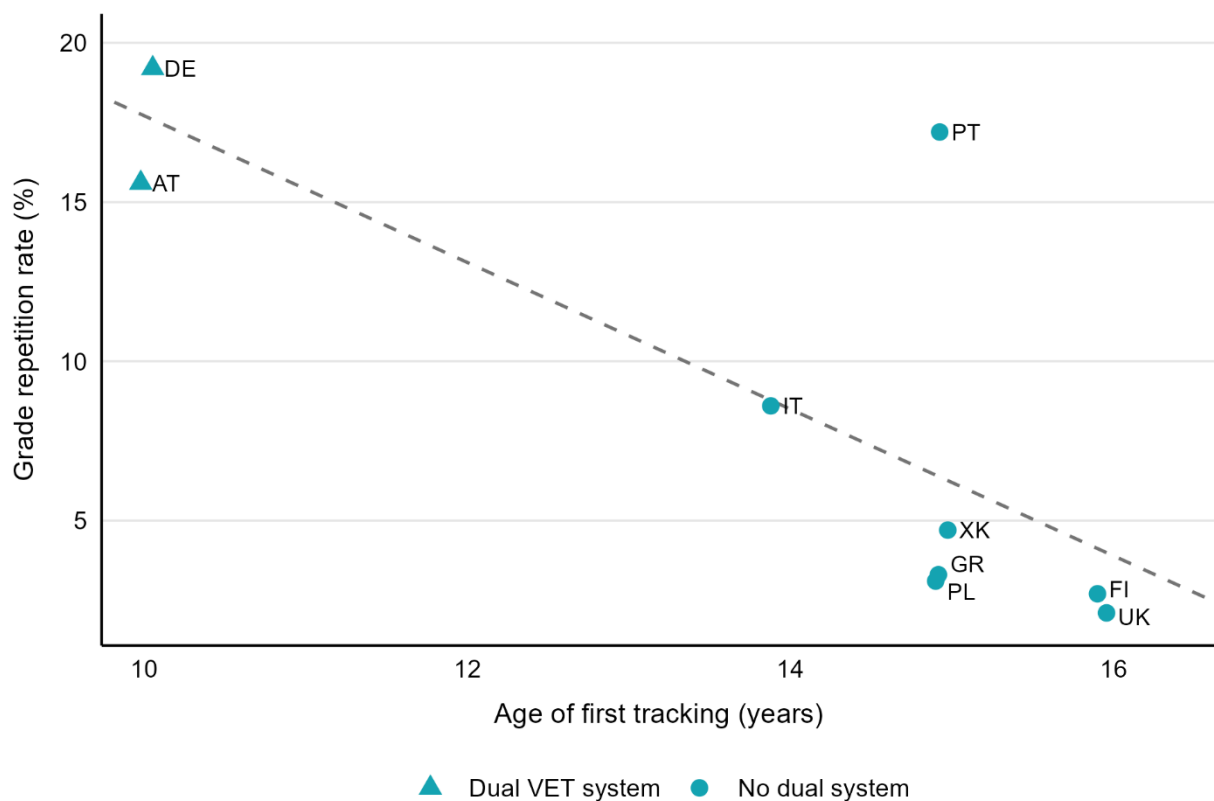
These institutional indicators do not coincide with the transition regimes introduced in Section 2.3. The two Continental systems select at age ten and have large apprenticeship sectors, the Nordic and Liberal systems track late, and the Southern and Eastern systems, like Kosovo, select at fourteen or fifteen. Within the Southern regime, vocational shares range from about 30 per cent in Greece to about 50 per cent in Italy. The analyses of this chapter therefore rest on the institutional indicators themselves rather than on regime membership.

A data limitation shapes this chapter. The PIAAC public-use files do not record respondents' exact age for Austria and Germany, so most labour-market outcomes, including the tertiary employment premium used in Section 9.2, cannot be computed for the two countries whose systems best exemplify dual vocational training. Youth NEET is the exception: for Austria and Germany it is taken from Eurostat (share of 15- to 29-year-olds, 2022), while for the other countries it is estimated from the most recent PIAAC cycle — Cycle 2, except for Greece (Cycle 1) — with values for the United Kingdom referring to England. The NEET analyses therefore cover eight countries and the tertiary-premium analysis six, and the association between dual systems and the employment premium cannot be examined with public data. The school-side analyses draw on PISA and cover all nine partner countries.

The cross-country associations are summarised by two correlation coefficients, both ranging from -1 to $+1$. The Pearson coefficient r measures how closely the countries lie along a straight line. The Spearman coefficient ρ measures how closely their rank orders agree, and is therefore less affected by a single country with extreme values. With nine countries or fewer, one such country can shift the Pearson coefficient considerably, so the two are reported together. Section 9.4 examines in addition how far each correlation depends on individual countries: an association is described as robust if it remains statistically significant when each country is omitted in turn, and with fewer countries a stronger correlation is needed to meet this condition.

9.1 Tracking and progression

Figure 36. Age of first tracking versus grade repetition



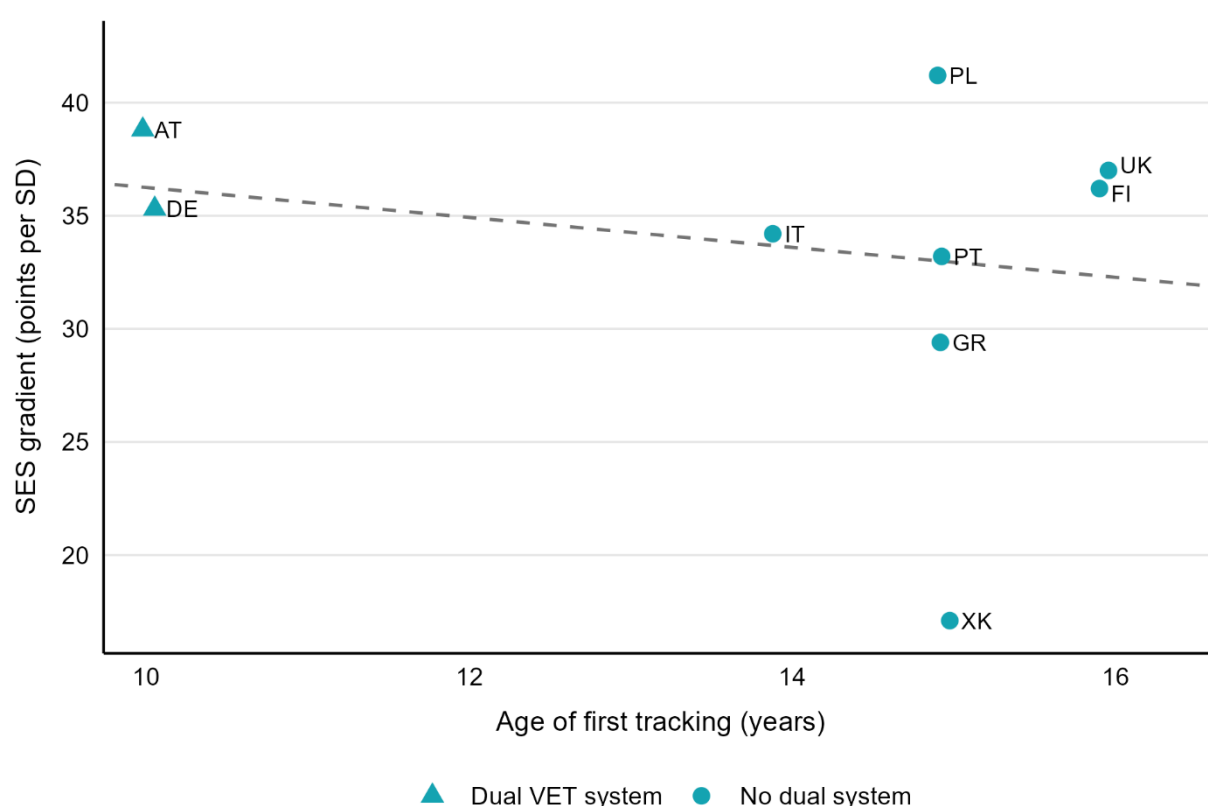
Note: Each point is one partner country ($n = 9$). Grade repetition is the share of fifteen-year-old students who report having repeated at least one grade, PISA 2022 (Figure 8). The age of first tracking and the dual-system classification are compiled from OECD Education at a Glance, Eurydice and Cedefop. The dashed line is a least-squares fit. Pearson $r = -0.78$; Spearman $\rho = -0.83$.

The clearest systemic pattern in the data concerns the age of first tracking and grade repetition. The two are strongly and negatively associated (Pearson $r = -0.78$, Spearman $\rho = -0.83$). In the two systems that sort students into separate school types at age ten, Austria and Germany, 16 to 19 per cent of fifteen-year-olds

have repeated a grade; in Finland and the United Kingdom, which defer selection to age sixteen, only 2 to 3 per cent have. Portugal is the exception: it selects at fifteen but has a repetition rate close to that of the early-tracking systems.

The association is one of the two that remain robust when each country is omitted in turn (Section 9.4), and its interpretation deserves care. Average achievement in the early-tracking systems is broadly similar to that of the comprehensive systems, so their far higher repetition rates are unlikely to reflect lower learning alone. The pattern is consistent with grade repetition being to a large degree an institutional practice of early-tracking systems (Hanushek and Wößmann, 2006). A cross-country correlation cannot settle why the two go together. Whether repetition mainly enforces entry standards within particular tracks, and in which tracks students actually repeat, cannot be observed in these data. Why late-tracking systems attain comparable outcomes without repetition remains an open question about mechanisms, handed to WP3B and WP4 (Section 22.7).

Figure 37. Age of first tracking versus the socioeconomic gradient



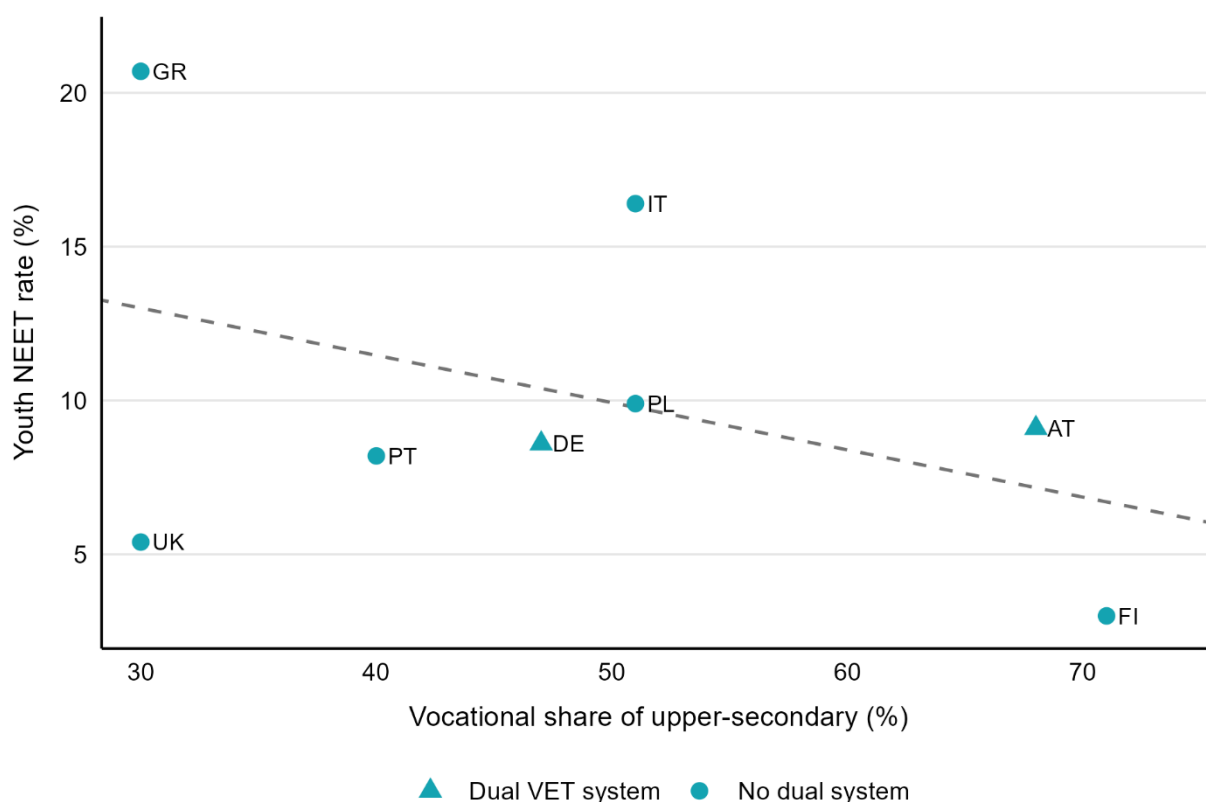
Note: Each point is one partner country ($n = 9$). The socioeconomic gradient is the coefficient on ESCS, in score points per standard deviation, from the regressions of Figure 5, PISA 2022. The age of first tracking and the dual-system classification are compiled from OECD Education at a Glance, Eurydice and Cedefop. The dashed line is a least-squares fit. The Kosovan gradient is attenuated by low and compressed performance (Section 5.3). Pearson $r = -0.22$; Spearman $\rho = -0.01$.

The comparative literature would also lead one to expect earlier tracking to be associated with a steeper socioeconomic gradient, since early sorting tends to align track placement with family background. In this sample, however, the association between tracking age and the size of the gradient is weak (Pearson $r = -0.22$, Spearman $\rho = -0.01$) and remains so when the Kosovan outlier is set aside ($r = -0.17$). The gradient varies relatively little across most of the partner systems, so any relationship between tracking and inequality is not visible at this level of aggregation. Detecting it would require within-country designs, for example comparing cohorts before and after a reform of the tracking age. The result cautions against reading cross-country differences in the gradient as direct evidence of tracking effects.

9.2 Vocational orientation and labour-market transitions

Across the eight countries with NEET data, a higher vocational share of upper-secondary education is associated with somewhat lower youth NEET (Pearson $r = -0.41$, Spearman $\rho = -0.18$). The association rests mainly on Greece, which combines the smallest vocational share with the highest NEET rate, and Finland, which combines the largest vocational share with the lowest. It is not robust to the omission of individual countries (Section 9.4). Its direction is consistent with the comparative literature, which holds that strong vocational pathways ease the school-to-work transition by giving young people occupation-specific skills and direct links to employers (Raffe, 2003), but the evidence remains provisional. Austria and Germany, the two dual-system countries, lie close to the fitted line.

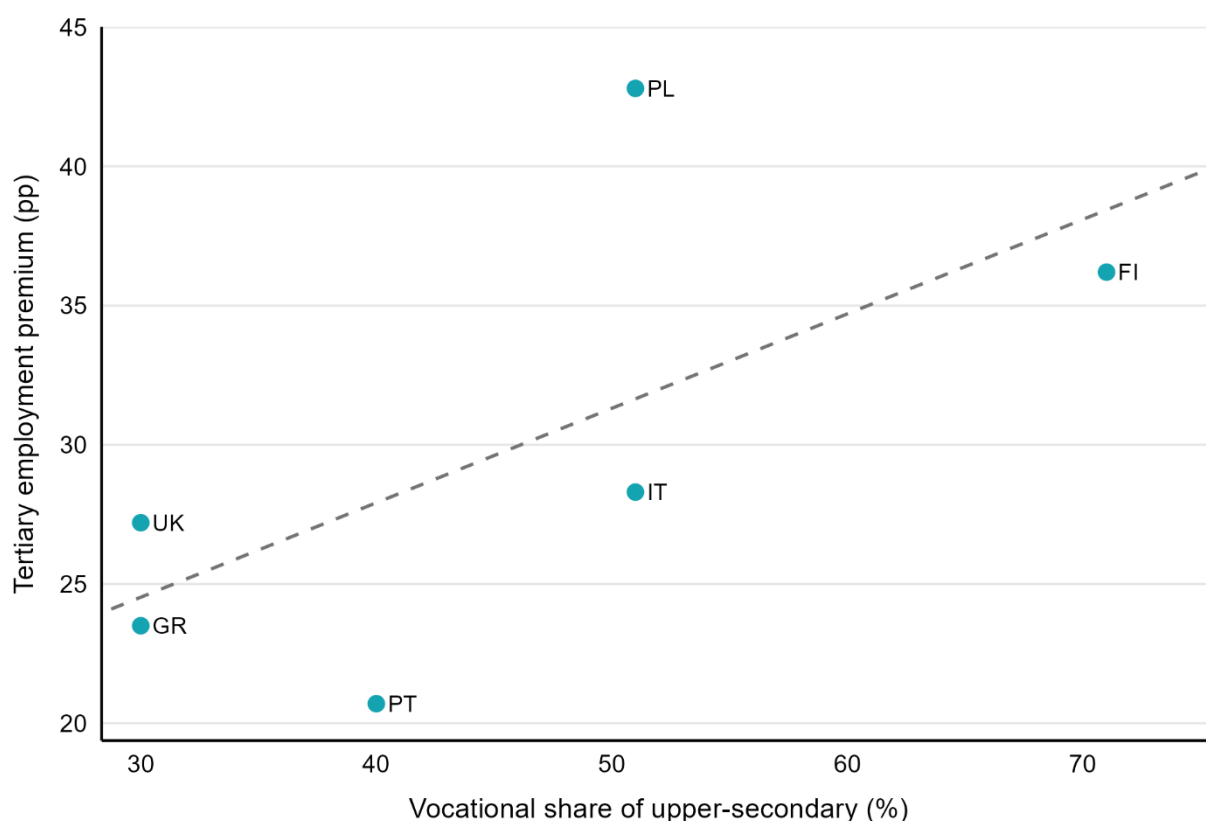
Figure 38. Vocational share of upper-secondary education versus youth NEET



Note: Each point is one partner country ($n = 8$). Youth NEET for Austria and Germany is taken from Eurostat (ages 15–29, 2022), because the PIAAC public-use files do not record respondents' exact age for these two countries; for the other countries it is estimated from the most recent PIAAC cycle (ages 16–29; Greece: Cycle 1), with values for the United Kingdom referring to England. Kosovo did not take part in PIAAC. Vocational share and dual-system classification from OECD Education at a Glance, Eurydice and Cedefop. The dashed line is a least-squares fit. Pearson $r = -0.41$; Spearman $\rho = -0.18$.

Figure 39 turns to the tertiary employment premium. Across the six countries with PIAAC-based employment data, a higher vocational share is associated with a larger premium (Pearson $r = +0.64$, Spearman $\rho = +0.71$), again not robust (Section 9.4). At first sight the association is counterintuitive, since strong vocational systems might be expected to narrow the gap between tertiary and non-tertiary adults. It is carried by Poland and Finland, where large premia coincide with high vocational shares, while Portugal combines a mid-sized vocational sector with the smallest premium. The comparison also lacks precisely the two dual-system countries: Austria and Germany cannot be included because the PIAAC public-use files do not record their respondents' exact age, so the systems in which a vocational effect on the premium would be most expected are not observed. With six countries the pattern depends heavily on individual cases. It is consistent with the premium reflecting, above all, how poorly adults without upper-secondary education fare in some systems with large vocational sectors, rather than a property of the vocational track itself.

Figure 39. Vocational share of upper-secondary education versus the tertiary employment premium



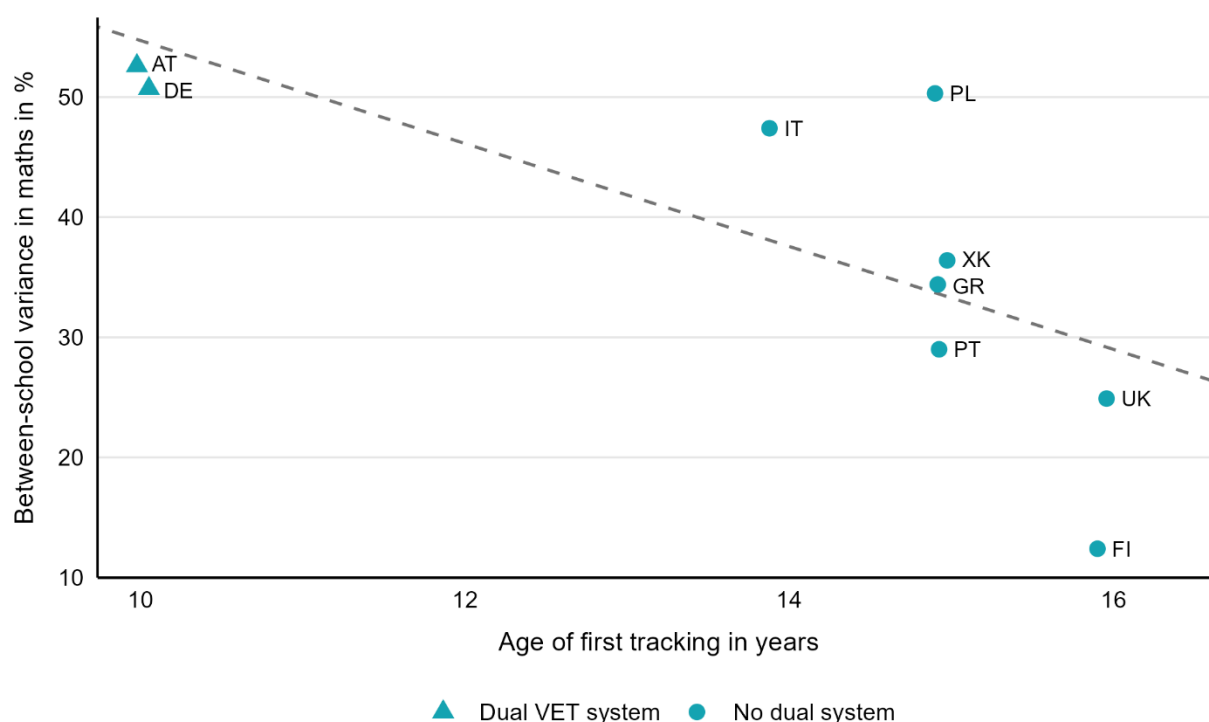
Note: Each point is one partner country ($n = 6$). The tertiary employment premium is the difference in the employment rate between tertiary-educated and below-upper-secondary adults aged 25–64, in percentage points, both PIAAC cycles pooled (Figure 26). Values for the United Kingdom refer to England. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age; Kosovo did not take part in PIAAC. Vocational share from OECD Education at a Glance. The dashed line is a least-squares fit. Pearson $r = +0.64$; Spearman $\rho = +0.71$.

9.3 Between-school segregation

A second measure of how far a system sorts students complements the tracking–repetition correlation above: the share of the total variance in achievement that lies between schools rather than within them (Jenkins, Micklewright and Schnepf, 2008). Estimated from PISA 2022, this between-school share ranges from about 12 per cent in Finland and 25 per cent in the United Kingdom to roughly half in Austria (53 per cent), Germany (51 per cent) and Poland (50 per cent). The partner-country average is 37.6 per cent for mathematics and 25.7 per cent for socioeconomic status itself, which is a direct measure of social segregation between schools.

The between-school share rises the earlier a system tracks (Pearson $r = -0.72$, Spearman $\rho = -0.91$; Figure 40). Poland is the main exception, with segregation at the level of the early-tracking systems despite selecting at fifteen. The association remains strong when Austria and Germany are removed ($r = -0.81$), so it is not driven by the two early-tracking countries alone, and it is one of the two associations that are robust to the omission of individual countries (Section 9.4). Between-school segregation thus gives the institutional role of early tracking a second quantitative expression, alongside grade repetition, and complements the direct association between socioeconomic status and grade repetition documented in Section 12.6.

Figure 40. Between-school share of variance in PISA mathematics versus the age of first tracking, 2022



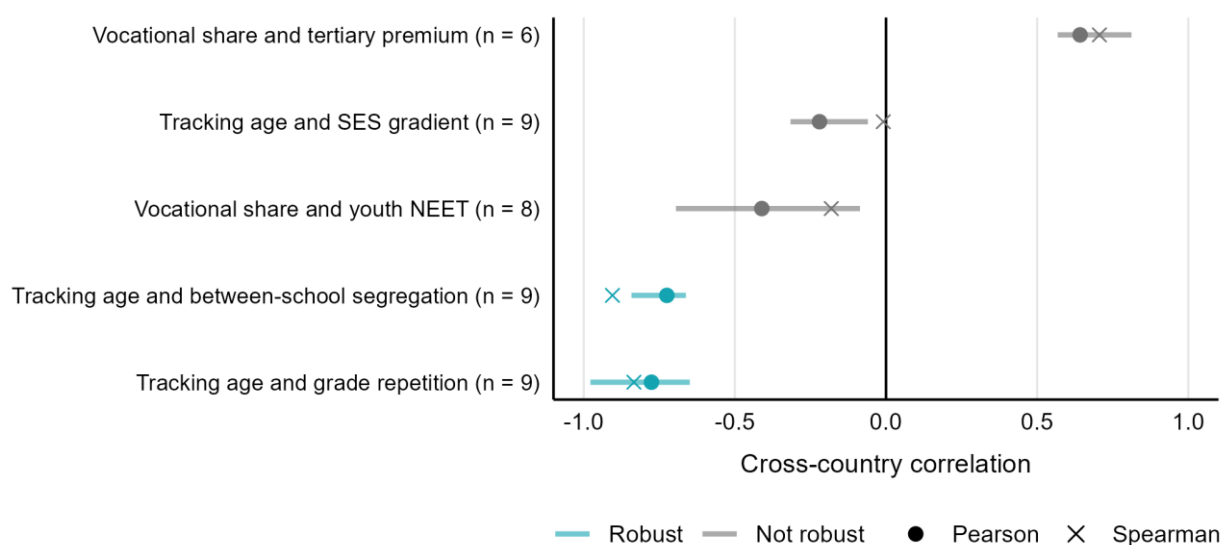
Note: Each point is one partner country ($n = 9$). The between-school share is the proportion of the total variance in mathematics achievement that lies between schools, PISA 2022, estimated with the final student weights on the average of the ten plausible values. The age of first tracking and the dual-system classification are compiled from OECD Education at a Glance, Eurydice and Cedefop. The dashed line is a least-squares fit. Pearson $r = -0.72$; Spearman $\rho = -0.91$.

9.4 Robustness of the cross-country correlations

Because the associations in this chapter rest on nine partner countries or fewer, each was re-estimated with one country omitted at a time (Figure 41). The two associations that are robust in the sense defined at the start of this chapter both concern early tracking: the association between the age of first tracking and grade repetition, and that between tracking age and between-school segregation, the latter also holding when Austria and Germany are removed together.

The other three are not robust. The association between tracking age and the socioeconomic gradient remains weak whichever country is omitted. The associations of the vocational share with youth NEET and with the tertiary employment premium keep their sign under every omission, but with eight and six countries respectively they do not meet the robustness criterion. The early-tracking findings are therefore the firm ones. The associations of the vocational share indicate a direction only, and firmer tests would require more countries or within-country designs.

Figure 41. Cross-country correlations re-estimated with Pearson and Spearman coefficients and leave-one-out ranges



Note: Pearson (dots) and Spearman (crosses) correlation coefficients across partner countries; bars show the range of the Pearson coefficient when each country is omitted in turn. An association is classified as robust if it remains significant at the 10 per cent level under every single-country omission; the number of countries is given for each row.

9.5 Summary

At the systems level the firmest findings are institutional and concern early tracking. Grade repetition is closely tied to the age of first tracking. In Austria and Germany, which select students into separate school types at age ten, 16 to 19 per cent of fifteen-year-olds have repeated a grade, compared with 2 to 3 per cent in Finland and the United Kingdom, which defer selection to sixteen. Portugal is the one clear exception, with a repetition rate close to that of the early-tracking systems despite selecting at fifteen. Since average achievement in the early-tracking systems is broadly similar to that of the comprehensive ones, the pattern is consistent with grade repetition being largely an institutional practice rather than a reflection of lower learning. The mechanism behind the association, however, cannot be identified with these data and is handed to WP3B and WP4.

Between-school segregation points the same way. The share of achievement variance lying between schools ranges from about 12 per cent in Finland to around half in Austria and Germany, with Poland the main exception among the later-tracking systems. Unlike the tracking–repetition association, it remains strong when Austria and Germany are excluded. These two are the only cross-country associations in this chapter that are robust to the omission of individual countries (Section 9.4).

The expected link between early tracking and a steeper socioeconomic gradient is not visible at the level of nine countries. A larger vocational share goes together with lower youth NEET and with a larger tertiary employment premium, but neither association is robust. The premium comparison, moreover, lacks the two dual-system countries. The PIAAC scientific-use files, planned for D3.3, restore age for Austria and Germany and would extend the premium comparison to eight countries.

10 Economic crises

The seventh research-question cluster asks how economic and societal crises affect young people's pathways and transitions, and whether their effects fall unevenly. This chapter focuses on two crises that fall within the period covered by the harmonised data: the COVID-19 pandemic and the financial and eurozone crisis of 2008–2013. The COVID-19 disruption of 2020–2022 is captured by the comparison of PISA 2018 and 2022 and is the stronger pillar of this chapter, because it is measured for all nine partner countries. The chapter examines the change in mathematics by country, whether it differed by socioeconomic status, immigrant background and gender, and how it compares with changes in reading and science. The financial crisis is

captured, more loosely, by the contrast between the two PIAAC cycles, the first conducted around 2012 in the aftermath of the crisis and the second around 2023 in recovery. The PIAAC evidence is necessarily exploratory. The two cycles are repeated cross-sections rather than a panel, so entry-cohort scarring cannot be tracked at the individual level. Greece participated only in the first cycle and Portugal only in the second, so their crisis-to-recovery change is not observed. And the public-use files do not record exact age for Austria and Germany. These limitations govern the strength of the claims that follow.

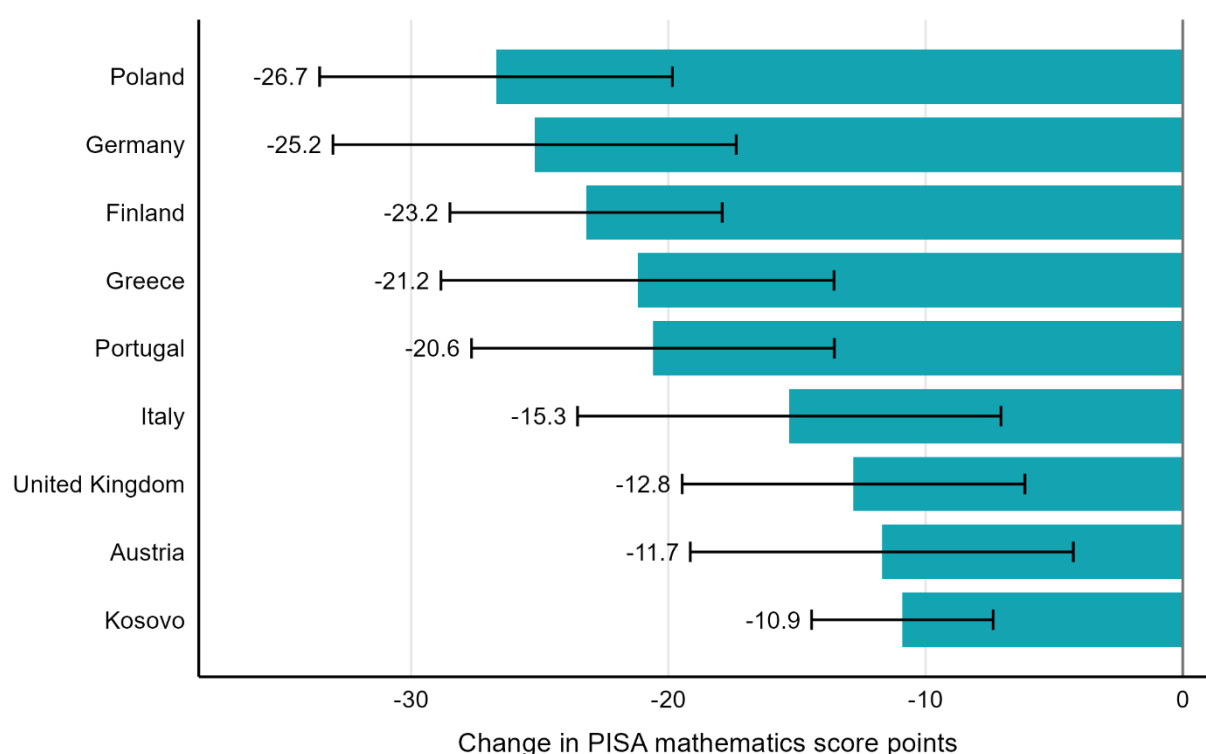
10.1 The COVID-19 achievement shock

The pandemic interrupted schooling for an entire generation of students at once, and skills lost at the age of 15 carry over into the later transitions this report follows, from upper-secondary education into training, higher education and work. PISA tested 15-year-olds in 2018, shortly before the pandemic, and again in 2022, so the change between the two rounds shows how achievement developed over the pandemic period.

Figure 42 shows this change for mathematics. Performance fell in every partner country, and in each the interval lies clearly below zero. The losses were largest in Poland, Germany and Finland (23 to 27 score points) and smallest in Austria, the United Kingdom and Kosovo (11 to 13 points); across the partner countries, the average decline was 18.6 points, close to one school year on the OECD benchmark of about 20 score points per year of schooling (Section 5.3).

The decline occurred across education systems that differ widely in structure and performance, which suggests a common cause in the disruption of schooling during the pandemic; a meta-analysis of studies from many countries likewise finds substantial learning deficits over this period (Betthäuser, Bach-Mortensen and Engzell, 2023). Beyond the differences between countries, the loss may also have differed between groups of students within them.

