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Strategies for Achieving Equity and Inclusion in Education, Training and Learning in Democratic Europe (STRIDE)

Trends in Inequality in Educational Achievement in Europe

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Trends in Inequality in Educational Achievement in Europe

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Publisher: Lifelong Learning Platform, Brussels, Belgium, 2026
Authors: Márton Medgyesi, Zsófia Tomka, Thea Bertnes Strømme, Magdalena Ślusarczyk
Contributors: Lihong Huang, István György Tóth, Mark Pearth, Maria Tatto
Design, Typeset and Layout: María Arguedas, Veronica Arduino, Matilde Fanutti

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1. Introduction[1]

The overall objective of the STRIDE project is to assess inequalities in education, training, and learning outcomes over time and identify reforms and interventions that can compensate for those inequalities and formulate recommendations and a guide to good practices. This report presents the trends of inequalities in education achievement in Europe and an analysis of policy reforms based on re-analyses of international large-scale educational assessment studies: Trends in International Mathematics and Science Study (TIMSS), Programme for International Student Assessment (PISA) and Progress in International Reading Literacy Study (PIRLS). We have selected Early Childhood Education and Care (ECEC) policy reforms and examined the results in terms of inequalities in educational achievement. The report builds on Deliverable D3.3 Spreadsheet of key indicators (see Steinmann et al. 2025) and provides input for later outputs of the project such as the digital policy toolbox (Deliverable D6.1.). The report includes the following chapters.

Chapter 2 describes the trends of inequalities in educational achievement of students (in 27 EU member states, Norway and the UK) based on the analysis of international large-scale educational assessment (ILSA) data. We focus on inequality between groups, rather than inequality as dispersion, analysing differences in educational achievement among students with different parental education, gender, immigrant status and urbanisation. In addition to the sequential analysis of dimensions of inequality, we are also applying an intersectional lens, looking at how different