Figure 42. COVID-era change in PISA mathematics, 2018 to 2022

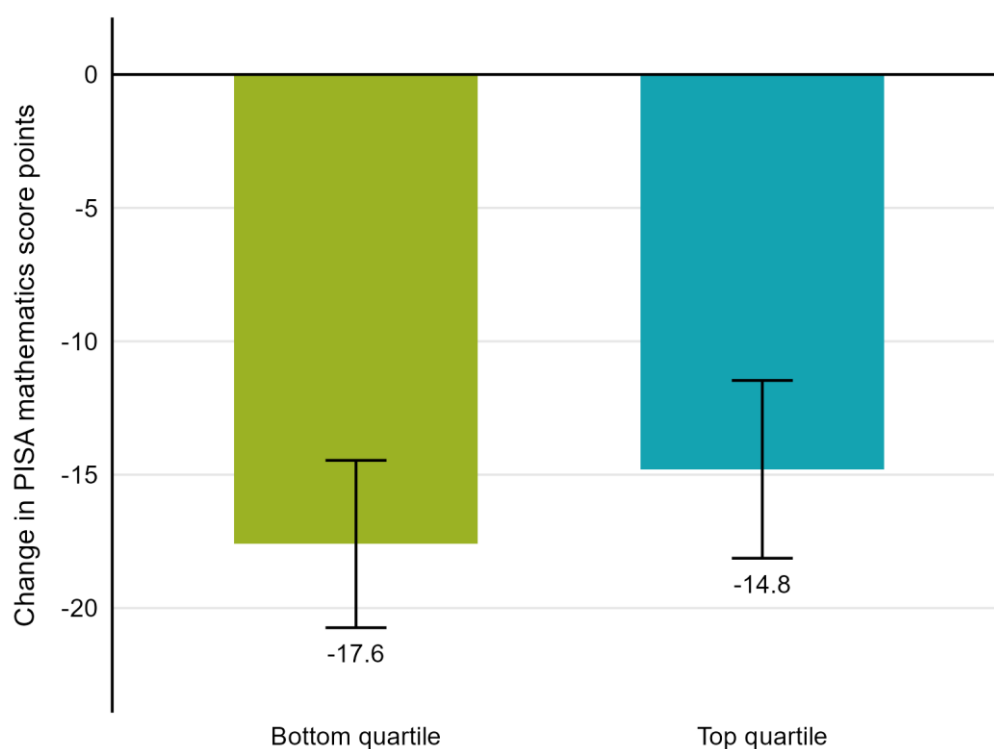


Note: Change in mean mathematics score between PISA 2018 and PISA 2022 by country, in score points, with 95% confidence intervals based on replicate weights and plausible values.

Whether the pandemic widened existing inequalities matters as much as the size of the average loss, because students who were already behind may have had fewer resources at home to compensate for lost schooling. Figure 43 compares the change in the bottom and the top socioeconomic quartile, averaged across the

partner countries. The bottom quartile lost 17.6 points and the top quartile 14.8, so the socioeconomic gap widened by about 3 points on average, a change that is small relative to its sampling uncertainty. The country estimates vary more: the gap widened most in Austria (14.8 points), Finland (8.8) and Germany (6.6), and narrowed in Kosovo, Greece and Portugal. Only the widening in Austria is clearly larger than its sampling uncertainty; in Finland it is borderline, and all other changes lie within it.

Figure 43. Change in PISA mathematics performance by socioeconomic quartile, 2018 to 2022



Note: Change in mean mathematics score in the bottom and top quartile of the PISA index of economic, social and cultural status; quartiles are weighted and formed within each country and survey year. Unweighted average of the nine partner countries, with 95% confidence intervals based on replicate weights and plausible values

Averaged across the partner countries, the gap between students with and without an immigrant background shows no change distinguishable from zero. The one average change larger than its sampling uncertainty concerns gender: girls lost about three points more than boys (20.1 against 17.1 points), although the confidence interval on this estimate only just excludes zero.

The decline differed across the three PISA domains. Averaged across the partner countries, mathematics fell by 18.6 points between 2018 and 2022, reading by 13.9 points and science by only 5.9 points. At grade four the pattern differed. PIRLS reading fell in every partner country with data between 2016 and 2021, whereas TIMSS mathematics moved in both directions between 2019 and 2023 (Section 5.1).

10.2 The financial crisis: youth transitions and recovery

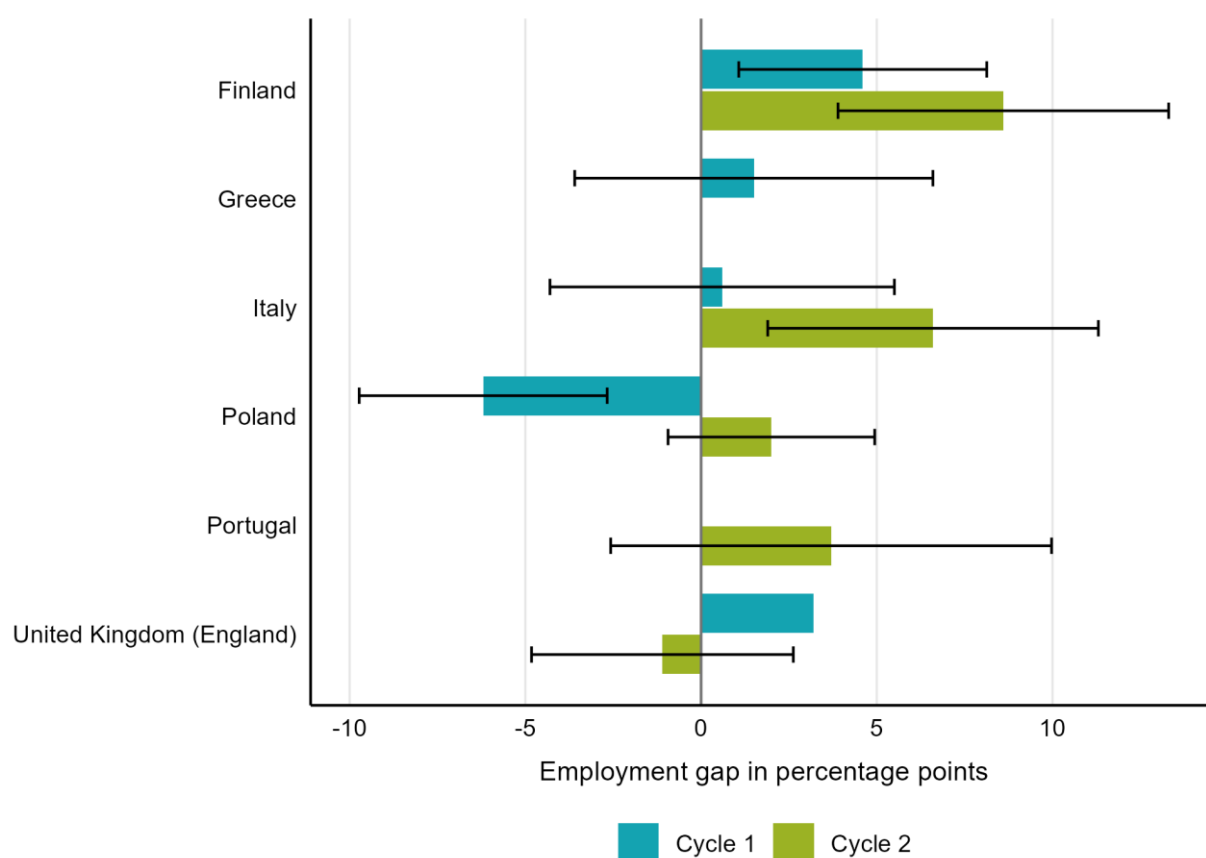
The financial and eurozone crisis of 2008–2013 hit young people hardest, and the concern it raised was that a weak start in the labour market leaves lasting marks on later careers. The two PIAAC cycles bracket this crisis: the first was conducted in its aftermath, the second during the recovery.

Youth NEET, the share of 16- to 29-year-olds not in employment, education or training, was introduced in Section 7.1 (Figure 23); here it is read from the perspective of the crisis. In Cycle 1, youth NEET was highest in Greece (20.7 per cent) and Italy (14.9 per cent), against 11.8 per cent in the United Kingdom (England), 10.4 per cent in Poland and 4.8 per cent in Finland. Greece and Italy thus averaged 17.8 per cent, twice the level of the other three countries at 9.0 per cent, consistent with the eurozone youth-employment crisis. Between the cycles, youth NEET fell markedly in the United Kingdom (England), from 11.8 to 5.4 per cent,

and, from a lower level, in Finland, from 4.8 to 3.0 per cent. It barely changed in Poland (from 10.4 to 9.9 per cent) and rose slightly in Italy (from 14.9 to 16.4 per cent), within the range of sampling error. PIAAC offers no pre-crisis observation, and Greece and Portugal are observed in only one cycle, so a crisis-and-recovery trajectory cannot be traced.

The NEET rates show the level of disengagement in each cycle but not whether the crisis left a lasting disadvantage for those who entered the labour market during it. A second exercise approaches this question through employment. It compares the employment rate of 45- to 54-year-olds with that of 25- to 34-year-olds in each cycle: if the crisis had weighed on the young in particular, the gap should be larger in Cycle 1 and smaller in Cycle 2. Figure 44 shows no such pattern. The gap widened between the cycles in Poland, and the changes in Finland and Italy point the same way but lie within their sampling uncertainty. Only in the United Kingdom (England) did it narrow, although no interval can be estimated for its first cycle. Within what two cross-sections can show, there is thus no common sign of crisis scarring in youth employment. Because the gap also reflects changes in prime-age employment and PIAAC does not follow cohorts, the analysis is exploratory. Estimates of entry-cohort scarring would require the PIAAC scientific-use files, which record exact age and allow labour-market entry cohorts to be constructed, or longitudinal data such as panel surveys and administrative employment histories.

Figure 44. Employment gap between prime-age and young adults by PIAAC cycle



Note: Employment rate of 45- to 54-year-olds minus that of 25- to 34-year-olds, in percentage points, with 95% confidence intervals from replicate weights. No interval is shown for the United Kingdom (England) in Cycle 1 because employment by age group is a calibration target of the survey weights there, so replication yields no sampling variance. Cycle 1 fieldwork 2011–12 (Greece 2014–15), Cycle 2 2022–23. United Kingdom estimates refer to England only. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age; Greece took part only in Cycle 1 and Portugal only in Cycle 2.

10.3 Summary

The COVID-19 pandemic left a clear mark on the achievement of fifteen-year-olds, although its size varied between countries. Mathematics performance fell in every partner country between the two PISA rounds before and after the pandemic, on average by close to one school year. The losses were largest in Finland, Germany and Poland and smallest in Austria, the United Kingdom and Kosovo. Reading fell by less and science least, so the setback was largest in mathematics. Whether the pandemic widened existing inequalities cannot be established for the partner countries as a whole. The bottom socioeconomic quartile lost somewhat more than the top, but the widening of the gap lies within its sampling uncertainty, and only in Austria did the gap clearly widen. The immigrant gap shows no change distinguishable from zero, while girls lost slightly more than boys.

The evidence on the financial crisis is thinner. In the crisis-era PIAAC cycle, youth NEET was about twice as high in Greece and Italy as in Finland, Poland and the United Kingdom (England), consistent with the eurozone youth-employment crisis. Between the cycles it fell markedly only in the United Kingdom (England). The gap in employment between prime-age and young adults shows no common sign of crisis scarring, but PIAAC offers no pre-crisis benchmark and cannot follow entry cohorts. Establishing whether the crisis left lasting effects on those who entered the labour market during it requires longitudinal data.

11 Policy programmes and investment

The eighth research-question cluster asks whether policies and investments improve youth transitions, and how they differ across the partner countries. This chapter combines two sources. The qualitative policy landscape and the EU and national investment figures are drawn from WP2's Deliverable D2.1, which maps the policies, programmes and investments addressing youth transitions across the European Education Area (EEA) and reviews the evidence on their effectiveness and efficiency. The quantitative side relates three macro indicators — public expenditure on education and active-labour-market-policy (ALMP) spending, each as a share of GDP, and the ESF+ envelope for 2021–2027 — to the transition outcomes estimated in the field chapters. The spending indicators are indicative, compiled from OECD and Eurostat sources for approximately 2019–2022, and should be reconciled with D2.1's figures in the next phase. With nine countries at most, and seven or eight where youth NEET is the outcome, the quantitative analysis is descriptive rather than causal. It is complemented by one reform case study in which the timing of a policy change is sharp enough to support a difference-in-differences comparison.

11.1 The policy landscape

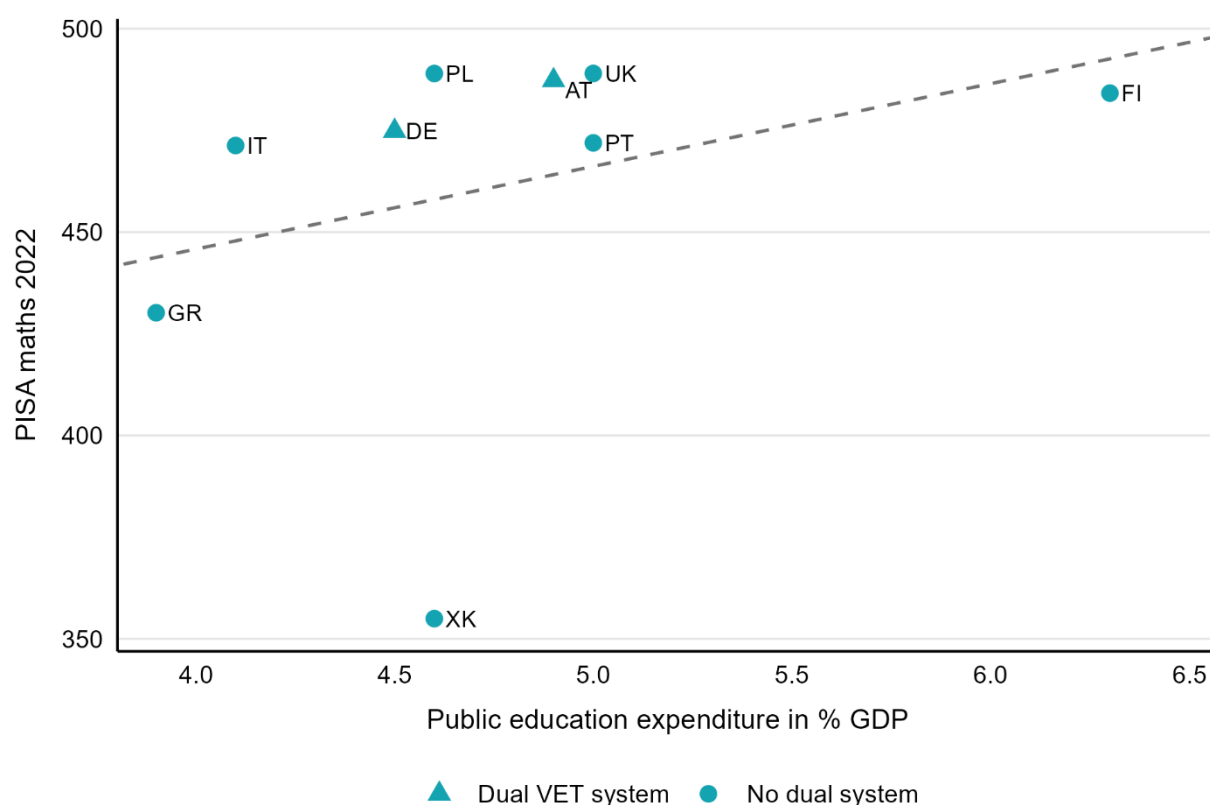
D2.1 records that NEET rates across Europe fell over the decade in which the EU Youth Guarantee has operated — the EU average declining from 15.2 per cent in 2015 to 11.1 per cent in 2024 — while the United Kingdom and Southern Europe lagged. It identifies the recurring ingredients of effective youth-transition systems as integrated support structures, targeted programmes for disadvantaged youth and strong vocational pathways, and the ingredients of efficient ones as early investment, coordinated funding, robust evaluation and work-based learning. It also groups the partner countries into transition regimes: Continental (Austria, Germany), Nordic (Finland), Liberal (United Kingdom), Southern (Greece, Italy, Portugal) and Eastern (Poland). Kosovo, outside the EU, is not covered by that typology and is carried in the WP3A matrix as a separate transition category. D2.1's investment figures show that the European Social Fund Plus (ESF+, €142.7 billion for 2021–2027) and Erasmus+ dominate EU-level funding. The largest country envelopes go to Italy (€14.8 billion), Poland (€12.9 billion) and Portugal (€7.8 billion), and far smaller ones to Austria (€0.4 billion) and Finland (€0.6 billion). A central finding of D2.1 is that investment does not map neatly onto outcomes: Italy and Greece record high youth NEET despite large ESF+ envelopes, which D2.1 attributes to structural labour-market conditions, fragmented governance and gaps in guidance and outreach.

11.2 Investment and outcomes

The quantitative indicators bear out D2.1's caution. Higher public expenditure on education as a share of GDP shows only a weak positive association with achievement (Pearson $r = 0.32$, Spearman $\rho = 0.54$) and an even weaker, positive association with the socioeconomic gradient ($r = 0.25$, $\rho = 0.37$). Neither pattern is

robust (Figure 48). This is consistent with the conclusion in the economics of education that how money is spent matters more than how much is spent (Hanushek, 2003).

Figure 45. Public education expenditure versus achievement

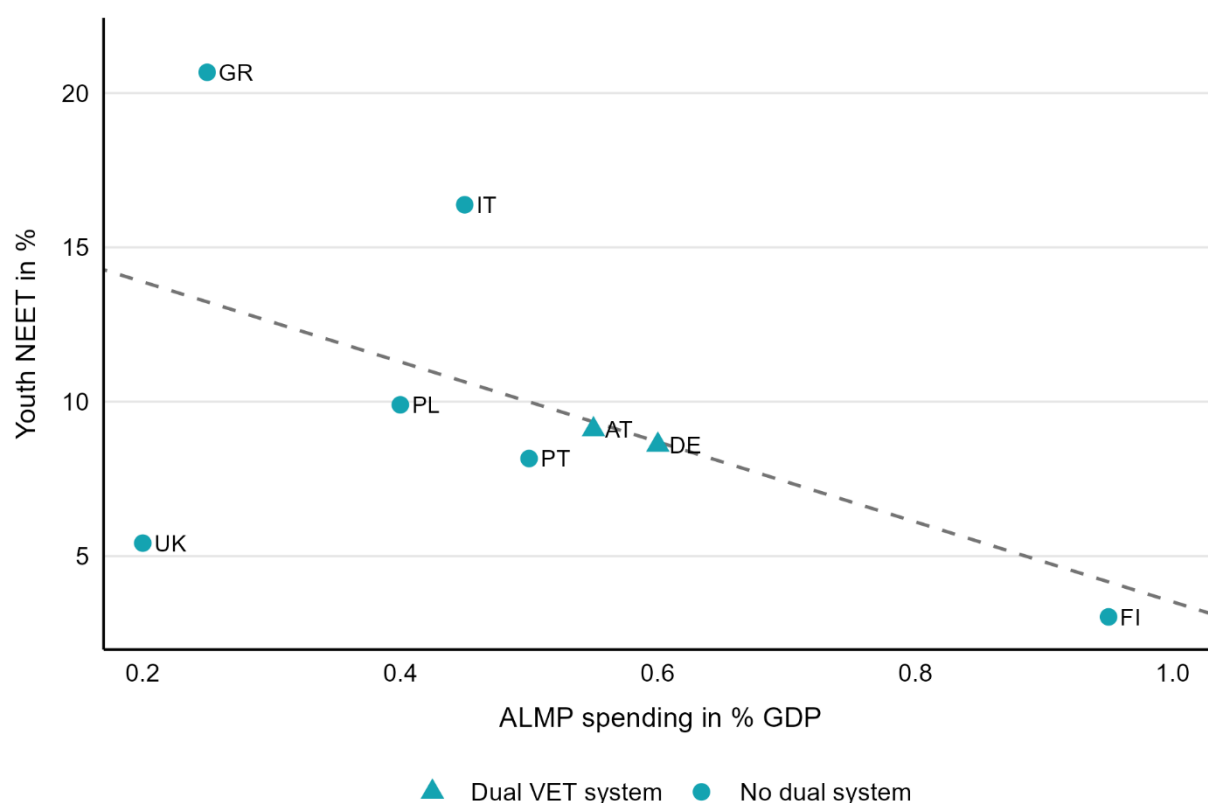


Note: Each point is one partner country ($n = 9$). Public expenditure on education as a share of GDP, approximately 2019–2022, compiled from OECD and Eurostat sources; mean mathematics score, PISA 2022. The dashed line is a least-squares fit. Pearson $r = 0.32$; Spearman $\rho = 0.54$.

Across the eight countries with ALMP spending data, higher active-labour-market spending goes together with lower youth NEET (Pearson $r = -0.53$, Spearman $\rho = -0.41$), the direction the literature predicts. The association rests mainly on Finland, which combines the highest spending with the lowest NEET rate, and Greece, which combines very low spending with the highest rate. The United Kingdom runs against it, with the lowest spending and a low NEET rate. It keeps its sign whichever country is omitted, but is not robust with eight countries (Figure 48).

ALMP spending shows no comparable pattern for the tertiary employment premium. Since active labour-market measures are aimed mainly at the unemployed and the less qualified, higher spending might be expected to narrow the employment gap between tertiary-educated and less-educated adults. Across the six countries with PIAAC-based employment data, however, the association is weak and, if anything, positive ($r = 0.36$, $\rho = 0.14$), and it comes close to zero when individual countries are omitted.

Figure 46. Active-labour-market spending versus youth NEET

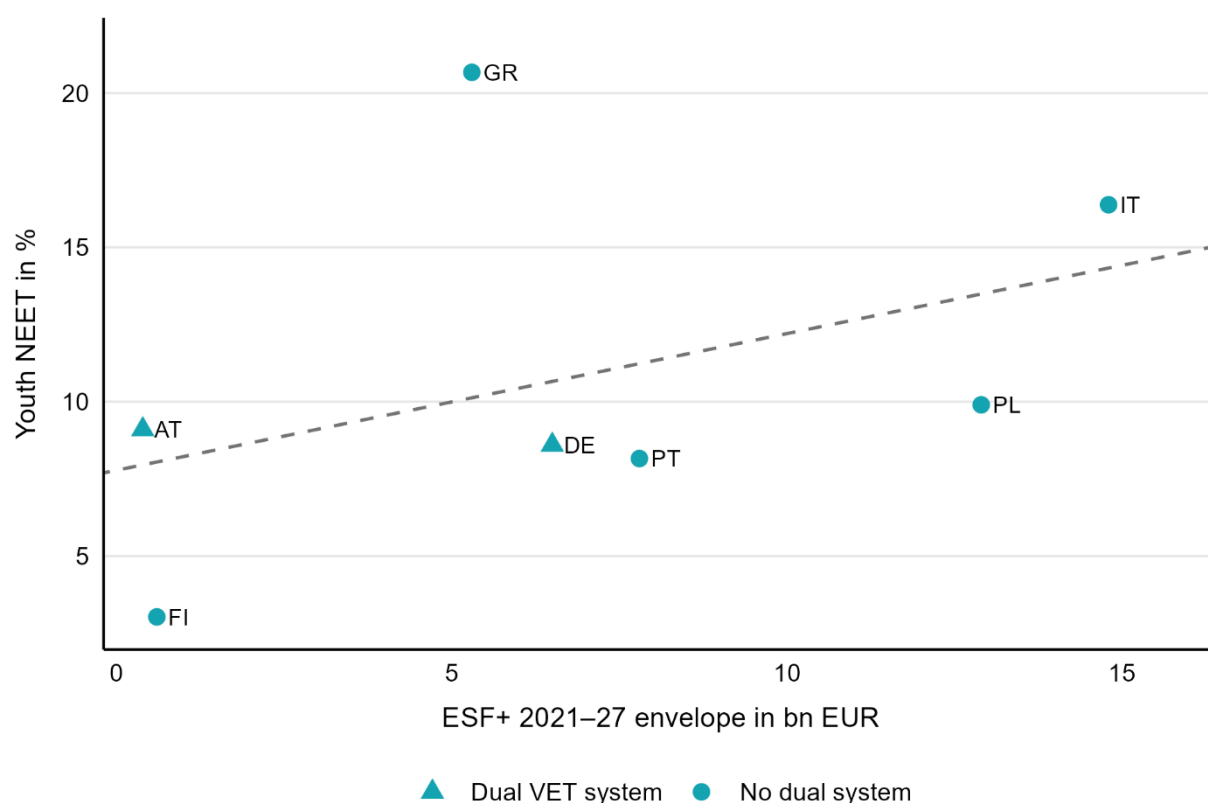


Note: Each point is one partner country ($n = 8$). ALMP spending as a share of GDP, approximately 2019–2022, compiled from OECD and Eurostat sources. Youth NEET for Austria and Germany is taken from Eurostat (ages 15–29, 2022), because the PIAAC public-use files do not record respondents' exact age for these two countries; for the other countries it is estimated from the most recent PIAAC cycle (ages 16–29; Greece: Cycle 1), with values for the United Kingdom referring to England. No ALMP data are available for Kosovo. The dashed line is a least-squares fit. Pearson $r = -0.53$; Spearman $\rho = -0.41$.

For EU structural investment the data permit no firm statement. Across the seven countries with both an ESF+ envelope and a youth-NEET estimate (Austria and Germany from Eurostat), larger envelopes go together with somewhat higher youth NEET (Pearson $r = 0.42$, Spearman $\rho = 0.32$); the sign holds whichever country is omitted, but the association is not robust (Figure 48). Two distinct statements should not be conflated here. That large envelopes coexist with high NEET follows from how ESF+ is allocated: envelopes are larger where regional prosperity is lower and labour-market problems are greater, and member states with above-average NEET rates must devote at least 12.5 per cent of their ESF+ funds to young people who are NEET (D2.1). The association therefore says nothing about whether the investment works; judging effectiveness would require within-country variation over time. What the pattern does underline is D2.1's narrower point that the volume of investment cannot serve as a predictor of outcomes.

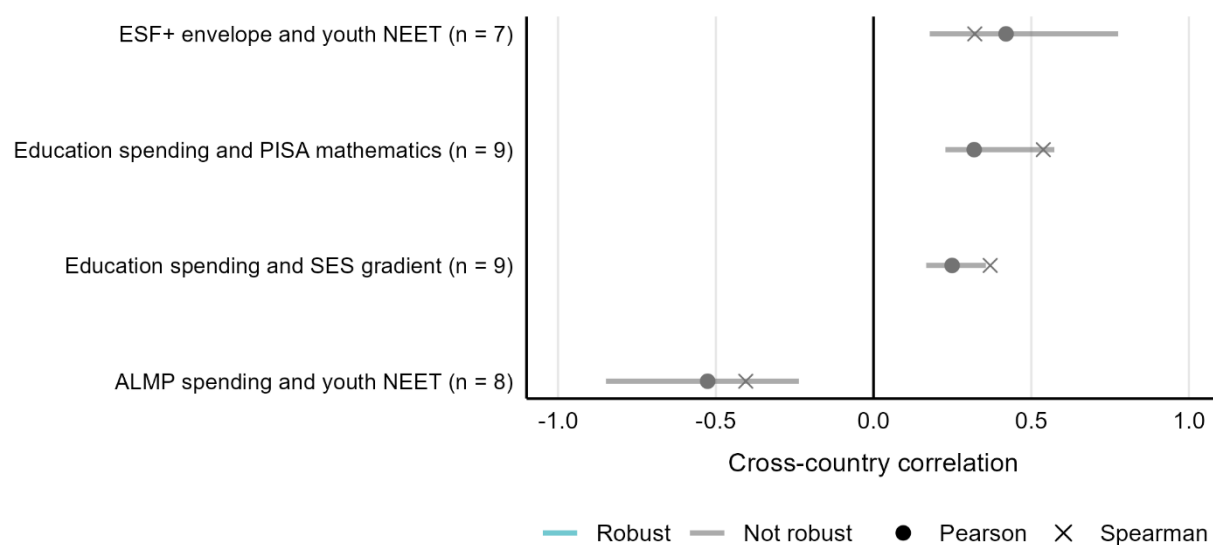
Each of these associations was re-estimated with one country omitted at a time, as for the systems indicators in Section 9.4 (Figure 48). None of the five is robust. Education spending is only weakly associated with achievement and with the socioeconomic gradient, and ALMP spending with the tertiary employment premium, whichever country is omitted. The associations of ALMP spending and of the ESF+ envelope with youth NEET keep their sign under every omission, but with eight and seven countries they do not meet the robustness criterion. The spending and investment indicators therefore describe how the partner countries differ, but do not support conclusions about the effects of spending.

Figure 47. EU structural investment (ESF+) versus youth NEET



Note: Each point is one partner country ($n = 7$). ESF+ envelope for 2021–2027 in billion euros, from D2.1. Youth NEET for Austria and Germany is taken from Eurostat (ages 15–29, 2022), because the PIAAC public-use files do not record respondents' exact age for these two countries; for the other countries it is estimated from the most recent PIAAC cycle (ages 16–29; Greece: Cycle 1). The United Kingdom and Kosovo receive no ESF+ funding. The dashed line is a least-squares fit. Pearson $r = 0.42$; Spearman $\rho = 0.32$.

Figure 48. Robustness of the cross-country correlations of spending and investment

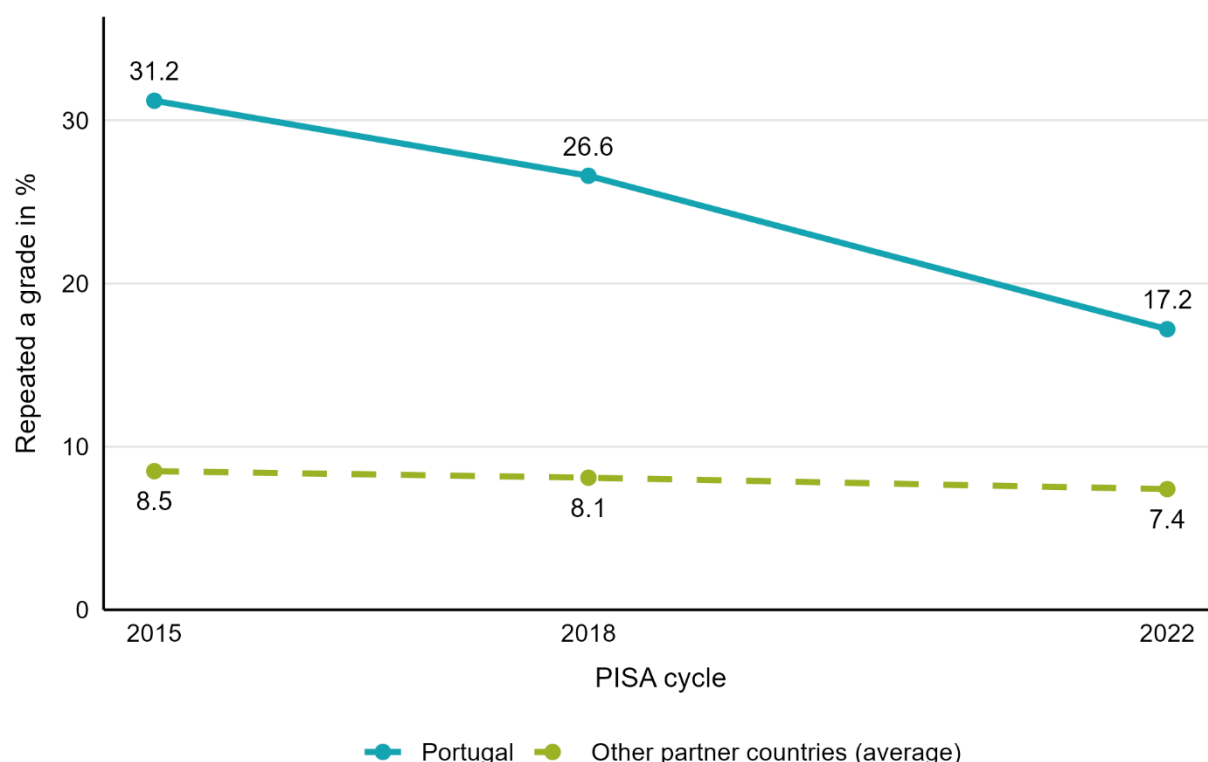


Note: Pearson (dots) and Spearman (crosses) correlation coefficients across partner countries; bars show the range of the Pearson coefficient when each country is omitted in turn. An association is classified as robust if it remains significant at the 10 per cent level under every single-country omission; the number of countries is given for each row. Youth NEET for Austria and Germany is taken from Eurostat (ages 15–29, 2022).

11.3 A reform case study: Portugal's anti-repetition policy

Portugal offers a rare case in which a policy change is sharp enough, and visible enough in the data, to support a quasi-experimental reading. Alongside the labour-market reforms recorded in D2.1 — the expansion of vocational education and training, the ATIVAR.PT internship programme and a dedicated NEET strategy — Portugal launched a national programme to reduce grade repetition in 2016. Its grade-repetition rate fell from 31.2 per cent in 2015 to 17.2 per cent in 2022, while the average of the other partner countries changed little (from 8.5 to 7.4 per cent). The difference-in-differences, Portugal's additional reduction relative to the other partner countries, is 12.9 percentage points (Figure 49).

Figure 49. Grade repetition in Portugal and the other partner countries, PISA 2015–2022



Note: Share of fifteen-year-old students who report having repeated at least one grade, estimated with the final student weights. The comparison group is the unweighted mean of the other eight partner countries. The difference-in-differences between 2015 and 2022 is –12.9 percentage points (standard error 1.48).

The comparison has clear limits. With a single treated country and three PISA cycles, other concurrent changes cannot be ruled out. The repetition series used here begins in 2015, one year before the reform, so whether Portugal's repetition rate was already falling beforehand cannot be examined with these data; and a country starting from a far higher level may have more room to fall. A falling repetition rate may also partly reflect changed promotion standards rather than improved learning. Portugal's mathematics performance moved with the partner-country average over the same period (Section 5.1), which speaks against a collapse of standards. Within these limits, the timing and size of the decline are consistent with the reform having reduced grade repetition substantially within a few years.

11.4 A joint WP2–WP3A policy-effectiveness matrix

The recommendation to link WP2's policy mapping to WP3A's quantitative outcomes is realised in a joint policy-effectiveness matrix, provided as a standalone file (WP3A_D32_Policy_Effectiveness_Matrix.xlsx). For each partner country it sets system and policy inputs — the transition regime and ESF+ envelope from D2.1, and the tracking age, dual-VET strength, vocational share and education and active-labour-market spending used in Chapters 9 and 11 — alongside the outcomes documented in this deliverable: youth NEET and early leaving from the macro layer (Chapter 19), and the design-based estimates of grade repetition, the tertiary

employment premium, the socioeconomic gradient, the immigrant gap, between-school segregation and the share of low performers. It adds a joint reading of policy effort against outcome for each country and summarises the pattern by transition regime.

Three readings stand out. First, the volume of investment cannot be read as a predictor of outcomes. Italy pairs the largest ESF+ envelope with persistently high youth NEET, but since envelopes are allocated where structural problems are deepest, the pairing reflects the allocation rule at least as much as any shortfall of the spending. The contrast with Portugal, where a focused reform coincided with a large fall in grade repetition, suggests that design and targeting matter; it does not show that the large envelopes are ineffective. Second, the dual-vocational systems of Austria and Germany combine low youth NEET with the highest grade repetition and between-school segregation of the partner set. Their vocational employment advantage in the Eurostat programme-orientation split (Section 19.2) is pronounced for Germany (+12.0 percentage points) but slight for Austria (+2.6). Third, where schools already retain young people but youth NEET remains high — Greece and, most sharply, Kosovo — the pattern is consistent with labour demand rather than education supply being the binding constraint. The matrix is intended as a living exhibit, to be extended as the WP2 efficiency assessment and current Eurostat and OECD series are reconciled.

11.5 Summary

The policy evidence from WP2 and WP3A points the same way. D2.1 identifies strong vocational pathways, early and integrated support and robust evaluation as the ingredients of effective youth-transition systems. WP3A's quantitative indicators add that the volume of spending shows no robust cross-country association with outcomes, an association that the allocation of funds toward the greatest need would blur even if spending were highly effective. Portugal suggests that a focused reform can coincide with a substantial improvement in the targeted outcome. A falling repetition rate could, however, in part reflect changed promotion standards rather than improved learning. Portugal's mathematics performance moved with the average of the other partner countries over the same period, which speaks against a collapse of standards but cannot by itself attribute learning gains to the reform. The clear next step is to extend the joint policy-effectiveness matrix with D2.1's full country policy tables and efficiency assessment.

12 Deep Dive 1 — Decompositions of gaps

The field chapters document gaps between groups in achievement and in labour-market outcomes. This chapter asks how far these gaps are associated with differences in measured characteristics between the groups.

Sections 12.1 to 12.3 decompose four gaps with the Oaxaca–Blinder method: the native–immigrant gap in mathematics, the gender pay gap among employed adults and among recent graduates, the achievement gap between the top and bottom socioeconomic quartiles, and the gender gap in NEET rates.

Each gap is split into two parts. First, a regression of the outcome on the characteristics is estimated for both groups together. The explained part is the gap that this regression predicts from the differences between the groups' average characteristics. The unexplained part is the difference between the observed gap and this predicted gap. It arises because the same characteristic can be associated with the outcome differently in the two groups, and because the outcome also depends on factors the model does not include. The unexplained part is therefore not a measure of discrimination or of an effect of group membership, and its size depends on which characteristics are included (Section 4.3).

Sections 12.4 to 12.7 then relax the additive structure. Interaction terms allow the socioeconomic gradient and the returns to education to differ between groups. Two path models then separate the part of a background association that runs through intervening variables from the part that does not.

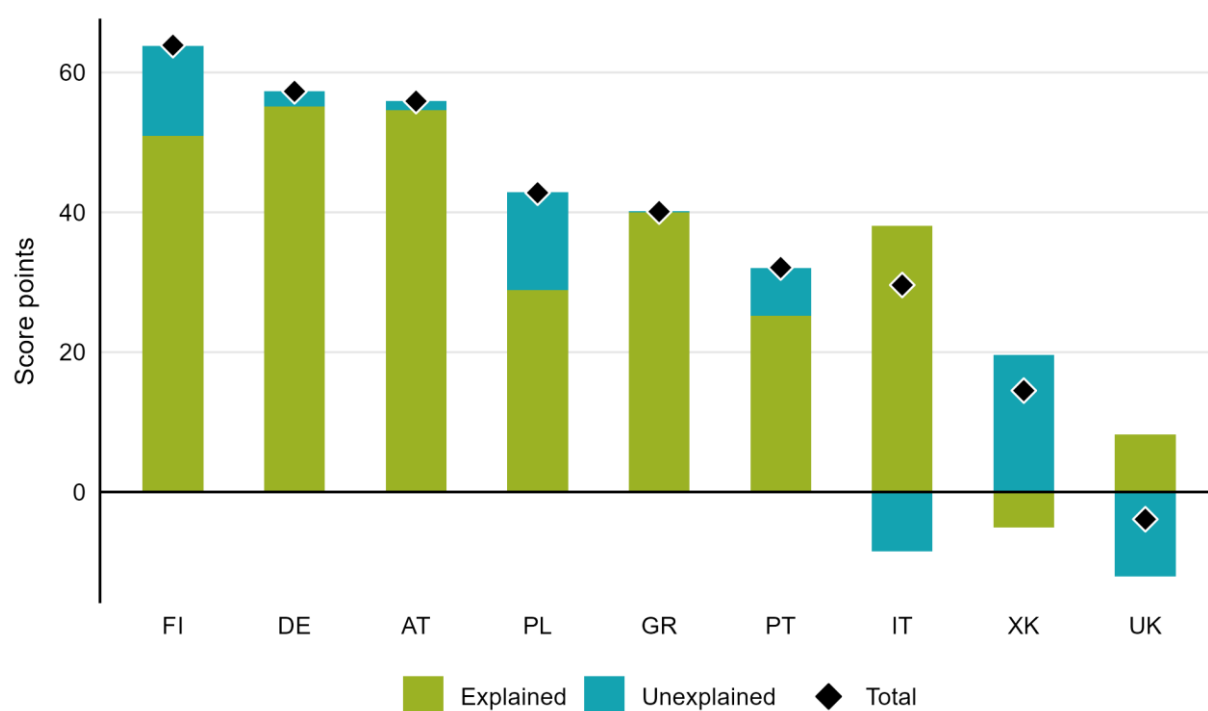
Inference in this chapter is design-based (Appendix A.2). The exception is the EUROGRADUATE decomposition, which is weighted and bootstrapped (Section 4.1). All results describe associations, not causal effects.

12.1 The immigrant achievement gap

Section 5.4 shows that immigrant-background students score below their native peers in mathematics in most partner countries, by very different margins. A first question is how much of this gap reflects differences in family background and home language between the two groups.

To answer it, the native–immigrant gap in PISA 2022 mathematics is decomposed separately for each country using three characteristics: the ESCS index, the index of home possessions, and whether a language other than the test language is spoken at home. Figure 50 shows the results.

Figure 50. Native–immigrant gap in mathematics: explained and unexplained parts, PISA 2022



Note: Difference in mean mathematics score between native and immigrant-background students, in score points, split by a two-fold Oaxaca–Blinder decomposition, estimated for each country with coefficients pooled over both groups, into the part explained by ESCS, home possessions and home language and an unexplained part; the diamond marks the total gap. Estimates based on plausible values.

In seven of the eight countries where natives score higher, the three characteristics account for the greater part of the gap. They account for almost all of it in Austria, Germany and Greece (98, 96 and 100 per cent), for about four-fifths in Finland and Portugal (80 and 79 per cent), and for 68 per cent in Poland. In Italy the explained part (38.1 points) exceeds the total gap (29.6 points). Given their characteristics, immigrant-background students there score higher than the model predicts.

Kosovo and the United Kingdom depart from this pattern. In Kosovo, immigrant-background students do not differ unfavourably from natives in the three characteristics, so the gap of 14.5 points is almost entirely unexplained. In the United Kingdom there is no significant gap, although the characteristics would predict one of 8.2 points in favour of natives. The only country with a significant unexplained disadvantage besides Kosovo is Finland (12.9 points).

The three characteristics differ in their weight. Home language is the largest single contribution in Finland, Germany and Poland, and about as large as ESCS in Austria. ESCS contributes most in Greece, and home possessions contribute most in Italy and Portugal.

12.2 The gender pay gap

The second decomposition turns from school to the labour market, where the gender gap runs in the opposite direction to the one in school achievement. Section 7.3 describes the earnings returns to education for all employed adults. This section asks how far the difference in hourly earnings between employed men and women is associated with differences in their education, skills and jobs.

Among employed adults, men earn 13.0 log points² more per hour than women, pooled across the five partner countries with PIAAC earnings data: Finland, Greece, Italy, Poland and the United Kingdom. Log points are 100 times the difference in log hourly earnings, roughly per cent for gaps of this size. Because the comparison is restricted to people in work, the gap refers to employed men and women only.

Two specifications are estimated (Table 8). The first includes education, literacy and age. Its explained part is negative (–6.1 log points), mainly because of education: given these characteristics, employed women would be expected to earn slightly more than men, and the unexplained part (19.1) exceeds the total gap. The second specification adds public or private sector, weekly working hours, contract type, firm size and occupation. Occupation now contributes positively to the explained part, and working hours negatively, so that the explained part as a whole rises to –1.4 log points and is no longer significantly different from zero. The unexplained part falls to 14.4 log points. Occupation, hours and sector may themselves differ by gender for reasons the model does not capture, so the two specifications bracket the explained part rather than one of them being the correct one.

Table 8. Decomposition of the gender pay gap among employed adults, PIAAC Cycles 1 and 2 (log points)

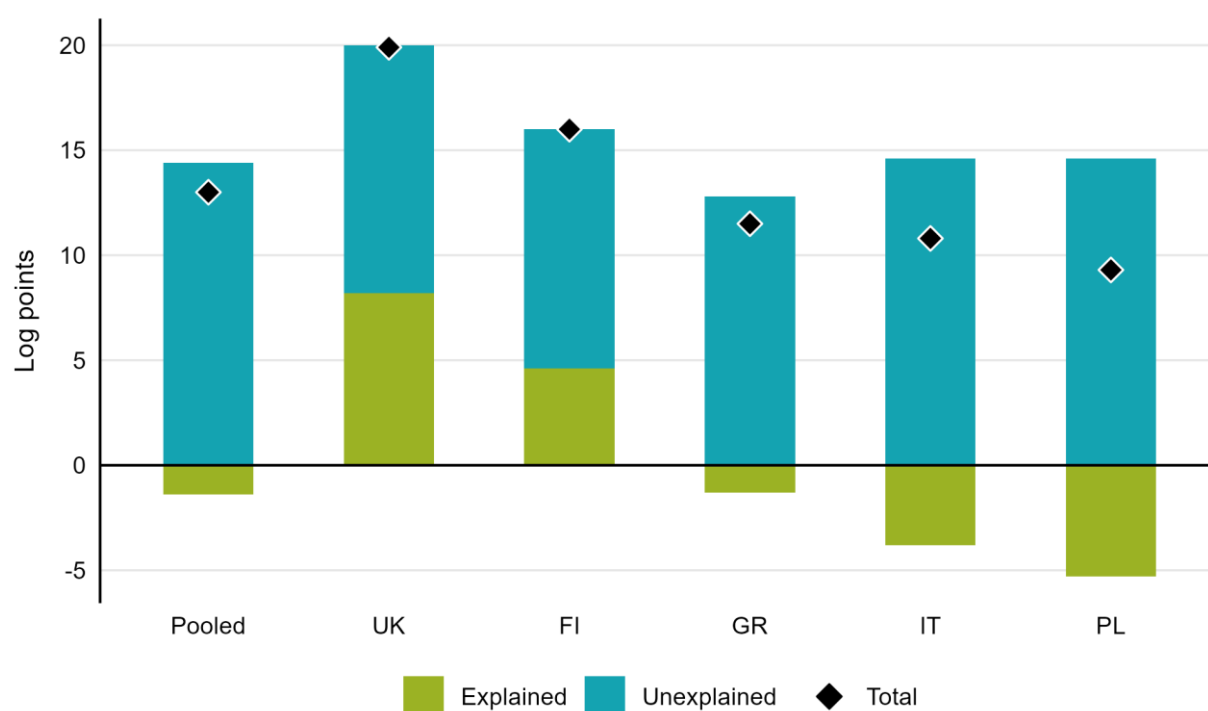
Component	Education, literacy, age	Adding job characteristics
Total gap	13.0	13.0
Explained	–6.1	–1.4
<i>education</i>	–4.7	–2.1
<i>literacy</i>	–0.8	–0.5
<i>age</i>	–0.4	–0.3
<i>sector</i>	—	+0.6
<i>weekly hours</i>	—	–3.3
<i>contract type</i>	—	+0.1
<i>firm size</i>	—	+0.8
<i>occupation</i>	—	+3.5
<i>country and cycle</i>	–0.1	–0.1
Unexplained	19.1	14.4

Note: Difference in mean log hourly earnings between employed men and women, in log points, split by a two-fold Oaxaca–Blinder decomposition with pooled coefficients. Positive contributions widen the gap, negative contributions narrow it. Contributions may not add up to the explained part because of rounding. Ages 25–64; Finland, Greece, Italy, Poland and the United Kingdom (England) pooled, with country-by-cycle fixed effects.

Figure 51 shows the second specification, estimated separately for each country. The explained part is positive in Finland (4.6 log points, 29 per cent of the gap) and the United Kingdom (8.2, 41 per cent). It is negative in Italy (–3.8) and Poland (–5.3), and close to zero in Greece. The unexplained part lies between 11.4 and 14.6 log points in all five countries.

² A difference of d log points corresponds to a percentage difference of $100 \times (e^{d/100} - 1)$. The gap of 13.0 log points thus means that men earn 13.9 per cent more per hour than women ($e^{0.130} - 1 = 0.139$). For small differences, log points and per cent are approximately equal.

Figure 51. Gender pay gap among employed adults: explained and unexplained parts, PIAAC Cycles 1 and 2



Note: Difference in mean log hourly earnings between employed men and women, in log points, split by a two-fold Oaxaca–Blinder decomposition, with coefficients pooled over men and women, into the part explained by education, literacy, age, sector, weekly hours, contract type, firm size and occupation (nine groups) and an unexplained part; the diamond marks the total gap. Country estimates are computed separately for each country; the pooled estimate covers all five countries with country-by-cycle fixed effects. Ages 25–64. Finland, Greece, Italy and the United Kingdom (England): Cycle 1; Poland: Cycles 1 and 2.

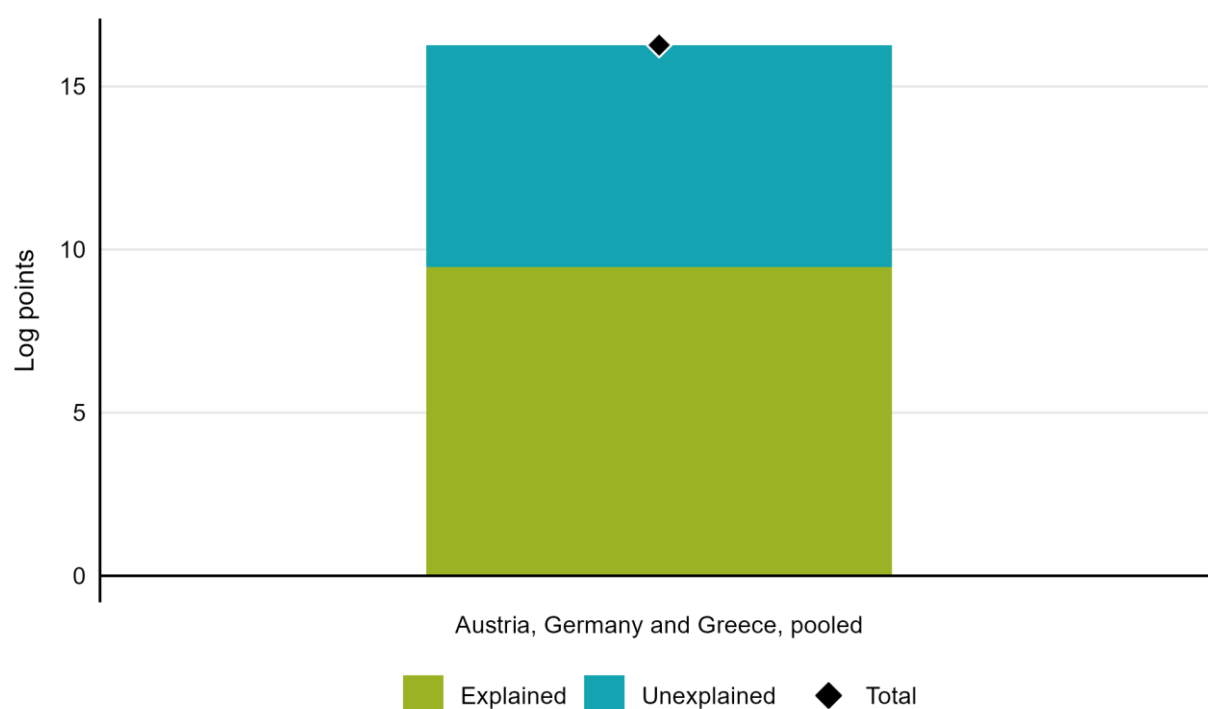
A negative explained part, with an unexplained part larger than the gap itself, is not unusual in comparable analyses. For European countries, Dupuy, Fouarge and Buligescu (2009) use the Structure of Earnings Survey. They find that the gender pay gap adjusted for individual and job characteristics exceeds the raw gap in Italy, Spain, Portugal, Ireland and Germany. For Colombia, Mora and Herrera (2025) report a gap of about 13 per cent in a pooled cross-section, with an explained component of –8.6 per cent and an unexplained component of 21.6 per cent.

A related question is whether the unexplained gap is accompanied by lower returns to education for women. A pooled earnings regression of employed adults aged 25–64 answers it by allowing the association between years of education and earnings to differ by sex. The regression controls for immigrant background, age and its square, and country-by-cycle fixed effects. A year of education is associated with 5.8 log points higher hourly earnings for men and 7.1 for women, a significant difference of 1.3 log points. The unexplained gap therefore lies in the level of pay at given education, not in a lower return to education for women.

If this is the case, the gap should also appear among men and women who hold the same qualification and are at the same career stage. EUROGRADUATE allows this to be examined for higher-education graduates about one and five years after graduation. Its estimates are weighted and robust rather than design-based (Section 4.1).

In the 2018 pilot, which covers Austria, Germany and Greece among the partner countries, employed male graduates earn 16.3 log points more than female graduates in total earnings (PPP-adjusted). A weighted Oaxaca–Blinder decomposition uses field of study, parental tertiary education, migration background and age. It attributes 9.5 log points (58 per cent) to composition and 6.8 log points (42 per cent) to the unexplained part (Figure 52). Field of study, in which men and women differ strongly (Section 6.2), is among the characteristics included.

Figure 52. Gender pay gap among recent graduates: explained and unexplained parts, EUROGRADUATE 2018



Note: Difference in mean log total earnings (PPP-adjusted) between employed male and female graduates, in log points, split by a weighted two-fold Oaxaca–Blinder decomposition into the part explained by field of study, parental tertiary education, migration background and age and an unexplained part; the diamond marks the total gap. Austria, Germany and Greece.

In the same model, having a tertiary-educated parent is not significantly associated with graduates' earnings. This sits alongside the finding of Section 8.1 that first-generation graduates are somewhat more often overqualified. The two could be reconciled if first-generation graduates differ in field, sector or working hours, but the data available here do not allow this to be examined.

The 2022 wave adds a view of earnings growth over the early career. Among graduates observed about five years after graduation in Austria, Germany and Portugal, the median real increase in earnings between 2018 and 2022 was 40 per cent for men and 30 per cent for women. Men's earnings thus grow faster than women's in the first years after graduation. The gender pay gap that is already present among recent graduates therefore widens rather than narrows as careers progress. The two waves cover different graduate cohorts and partly different countries, so this is a consistent pattern across the two sources rather than a measured change for the same graduates.

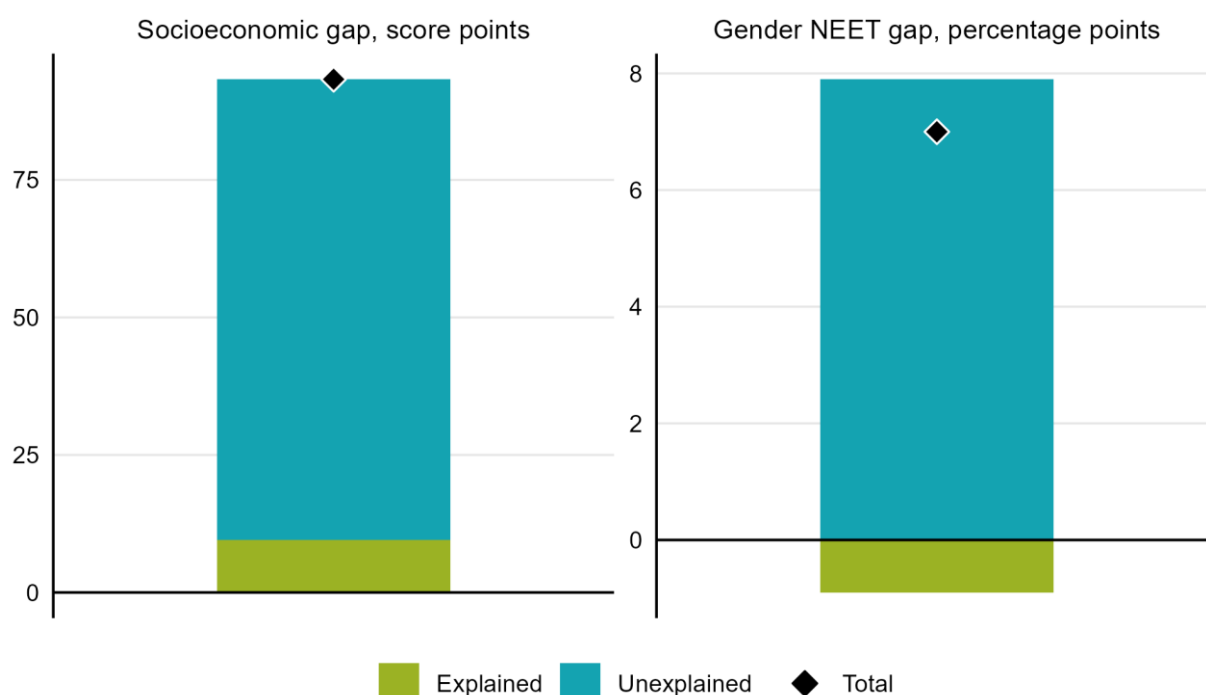
12.3 The socioeconomic and the NEET gaps

The two decompositions so far concern migration background and gender. The same method can be applied to two further gaps from the field chapters: the socioeconomic gap in achievement (Section 5.3) and the gender gap in NEET status (Section 7.1). Figure 53 shows both.

The first is the gap in PISA 2022 mathematics between students in the top and the bottom ESCS quartile of their country. Pooled across the nine partner countries, it amounts to 93.3 score points. Differences between the two quartiles in immigrant background, sex, home language and country account for 9.6 points, about 10 per cent. The unexplained part is 83.7 points. Unlike the immigrant gap, the socioeconomic gap is thus hardly associated with the other background characteristics included. The unexplained part is not a pure effect of socioeconomic status, however. It contains all differences between the quartiles that these characteristics do not capture, such as the schools and school tracks students attend, parental support with learning, participation in early childhood education or private tutoring, and differences in prior achievement.

The second gap concerns NEET status. Among 16–34-year-olds, the NEET rate of women exceeds that of men by 7.0 percentage points. The explained part is negative (–0.9 points): given their years of education, literacy and age, women would be expected to have a slightly lower NEET rate than men. The unexplained part (7.9 points) therefore exceeds the total gap. As with the pay gap in Section 12.2, the female NEET excess thus persists although young women's measured qualifications match or exceed young men's. It is consistent with caregiving and family formation (Section 7.1), which the model does not include, rather than with a qualification deficit. The same holds for the association between education and NEET status. In a linear probability model of 16–34-year-olds that allows it to differ by sex, a year of education is associated with a 2.0 percentage-point lower NEET probability for men and a significantly larger reduction, by a further 0.7 points, for women.

Figure 53. Socioeconomic achievement gap and gender NEET gap: explained and unexplained parts, PISA 2022 and PIAAC Cycles 1 and 2.



Note: Left: difference in mean mathematics score between the top and bottom within-country ESCS quartile, in score points, with the part explained by immigrant background, sex, home language and country; nine partner countries pooled. Right: difference in NEET rates between women and men aged 16–34, in percentage points, linear probability decomposition with the part explained by years of education, literacy, age and country-by-cycle fixed effects; Finland, Greece, Italy, Poland, Portugal and the United Kingdom (England). The diamond marks the total gap.

12.4 Beyond additive decompositions

The decompositions above, like the regressions of the field chapters, treat the determinants additively: each gap is split, and each association estimated, net of the others. WP1, however, defines its determinants as intersectional. They are factors that "cannot be approximated by linear models where the individual outcomes of different determining factors just add up", forming "a complex network characterized by non-linear interactions" (D1.1). The EDU-LAB research-question programme accordingly lists interaction models and structural-equation (path) methods among WP3A's tools (Ullman and Bentler, 2012).

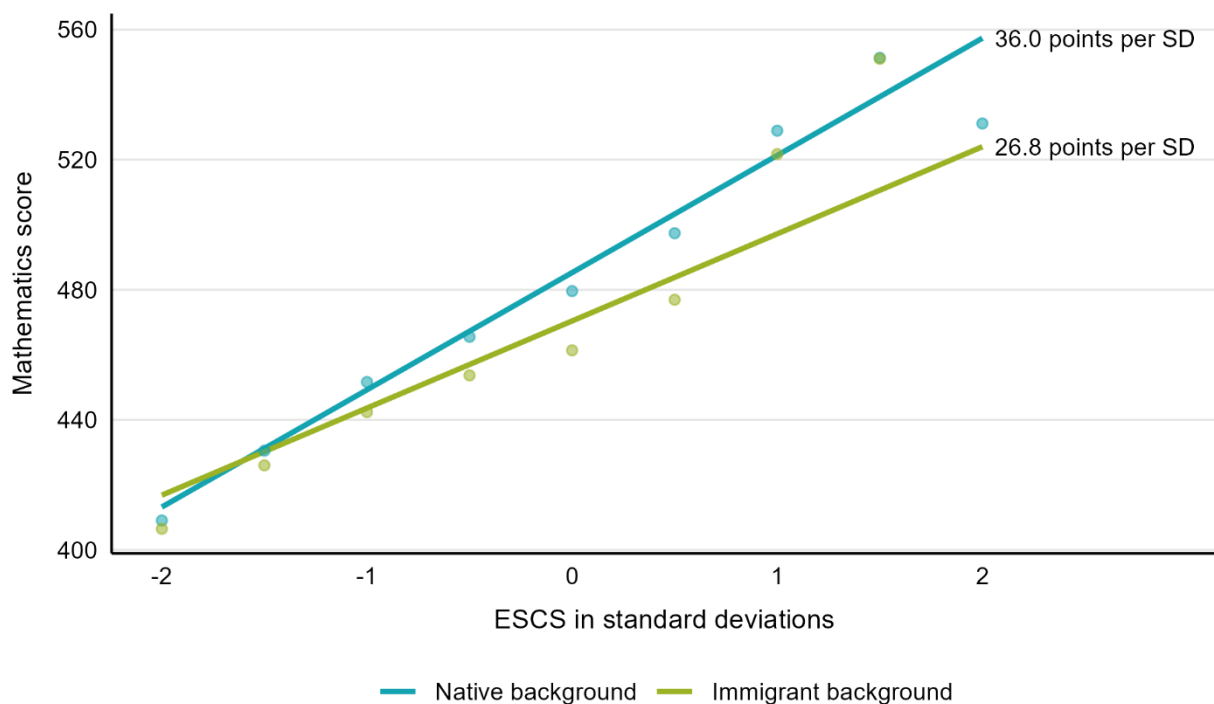
Sections 12.5 to 12.7 extend the additive picture in two ways. Sections 12.5 and 12.7 add interaction terms to the achievement and earnings models. Sections 12.6 and 12.7 estimate two path models that separate the part of a background association transmitted through intervening variables from the part that remains at equal values of those variables (Baron and Kenny, 1986; Imai, Keele and Tingley, 2010). The path models decompose associations under an assumed ordering of the variables and do not identify causal effects.

12.5 The socioeconomic gradient by migration background

Section 12.1 showed that the immigrant gap is largely associated with socioeconomic background and home language. The additive models, however, assume that socioeconomic status is associated with achievement in the same way for native and immigrant-background students. This section tests that assumption.

Section 5.3 reports the socioeconomic gradient as a single figure, 36.3 score points per standard deviation of ESCS pooled in 2022. To test whether it differs by migration background, an interaction between ESCS and immigrant background is added to a pooled PISA 2022 model. The model controls for sex and home language and includes country fixed effects. The gradient differs between the two groups (Figure 54). It is 36.0 points per standard deviation for native students and 26.8 points for immigrant-background students, a significant interaction of -9.3 points. Among immigrant-background students, a given difference in ESCS is thus associated with a smaller difference in achievement than among native students. The interactions of ESCS with sex and of immigrant background with sex are small and not significant.

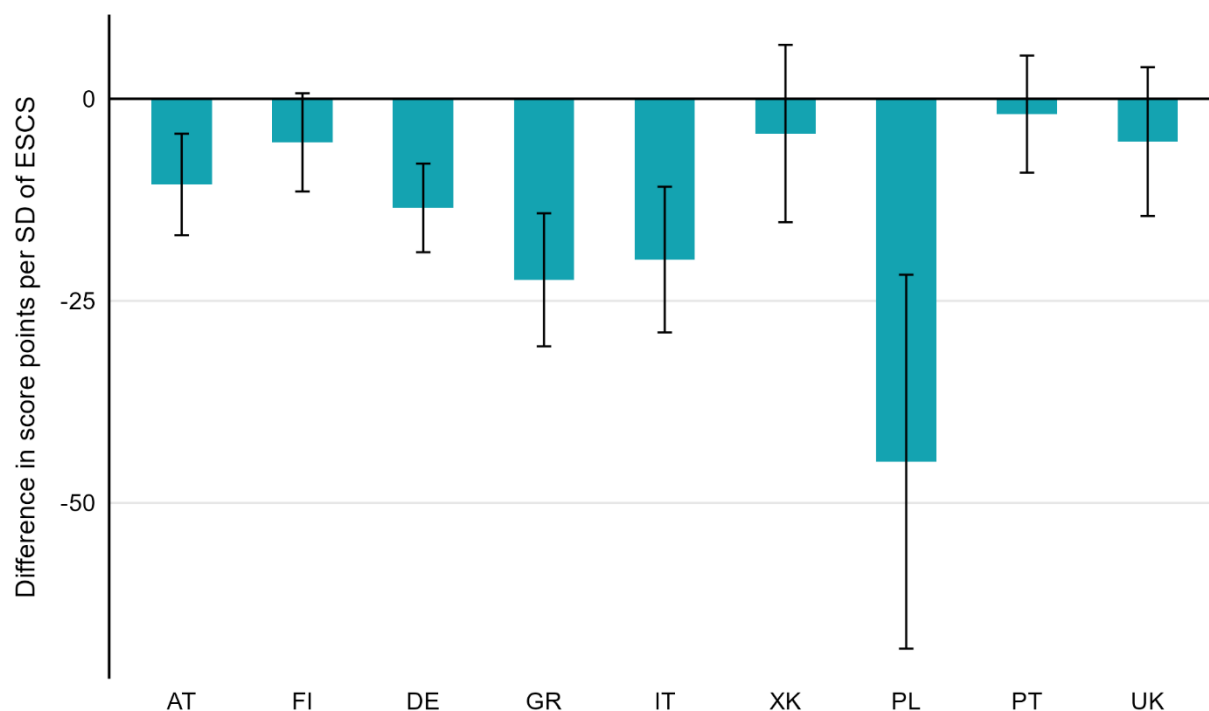
Figure 54. Socioeconomic gradient in mathematics, native and immigrant-background students, PISA 2022.



Note: Lines show the estimated gradient for each group from a pooled regression with an ESCS $\times$ immigrant-background interaction, sex, home language and country fixed effects, drawn through the group mean; dots show mean scores within ESCS intervals of half a standard deviation. Nine partner countries pooled.

The pooled estimate could conceal differences between countries. Estimated separately for each country (Figure 55), the gradient is flatter for immigrant-background students in all nine partner countries. The difference is significant at the 5 per cent level in Austria, Germany, Greece, Italy and Poland, and at the 10 per cent level in Finland. It is largest in Poland, where it is imprecisely estimated, and in Greece and Italy, and smallest in Portugal and Kosovo.

Figure 55. Difference in the socioeconomic gradient between immigrant-background and native students by country, PISA 2022.



Note: Immigrant-background gradient minus native gradient, in score points per standard deviation of ESCS, from country-specific regressions of mathematics on ESCS, immigrant background, sex and an ESCS $\times$ immigrant-background interaction. Negative values indicate a flatter gradient for immigrant-background students. 95% confidence intervals based on BRR replication and plausible values.

The model can be extended to a third dimension by allowing the difference in gradients between immigrant-background and native students to vary by sex. To do so, the pooled model is re-estimated with all two-way interactions between ESCS, immigrant background and sex. It also adds a three-way interaction between the three variables, again controlling for home language and with country fixed effects. The three-way interaction measures how much the flatter gradient among immigrant-background students differs between girls and boys. It is positive (+6.8 points), meaning that the gradient of immigrant-background girls is flattened somewhat less than that of immigrant-background boys. The estimate is significant only at the 10 per cent level, however, so it does not support a firm conclusion. The substantive departure from additivity therefore remains the two-way interaction between socioeconomic status and immigrant background.

12.6 Socioeconomic status, achievement and grade repetition

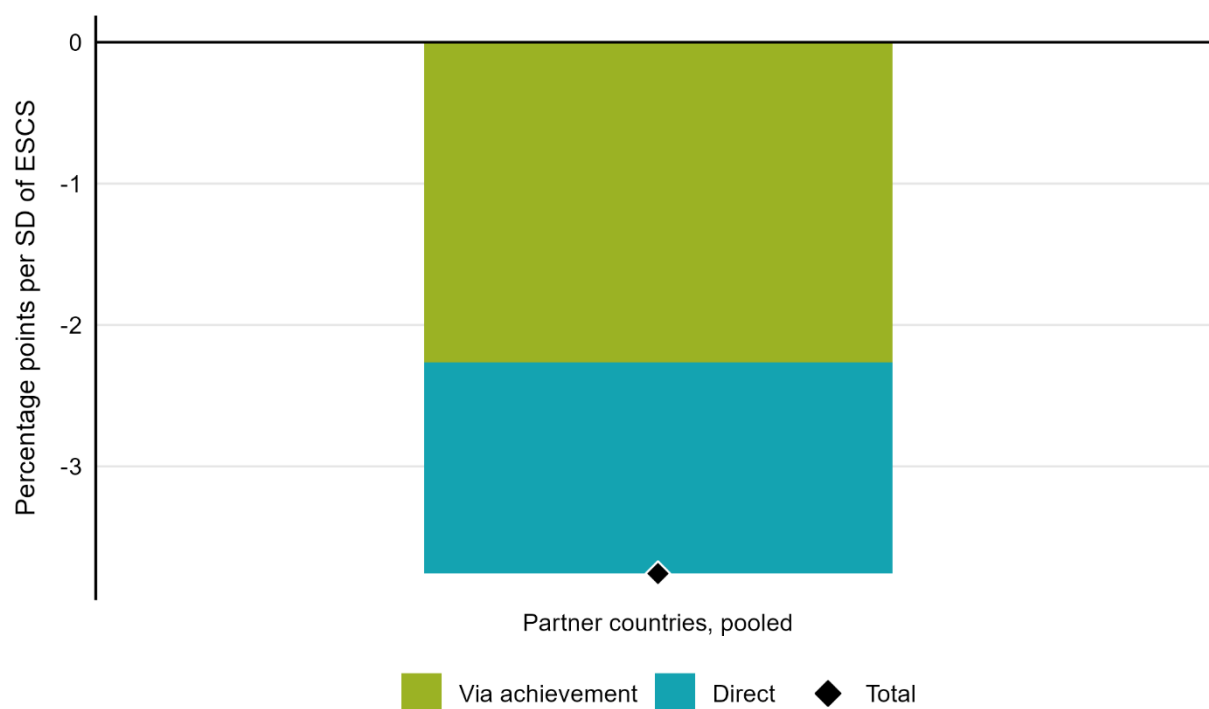
Grade repetition is one of the clearest socioeconomic gradients in the school-age data (Section 6.1). Students from less advantaged homes also score lower. The question is therefore whether the association with repetition simply reflects lower achievement, or persists at equal achievement. A path model separates the two.

The model consists of three regressions, each estimated on the pooled PISA 2022 sample with country fixed effects. The first regresses repetition on ESCS, controlling for immigrant background, sex and home language. Repetition is measured as the student's report of having repeated at least one grade. The ESCS coefficient in this regression is the total association between socioeconomic status and repetition. The second regression relates mathematics achievement to ESCS with the same controls and shows how strongly achievement differs with socioeconomic status. The third regresses repetition on ESCS and mathematics achievement together, again with the same controls. Its ESCS coefficient is the direct part: the association between socioeconomic status and repetition among students with the same achievement.

The part that runs through achievement is the difference between the total association and the direct part. In a linear model this equals the product of the ESCS coefficient in the achievement regression and the achievement coefficient in the third regression. Repetition is modelled as a linear probability, so all coefficients read as percentage points, and the two parts add up exactly to the total.

A one-standard-deviation higher ESCS is associated with a 3.8 percentage-point lower probability of having repeated a grade. Of this, 2.3 points (60 per cent) run through achievement: more advantaged students score higher, and higher-scoring students repeat less often. The remaining 1.5 points (40 per cent) are the direct part (Figure 56). At the same measured mathematics achievement, students from less advantaged homes are thus more likely to have repeated a grade.

Figure 56. Socioeconomic status and grade repetition: the role of mathematics achievement, PISA 2022



Note: Difference in the probability of having repeated a grade associated with one standard deviation higher ESCS, in percentage points, split into the part through mathematics achievement and the direct part at equal achievement; the diamond marks the total. Linear probability models with immigrant background, sex, home language and country fixed effects. Nine partner countries pooled.

Two limits apply to this decomposition. First, achievement is measured at age fifteen, after any repetition has taken place, and repeating a grade may itself affect achievement. Treating achievement as preceding repetition is therefore an approximation. Second, characteristics that are correlated with socioeconomic status but not measured, such as motivation or parental involvement in promotion decisions, may contribute to the direct part. The split therefore describes how the association is composed; it does not identify how much of it is caused by achievement.

12.7 Parental education, own education and labour-market outcomes

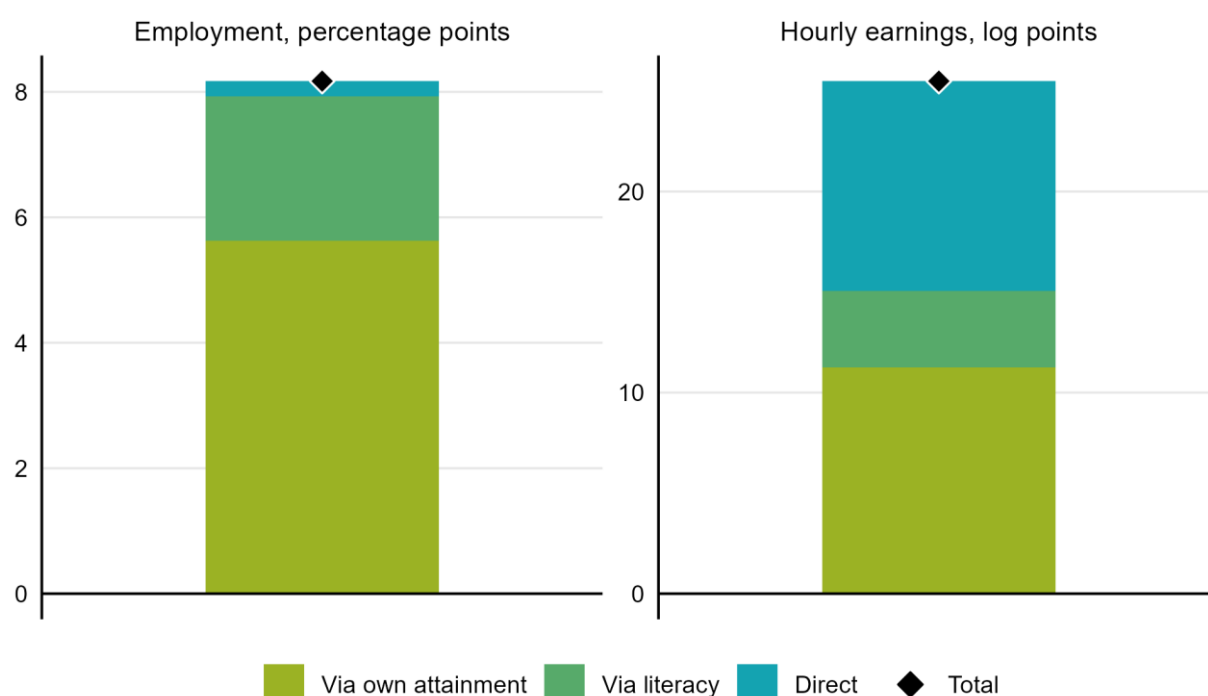
The second path model concerns how family background is transmitted into the labour market. Section 12.6 showed that part of the socioeconomic gradient in grade repetition persists at equal achievement. The corresponding question for adults is how far the advantage of having a tertiary-educated parent runs through the respondent's own education and skills, and how far it persists beyond them. The path model traces the association between having at least one tertiary-educated parent and labour-market outcomes through the

respondent's own years of education and measured literacy (Figure 57). It covers adults aged 25–64 and controls for sex, immigrant background, age and its square, and country-by-cycle fixed effects.

For employment, the association runs almost entirely through the two mediators. A tertiary-educated parent is associated with an 8.2 percentage-point higher employment probability, of which 5.6 points run through own education and 2.3 through literacy. The direct part is close to zero.

For hourly earnings, the total association is 25.5 log points, of which 11.2 run through own education and 3.8 through literacy. A direct part of 10.4 log points remains, about two-fifths of the total. This part collects all routes between parental education and earnings that are not represented by years of education and literacy. These may include field of study, the quality of the institutions attended, access to better-paying employers and occupations through family networks, and aspirations. None of these is measured here. The direct part therefore shows how much of the association the two mediators leave unaccounted for, not a causal effect of parental education.

Figure 57. Parental tertiary education and adults' employment and earnings: the role of own education and literacy, PIAAC Cycles 1 and 2



Note: Difference associated with having at least one tertiary-educated parent, in percentage points (employment) and log points (hourly earnings), split into the parts through the respondent's years of education and literacy and a direct part; the diamond marks the total. Controls: sex, immigrant background, age, age squared and country-by-cycle fixed effects. Ages 25–64. Employment: Finland, Greece, Italy, Poland, Portugal and the United Kingdom (England). Earnings: employed adults in Finland, Greece, Italy, Poland and the United Kingdom (England), trimmed at the 1st and 99th percentiles.

12.8 Summary

The field chapters show how large the gaps between groups are. This chapter asked how far each gap reflects differences in measured characteristics between the groups, and how far it remains among people who are alike in these characteristics. The answer differs sharply between gaps.

The native–immigrant gap in mathematics is largely explained. In seven of the eight countries where natives score higher, socioeconomic status, home possessions and home language account for most of it, and a substantial unexplained part remains only in Finland and Kosovo. The socioeconomic achievement gap is the opposite case. Immigrant background, sex and home language explain only about a tenth of it.

The gender pay gap arises although women are as well or better qualified than men. Among employed adults, women's education, literacy and age would predict slightly higher pay than men's. Job characteristics change this only a little, and education pays off at least as well for women. Among recent graduates, who all hold a tertiary qualification, differences in field of study explain a little more than half of the pay gap. The remainder persists and widens in the first years after graduation. Overall, the pay gap remains to a large degree unexplained.

The interaction and path models show that background does not act through a single, uniform channel. Among immigrant-background students, a higher socioeconomic status goes along with a smaller gain in achievement than among natives, and this holds in every partner country. A single socioeconomic gradient therefore overstates the association for immigrant-background students and understates it for natives. Following background along the trajectory shows that lower achievement accounts for only part of the higher repetition rate of students from less advantaged homes: at the same achievement, they are still more likely to have repeated a grade. Among adults, the employment advantage of having a tertiary-educated parent runs almost entirely through own education and literacy. About two-fifths of the earnings advantage is not accounted for by these qualifications and skills.

All of these results describe how associations are composed; they do not identify causal effects. Chapter 13 turns from the decomposition of gaps to a competence not yet examined in this report, digital skills.

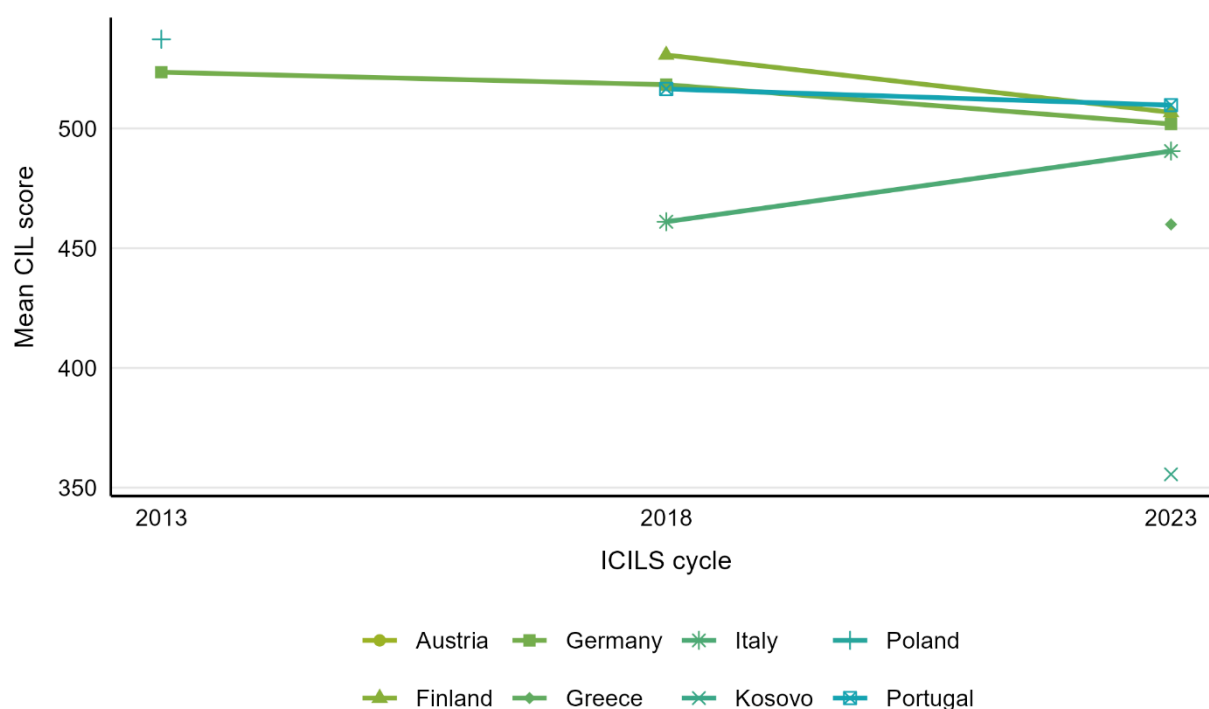
13 Deep Dive 2 – Digital skills and the digital divide

The digital transformation of education and work is one of the defining themes of the contemporary literature on transitions, and digital competence is increasingly a precondition for both further study and employment. The International Computer and Information Literacy Study (ICILS) measures two digital competences at grade eight that no other dataset in the holdings captures. Computer and information literacy (CIL) is the ability to use computers to investigate, create and communicate; computational thinking (CT), assessed since 2018, is the ability to formalise and solve problems in ways a computer could execute. This chapter asks how these competences are distributed across the partner countries and how unequally, with design-based (jackknife) inference throughout. ICILS holds no data for the United Kingdom, and Poland last took part in 2013, so the 2023 analyses cover seven partner countries; the migration gap, which also requires a sufficient number of students with an immigrant background, covers six. The chapter first describes levels and trends in CIL, then turns to its distribution by socioeconomic background, gender and migration, and finally examines computational thinking.

13.1 Levels and trends in digital literacy

Before asking how unequally digital competence is distributed, it helps to know how the partner countries compare in its level. Figure 58 shows mean CIL by country across the three ICILS cycles. In 2023, Portugal, Finland, Austria and Germany lie close together at around 500 to 510 points, Italy follows at about 490, and Greece (460) and Kosovo (356) score clearly lower. The level of digital literacy thus does not follow the transition regimes: the Southern systems span almost the whole range, from Portugal at the top to Greece near the bottom. Among the countries observed in more than one cycle, CIL declined between 2018 and 2023 in Finland (by 24 points), Germany (16) and Portugal (7), whereas Italy improved markedly (by 30 points). Levels alone, however, say little about who acquires digital skills within each country, and that is the question of the next section.

Figure 58. Computer and information literacy (CIL), ICILS 2013–2023



Note: Mean CIL score by country and ICILS cycle. The United Kingdom did not take part in ICILS; Poland took part only in 2013; Austria, Greece and Kosovo have data for 2023 only.

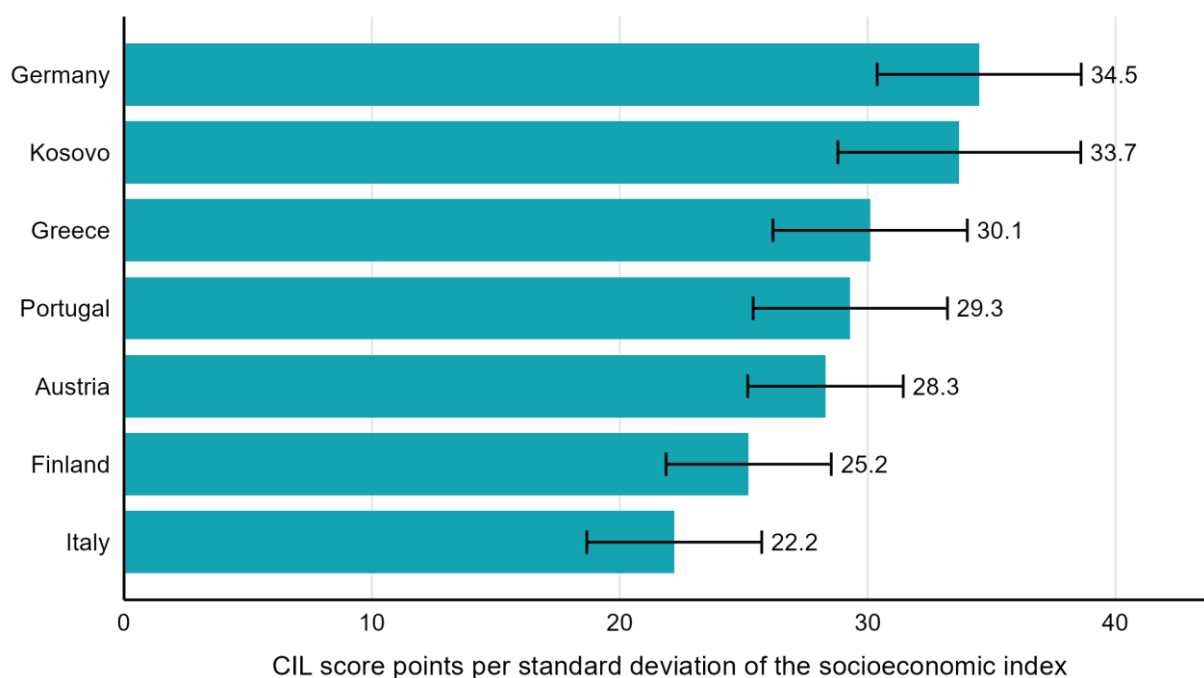
13.2 Heterogeneity in digital literacy

If digital competence is becoming a gateway to further study and work, it matters whether it is distributed more equally than traditional academic achievement or reproduces the same inequalities. Figure 59 shows the socioeconomic gradient in CIL, the score advantage associated with one standard deviation of the ICILS socioeconomic index. In 2023 it ranged from about 22 points in Italy and 25 in Finland to 28–30 in Austria, Portugal and Greece and about 34 in Germany and Kosovo. Digital skills are thus clearly stratified by socioeconomic background, although the gradients rest on a different socioeconomic index from PISA's and cannot be compared point for point with those in Chapter 5.

Two further patterns distinguish digital competence from mathematics. First, the gender gap runs the other way (Figure 60). Girls outperform boys in CIL in every partner country with 2023 data, by between about 9 points in Germany and Portugal and 24 points in Finland; only in Germany and Portugal does the interval include zero. This is the mirror image of the male advantage in mathematics documented in Chapter 5, and it underlines that gender gaps in achievement are domain-specific.

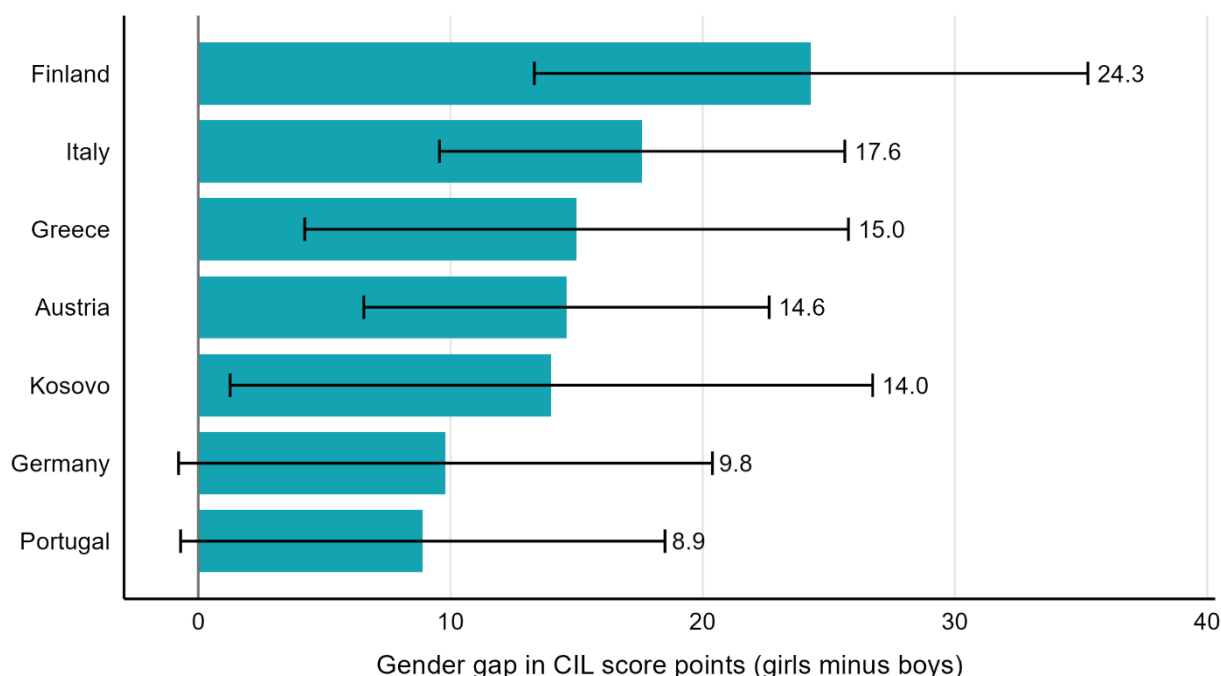
Second, the gap between students with and without an immigrant background is large: about 58 points in Finland, 42 in Germany and Greece, 30 in Portugal, 24 in Austria and 11 in Italy. In five of these six countries it exceeds the corresponding gap in PISA mathematics (Chapter 5); in Austria the two are about equal. Because the two studies differ in age group and controls, the comparison is only indicative. Digital competence thus reproduces the socioeconomic and migration gaps of traditional achievement while reversing its gender gap. Because digital competence is increasingly a gateway skill for both further study and employment, these socioeconomic and migration divides in CIL are a distinct and policy-relevant inequality, not merely a restatement of the academic gradient.

Figure 59. Socioeconomic gradient in digital literacy, ICILS 2023



Note: Difference in mean CIL score associated with one standard deviation of the ICILS socioeconomic index, with 95% confidence intervals based on jackknife replication and plausible values. The United Kingdom and Poland are not included because they have no 2023 data.

Figure 60. Gender gap in digital literacy (girls minus boys), ICILS 2023



Note: Difference in mean CIL score between girls and boys, with 95% confidence intervals based on jackknife replication and plausible values. The United Kingdom and Poland are not included because they have no 2023 data.

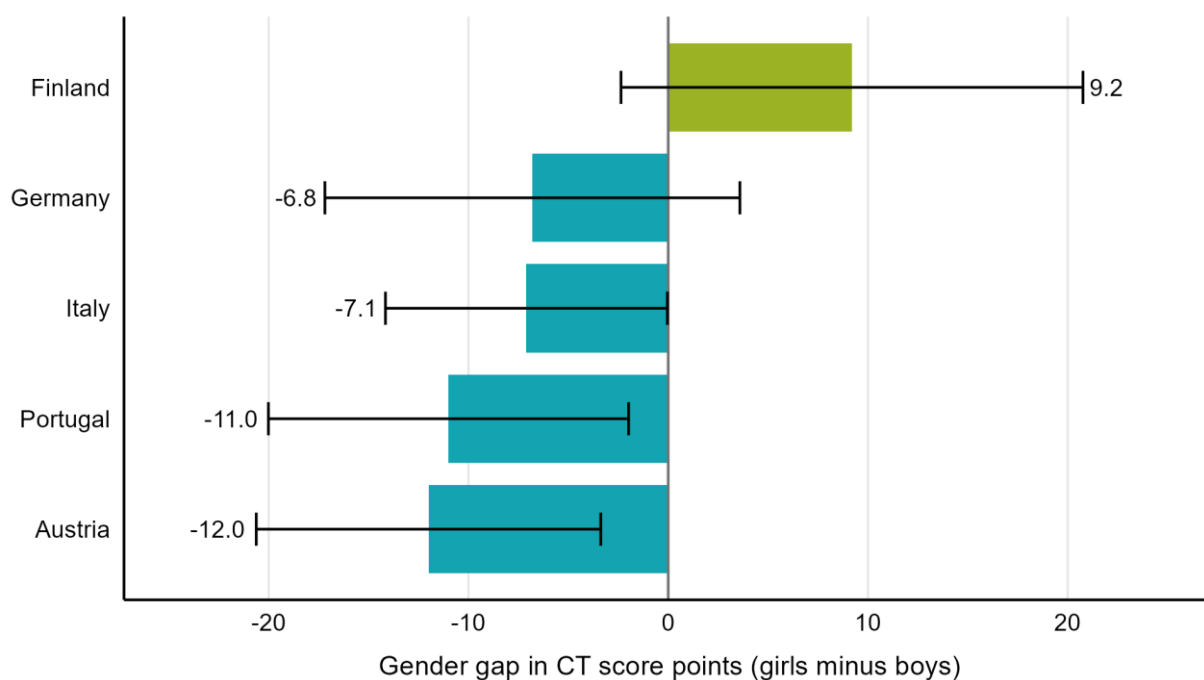
13.3 Heterogeneity in computational thinking

Computer and information literacy is only one side of digital competence. Computational thinking (CT), the more mathematical skill of formalising problems so that a computer could solve them, is closer to what

programming and data-related work require (Fraillon et al., 2020). The CT module was not administered in Greece, Kosovo or Poland, so this section covers Austria, Finland, Germany, Italy and Portugal. CT is more strongly graded by socioeconomic background than CIL. One standard deviation of the ICILS socioeconomic index is associated with about 36 points in CT on average across these five countries, ranging from about 26 in Italy to 47 in Germany, against 28 points in CIL. The CT gradient is steeper than the CIL gradient in each of the five countries. The digital divide thus extends to computational reasoning and is even wider there.

The gender pattern, by contrast, differs between the two competences (Figure 61). Across the five countries with CT data, girls score on average about 15 points higher than boys in CIL, whereas in computational thinking boys lead by about 5 points. Finland is the only country where girls lead in CT, although its interval includes zero, and the male advantage is clearly established only in Austria and Portugal. The female advantage is thus specific to information handling and gives way to a male advantage in the more mathematical domain of problem formalisation, which parallels the contrast between mathematics and reading among fifteen-year-olds (Chapter 17). Digital competence is therefore no exception to the patterns found elsewhere in this report: it is socially graded in both its forms, and its gender gap depends on the domain, just as in traditional achievement.

Figure 61. Gender gap in computational thinking (girls minus boys), by country, ICILS 2023.



Note: Difference in mean CT score between girls and boys; the dashed line marks the gender gap in computer and information literacy across the partner countries with 2023 data. The CT module was not administered in Greece, Kosovo or Poland, and the United Kingdom did not take part in ICILS.

13.4 Summary

The chapter asked how digital competence is distributed across the partner countries and how unequally. In computer and information literacy, Portugal, Finland, Austria and Germany lie close together in 2023, Italy follows, and Greece and Kosovo score clearly lower. Within countries, digital competence is stratified by socioeconomic background, and computational thinking even more so than information literacy. Students with an immigrant background lag well behind, in most countries by more than in mathematics. The gender gap depends on the domain: girls lead in information literacy, whereas boys hold a small advantage in computational thinking. None of these patterns follows the transition regimes, whose members spread across the whole range; only Finland, the sole Nordic system, stands out, with the largest female advantage and the largest immigrant gap, as in mathematics. Digital skills thus reproduce the socioeconomic and

migration gaps of traditional achievement rather than offsetting them. The next chapter follows the socioeconomic gradient across the life course and over two decades.

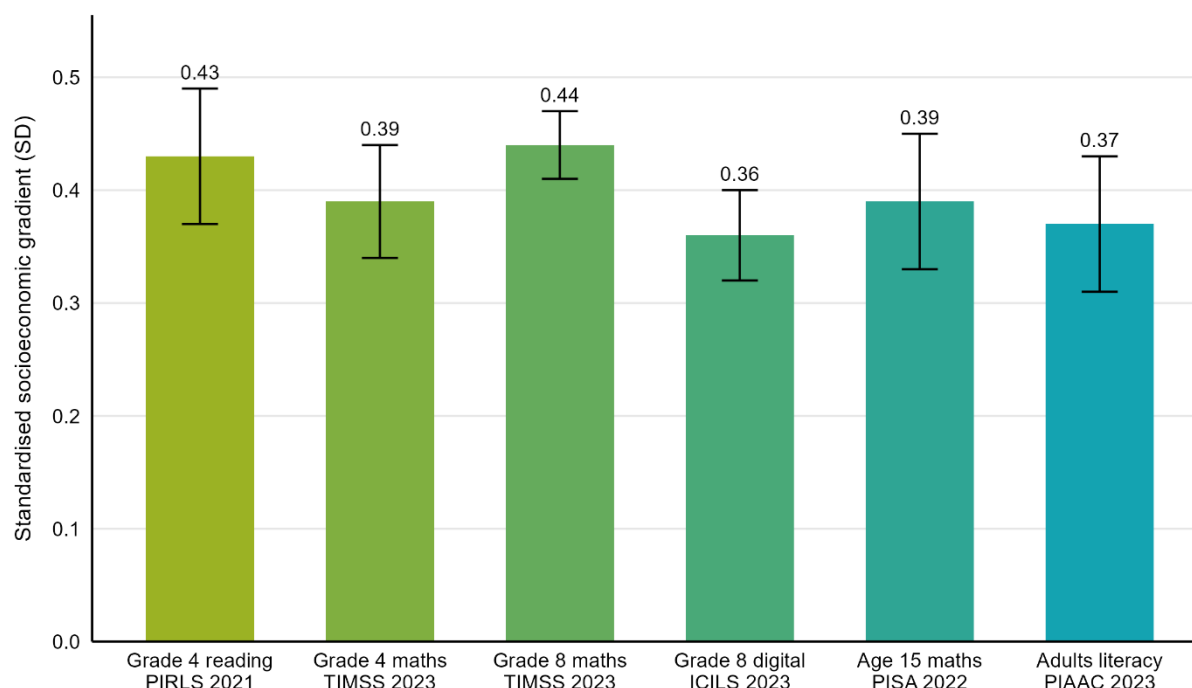
14 Deep Dive 3 — The evolution of the socioeconomic gradient

The field chapters and the preceding deep dives estimate the socioeconomic gradient separately for each survey, age group and period. This chapter brings these estimates together and asks how the gradient changes along the educational pathway and over time. Section 14.1 compares the gradient from grade four to the adult population on a common standardised scale. Section 14.2 adds the years in higher education for Austria, which is covered by both EUROSTUDENT and EUROGRADUATE. Section 14.3 turns from stages to periods and follows the grade-four gradient in TIMSS and PIRLS since 2011. All three analyses compare different people at each point rather than following the same individuals. They therefore describe how the gradient differs between stages and periods, not how it develops within persons.

14.1 The gradient over the life-course

To place the surveys on a common scale, the gradient is expressed at each stage as a standardised association: the difference in achievement, in standard deviations, associated with one standard deviation of the socioeconomic measure available in that survey. The measure differs between surveys: home learning resources in PIRLS and TIMSS, the ICILS socioeconomic index, ESCS in PISA and parental education in PIAAC. Each value in Figure 62 is the mean of the country-specific gradients across the partner countries with data, which range from five countries in TIMSS grade eight to nine in PISA.

Figure 62. Standardised socioeconomic gradient from grade four to adulthood, partner-country averages



Note: Mean of the country-specific standardised gradients: the difference in achievement, in standard deviations, associated with one standard deviation of the socioeconomic measure of each survey, from bivariate weighted regressions without further controls. Whiskers show ± 1 standard deviation of the country gradients around the partner mean; they describe differences between countries and are not confidence intervals. Grade four: PIRLS 2021 reading (8 countries) and TIMSS 2023 mathematics (6), home learning resources. Grade eight: TIMSS 2023 mathematics (5), home learning resources; ICILS 2023 computer and information literacy (7), ICILS socioeconomic index. Age fifteen: PISA 2022 mathematics (9), ESCS. Adults aged 16–65: PIAAC Cycle 2 literacy (7), parental education.

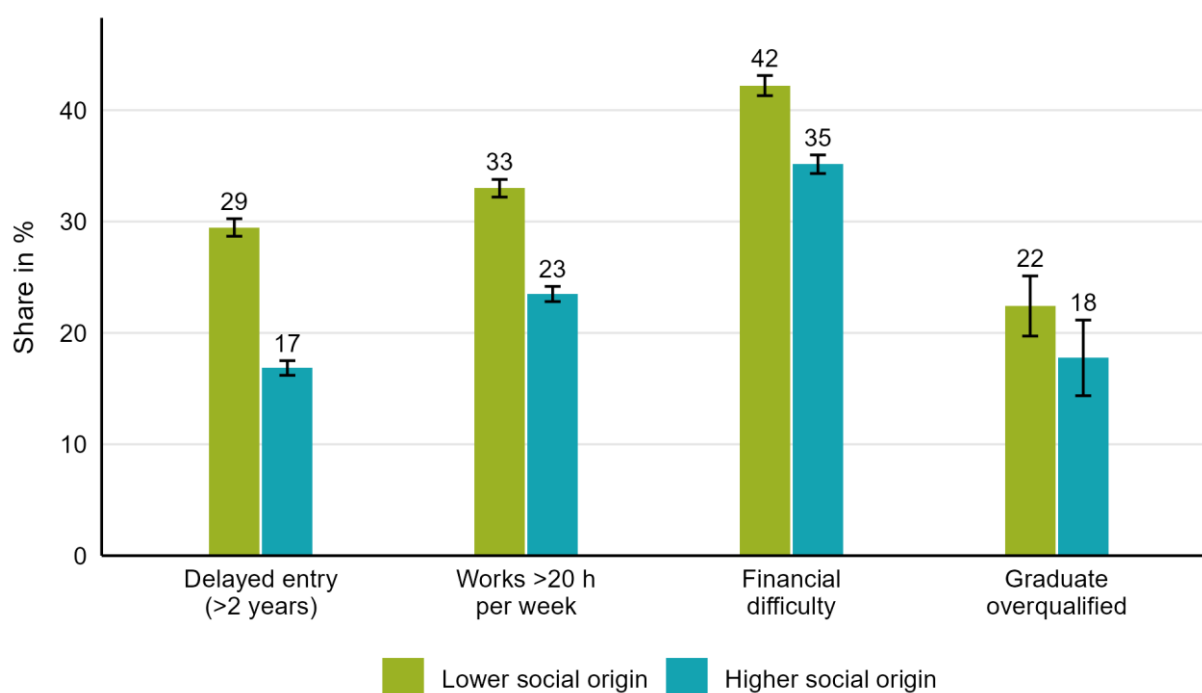
At grade four, one standard deviation of home learning resources is associated with 0.43 standard deviations in reading and 0.39 in mathematics. The later stages lie in the same range: 0.44 in grade-eight mathematics, 0.36 in grade-eight computer and information literacy, 0.39 in mathematics at age fifteen and 0.37 in adult literacy. In standardised terms, the socioeconomic gradient is therefore clearly established by grade four and of similar strength at every later stage, including among adults. Moreover, the partner countries differ little from one another at each stage, with standard deviations of 0.03 to 0.06 around the mean as indicated by the whiskers in Figure 62.

Three qualifications limit this reading. First, the stages refer to different cohorts and partly to different countries, so the profile compares populations rather than following individuals. Second, the socioeconomic measures differ in content and precision, and a coarser measure tends to yield a weaker association; similar values therefore do not necessarily imply that the gradient is identical across stages. Third, a stable standardised association is compatible with a widening gradient in score points when the dispersion of achievement grows with age; Section 17.2 examines this for the step from grade four to grade eight. The profile thus shows that socioeconomic differences in competence are present before the end of primary school and are of similar relative size among adults. It does not show whether individual stages of the education system reduce, reproduce or add to them.

14.2 The socioeconomic gradient in higher education

The life-course profile of Section 14.1 runs from primary school to the adult population but leaves out the years in higher education. For Austria these years can be added, because the country appears in both EUROSTUDENT and EUROGRADUATE. Figure 63 compares students and graduates of lower and higher social origin at three points: entry into higher education, the conditions of study, and the first years after graduation.

Figure 63. The social gradient in higher education, Austria.



Note: Weighted shares in per cent, with 95% confidence intervals. Delayed entry, working hours and financial difficulty: students in EUROSTUDENT 8, by whether at least one parent has a tertiary qualification. Financial difficulty refers to students giving a clear yes or no answer. Overqualification: employed graduates in EUROGRADUATE 2018, by whether at least one parent holds a bachelor's degree or higher.

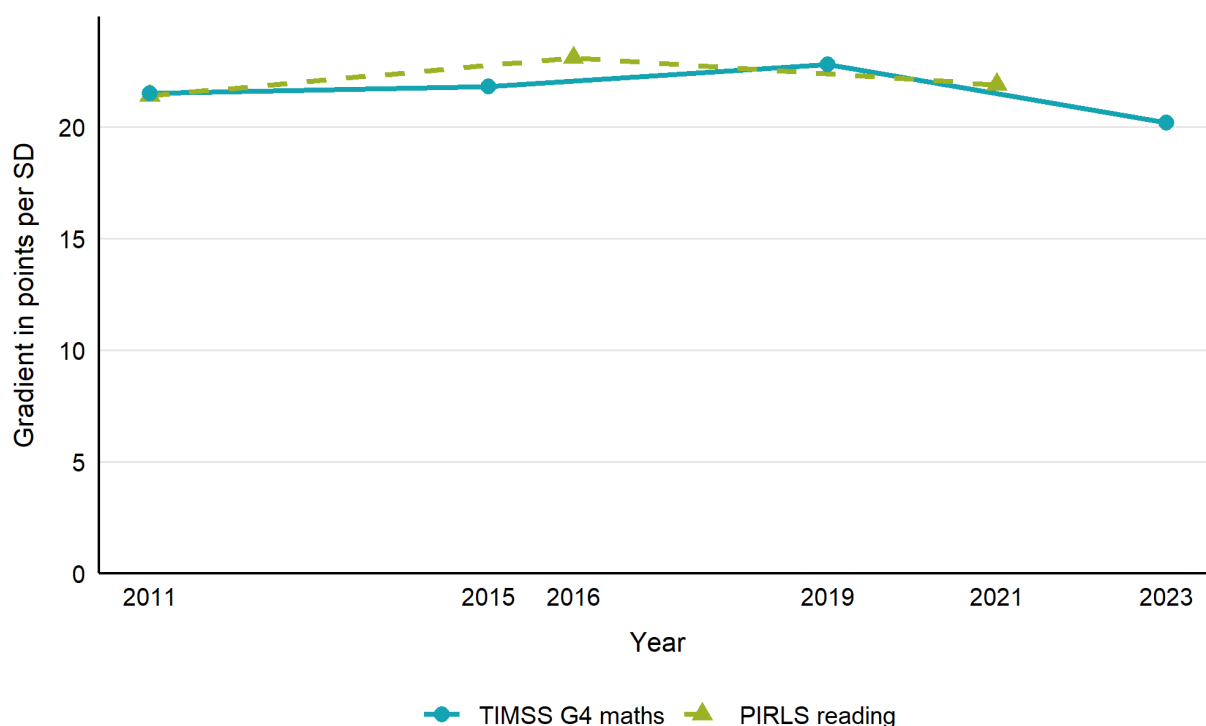
At every point the gradient runs in the same direction. Students of lower social origin more often enter higher education with a delay of more than two years (29 against 17 per cent). During their studies, they more often work more than 20 hours a week (33 against 23 per cent) and more often report financial difficulties (42 against 35 per cent). After graduation, first-generation graduates are more often overqualified for their job (22 against 18 per cent). This last difference rests on a much smaller sample and is less precisely estimated, but it is still larger than its sampling uncertainty. The two surveys cover different people and cohorts, so the figure does not follow individuals through higher education. The consistent direction across all three points is, however, in line with disadvantage accumulating along the pathway rather than arising at a single transition.

14.3 The gradient over time

Sections 14.1 and 14.2 compare stages at a given point in time. Whether the gradient has changed across cohorts can be examined for grade four, where TIMSS and PIRLS provide a consistent socioeconomic measure, books at home, since 2011. In mathematics (TIMSS), the gradient was 21.5 score points per standard deviation in 2011, 21.8 in 2015, 22.8 in 2019 and 20.2 in 2023. In reading (PIRLS), it was 21.4 in 2011, 23.1 in 2016 and 21.9 in 2021 (Figure 64). The changes between cycles amount to at most 2.6 points and are small compared with the differences between countries, whose gradients vary around the partner average with a standard deviation of 4.0 to 6.6 points. Because the averages include all partner countries that took part in a given cycle, part of these changes may also reflect changes in participation. Among grade-four students, the socioeconomic gradient thus shows no clear trend in either direction over the period.

This differs from age fifteen, where the ESCS gradient in PISA mathematics widened from 33.2 points in 2015 to 36.3 in 2022 (Section 5.3). The two series refer to different ages, socioeconomic measures and periods and are not directly comparable. Neither shows a narrowing of the gradient.

Figure 64. Socioeconomic gradient (books at home) in grade four, TIMSS 2011–2023 and PIRLS 2011–2021



Note: Mean of the country-specific gradients: the difference in score points associated with one standard deviation of the number of books at home, standardised within country and cycle, from bivariate weighted regressions without further controls, averaged over plausible values. The averages include all partner countries participating in each cycle. TIMSS: mathematics; PIRLS: reading.

14.4 Summary

The chapter asked how the socioeconomic gradient changes along the educational pathway and over time. In standardised terms, the gradient is clearly established by grade four. One standard deviation of the socioeconomic measure is associated with about 0.4 standard deviations in achievement at grade four, and the gradient is of similar size at grade eight, at age fifteen and among adults, with little variation between the partner countries. For Austria, the years in higher education point the same way. Students of lower social origin more often enter late, work long hours and report financial difficulty, and first-generation graduates are more often overqualified. Among grade-four students, the gradient in TIMSS and PIRLS shows no clear trend since 2011, whereas at age fifteen it widened between 2015 and 2022. All comparisons refer to different cohorts and partly to different countries and socioeconomic measures. They show that socioeconomic differences in competence are present before the end of primary school and persist at every later stage, but not whether individual stages reduce, reproduce or add to them. The next chapter examines adult skills more closely, using PIAAC.

15 Deep Dive 4 — Adult skills and lifelong learning

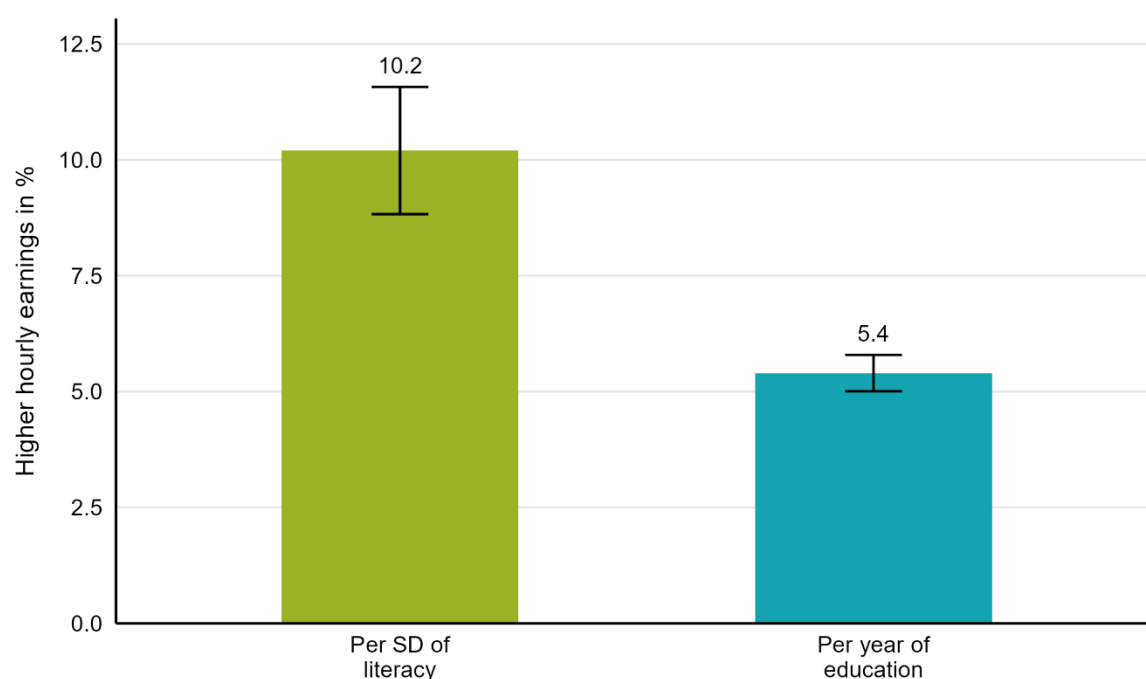
Section 14.1 showed that the socioeconomic gradient in skills is present among adults as well as among school students. This chapter examines adult skills more closely, using PIAAC, which measures literacy and numeracy directly among adults. Section 15.1 asks whether earnings are associated with measured literacy in addition to years of education. Section 15.2 compares participation in adult education and training by educational attainment. Section 15.3 compares adults' literacy and numeracy by parental education, and Section 15.4 repeats the earnings comparison of Section 15.1 for numeracy. All analyses pool PIAAC Cycles 1 and 2 and refer to adults aged 25–64. They compare adults at one point in time and do not follow individuals. The pooled estimates use the survey weights without rescaling, so countries contribute in proportion to their population, and countries observed in both cycles contribute with both. Austria and Germany are not included, because the PIAAC public-use files do not record respondents' exact age, and Kosovo did not take part in PIAAC.

15.1 Skills and credentials in earnings

Section 7.3 showed that hourly earnings rise with years of education. That model does not control for measured skills, so its estimates include any part of the return that operates through them. PIAAC's direct measurement of literacy makes it possible to consider both together. A regression of log hourly earnings on years of education and literacy is estimated for employed adults. It controls for gender, age, and country and cycle, and covers the five partner countries for which PIAAC records hourly earnings. Literacy is standardised, so its coefficient refers to a difference of one standard deviation.

Holding literacy constant, each additional year of education is associated with about 5.4 per cent higher hourly earnings (Figure 65). Holding years of education constant, one standard deviation of literacy is associated with about 10.2 per cent higher earnings. Both associations are statistically significant. Earnings are therefore associated with measured skills in addition to formal education, and with formal education in addition to measured skills. The two coefficients refer to different units, a year of education and a standard deviation of literacy, so their sizes cannot be compared directly. The model describes associations among the employed and does not show whether education or literacy causes the differences in earnings.

Figure 65. Earnings returns to years of education and literacy, PIAAC Cycles 1 and 2



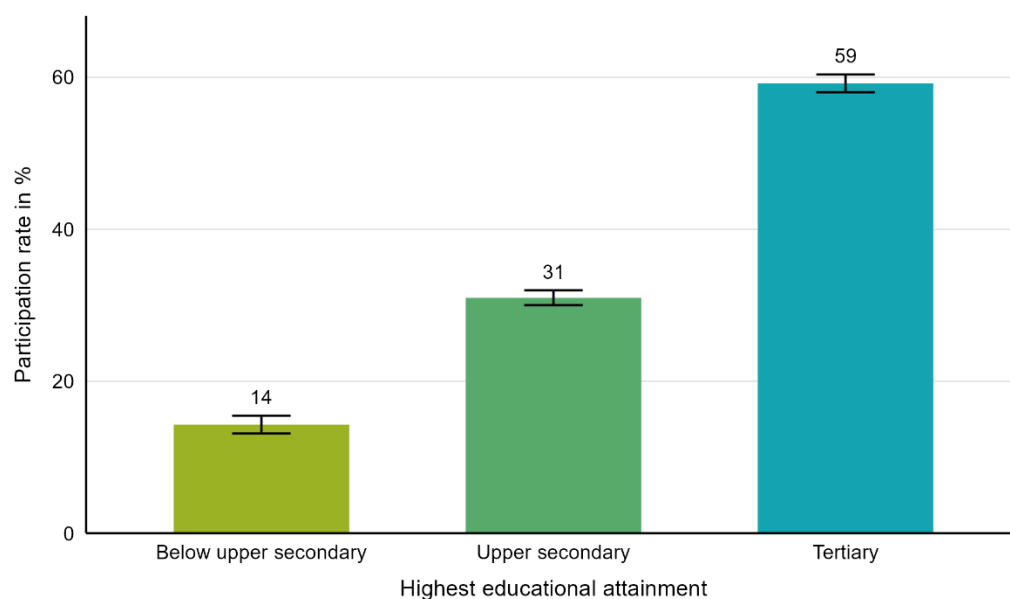
Note: Coefficients on years of education and on literacy from a weighted regression of log hourly earnings, multiplied by 100 so that they approximate percentage differences, with 95% confidence intervals based on replicate weights. Literacy is the mean of the plausible values, standardised with the unweighted mean and standard deviation of the estimation sample. The model also controls for gender, age and its square, and includes fixed effects for each combination of country and cycle. Employed adults aged 25–64 with positive earnings; Cycles 1 and 2 pooled across Finland, Greece, Italy, Poland and the United Kingdom (England only). Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age; Portugal's file does not record hourly earnings.

15.2 Participation in adult learning

Education and training can continue in adulthood. PIAAC records whether respondents took part in non-formal education or training in the twelve months before the survey. This includes courses, private lessons, seminars, workshops, distance education and organised on-the-job training.

Participation rises with educational attainment (Figure 66). Among adults with less than upper-secondary education, 14 per cent took part, against 31 per cent of those with upper-secondary and 59 per cent of those with tertiary education. Adults with tertiary education are thus about four times as likely to take part as those without an upper-secondary qualification, so adult learning most often reaches those who already have the most initial education. The comparison does not account for other characteristics, such as age, occupation or employment status, which differ between the groups and are also associated with participation. The data do not show whether participation is associated with later earnings or employment.

Figure 66. Participation in non-formal adult education and training by educational attainment, PIAAC Cycles 1 and 2

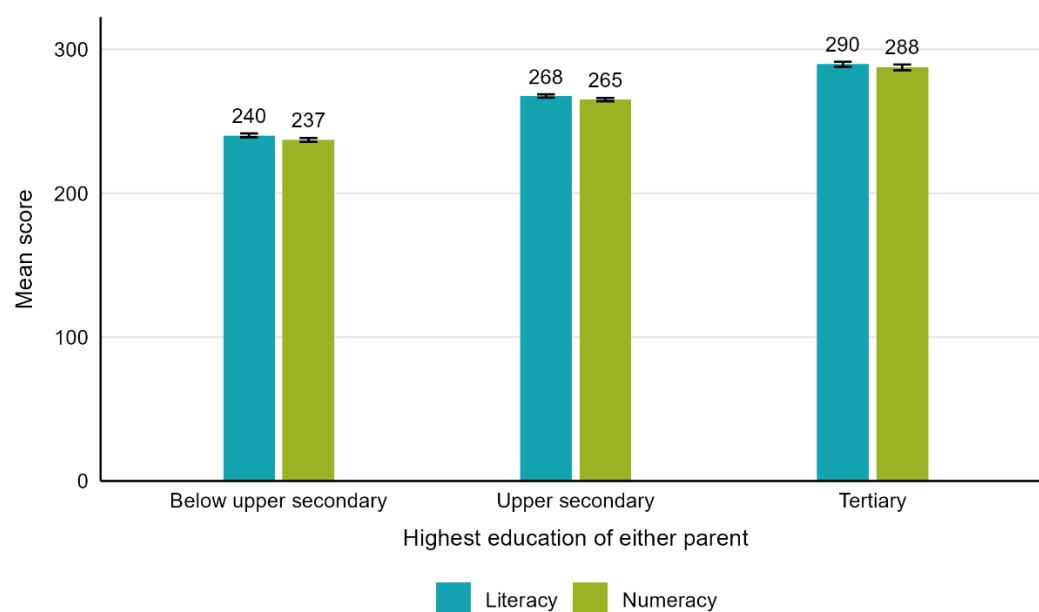


Note: Share of adults aged 25–64 who took part in non-formal education or training in the twelve months before the survey, in per cent, by highest educational attainment, with 95% confidence intervals based on replicate weights. Upper secondary includes post-secondary non-tertiary education. Cycles 1 and 2 pooled across Finland, Greece, Italy, Poland, Portugal and the United Kingdom (England only). Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age.

15.3 The inheritance of skills

Section 6.3 showed that tertiary attainment is closely associated with parental education. Section 14.1 showed that the socioeconomic gradient in literacy is of similar standardised size among adults as among school students. Figure 67 shows this gradient in score points.

Figure 67. Adult literacy and numeracy by parental education, PIAAC Cycles 1 and 2



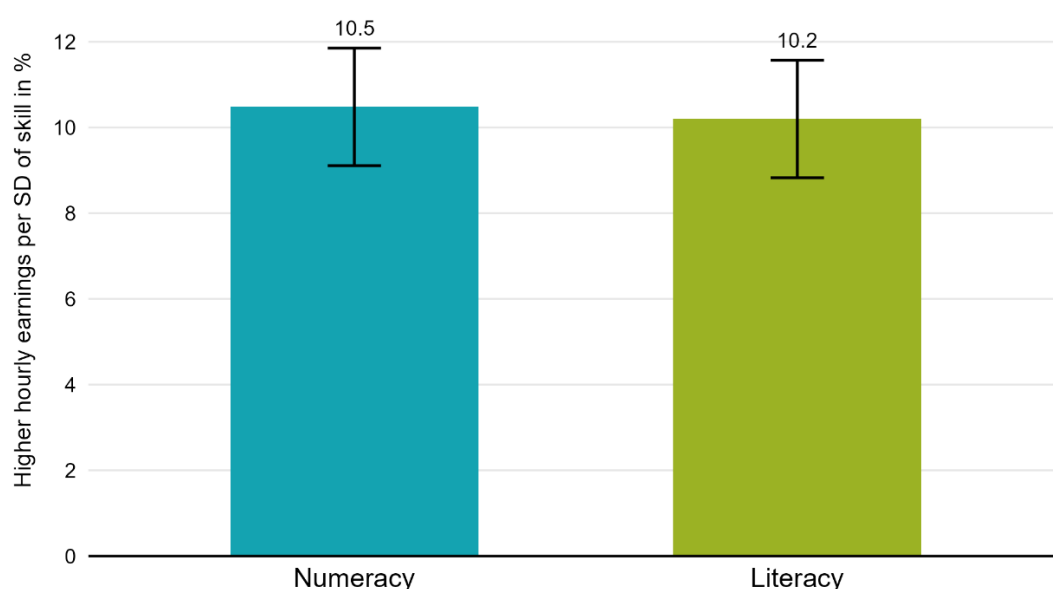
Note: Mean literacy and numeracy scores of adults aged 25–64 by the highest educational attainment of either parent, with 95% confidence intervals based on replicate weights; scores averaged over plausible values. Cycles 1 and 2 pooled across Finland, Greece, Italy, Poland, Portugal and the United Kingdom (England only). Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age.

Mean literacy is about 240 points among adults whose parents did not complete upper-secondary education. It is 268 among those with at least one parent holding an upper-secondary qualification, and 290 among those with at least one tertiary-educated parent. This is a difference of about 50 points between the lowest and the highest group. Numeracy shows the same pattern, rising from about 237 to 265 and 288 points. In both domains, each step in parental education is associated with a statistically significant difference. However, the comparison covers adults of different ages and cohorts.

15.4 The labour-market value of adult skills

Section 15.1 related earnings to literacy. Because PIAAC also measures numeracy, the same model can be estimated with numeracy in place of literacy, on the same sample and with the same controls. Holding years of education constant, one standard deviation of numeracy is associated with about 10.5 per cent higher hourly earnings, against 10.2 per cent for literacy (Figure 68). The two returns are of similar size, and their confidence intervals overlap almost entirely. When interpreting these findings, it should be considered that literacy and numeracy are closely correlated but are entered in separate models, so each coefficient also reflects part of the association with the other skill.

Figure 68. Earnings returns to numeracy and literacy, PIAAC Cycles 1 and 2.



Note: Coefficients on numeracy and on literacy from two separate weighted regressions of log hourly earnings, each also including years of education, multiplied by 100 so that they approximate percentage differences, with 95% confidence intervals based on replicate weights. Skills are the mean of the plausible values, standardised with the unweighted mean and standard deviation of the estimation sample; the intervals do not include imputation variance. Sample and further controls as in Figure 65.

15.5 Summary

The chapter examined adult skills with PIAAC. Among employed adults, earnings are associated both with years of education and with measured skills. Holding the other constant, a year of education is associated with about 5.4 per cent and one standard deviation of literacy with about 10.2 per cent higher hourly earnings; the return to numeracy, 10.5 per cent, is of similar size. Participation in non-formal adult education and training rises from 14 per cent among adults without upper-secondary education to 59 per cent among those with tertiary education. Adults' literacy and numeracy differ by about 50 points between those whose parents did not complete upper-secondary education and those with a tertiary-educated parent. All comparisons are cross-sectional and descriptive. The next chapter turns from skills and earnings to two subjective outcomes, life satisfaction and social trust.

16 Deep Dive 5 – Subjective outcomes of education

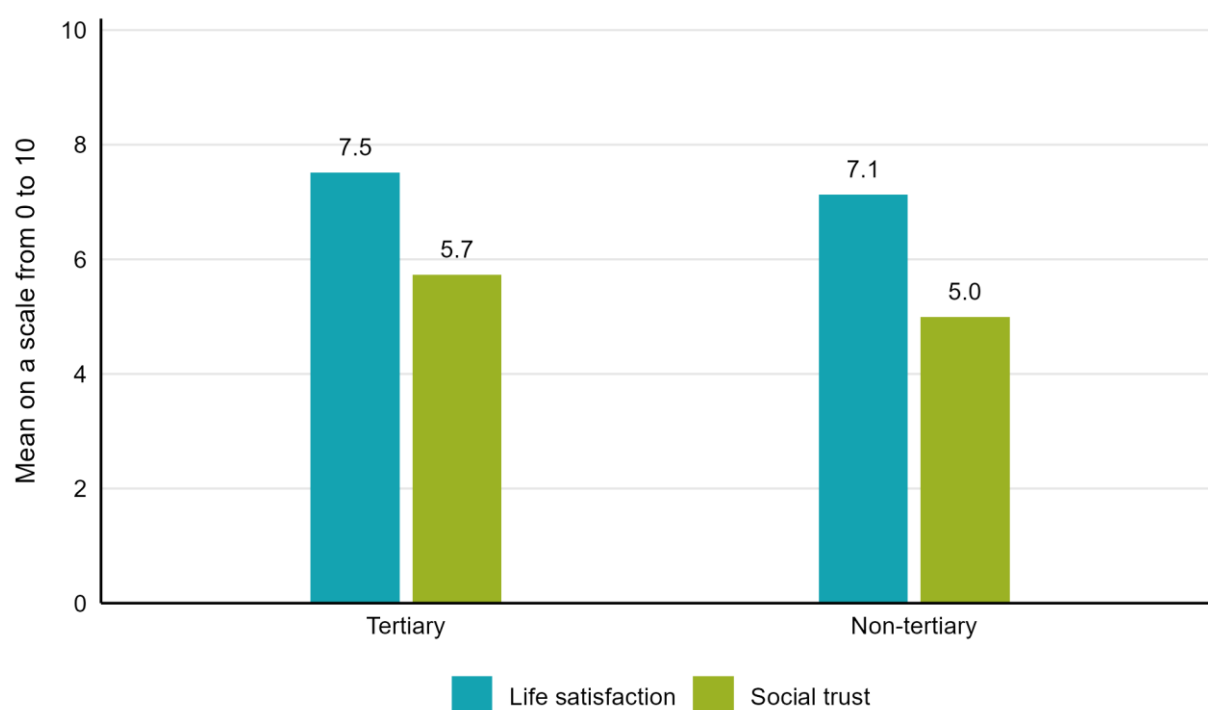
The preceding chapters measure the outcomes of education in attainment, skills, employment and earnings. This chapter turns to two subjective outcomes measured in the European Social Survey (ESS), introduced in Section 6.3. Life satisfaction is measured by how satisfied respondents are with their life as a whole, on a scale from 0 (extremely dissatisfied) to 10 (extremely satisfied). Social trust is measured by whether respondents think that, generally speaking, most people can be trusted or that one cannot be too careful in dealing with people, on a scale from 0 (cannot be too careful) to 10 (most people can be trusted).

The ESS covers eight of the nine partner countries, all except Kosovo. The analyses pool the 2020 and 2023 rounds and are restricted to adults aged 30–59, an age range in which initial education is largely completed. Values are unweighted averages of the country estimates, each estimated using the ESS analysis weight. Country cells with thirty or fewer respondents are not used; this affects only the unemployed in Poland, so the averages for the unemployed rest on seven countries. Section 16.1 compares adults by education, Section 16.2 by employment status. Both comparisons are descriptive.

16.1 Well-being and trust by education

Adults with tertiary education report higher life satisfaction than those without (7.5 against 7.1) and higher social trust (5.7 against 5.0); both differences are statistically significant, and the difference in trust is about twice that in life satisfaction (Figure 69). The comparison does not account for other characteristics. It may therefore partly reflect the higher employment and earnings of tertiary graduates (Sections 7.2 and 7.3) and other characteristics associated with education, such as parental background.

Figure 69. Life satisfaction and social trust by education, ESS



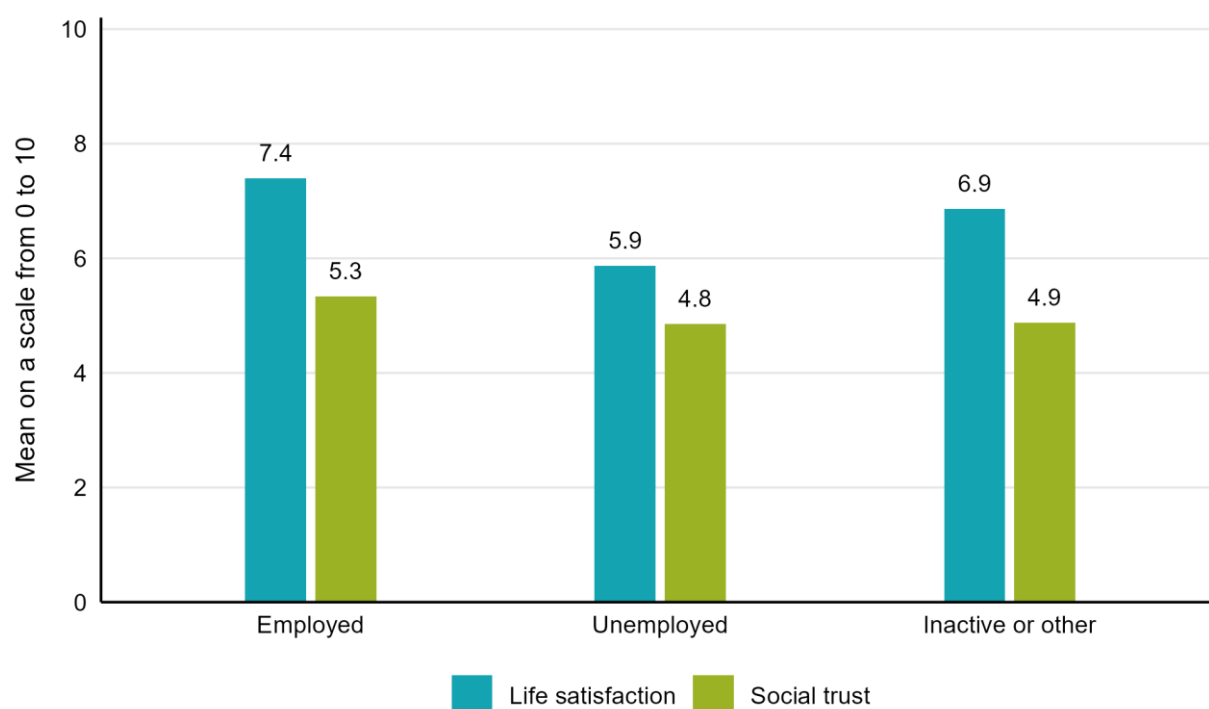
Note: Mean scores on a scale from 0 to 10 among adults aged 30–59, by whether the respondent has attained tertiary education; respondents with missing information on their own education are counted as non-tertiary. Values are unweighted averages of the eight partner countries covered by the ESS (2020 and 2023 rounds pooled), each estimated using the ESS analysis weight.

16.2 Well-being and trust by employment status

Differences by employment status are larger. Employed adults report a mean life satisfaction of 7.4, against 5.9 for the unemployed and 6.9 for those neither employed nor unemployed (Figure 70). The gap between the employed and the unemployed, 1.5 points, is about four times the gap between adults with and without

tertiary education. Social trust is lower among both the unemployed and the inactive (4.8 and 4.9) than among the employed (5.3). Because the unemployed form a small group in each country, their averages are less precise than those for the employed. The data do not show the direction of the association: unemployment may lower well-being, but lower well-being or poor health may also make employment less likely.

Figure 70. Life satisfaction and social trust by employment status, ESS



Note: Mean scores on a scale from 0 to 10 among adults aged 30–59, by main activity. Inactive or other comprises respondents neither in paid work nor unemployed. Values are unweighted averages of the partner countries covered by the ESS (2020 and 2023 rounds pooled), each estimated using the ESS analysis weight; country cells with thirty or fewer respondents are excluded, so the averages for the unemployed do not include Poland.

16.3 Summary

The chapter asked whether the differences by education and employment documented in the earlier chapters extend to subjective outcomes. Adults with tertiary education report somewhat higher life satisfaction and clearly higher social trust than those without. Differences by employment status are larger: the unemployed report a life satisfaction about 1.5 points below that of the employed, and both the unemployed and the inactive report lower trust. Both comparisons are descriptive and do not establish the direction of the association. The subjective experience of transitions is examined in more depth in the WP3B expert survey and the WP4 case studies. The next chapter returns to school-age achievement, comparing gaps across domains and the socioeconomic gradient between grade four and grade eight.

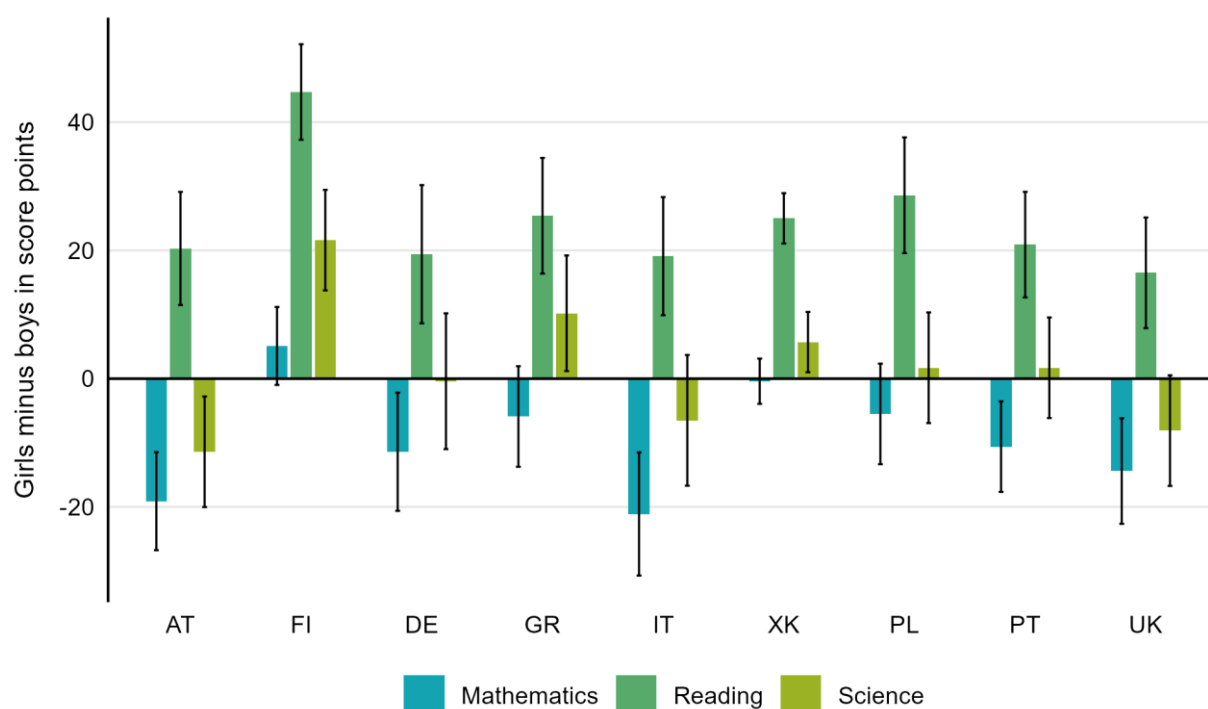
17 Deep Dive 6 — Achievement gaps at school age

The field chapters describe achievement gaps mainly in mathematics at age fifteen. This chapter asks whether those gaps look the same in the other domains and at other points of schooling. Section 17.1 begins with gender, whose gap reverses between mathematics and reading. Section 17.2 turns to the socioeconomic gradient and follows it in mathematics from grade four to grade eight. Sections 17.3 and 17.4 then apply the analysis of Chapter 5 to science and reading, with the socioeconomic gradient in both domains and the immigrant gap in reading; Section 17.3 also repeats the comparison between grade four and grade eight for science.

17.1 The gender gap across domains

The male advantage in mathematics documented in Section 5.5 does not extend to the other domains (Figure 71). In PISA 2022, girls score on average about 9 points lower than boys in mathematics across the partner countries, about 2 points higher in science and about 24 points higher in reading. The female advantage in reading is statistically significant in every partner country and ranges from about 17 points in the United Kingdom to 45 in Finland. In mathematics, boys lead significantly in Austria, Germany, Italy, Portugal and the United Kingdom, whereas the gap is not statistically significant in Finland, Greece, Kosovo and Poland. In science, the gap is significant in only four countries, in favour of girls in Finland, Greece and Kosovo and of boys in Austria. In every partner country except Italy, the female advantage in reading exceeds any male advantage in mathematics. Together with the female advantage in computer and information literacy (Section 13.2), this shows that the direction and size of gender gaps depend on the domain.

Figure 71. Gender gap by domain, PISA 2022

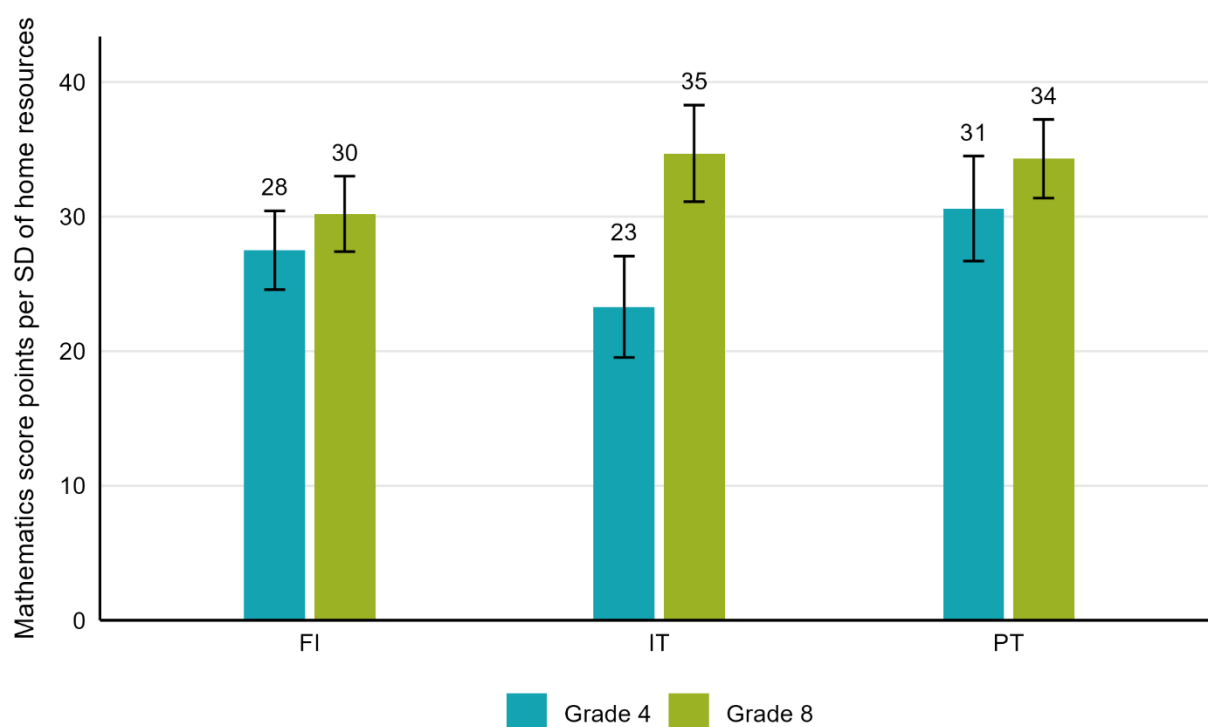


Note: Difference in mean score between girls and boys (girls minus boys), without further controls, with 95% confidence intervals based on BRR replication and plausible values.

17.2 The socioeconomic gradient from grade four to grade eight

Section 14.1 showed that the standardised socioeconomic association is of similar size at every stage. In score points, however, the TIMSS data point to a steeper gradient at grade eight than at grade four. Three partner countries, Finland, Italy and Portugal, took part at both grades in 2023 with data on home resources (Figure 72). On average across the three, one standard deviation of the home resources index is associated with 27 points in mathematics at grade four and 33 points at grade eight. The gradient is steeper at grade eight in all three countries, but the difference is statistically significant only in Italy (23 against 35 points). The two findings are compatible: Section 14.1 expresses the gradient in standard deviations of achievement, and because achievement is more dispersed at grade eight, a similar standardised association can correspond to a larger gradient in score points. The comparison is cross-sectional, since the grade-eight students of 2023 belong to an earlier cohort than the grade-four students, and three countries are too few to relate the difference to tracking or other features of the education systems.

Figure 72. Socioeconomic gradient in mathematics at grade four and grade eight, TIMSS 2023



Note: Difference in mathematics score associated with one standard deviation of the home resources index, with 95% confidence intervals based on jackknife replication and plausible values. Partner countries that took part at both grades with data on home resources.

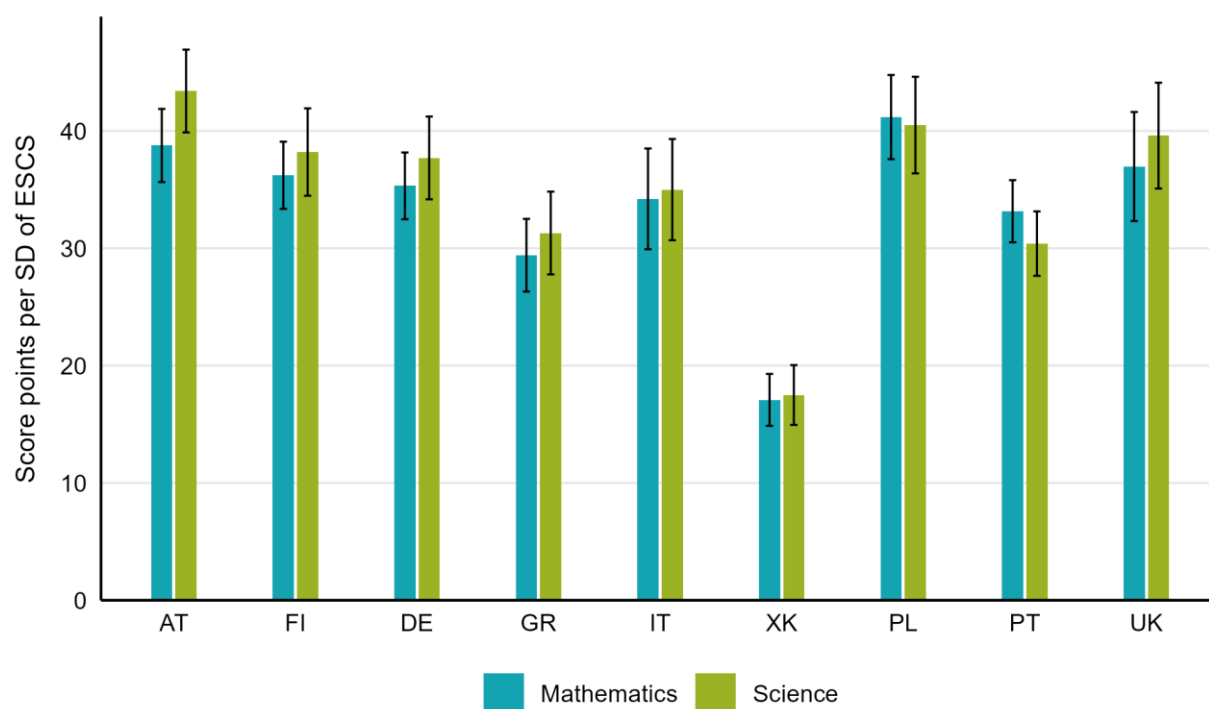
17.3 The science domain

Sections 17.1 and 17.2 examined the gender gap across domains and the socioeconomic gradient in mathematics. This section asks whether the socioeconomic gradient in science, a domain not covered in the field chapters, resembles the gradient in mathematics, both at age fifteen and in the step from grade four to grade eight.

At age fifteen, the socioeconomic gradient in science is of similar size to that in mathematics (Figure 73). As in Section 5.3, the gradient is estimated controlling for immigrant status and gender. In PISA 2022, one standard deviation of ESCS is associated with about 35 points in science on average across the partner countries, against 34 in mathematics. The science gradient is steepest in Austria (43), Poland (41) and the United Kingdom (40) and by far the shallowest in Kosovo (18), where, as in mathematics, low and compressed performance attenuates the measured gradient (Section 5.3). In seven of the nine partner countries the science gradient is slightly steeper than the mathematics gradient, most markedly in Austria (43 against 39 points); in Poland and Portugal it is flatter.

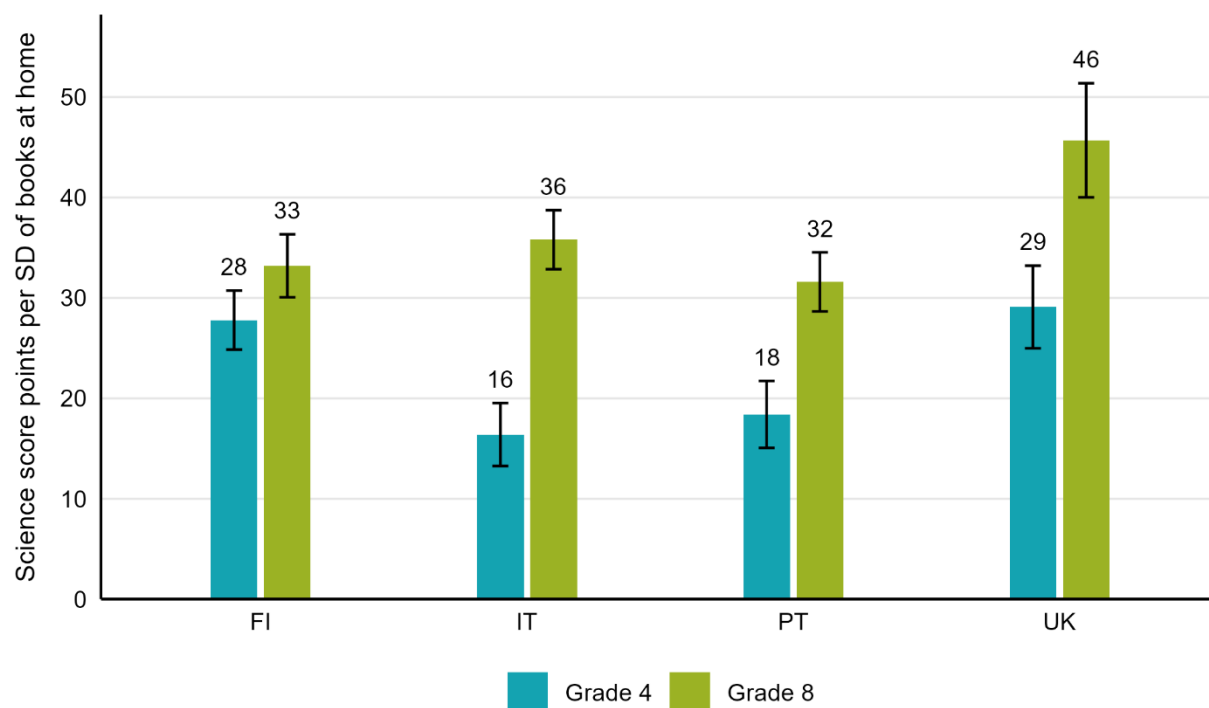
The step from grade four to grade eight shows the same pattern in science as in mathematics (Section 17.2). TIMSS measures it for science with books at home as the socioeconomic measure (Figure 74). In the four partner countries that took part at both grades, the gradient is steeper at grade eight in every case: from 28 to 33 points in Finland, from 18 to 32 in Portugal, from 29 to 46 in the United Kingdom and from 16 to 36 in Italy. Unlike in mathematics, the difference is statistically significant in all four countries. As in mathematics, the comparison is cross-sectional, and the four countries are too few to relate the difference to features of the education systems. Reading, the third domain, is examined in the next section.

Figure 73. Socioeconomic gradient in mathematics and science, PISA 2022



Note: Difference in score associated with one standard deviation of ESCS, adjusted for immigrant status and gender, with 95% confidence intervals based on BRR replication and plausible values.

Figure 74. Socioeconomic gradient in science at grade four and grade eight, TIMSS 2023.



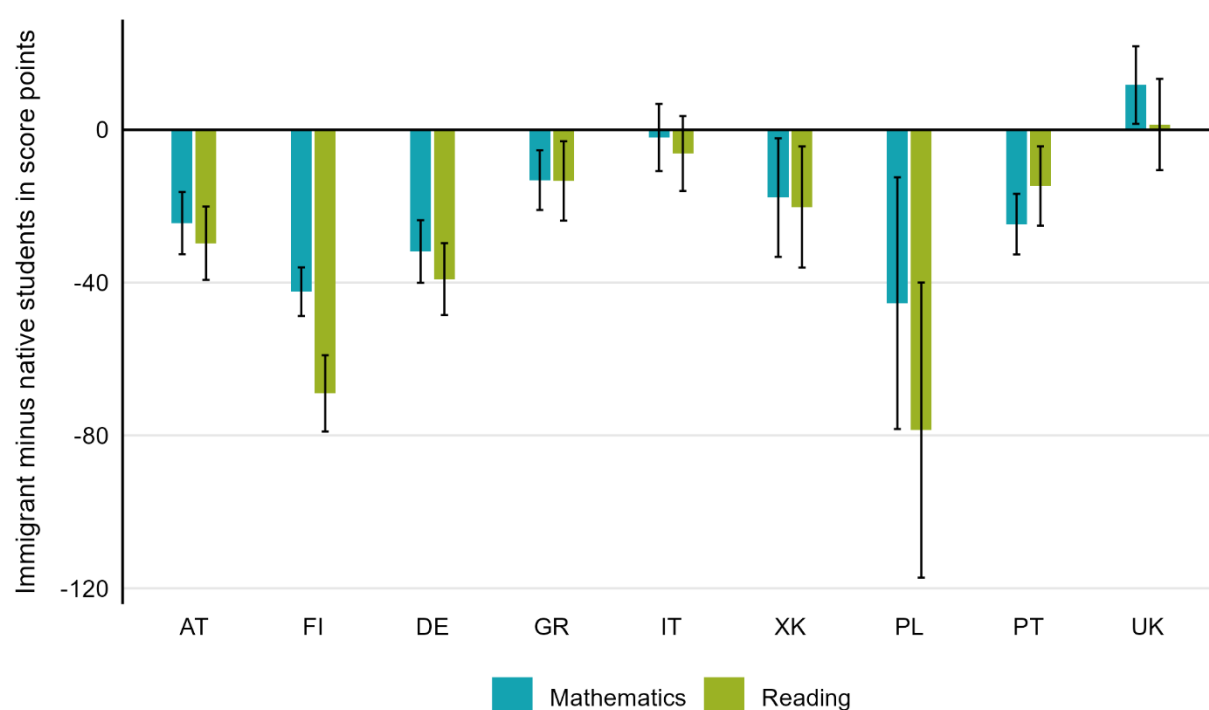
Note: Difference in science score associated with one standard deviation of the number of books at home, without further controls, with 95% confidence intervals based on jackknife replication and plausible values. Partner countries that took part at both grades.

17.4 The reading domain

Reading, the third domain, completes the comparison. As for mathematics in Chapter 5 and for science in Section 17.3, the estimates come from a regression of achievement on ESCS, immigrant status and gender. The socioeconomic gradient in reading is of similar size to those in the other two domains: one standard deviation of ESCS is associated with about 33 points on average across the partner countries, against 34 in mathematics and 35 in science.

Reading differs from the other domains in the immigrant achievement gap (Figure 75). The gap is larger in reading than in mathematics in most partner countries, consistent with the greater weight of language in this domain. The difference is most marked in Finland (69 against 42 points) and Germany (39 against 32); the Polish estimate is similarly large but very imprecise. Portugal is the main exception, with a smaller gap in reading than in mathematics (15 against 25 points), and in Greece the two gaps are about equal. In the United Kingdom, immigrant-background students score about as well as their peers in reading and better in mathematics.

Figure 75. Immigrant achievement gap in mathematics and reading, PISA 2022.



Note: Difference in mean score between students with and without an immigrant background (first and second generation), adjusted for ESCS and gender, with 95% confidence intervals based on BRR replication and plausible values. Negative values indicate lower scores of immigrant-background students.

17.5 Summary

The chapter asked whether the achievement gaps found for mathematics at age fifteen hold in other domains and at other points of schooling. For gender, the answer depends on the domain. Girls lead in reading in every partner country, by about 24 points on average, whereas boys lead in mathematics by about 9 points, significantly so in five of the nine countries; in science the gap is small and significant in only four. The socioeconomic gradient, by contrast, is of similar size in all three domains at age fifteen, at 33 to 35 points per standard deviation of ESCS on average. Science is slightly more strongly graded than mathematics in seven of the nine countries, and the gradient is shallowest in Kosovo in every domain. In score points, the gradient is steeper at grade eight than at grade four in every partner country observed at both grades. This difference is statistically significant in all four countries in science, but only in Italy in mathematics. Both comparisons are cross-sectional and rest on few countries, and a steeper gradient in score points is compatible with the broadly stable standardised association of Section 14.1. The immigrant gap, finally, is

larger in reading than in mathematics in most partner countries, most markedly in Finland, with Portugal the main exception and no gap in reading in the United Kingdom. The next chapter compares general and vocational pathways.

18 Deep Dive 7 – General versus vocational pathways

Chapters 7 and 8 treated the transition from education to work through levels of attainment: below upper secondary, upper secondary and tertiary. The D3.2 specification, however, distinguishes two transition fields that this view merges. Field 3 is the transition from general education (GE) to the labour market, and Field 4 the transition from professional and vocational education and training (PVET) to the labour market. Separating them requires knowing, within upper-secondary attainment, whether a qualification is general or vocational. PIAAC records this orientation, and this chapter uses it to compare the two branches.

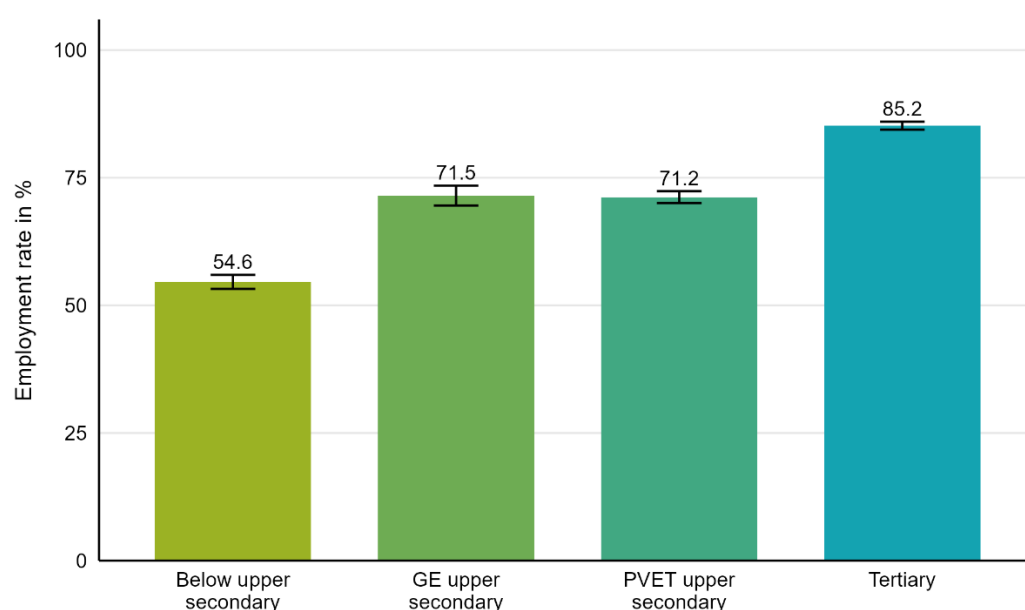
The chapter proceeds in three steps. Section 18.1 compares the employment rates of the two branches, and Section 18.2 their earnings. Because the field definitions also cover transitions "and back" into education, Section 18.3 examines how often adults complete their highest qualification later in life.

All analyses use PIAAC Cycles 1 and 2 pooled and cover adults aged 25 to 64. Austria and Germany are not included, because the PIAAC public-use files do not record respondents' exact age, and Kosovo did not take part in PIAAC. Italy enters the pooled comparisons and the analysis of late completion, but not the comparisons between the two branches. Its harmonised vocational indicator classifies virtually no upper-secondary qualification as general, so there is no general branch to compare with. Portugal enters the employment analysis only, because its public-use file records neither hourly earnings nor the age at completion.

18.1 Employment returns to education by track

Whether a vocational or a general upper-secondary qualification offers the better route into work is one of the central questions for education systems that offer both, and it cannot be answered by comparing levels of attainment alone.

Figure 76. Employment rate by educational track (PIAAC)



Note: Weighted employment rate of 25- to 64-year-olds by highest qualification and, for upper secondary, by general or vocational orientation, with 95% confidence intervals from replicate weights; Cycles 1 and 2 pooled across the partner countries. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age; Kosovo did not take part in PIAAC.

Figure 76 therefore splits upper-secondary education into its general and vocational branches and shows the share of 25- to 64-year-olds in employment for each track, across the partner countries taken together. As in Chapter 7, employment rises with the level of education, from 54.6 per cent among adults without an upper-secondary qualification to 85.2 per cent among the tertiary-educated. The two upper-secondary branches lie almost exactly level: 71.5 per cent of adults with a general and 71.2 per cent of those with a vocational qualification are employed. Both groups are thus about 17 percentage points more likely to be in work than adults without upper-secondary education, and about 14 percentage points less likely than the tertiary-educated.

This pooled equivalence between the returns to GE and PVET does not hold within countries. Table 9 gives employment in the two branches by country, and Figure 77 shows the employment gap between them. The vocational branch has the higher employment rate in all five countries, by between 1.7 points in Poland and 8.3 points in Portugal. In Finland, Greece and Portugal the gap is larger than its sampling uncertainty; in Poland and the United Kingdom it is not. The pooled comparison nonetheless shows no vocational advantage, because of the country mix. The pooled vocational group includes Italy, which has a large vocational sample, no general-branch counterpart and lower employment overall, so the pooled and the within-country comparisons rest on different sets of countries.

Table 9. Upper-secondary employment rate by branch and the gap between them, by country (PIAAC)

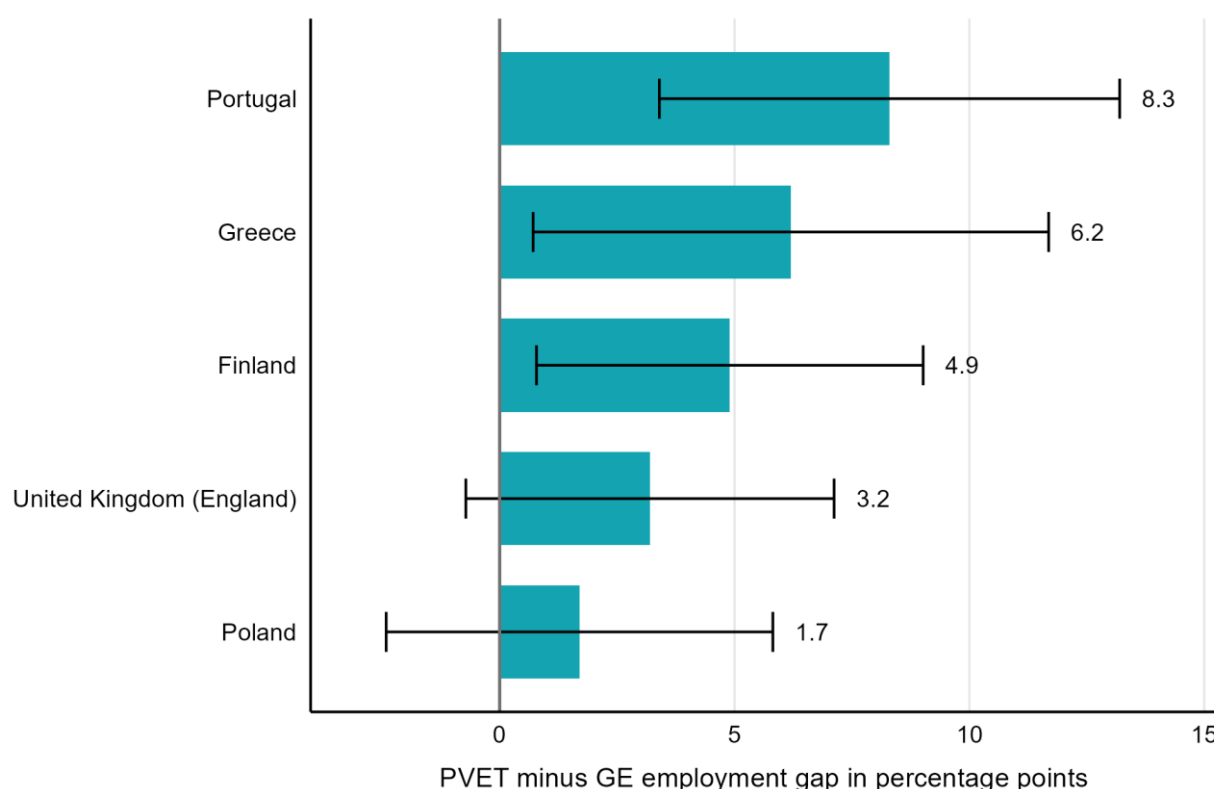
Country	General (%)	PVET (%)	Gap (pp)
Finland	73.0	77.9	+4.9
Greece	48.5	54.7	+6.2
Poland	67.6	69.2	+1.7
Portugal	79.8	88.1	+8.3
United Kingdom (England)	75.1	78.3	+3.2

Note: Weighted employment rates of 25- to 64-year-olds whose highest qualification is at upper-secondary level; Cycles 1 and 2 pooled. The gap is the vocational minus the general rate; its confidence intervals are shown in Figure 77. United Kingdom estimates refer to England only. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age; Italy because the harmonised vocational indicator classifies virtually no upper-secondary qualification as general; Kosovo did not take part in PIAAC.

The confidence intervals in Figure 77 show how firmly each gap is established. In Portugal, Greece and Finland the interval lies entirely above zero, so the vocational advantage is larger than its sampling uncertainty. In the United Kingdom and Poland the interval includes zero, and a gap of this size could also arise from sampling variation alone. Taken together, the direction is nevertheless the same in all five countries. If there were no difference between the branches, a positive gap in every country would be expected by chance only about once in thirty trials. The advantage is largest in the two Southern systems with a general branch, Portugal and Greece, and smallest in the Eastern system, Poland.

A vocational employment advantage in all five countries, across systems of very different design, is consistent with the comparative finding that the occupational specificity of vocational qualifications eases entry into work (Milmeister et al., 2022). The advantage amounts to a few percentage points, however, well below the tertiary advantage of about 30 points. Employment is only the first margin on which the two branches can differ; the next section asks whether the vocational advantage in finding work carries over into earnings.

Figure 77. Vocational minus general upper-secondary employment gap, by country (PIAAC)

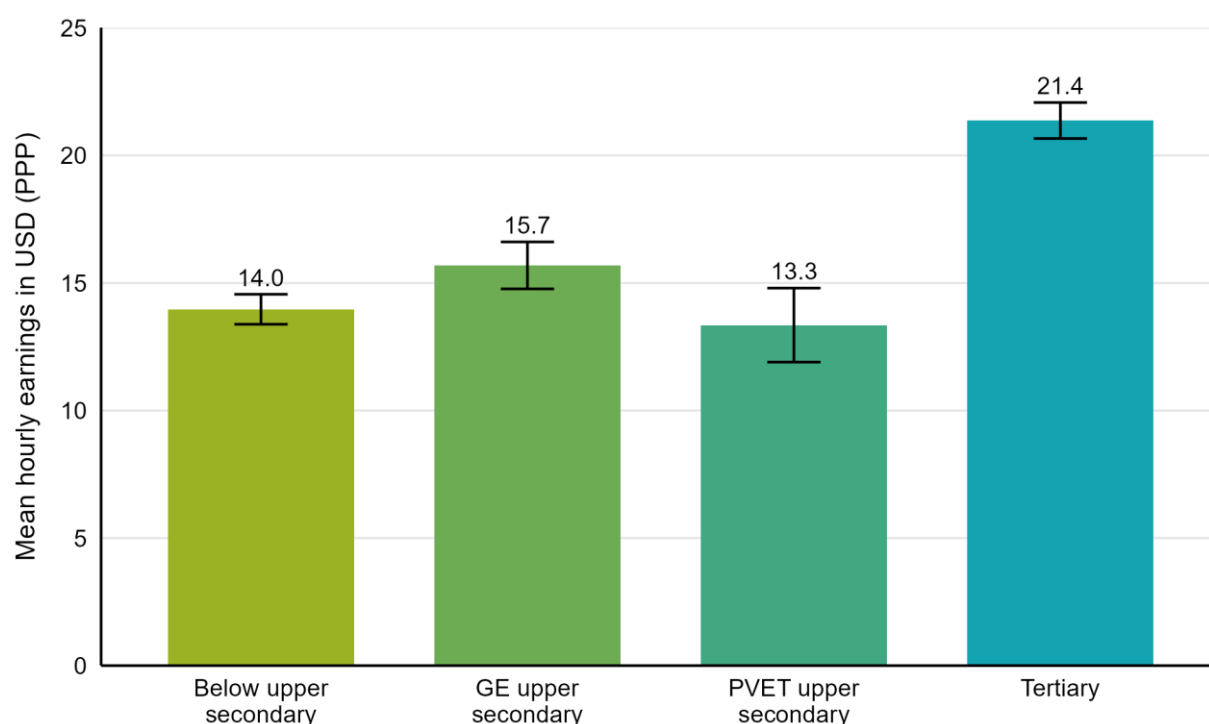


Note: Difference between the employment rates of 25- to 64-year-olds with a vocational and a general upper-secondary qualification, in percentage points, with 95% confidence intervals from replicate weights; Cycles 1 and 2 pooled. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age; Italy because the harmonised vocational indicator classifies virtually no upper-secondary qualification as general; Kosovo did not take part in PIAAC. United Kingdom estimates refer to England only.

18.2 Earnings returns to education by track

Finding work is one part of the return to a qualification; how well that work is paid is the other. Figure 78 shows mean hourly earnings by educational track, pooled across the five partner countries for which PIAAC provides both exact age and hourly earnings: Finland, Greece, Italy, Poland and the United Kingdom (England). The clearest result is the tertiary advantage: tertiary-educated workers earn about 21 US dollars per hour at purchasing-power parity, against roughly 13 to 16 dollars in all other groups. Below tertiary level, however, the pooled means mix countries with very different wage levels, so the two upper-secondary branches have to be compared within countries.

Figure 78. Mean hourly earnings by educational track (PIAAC, pooled)



Note: Weighted mean gross hourly earnings including bonuses, in US dollars at purchasing-power parity, of employed 25- to 64-year-olds with positive earnings, with 95% confidence intervals from replicate weights; Cycles 1 and 2 pooled across the partner countries. United Kingdom estimates refer to England only. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age; Portugal because hourly earnings are not available in its public-use file; Kosovo did not take part in PIAAC.

Table 10 gives mean hourly earnings in the two branches by country, and Figure 79 shows the gap between them, expressed as the percentage by which vocational earnings differ from general earnings. Unlike employment, earnings show no vocational advantage. Workers with a vocational qualification earn about 16 per cent less than those with a general one in Greece and about 9 per cent less in the United Kingdom (England); in Finland and Poland the two branches earn almost the same.

Table 10. Upper-secondary mean hourly earnings by branch and the gap between them, by country (PIAAC)

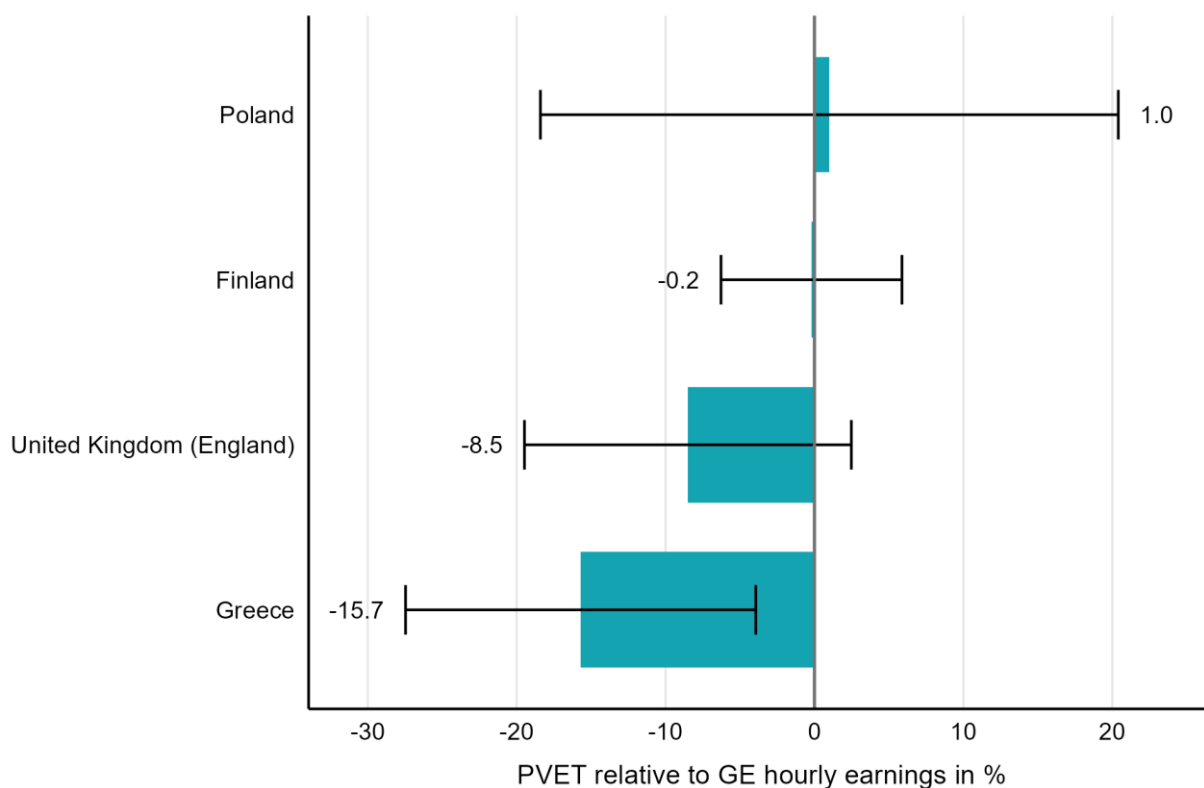
Country	GE (USD)	PVET (USD)	Gap (%)
Finland	17.59	17.55	-0.2
Greece	10.75	9.07	-15.7
Poland	12.63	12.75	+1.0
United Kingdom (England)	18.23	16.68	-8.5

Note: Weighted mean gross hourly earnings including bonuses, in US dollars at purchasing-power parity, of employed 25- to 64-year-olds whose highest qualification is at upper-secondary level; Cycles 1 and 2 pooled. The gap is the percentage difference of vocational from general earnings; its confidence intervals are shown in Figure 79. United Kingdom estimates refer to England only. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age; Italy because the harmonised vocational indicator classifies virtually no upper-secondary qualification as general; Portugal because hourly earnings are not available in its public-use file; Kosovo did not take part in PIAAC.

The confidence intervals in Figure 79 show how firmly each gap is established. Only in Greece does the interval lie entirely below zero, so the vocational earnings disadvantage there is larger than its sampling uncertainty. In the United Kingdom (England) the disadvantage is about half as large and less precisely estimated, because only about 120 workers with a vocational qualification report earnings. In Finland and

Poland the intervals are centred close to zero. The one clearly established earnings disadvantage thus falls in a Southern system, Greece, which also has one of the largest vocational employment advantages.

Figure 79. Vocational relative to general upper-secondary hourly earnings, by country (PIAAC)



Note: Percentage difference of mean hourly earnings of employed 25- to 64-year-olds with a vocational from those with a general upper-secondary qualification, with 95% confidence intervals from replicate weights; Cycles 1 and 2 pooled. United Kingdom estimates refer to England only. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age; Italy because the harmonised vocational indicator classifies virtually no upper-secondary qualification as general; Portugal because hourly earnings are not available in its public-use file; Kosovo did not take part in PIAAC.

Taken together with Section 18.1, the vocational branch offers somewhat better chances of being in work, but no higher pay once in work. The tertiary qualification remains the only one of the tracks with a clear advantage on both margins. The next section turns from the returns to a qualification to the timing of its completion.

18.3 Late completion and re-entry into education

The field definitions describe transitions to the labour market "and back", so they include adults who return to education after leaving it. PIAAC does not record interruptions of the educational career directly, but it does record the age at which respondents completed their highest qualification. Completing at 25 or later can serve as an approximation for extended or interrupted pathways. It also captures long continuous periods of study, however, and this has to be separated out before the measure says anything about re-entry.

Across the five partner countries for which PIAAC records the completion age, 20.6 per cent of 25- to 64-year-olds completed their highest qualification at 25 or older. The first column of Table 11 shows that this share ranges from 14 per cent in Italy and Greece to 34 per cent in the United Kingdom (England) and 44 per cent in Finland. These differences say more about tertiary education than about re-entry. Among tertiary-educated adults, 56.1 per cent completed at 25 or later, largely because bachelor's, master's and doctoral studies take that long. A country's overall share therefore rises with the proportion of adults holding a tertiary degree and with the length of its programmes.

Table 11. Adults who completed their highest qualification at age 25 or older, by country and track (PIAAC)

Country	All adults	Upper secondary	GE	PVET
Finland	44.4	29.2	6.1	34.8
Greece	14.2	4.9	1.2	9.0
Italy	13.9	6.8	–	6.8
Poland	20.7	5.0	10.6	4.2
United Kingdom (England)	33.6	13.6	8.4	24.9

Note: Weighted share of 25- to 64-year-olds who completed their highest qualification at age 25 or older, in per cent; Cycles 1 and 2 pooled. "Upper secondary" includes post-secondary non-tertiary qualifications. United Kingdom estimates refer to England only. Italy has no general-branch estimate because the harmonised vocational indicator classifies virtually no upper-secondary qualification as general. Austria and Germany are not included because the PIAAC public-use files do not record respondents' exact age; Portugal because the age at completion is not recorded in its public-use file; Kosovo did not take part in PIAAC.

A closer approximation of re-entry is late completion among adults whose highest qualification is at upper-secondary level, because regular upper-secondary education ends well before age 25. The remaining columns of Table 11 show this share, in total and by branch. Late completion at this level is rare in Greece, Poland and Italy (5 to 7 per cent), but common in the United Kingdom (England), at 14 per cent, and above all in Finland, at 29 per cent. In both countries it is concentrated in the vocational branch: a third of Finnish and a quarter of English adults with a vocational qualification completed it at 25 or later, compared with 6 and 8 per cent in the general branch. This is consistent with the large adult vocational sectors in both countries, which allow adults to acquire or upgrade a vocational qualification while working. Poland shows the reverse pattern, with more late completion in the general than in the vocational branch. By transition regime, late completion below tertiary level is thus common in the Nordic and Liberal systems and rare in the Southern and Eastern ones.

Even this measure remains an approximation. It captures adults who completed their highest qualification late, whether after an interruption or through a delayed first pass. It misses those who returned to education and went on to a tertiary degree, because they appear as tertiary-educated. Measuring re-entry directly would require the timing of all educational spells, which only longitudinal data provide.

18.4 Summary

Separating the general and vocational branches of upper-secondary education allows the two labour-market transition fields of the D3.2 specification to be measured separately. The vocational branch has the higher employment rate in all five countries where both branches can be compared, by between 2 and 8 percentage points, and the gap is larger than its sampling uncertainty in Finland, Greece and Portugal. In earnings, by contrast, it shows no advantage: vocational workers earn about the same as general workers in Finland and Poland, and less in Greece and the United Kingdom (England). The vocational branch thus offers somewhat better chances of being in work but no higher pay, and the tertiary qualification is the only track with a clear advantage on both margins. Late completion of the highest qualification mainly reflects the length of tertiary studies. Below tertiary level, it is common only in Finland and the United Kingdom (England), and there mostly in the vocational branch, consistent with their large adult vocational sectors. The next chapter checks the main patterns of the preceding chapters against official European statistics.

19 Triangulation with official European statistics

The analyses of the preceding chapters rest on harmonised survey microdata. A recurring limitation of that evidence, flagged in the WP3A policy briefing as the most important data gap, is the difficulty of strictly comparable pan-European measurement: the surveys differ in timing, instruments and coverage, and some are incomplete for individual partner countries, notably PIAAC for Austria and Germany. This chapter therefore adds aggregate statistics from the dissemination services of Eurostat, the World Bank and the

OECD. They are assembled in a standalone exhibit (WP3A_Macro_Eurostat.xlsx), which records each value with its dataset code, query and retrieval date.

The layer serves two purposes. It checks whether the patterns established in the microdata reappear in independent official series, and it supplies the comparable cross-country and time-series context that the microdata alone cannot provide.

19.1 Disengagement across the European Education Area

The microdata approached youth disengagement through NEET status (Chapter 7). The official statistics add three headline rates: early leaving from education and training, the NEET rate and youth unemployment. Table 12 reports them for 2023, the latest comparable year, for the EU27 and the seven partner countries in the Eurostat series.

Table 12. Youth disengagement indicators in the partner countries (Eurostat)

Country	Early leavers 18–24 (%)	NEET 15–29 (%)	Youth unemployment 15–24 (%)
EU27	9.6	11.3	14.6
Austria	8.6	9.4	10.4
Germany	13.0	8.8	5.9
Greece	3.7	16.0	26.7
Finland	9.6	9.4	16.2
Italy	10.5	16.1	22.7
Poland	3.7	9.1	11.4
Portugal	8.1	8.9	20.5

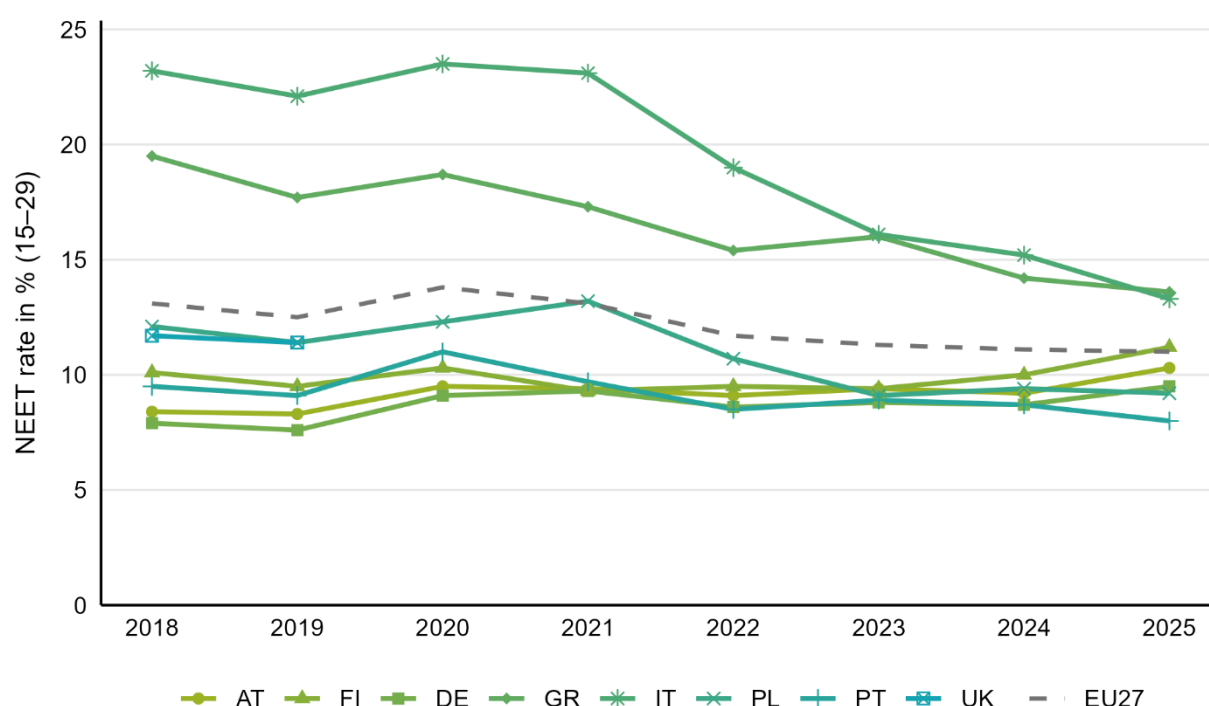
Note: Latest comparable year, 2023. The United Kingdom is not included because it is no longer covered by most Eurostat series after 2019, and Kosovo because it is not covered by Eurostat; Kosovo values from the ETF KIESE compilation are given in the text.

The official series confirm the microdata finding that youth disengagement is highest in Italy and Greece, and they add a distinction the microdata could not draw. Italy's early-leaving rate is slightly above the EU average, although it has fallen markedly since 2018. Greece has one of the lowest early-leaving rates in Europe (3.7 per cent) yet high NEET and youth unemployment. Greece thus retains young people in education, but many do not find work, a pattern consistent with labour demand rather than education supply being the binding constraint. Germany shows the opposite combination. Its early-leaving rate is comparatively high and has risen since 2020 (13.0 per cent in 2023), yet youth unemployment is the lowest in the partner set (5.9 per cent).

For Kosovo, the KIESE figures show a sharper version of the Greek pattern. Early leaving is low (7.8 per cent in 2020). Youth NEET, however, reaches 40.4 per cent and youth unemployment 49.1 per cent (2021), more than three times the EU27 levels and by far the highest values in the partner set. Adult participation in education and training is also low (5.6 per cent in 2020). These labour-market difficulties are combined with weak early achievement: 85 per cent of Kosovar fifteen-year-olds perform below the PISA baseline in mathematics (Section 5.2).

In a longitudinal perspective, NEET rates have fallen in most partner countries since 2018 (Figure 80), most markedly in Italy and Greece, the two countries with the highest rates. In Italy the rate fell from 23.2 per cent in 2018 to 16.1 per cent in 2023, and in Greece from 19.5 to 16.0 per cent. Across the EU27, it fell from 13.1 to 11.3 per cent over the same period.

Figure 80. NEET rate of 15- to 29-year-olds by country, 2018–2025 (Eurostat)



Note: Share of 15- to 29-year-olds not in employment, education or training. The dashed line shows the EU27 average. Series break in 2021 (EU Labour Force Survey redesign). United Kingdom 2018–2019 only; Kosovo not covered by Eurostat.

19.2 Employment returns to education

The official series reproduce the central labour-market finding of Chapters 7 and 18. Across the EU27, the employment rate of 25- to 64-year-olds is about 59 per cent below upper-secondary level, 78 per cent at upper-secondary and 88 per cent at tertiary level. This is a gradient of about thirty percentage points, the same size as in the PIAAC microdata. Tertiary attainment among 25- to 34-year-olds reached 44.1 per cent in the EU27 in 2024, with the partner countries ranging from 31.6 per cent in Italy to the mid-forties in Poland, Greece and Austria.

Table 13. General and vocational upper-secondary employment rates, by country (Eurostat, 2023)

Country	General upper-sec employment (%)	Vocational upper-sec employment (%)	Vocational advantage (pp)
EU27	73.2	79.2	+6.0
Germany	72.2	84.2	+12.0
Greece	63.7	73.8	+10.1
Italy	65.5	75.9	+10.4
Finland	72.8	78.8	+6.0
Austria	75.5	78.1	+2.6
Portugal	84.6	85.8	+1.2
Poland	77.4	75.1	-2.3

Note: Employment rates of 25- to 64-year-olds whose highest qualification is general (ISCED 34 and 44) or vocational (ISCED 35 and 45) upper-secondary or post-secondary non-tertiary education, 2023. The vocational advantage is the vocational minus the general rate, in percentage points. Eurostat has published the split by orientation since 2021. The United Kingdom is not included because Eurostat has not covered it since 2019, and Kosovo because it is not covered by Eurostat.

The Eurostat split by programme orientation, available since 2021, also allows the vocational employment advantage of Chapter 18 to be checked. The PIAAC microdata could not estimate it for Austria and Germany, because their public-use files do not record exact age. In the official series, adults with a vocational upper-secondary qualification are employed more often than those with a general one in six of the seven partner countries with data (Table 13).

The advantage is largest in Germany, where vocational upper-secondary holders are twelve percentage points more likely to be employed than general upper-secondary holders, and slight in Austria. Italy, which the microdata could not include in the branch comparison, shows one of the largest advantages. Poland is the only reversal in the official series, whereas in PIAAC its vocational branch has a small advantage.

The official series also cover the risk side of the transition to the labor market, which the microdata did not capture: the incidence of long-term unemployment, the share of the unemployed who have been without work for twelve months or more (Table 14). Long-term unemployment is more common among the unemployed with below upper-secondary education than among the tertiary-educated in all eight partner countries with data and in the OECD average. The step is not uniform, however. In Finland the upper-secondary and tertiary rates are almost equal. In Greece the incidence is around 56 to 58 per cent at every level of education, so a tertiary qualification is associated with far less protection against long-term unemployment than elsewhere. Like the combination of low early leaving with high youth NEET in Section 19.1, this is consistent with labour demand rather than education supply being the binding constraint in Greece.

Table 14. Incidence of long-term unemployment by educational attainment (OECD)

Country	Below upper-sec (%)	Upper-sec (%)	Tertiary (%)
OECD average	39.0	31.9	26.5
Italy	61.6	53.1	41.2
Greece	56.4	57.7	56.1
Portugal	50.2	40.9	32.3
Poland	44.5	31.7	18.7
Germany	38.7	34.8	23.6
United Kingdom	37.2	27.0	17.2
Austria	33.8	23.2	20.3
Finland	30.0	25.9	26.5

Note: Share of unemployed 25- to 64-year-olds who have been unemployed for twelve months or more, by educational attainment, 2024. OECD Education at a Glance. Kosovo is not covered.

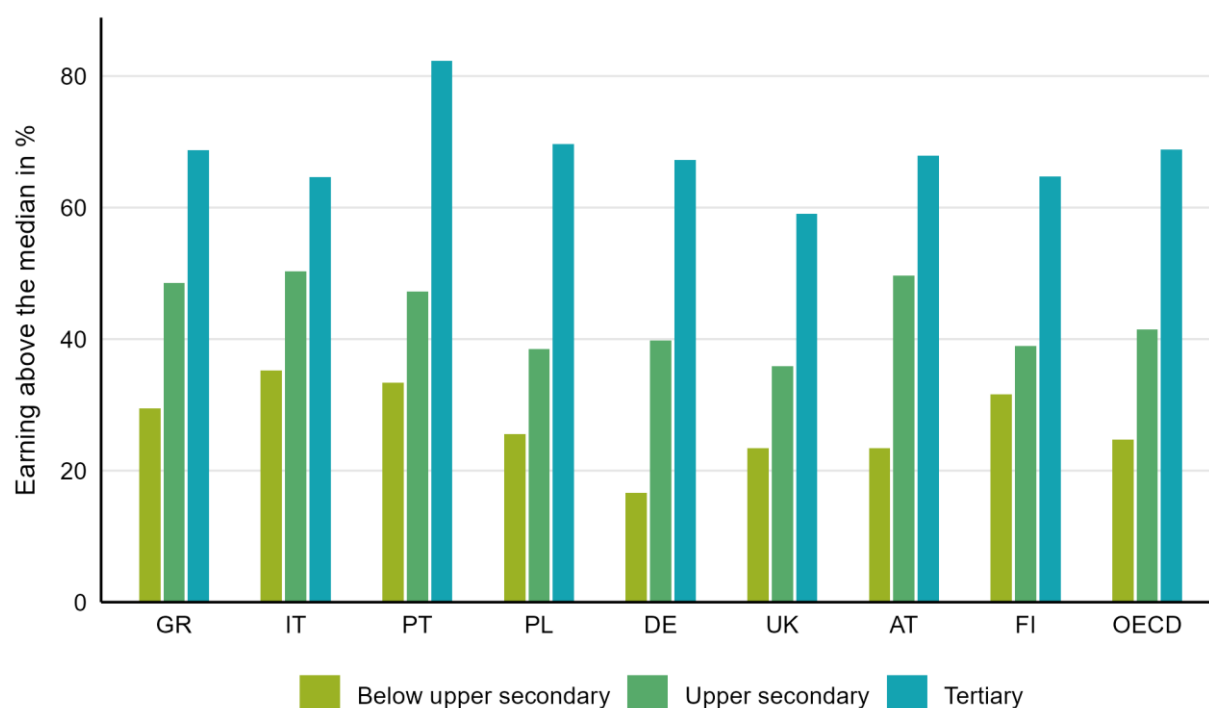
19.3 Earnings returns to education

The OECD Education at a Glance series also allow the earnings analysis of Chapter 7 to be checked. In every partner country with data, the share of workers earning more than the national median rises with each level of education (Figure 81). Across the OECD, it rises from about a quarter of workers below upper-secondary level (24.7 per cent) to about seven in ten tertiary-educated workers (68.8 per cent). This is the OECD counterpart of the tertiary earnings premium estimated from PIAAC. It also covers Austria and Germany, which PIAAC could not include, and Portugal, whose PIAAC file records no hourly earnings.

The size of the difference varies between countries. The gap between tertiary-educated workers and those below upper-secondary level in the share earning more than the median is largest in Germany (51 percentage points) and Portugal (49), and smallest in Italy (29) and Finland (33). In Germany the gap is large mainly because few workers without an upper-secondary qualification earn more than the median (17 per cent). In Portugal it is large because a particularly high share of tertiary-educated workers do (82 per cent), and more than a third of them earn more than twice the median. At the other end, the share of tertiary-educated

workers earning more than twice the median is lowest in the United Kingdom, Greece and Finland (13 to 15 per cent).

Figure 81. Share of workers earning more than the national median, by educational attainment and country (OECD)



Note: Share of workers aged 25–64 earning more than the national median, by educational attainment. OECD Education at a Glance; latest year available (Greece 2018; Finland, Italy and Poland 2022; other countries and OECD average 2023).

19.4 Investment and lifelong learning

The macro layer also supplies the investment and adult-learning context for Chapters 11 and 15. Public expenditure on education was 4.7 per cent of GDP across the EU27 in 2023 and has changed little since 2018. Among the partner countries it was highest in Finland (6.1 per cent) and lowest in Italy and Greece (about 4 per cent). The World Bank series give similar values except for Greece, where they are lower because the two sources define education expenditure differently. The cross-country analysis of Chapter 11 found no robust association between this spending and outcomes.

Participation in adult education and training in the four weeks before the survey was 12.8 per cent across the EU27 in 2023, up from 10.7 per cent in 2018. It ranged from 3.4 per cent in Greece to 26.1 per cent in Finland, with Austria also well above the EU average (17.1 per cent). It rose markedly in Poland and Portugal over the period, but in Germany it remained well below the EU average (8.1 per cent). In Kosovo it was 5.6 per cent in 2020. The countries thus differ as widely in adult learning as the groups within them do in PIAAC, where participation rises steeply with initial education (Section 15.2).

19.5 Summary

The macro layer provides an independent check on the microdata findings, and three cross-source agreements stand out. The vocational employment advantage of Chapter 18 reappears in the Eurostat series in six of the seven countries with data, including the two dual-system countries that the microdata could not reach. The tertiary earnings premium of Chapter 7 reappears in the OECD earnings distribution in all eight countries with data. And the World Bank and Eurostat youth-unemployment series agree at country level to within 0.6 percentage points, confirming that the figures are read consistently.

The macro layer also adds evidence the microdata could not provide: the gradient of long-term unemployment by education, and the Greek and Kosovar combination of low early leaving with high NEET and youth unemployment. The contribution of this chapter is therefore twofold. It raises confidence that the

microdata findings are not artefacts of a single survey, and it supplies the comparable pan-European context that the WP3A policy briefing identified as missing. The standalone macro exhibit, with its full provenance and verification, can be inspected and extended in its own right.

20 Country profiles

Chapter 19 checked the microdata findings against independent macro sources. This chapter turns from the cross-national view to the individual partner countries, reassembling the results of the field chapters and deep dives into a profile of each. The regime labels place each country in the D2.1 transition-regime typology, but they do not by themselves predict outcomes: as Chapter 9 shows, tracking age and vocational orientation cut across the regimes.

Several findings hold for all or most partner countries and are therefore not repeated in each profile. Mathematics fell in every partner country between 2018 and 2022, and every country is above the EU-level target for low achievers. In seven of the eight countries where natives score higher, the immigrant gap is largely accounted for by ESCS, home possessions and home language. The gender pay gap among employed adults is to a large degree unexplained, with an unexplained part between 11.4 and 14.6 log points in all five countries with earnings data. Against this common background, the profiles concentrate on where each country lies at the extremes of the partner distribution or departs from these patterns. They should be read alongside the figures and tables of the chapters they draw on.

20.1 Comparative scoreboard

Table 15 brings together the key indicators for each partner country. The full scoreboard, which also includes low-performer shares and the digital-skills gradient, is provided as a separate exhibit (WP3A_D32_Country_Scoreboard.xlsx). PIAAC labour-market indicators are unavailable for Austria and Germany, whose public-use files do not record exact age, and for Kosovo, which did not take part in PIAAC.

Table 15. Comparative scoreboard of the partner countries

Country	Regime	Track	PISA maths	SES grad.	Immig. gap	Repetition %	Youth NEET %	Tert. pre-mium
Austria	Continental	10	487.3	38.8	-24.4	15.6	–	–
Finland	Nordic	16	484.1	36.2	-42.4	2.7	3.0	36.2
Germany	Continental	10	474.8	35.3	-31.9	19.2	–	–
Greece	Southern	15	430.1	29.4	-13.2	3.3	20.7	23.5
Italy	Southern	14	471.3	34.2	-2.0	8.6	16.4	28.3
Kosovo	Transition	15	355.0	17.1	-17.7	4.7	–	–
Poland	Eastern	15	489.0	41.2	-45.4	3.1	9.9	42.8
Portugal	Southern	15	471.9	33.2	-24.7	17.2	8.2	20.7
United Kingdom	Liberal	16	489.0	37.0	+11.7	2.1	5.4	27.2

Note: Track is the age of first tracking. PISA 2022 mathematics mean score. SES gradient in score points per standard deviation of ESCS and immigrant gap (immigrant minus native) in score points, both from the same regression of mathematics on ESCS, immigrant status and gender (Table 3). Repetition: share of fifteen-year-olds who have repeated at least one grade, PISA 2022. Youth NEET: share of 16–29-year-olds, most recent PIAAC cycle (Greece: Cycle 1; other countries: Cycle 2). Tertiary employment premium: difference in the employment rate between tertiary-educated and below-upper-secondary adults aged 25–64, in percentage points, PIAAC Cycles 1 and 2 pooled. PIAAC values for the United Kingdom refer to England. Regime labels follow D2.1 (Section 2.3).

20.2 Austria

Austria is a Continental system that selects students into separate school types at age ten and sustains a large dual apprenticeship sector. It shows the institutional profile of early tracking most clearly. More than half of the variance in achievement lies between schools (53 per cent, the highest share in the partner set), and

grade repetition is high (15.6 per cent), both consistent with the two robust cross-country associations of Sections 9.1 and 9.3. Its socioeconomic gradient is the second steepest after Poland's. Austria is also the only partner country in which the gap between the top and bottom socioeconomic quartiles clearly widened over the pandemic period, by 14.8 points (Section 10.1), even though its average decline was among the smallest. Because the public PIAAC files do not record exact age, the country whose dual system is most central to the comparative literature cannot enter the labour-market analyses (Section 22.7).

20.3 Finland

Finland is the Nordic comprehensive case. It defers tracking to sixteen, has the largest vocational share in the partner set and the lowest between-school share of achievement variance (about 12 per cent), and records the lowest youth NEET rate (3.0 per cent). Its departures from the common pattern lie in migration and gender. Finland is one of only two partner countries where a significant unexplained immigrant disadvantage remains after ESCS, home possessions and home language are taken into account (12.9 points; Section 12.1). In mathematics, the data establish no gender difference. Among employed adults, by contrast, job characteristics account for part of the pay gap (29 per cent), and the unexplained part is the smallest of the five countries with earnings data. Finland's school-age decline was also steep: it had been below the EU low-achiever target in 2015, and at grade four its PIRLS reading fell more than in any other partner country between 2016 and 2021.

20.4 Germany

Germany shares Austria's selection at age ten, its strong dual sector and the absence of labour-market data in the public PIAAC files. It has the highest grade-repetition rate in the partner set (19.2 per cent), about one in five fifteen-year-olds. The Eurostat series add that Germany combines comparatively high early leaving (13.0 per cent) with the lowest youth unemployment in the partner set (5.9 per cent), and the largest employment advantage of vocational over general upper-secondary qualifications (12 percentage points; Sections 19.1 and 19.2). German students work far less alongside their studies than the European average and report less financial difficulty than students in any other of the 19 EUROSTUDENT countries (Section 6.2).

20.5 Greece

Greece is a Southern system with the smallest vocational share in the partner set, about 30 per cent. It is the lowest performer among the EU partner countries, with 47 per cent of fifteen-year-olds below the mathematics baseline, and it recorded the largest rise in that share between 2018 and 2022 (11 points). Its socioeconomic gradient is clearly shallower than in the other EU partner countries, although part of this reflects the attenuation produced by low and compressed performance (Section 5.3). Greece is also the only partner country where ESCS rather than home language or home possessions makes the largest contribution to the immigrant gap, which is entirely accounted for by the three characteristics. Its defining labour-market feature is the scale of youth disengagement in the crisis era. At 20.7 per cent, youth NEET in the first PIAAC cycle was the highest of any partner country, consistent with the eurozone youth-employment crisis (Section 10.2). Because Greece took part only in that cycle, the recovery cannot be traced in PIAAC.

20.6 Italy

Italy, a Southern system that tracks at fourteen, combines two extremes: the smallest immigrant gap in the partner set and the largest male advantage in mathematics (20.6 points). It is also the only partner country where ESCS, home possessions and home language would predict a larger immigrant gap than the one observed (Section 12.1). Italy's socioeconomic gradient rose more than in any other partner country between 2015 and 2022 (by 4.8 points). At the same time, grade repetition fell sharply, from 15.1 to 8.6 per cent, and computer and information literacy improved by 30 points between 2018 and 2023, where most partner countries declined (Section 13.1). In the labour market, Italy has the highest youth NEET rate in the second PIAAC cycle (16.4 per cent), essentially unchanged from the first.

20.7 Kosovo

Kosovo is the lowest-performing and least-documented partner country. Its mathematics performance (355 points) is far below the rest, and 85 per cent of its fifteen-year-olds perform below the baseline, yet its decline

since 2018 was the smallest in the partner set. It also has the shallowest socioeconomic gradient in the partner set and the only one to have flattened since 2015, but this predominantly reflects a floor effect rather than equity. Kosovo departs from the common migration pattern as well. Immigrant-background students there do not differ unfavourably from natives in ESCS, home possessions or home language, so none of the raw gap is accounted for by these characteristics (Section 12.1). Kosovo is absent from PIAAC and the ESS, and its profile is ultimately defined by the lack of any evidence on adult and labour-market outcomes.

20.8 Poland

Poland, an Eastern system that tracks at fifteen, was the one partner country that improved markedly before the pandemic. Grade-four TIMSS mathematics rose from 481 in 2011 to 546 in 2023, and PIRLS reading gained 45 points between 2006 and 2016. In PISA, however, it recorded the largest decline between 2018 and 2022 (27 points), although it still has the lowest share of low performers (23 per cent). High performance goes together with the steepest socioeconomic gradient in the partner set (41.2 points). Half of the achievement variance lies between schools, the level of the early-tracking systems despite selection at fifteen (Section 9.3). In the labour market, Poland has the largest tertiary employment premium in the data (42.8 percentage points), the smallest gender pay gap among employed adults and the smallest vocational employment advantage at upper-secondary level. Polish students work the most alongside their studies and report the most financial strain of the four partner countries covered in EUROSTUDENT.

20.9 Portugal

Portugal, a Southern system that tracks at fifteen, stands out for the sharpest policy-related change in the data. After a national programme to reduce grade repetition was launched in 2016, its repetition rate fell from 31.2 to 17.2 per cent between 2015 and 2022, a reduction of 12.9 percentage points relative to the other partner countries (Section 11.3). The fall could partly reflect changed promotion standards rather than improved learning, and the rate remains among the three highest in the partner set. Portugal's labour-market profile is also distinctive. Its tertiary employment premium is the smallest among the countries with PIAAC data (20.7 percentage points), while vocational upper-secondary graduates hold the largest employment advantage over general ones (8.3 points; Section 18.1).

20.10 United Kingdom

The United Kingdom is a Liberal, comprehensive system that defers tracking to sixteen, and it is the exception on migration. Immigrant-background students out-perform comparable native peers by 11.7 points, and the raw gap is not significant even though their characteristics would predict one in favour of natives (Sections 5.4 and 12.1). This pattern is consistent with a positively selected migration stream, although the estimates cannot separate selection from schooling. Despite a steep socioeconomic gradient, grade repetition is the lowest in the partner set (2.1 per cent). At grade four, England was the strongest TIMSS performer in most cycles and the only partner country whose PIRLS reading held its level between 2016 and 2021. In the labour market, England is the only partner country where youth NEET fell markedly between the PIAAC cycles (from 11.8 to 5.4 per cent). It also has the largest gender pay gap among employed adults (19.9 log points), but job characteristics account for a larger share of it than anywhere else (41 per cent; Section 12.2).

21 Mapping the findings to the research-question programme

The country profiles of Chapter 20 read the results country by country. This chapter reads them against the EDU-LAB research-question programme, in which the four transition fields are nested. For each of the nine clusters it states what the WP3A secondary-data analysis can and cannot establish, so that the reach of the deliverable and its gaps are explicit. The companion coverage matrix (WP3A_D32_RQ_Coverage_Matrix.xlsx) maps all thirty-four sub-questions and hypotheses of the programme to the estimate or dataset that addresses them, and classifies each one. Two sub-questions are covered by a direct estimate and seventeen in part. Four can be reached only at the macro level and five require data not held. Three could be answered with data already held but have not yet been analysed, and three belong mainly to WP3B and WP4.

21.1 Cluster 1 — Selection of early pathways and transitions

Cluster 1 asks which factors shape young people's first choices of education, training and employment. WP3A reaches the determinants of these choices but not the choices themselves. For the first choice of programme (RQ1.1a), achievement is the proximate determinant of track placement, and its socioeconomic, migration and gender gaps are measured for all nine partner countries (Chapter 5). The interaction models add that the socioeconomic gradient is flatter for immigrant-background students in every partner country, so the two determinants do not simply add up (Section 12.5). The track choice itself, parental expectations and ethnicity are not recorded in the assessment data.

Financial barriers at entry (RQ1.2a) have no adequate proxy in the assessments. EUROSTUDENT observes them only once students have reached higher education: in all four partner countries it covers, students from non-tertiary families report financial difficulty more often and more often enter late (Section 6.2). The barriers at the point of choice itself would require EU-SILC. The choice of first employment (RQ1.1b, RQ1.2b) is not recorded in the assessments either. EUROGRADUATE could address it for graduates, but this has not yet been analysed. Labour-market conditions (RQ1.3) are reachable only as macro context (Chapter 19). The cluster is thus covered on its socio-cultural and cognitive determinants and open on its financial and labour-demand ones.

21.2 Cluster 2 — Sustained participation

Cluster 2 asks who continues in education and training. Actual drop-out would require longitudinal data that the harmonised files do not contain, so the cluster is addressed through proxies. For social relations (RQ2.1), grade repetition marks impeded participation. It falls disproportionately on students from less advantaged homes, on boys and, in most countries, on immigrant-background students (Section 6.1). The path model of Section 12.6 adds that about two-fifths of the socioeconomic association with repetition remains among students with the same achievement. Early leaving is available at the macro level (Section 19.1), while ethnicity is not measured.

The financial dimension (RQ2.2) is addressed at tertiary level. Students from non-tertiary families report financial difficulty more often in all four EUROSTUDENT countries, most markedly in Poland and Germany. At equal values of the other characteristics, being female and having a migration background each add to this probability, so the disadvantages accumulate (Section 6.2). Whether financial strain leads to discontinuation is not observed. For skills (RQ2.5), home language, digital competence including computational thinking (Chapter 13), and adult literacy and numeracy are all measured, but none can be linked to a drop-out outcome. Whether non-financial support moderates the effect of financial difficulty (RQ2.6) could be estimated with the EUROSTUDENT support variables but has not yet been done. The socioeconomic conditions of participation (RQ2.3, RQ2.4) are reachable only at the macro level.

21.3 Cluster 3 — Progression and success

In Cluster 3, which concerns progression and completion, the gaps lie mainly on the side of the data. Teaching and curriculum quality (RQ3.1a) is measured by PISA's questionnaire scales on teaching, which have not yet been analysed; they could be related to achievement and grade repetition, but not to completion, which PISA does not observe. The pandemic (RQ3.1b) is measured through its association with achievement (Chapter 10), not with completion. Progression-support measures (RQ3.2) cannot be assessed, because EUROGRADUATE surveys only those who have completed higher education. The labour-market situation after an uncompleted programme (RQ3.3a) is reflected in the employment rate of adults without an upper-secondary qualification: 54.6 per cent, against 85.2 per cent among the tertiary-educated (Section 7.2). The need to combine study and work (RQ3.3b) is measured in EUROSTUDENT, where students from non-tertiary families more often work more than twenty hours a week in all four countries (Section 6.2).

Re-entry into education (RQ3.4a) is approximated by the age at which adults completed their highest qualification. Below tertiary level, completion at 25 or later is common only in Finland and the United Kingdom (England), and there mostly in the vocational branch (Section 18.3). The transition to NEET status (RQ3.4b) is addressed by the NEET model of Section 7.1. Low qualifications and low literacy are associated with a higher risk, and the odds for young women are more than twice those for young men. The

decomposition of Section 12.3 shows that this gender gap of 7.0 percentage points is not accounted for by education, literacy or age. It is consistent with caregiving and family formation, which the model does not include. For migration (RQ3.5), an immigrant background is associated with lower odds of NEET status once education and literacy are held constant (Section 7.1), although it is associated with a higher risk of not completing upper-secondary education (Section 6.3). The finer distinction by citizenship is available in the ESS but has not yet been analysed.

21.4 Cluster 4 — Qualifications and labour-market success

Cluster 4 relates qualifications to labour-market outcomes and is the cluster the data cover best. Which qualifications are most associated with NEET status (RQ4.1c) is answered directly. Tertiary education is associated with lower odds and the lack of an upper-secondary qualification with higher odds, and measured literacy is protective in addition to formal qualifications (Section 7.1). For employment (RQ4.1b), the employment rate rises by about thirty percentage points from below upper-secondary to tertiary level. After matching on background characteristics, tertiary attainment remains associated with an 8.2 percentage-point higher employment probability (Section 7.2). Within upper-secondary education, the vocational branch has a small employment advantage in all five countries where both branches can be compared, but no earnings advantage (Chapter 18). Parental education is associated with employment almost entirely through the respondent's own education and literacy, whereas about two-fifths of its association with earnings is not accounted for by them (Section 12.7). Contract type and working hours enter the pay-gap decomposition as controls (Section 12.2) but have not yet been analysed as outcomes. The time to employment (RQ4.1a) is not observed in PIAAC. EUROGRADUATE 2022 records the time to first job, and that analysis is planned for D3.3.

Mismatch (RQ4.2) is addressed directly by two self-assessed measures of overqualification, for recent graduates in EUROGRADUATE 2018 and for employed tertiary-educated adults in PIAAC (Section 8.1). Graduates born abroad are overqualified slightly more often than those born in the country (25 against 23 per cent). The difference remains of similar size at equal field of study, country and age at graduation, but it is too imprecisely estimated to confirm the programme's hypothesis. Working outside one's field of study is described for three partner countries (Section 8.2).

The gender pay gap is not a sub-question of the cluster, but it qualifies the cluster's premise that qualifications govern labour-market success. Given their education, literacy and age, employed women would be expected to earn slightly more than men, and a year of education pays off at least as well for women (Section 12.2). The pay gap is therefore mostly unexplained. Among recent graduates, field of study and the other characteristics included account for a little more than half of it.

21.5 Cluster 5 — Education systems and cross-country differences

Cluster 5 relates the institutional features of education systems to outcomes. For RQ5.1, the firmest evidence concerns the social-reproduction side of the hypothesis. Early tracking is associated with markedly higher grade repetition and between-school segregation, the only two cross-country associations that are robust to the omission of individual countries (Sections 9.1, 9.3 and 9.4). At the individual level, part of the socioeconomic association with repetition remains among students with the same achievement (Section 12.6). Both findings are consistent with the hypothesis that early tracking is socially reproductive. The expected association between early tracking and a steeper socioeconomic gradient in achievement, however, is not visible across the nine countries (Section 9.1). The speed of entry into work is not measured. The dual-system hypothesis cannot be tested with the public PIAAC files, which do not record age for Austria and Germany, although the Eurostat series show the largest vocational employment advantage in Germany (Section 19.2). Labour-market institutions (RQ5.2) can be examined only through cross-country associations: higher active-labour-market spending goes together with lower youth NEET across eight countries, but the association is not robust (Section 11.2). Job stability (RQ5.3) would require EU-LFS or EU-SILC.

21.6 Cluster 6 — Regional and territorial issues

Cluster 6 concerns regional and territorial differences, which the cross-national assessment data are not designed to capture, since they support national rather than sub-national estimation. RQ6.1 is therefore reached only minimally. The ESS shows a clear urban–rural difference in tertiary attainment, 44 against 26

per cent, while employment rates are almost identical (Section 6.3). A fuller regional analysis requires EU-LFS regional microdata or national registers, so this cluster falls largely outside WP3A's current holdings and is flagged for the national teams and WP4.

21.7 Cluster 7 — Economic crises

Cluster 7 concerns economic and societal crises, and Chapter 10 examines two that fall within the period of the data: the COVID-19 pandemic, through the comparison of PISA 2018 and 2022, and the financial and eurozone crisis of 2008–2013, through the contrast between the two PIAAC cycles. RQ7.1, which asks which groups of young people are most vulnerable, is addressed for the pandemic. Mathematics performance fell in every partner country between 2018 and 2022, by 18.6 points on average (Section 10.1). Averaged across the partner countries, neither the socioeconomic nor the immigrant achievement gap changed by more than its sampling uncertainty, and only in Austria did the socioeconomic gap clearly widen. Girls lost about three points more than boys. Whether crisis effects persist (RQ7.2) cannot be answered with the current data. For the financial crisis, the comparison of the two PIAAC cycles shows no common sign of scarring in youth employment, but repeated cross-sections cannot follow entry cohorts, so longitudinal data are required (Section 10.2). The data contain no evaluation of crisis measures (RQ7.3).

21.8 Cluster 8 — Policy programmes and investment

Cluster 8 asks whether youth-transition policies are effective and efficient (RQ8.1), and the data address it at the level of countries. Neither education spending, active-labour-market spending nor the ESF+ envelope shows a robust association with outcomes across the partner countries (Section 11.2). The ESF+ envelope goes together with higher youth NEET, which reflects its allocation to regions with greater need. In Portugal, a focused reform coincided with a fall in grade repetition of 12.9 percentage points relative to the other partner countries (Section 11.3). This suggests that the design and targeting of policy matter, although changed promotion standards may also have contributed. The joint WP2–WP3A policy-effectiveness matrix sets these outcomes against the D2.1 policy mapping (Section 11.4). With at most nine countries, all of these are descriptive associations, and identifying policy effects would require richer policy data.

21.9 Cluster 9 — Subjective transition experiences

Cluster 9 concerns the subjective experience of transitions. How young people handle uncertainty, how their expectations align with outcomes, and how subjective and expert assessments differ (RQ9.1 to RQ9.3) lie outside the assessment data and fall to the WP3B expert survey and the WP4 case studies. Whether institutional mismatch erodes trust and agency (RQ9.4) is touched only by proxy. In the ESS, tertiary-educated and employed adults report higher social trust and life satisfaction than others (Chapter 16), but the comparison is descriptive, and lived experience and agency remain the province of the qualitative strands.

21.10 Summary

In sum, the WP3A programme reaches the research questions most fully where individual-level outcomes are measured: in Clusters 4 and 7, and on the determinants side of Clusters 1 and 3. Clusters 5 and 8 are reached through cross-country associations that rest on few countries, and Cluster 2 through proxies and the tertiary evidence of EUROSTUDENT. Clusters 6 and 9 fall mainly to other work packages and data sources. The coverage matrix records the verdict for every sub-question and the data that would be needed to close each gap.

22 Synthesis and discussion

Chapter 21 set out, question by question, how far the findings answer the EDU-LAB research programme. This chapter reads them together. Section 22.1 traces the pattern of socioeconomic reproduction that runs through all four transition fields, and Section 22.2 shows how institutions and crises are associated with differences in its level. Section 22.3 contrasts the composition of the immigrant achievement gap and the gender pay gap. Section 22.4 relates the results to the EDU-LAB model and to the other work packages, and Section 22.5 draws the policy implications that follow from them. Sections 22.6 and 22.7 then turn to the

limits of secondary data and to the questions that WP3A hands to the WP3B expert survey and the WP4 case studies.

22.1 The thread of socioeconomic reproduction

Read across the chapters, the most important result of this deliverable is not a single estimate but a pattern that recurs in every field. Socioeconomic differences in competence are clearly established by grade four and are of similar standardised size at every later stage, including among adults (Section 14.1). At age fifteen, the socioeconomic gradient in mathematics is 36.3 points per standard deviation of ESCS, and it has widened since 2015 (Section 5.3). The same background differences reappear as a near four-fold difference in grade repetition between the bottom and top socioeconomic quartiles (Section 6.1), and as a more than four-fold difference in tertiary attainment by parental education (Section 6.3). The labour market adds a further step, because the earnings returns to education are about twice as high over the tertiary years as before them (Section 7.3), while access to tertiary education is socially graded. Across these stages, the association with background does not become weaker at any point. Because the comparisons are between cohorts rather than within persons, however, they cannot show whether individual stages reduce, reproduce or add to it.

The path and decomposition analyses of Chapter 12 show that the pattern is not only a matter of achievement. About two-fifths of the socioeconomic association with grade repetition remains among students with the same achievement (Section 12.6). About two-fifths of the earnings advantage of a tertiary-educated parent is not accounted for by the respondent's own education and literacy (Section 12.7). And immigrant background, sex and home language account for only about a tenth of the socioeconomic achievement gap (Section 12.3).

22.2 How institutions and shocks modulate the pattern

Around this common pattern, institutions and shocks are associated with differences in outcome levels. The firmest systems-level findings concern early tracking. Systems that track earlier have markedly higher grade repetition and a larger share of achievement variance between schools. These are the only two cross-country associations that are robust to the omission of individual countries (Sections 9.1, 9.3 and 9.4). Early tracking is not, however, associated with a steeper socioeconomic gradient across the nine countries. Larger vocational sectors and higher active-labour-market spending go together with lower youth NEET, but neither association is robust, so both indicate a direction only (Sections 9.2 and 11.2).

Of the two crises, the COVID-19 pandemic coincided with a decline in mathematics in every partner country. Its association with socioeconomic gaps was small on average and clear only in Austria (Section 10.1). The eurozone crisis is reflected in the high youth NEET of Greece and Italy in the first PIAAC cycle (Section 10.2).

The policy analysis cautions against a simple link between investment and outcomes. Education spending is only weakly associated with outcomes, and EU structural funds are allocated to the systems with the greatest problems. Cross-country associations between investment volume and outcomes therefore say nothing about the effectiveness of investment in either direction (Section 11.2). Portugal suggests that a focused reform can coincide with a substantial change in a targeted outcome. After a national programme, its grade-repetition rate fell by 12.9 percentage points more than in the other partner countries, although changed promotion standards may have contributed (Section 11.3).

22.3 Two gaps, two policy logics

The decompositions of Chapter 12 contrast two gaps: the immigrant achievement gap in school and the gender pay gap in the labour market. They are composed in opposite ways.

In seven of the eight countries where natives score higher in PISA mathematics, ESCS, home possessions and home language account for the greater part of the immigrant achievement gap, and for almost all of it in Austria, Germany and Greece. Only in Finland and Kosovo does a significant part remain unexplained (Section 12.1). The gender pay gap among employed adults is the opposite case. Given their education, literacy and age, employed women would be expected to earn slightly more than men. With job characteristics added, the explained part is close to zero, and the unexplained part (14.4 log points) exceeds the gap of 13.0; only in Finland and the United Kingdom is the explained part positive (Section 12.2). The pay gap is thus mostly

unexplained, as is the gender gap in NEET status (Section 12.3). Among recent graduates, field of study and the other characteristics included account for 58 per cent of the pay gap, which widens in the first years after graduation.

The explained parts describe how the gaps are composed, not what would happen if characteristics were equalised. Even so, they point to two policy logics. For the immigrant gap, the relevant margin lies in characteristics that immigrant-background students share with other disadvantaged students, so general support for socioeconomic disadvantage and home language reaches most of those concerned. For the gender pay gap, the margin lies beyond qualifications, in pay-setting, occupational structures and the combination of work and care, and among graduates also in the earlier choice of field.

22.4 Contribution to the EDU-LAB model

For WP1, the results supply comparable magnitudes for the determinants of the model. They show how strongly socioeconomic status, migration background, language and gender are associated with achievement, progression, completion and labour-market outcomes across the partner countries. They distinguish determinants whose association is similar across countries, such as socioeconomic status and parental education, from those that vary with context, such as the immigrant gap and the gender gap in achievement. They also give the intersectional framing of WP1 an empirical form. The socioeconomic gradient is flatter for immigrant-background students in all nine countries (Section 12.5), and among students, gender, migration background and impairment add to social origin in financial difficulty (Section 6.2).

For WP2, the results provide outcome measures against which the policy mapping can be read, brought together in the joint policy-effectiveness matrix (Section 11.4), together with a first descriptive look at the relationship between investment and outcomes. For WP3B and WP4, they identify the margins where expert and qualitative evidence would be most informative, which Section 22.7 sets out.

22.5 Implications for policy

The findings of the analytical chapters point to several implications for policy. Because they rest on associations rather than identified effects, these implications indicate where policy might act, not what a given measure would achieve.

Socioeconomic differences in competence are already present by grade four and are no smaller at later stages (Section 14.1). Measures that reach children before and during primary school therefore address these differences where they are first observed, while later measures meet gaps that already exist.

Grade repetition is closely tied to early tracking, and the comprehensive systems of Finland and the United Kingdom combine very low repetition with achievement broadly similar to that of the early-tracking systems (Section 9.1). Systems that rely on repetition can therefore look to alternatives such as targeted support, all the more because disadvantaged students repeat more often even at equal achievement (Section 12.6).

Access to tertiary education is strongly graded by parental education, while tertiary education carries the highest earnings returns (Sections 6.3 and 7.3). Widening access to tertiary and high-quality vocational qualifications thus addresses a point at which background is associated with lasting differences in adult outcomes.

The immigrant gap is largely associated with socioeconomic background and home language, so support targeted at these characteristics reaches most of the students concerned (Section 12.1). In Finland, a disadvantage remains beyond them, and measures directed at the specific situation of immigrant-background students may be needed in addition.

Neither the gender pay gap nor the gender NEET gap is accounted for by women's qualifications (Sections 12.2 and 12.3). Both therefore point less to education and training for women than to pay-setting, occupational structures, childcare, parental leave and the availability of flexible work. Guidance on field of study addresses the part of the graduate pay gap associated with composition.

Investment volumes show no robust association with outcomes, while Portugal shows that a focused reform can coincide with a substantial change in its targeted outcome (Sections 11.2 and 11.3). Together this argues for the systematic evaluation of programmes, and for directing funds towards the integrated, early and well-targeted measures that D2.1 identifies as effective.

22.6 What secondary data can and cannot contribute

The division of labour between this quantitative programme and the other strands of EDU-LAB follows from what secondary data can do. Secondary analysis of international surveys establishes, comparably across countries and with known sampling uncertainty, the size and variation of the determinants and outcomes the surveys measure. It allows EDU-LAB to state, for example, that the socioeconomic gradient in mathematics widened from 33.2 to 36.3 points between 2015 and 2022, or that tertiary-educated adults are 8.2 percentage points more likely to be employed than adults with similar observed background. It is correspondingly weak on mechanisms, on lived experience, on regional and institutional detail, and on anything the surveys do not measure or do not follow over time.

Its findings therefore work best as a quantified frame. They show where inequalities are largest and transitions most fragile. They leave to the WP4 case studies and the WP3B expert survey the questions of mechanism that qualitative and expert methods are better placed to answer: why part of the immigrant gap remains in Finland, why grade repetition goes together with early tracking, why young women are more often NEET at equal qualifications, and which features of the Portuguese programme accompanied the fall in repetition.

22.7 Targeted hypotheses for WP3B and WP4

The previous section named the mechanisms that secondary data can describe but not explain. WP3A therefore hands them to the two EDU-LAB strands better placed to study them, the WP3B expert survey and the WP4 case studies, as a set of targeted questions. Each question is anchored to a specific quantitative finding, so that the expert and qualitative work can start from the patterns established here. The full set is provided as a standalone file (WP3A_D32_Hypotheses_for_WP3B_WP4.docx).

Most of the questions concern the socioeconomic, migration and gender gaps documented in the field chapters. They ask:

- through which early-years, home and school processes socioeconomic differences arise before the end of primary school, and why disadvantaged pupils with the same achievement still repeat grades more often;
- how tracking and school allocation sort pupils between schools;
- why a given difference in family socioeconomic status goes together with a smaller difference in achievement among immigrant-background students, and what distinguishes Finland, where part of the immigrant gap remains at equal background and language;
- which pay-setting, working-time and care-related mechanisms lie behind the gender pay and NEET gaps, which persist although women's qualifications match or exceed men's;
- through which routes parental education remains associated with earnings at equal education and skills.

Other questions address policy and institutions directly:

- which features of the Portuguese programme accompanied the fall in grade repetition;
- which demand-side and employer-engagement measures matter where young people stay in education but do not find work, as in Greece and Kosovo;
- how school-to-work coupling operates in the dual systems of Austria and Germany, which the public microdata cannot reach;
- what drives graduate overqualification.

23 Limitations

The questions handed to WP3B and WP4 in Section 22.7 mark what the secondary data cannot explain. This chapter sets out the general limits of the evidence itself, in line with the transparency the D3.2 specification requires, and how WP3A plans to address them in D3.3.

The first limit is coverage. The public-use files do not cover all partner countries equally in each source. PIAAC does not record exact age for Austria and Germany, which removes the two dual-system countries from the labour-market analyses. Kosovo is absent from PIAAC, the ESS and Eurostat, and the United Kingdom from ICILS and, after 2019, from the Eurostat series. Several countries are observed in only one cycle of a survey. The set of countries therefore differs between analyses, and comparisons across chapters do not always refer to the same systems. For D3.3, WP3A plans to apply for the PIAAC scientific-use files, which record exact age and so return Austria and Germany to the labour-market analyses. It also plans to apply for the EU Labour Force Survey (EU-LFS), which covers all EU partner countries with large samples. Neither closes the gaps for Kosovo, or for the United Kingdom after 2020.

The second limit is that almost all sources are cross-sectional. They compare different people at different stages and in different periods rather than following the same individuals. The deliverable can therefore describe how inequalities differ between stages and cohorts, but not how they develop within persons. Drop-out, re-entry, scarring and income trajectories remain beyond its reach. The sources planned for D3.3 narrow this gap in part. The PIAAC scientific-use files allow labour-market entry cohorts to be constructed, and the EU-LFS records the time since leaving education. The longitudinal component of the EU Statistics on Income and Living Conditions (EU-SILC), for which WP3A also plans to apply, follows individuals over several years.

The third limit concerns measurement. The international surveys record only some of the determinants in the WP1 framework. Parental expectations, ethnicity, teaching practice, caregiving and family formation, household income and regional conditions are measured poorly or not at all. Where a determinant is not measured, its association is absorbed into the unexplained parts of decompositions and the direct parts of path models. EU-SILC records household income, material deprivation and household composition, and the EU-LFS records regional identifiers, contract type and working hours. Together they would allow financial barriers, the caregiving context of young adults, job stability and regional differences to be examined more closely. Some of the data already held have also not yet been fully analysed, and Chapter 21 identifies three sub-questions they could address.

The fourth limit concerns the restricted-access sources. EUROSTUDENT and EUROGRADUATE are confidential scientific-use files released only under a written data use agreement. They cannot be harmonised with the partner-country files or distributed with this deliverable, and they cover only the partner countries that deposited microdata. Because they carry no replicate weights, their estimates are weighted and robust rather than design-based.

The fifth limit is methodological. All results describe associations. Regression coefficients, decompositions and path models depend on the characteristics included, and none of them identifies causal effects. The matching estimate does so only under the assumption of selection on observed characteristics. The cross-country analyses rest on nine countries at most, and only the two early-tracking associations are robust to the omission of individual countries (Section 9.4). The additional sources will extend what can be described, but the analyses will remain associational.

These limitations bound the strength of the system-, crisis- and policy-level claims. The central findings rest on the large design-based analyses of PISA, TIMSS, PIRLS and PIAAC.

24 Conclusions

This deliverable has assembled six harmonised international datasets for the nine EDU-LAB partner countries, complemented them with two restricted-access sources on the tertiary and graduate stages, and used them for a first comprehensive analysis of the four transition fields and of the systems, crisis and policy clusters. The evidence describes a consistent pattern: socioeconomic differences established by the end of primary

school recur in progression, attainment and labour-market outcomes. Institutions and crises are associated with differences in its level, whereas the volume of investment is not robustly related to outcomes. Education carries a large employment and earnings premium, most of all at tertiary level. Grade repetition is closely tied to early tracking, as is between-school segregation, and these two associations are the firmest systems-level findings. Mathematics fell in every partner country over the pandemic period, with little change in socioeconomic gaps on average. The immigrant achievement gap is largely accounted for by socioeconomic background and home language, except in Finland and Kosovo, whereas the gender pay and NEET gaps are mostly unexplained. The determinants also do not simply add up: the socioeconomic gradient is flatter for immigrant-background students, and part of the socioeconomic association with repetition remains at equal achievement. All of these results describe associations rather than causal effects.

Together they give EDU-LAB a quantified and comparable baseline, against which the WP1 model, the WP2 policy assessment, the WP4 case studies and the WP3B expert survey can be developed. D3.3 will extend this baseline with the PIAAC scientific-use files, the EU Labour Force Survey and EU-SILC. These are planned to return Austria and Germany to the labour-market analyses, add regional, job-stability and income information, and allow individuals to be followed over time.

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Appendix A — Technical notes

This appendix documents the harmonised variables and the estimators used throughout the deliverable. Full variable mappings are in the dataset codebooks.

A.1 Key harmonised variables

Table 16. Key harmonised variables by programme

Construct	PISA	PIAAC	IEA (TIMSS/PIRLS/ICILS)	ESS
Socioeconomic status	ESCS index	parental education (PARED)	home-resources scale; ICILS NISB	parental education (eiscdm/f)
Achievement / skills	plausible values (maths/reading/science)	literacy/numeracy plausible values	plausible values (maths/science; reading; CIL/CT)	—
Education attainment	—	EDCAT (ISCED)	—	ES-ISCED (eiscde)
Gender	ST004D01T	GENDER_R	ITSEX / S_SEX	gndr
Migration	IMMIG	IMGEN	born-in-country / S_IMMIG	brncntr
Employment	—	C_D05 (derived)	—	mnactic / pdwrk
Weights	W_FSTUWT + 80 BRR	SPFWT0 + 80 replicate	TOTWGT + jackknife zones	anweight

Note: Entries are the variable or derived index taken from each programme's original files; a dash means that the construct is not applicable or not harmonised for that programme. NISB is the ICILS national index of students' socioeconomic background. Full variable mappings are given in the codebooks available online (<https://dashboard.edulab-project.eu/app/wp3a-method>).

A.2 Estimation and inference

This section explains the estimators behind Sections 4.1 and 4.2. In each case, θ_0 denotes the estimate computed with the final weight, and θ_r the estimate computed with the r -th replicate weight.

Plausible values (Rubin's rules). Achievement in PISA, TIMSS, PIRLS, ICILS and PIAAC is provided as M plausible values per respondent, so every statistic is computed M times. The point estimate is the average of the M results. The total variance is $U + (1 + 1/M) B$, where U is the average sampling variance across the plausible values and B is the variance between the M point estimates. B captures the uncertainty that arises because achievement is not observed exactly.

PISA — balanced repeated replication. The sampling variance is estimated from the 80 Fay replicate weights as $V = 1 / (80 (1 - k)^2) \cdot \sum_r (\theta_r - \theta_0)^2$, with Fay factor $k = 0.5$. Each replicate weight increases the weight of half of the sampled schools in each pair of strata and reduces the other half.

TIMSS, PIRLS and ICILS — jackknife repeated replication. The sampling variance is $\sum_z (\theta_z - \theta_0)^2$ over the 75 jackknife zones. In zone z , the weights of one randomly chosen half of the sampled schools are doubled and those of the other half set to zero.

PIAAC — replicate-weight variance. The variance is estimated separately for each country and cycle with the replication method the programme records (VEMETHOD), as $c \cdot \sum_r (\theta_r - \theta_0)^2$ over the first G replicate weights (VENREPS). G is 80 in most countries and 52 for Portugal in Cycle 2. The factor c is 1 for the paired jackknife (JK2), $(G - 1)/G$ for the delete-one jackknife (JK1), and $1 / (G (1 - k)^2)$ for Fay's balanced repeated replication. For pooled estimates, the variances of the country-cycle groups are summed.

ESS — Taylor linearisation. Without replicate weights, the variance of a weighted mean is approximated by linearisation over the survey's strata and primary sampling units. Strata with a single primary sampling unit

are centred on the overall mean. Partner-country averages treat the countries as independent samples, so their variance is the sum of the country variances divided by the squared number of countries.

EUROSTUDENT and EUROGRADUATE — weighted estimation with robust errors. Both files carry a design weight but no design information. Estimates are weighted, and regression standard errors are heteroskedasticity-robust. The graduate pay-gap decomposition obtains its standard errors by bootstrap resampling.

Threshold model. Log hourly earnings are regressed on years of education S and on $\max(0, S - 15)$, with the other controls of Section 7.3. The coefficient on S is the return per year below fifteen years. The coefficient on the second term is the additional return per year above fifteen years.

Oaxaca–Blinder decomposition (two-fold). For groups A and B, with reference coefficients β estimated on the pooled sample, the gap in mean outcomes is split into an explained part $\sum_k (\bar{x}_{A,k} - \bar{x}_{B,k}) \beta_k$ and an unexplained remainder. The contribution of each characteristic k is its term in the sum. For binary outcomes such as NEET status, the outcome equation is a linear probability model. Standard errors are obtained by re-estimating the decomposition under each replicate weight and, for achievement, each plausible value.

Propensity score matching. The propensity score is estimated by a weighted logistic model of tertiary attainment on the covariates. Within each country, each tertiary-educated adult is matched, with replacement, to the comparison adult with the nearest logit propensity score within a caliper of 0.2 standard deviations. The average treatment effect on the treated is the weighted mean difference in employment between the matched pairs. Its standard error comes from the replicate weights, and a Rosenbaum sensitivity analysis gauges the influence of unobserved confounding.

Difference-in-differences. The Portuguese estimate is $(P_{2022} - P_{2015}) - (C_{2022} - C_{2015})$. Here P is Portugal's grade-repetition rate and C the unweighted mean of the other eight partner countries.

Interaction and path models. Interaction models add product terms, such as $ESCS \times$ immigrant background, to the design-based regressions. A path model is a system of design-based regressions. The total association of a background variable with the outcome is split into a direct part, its coefficient when the intervening variables are included, and an indirect part, the difference between the total and the direct part, which equals the product of the path coefficients in a linear system. Binary outcomes are modelled as linear probabilities so that the two parts add up exactly to the total. The standard error of every quantity, including the share of the total that runs through the intervening variables, is obtained by recomputing the full decomposition under each replicate weight and, where achievement is involved, each plausible value.

Between-school variance share. The share is $V_{\text{between}} / (V_{\text{between}} + V_{\text{within}})$. V_{between} is the weighted variance of school-mean achievement, and V_{within} the weighted mean of the within-school variances. The standard error is obtained by balanced repeated replication over the PISA Fay replicate weights.

Cross-country correlations. Country-level associations are reported with the Pearson and the rank-based Spearman coefficient and with a leave-one-out range, the minimum and maximum Pearson coefficient when each country is omitted in turn. An association is classified as robust if it remains significant at the 10 per cent level under every single-country omission.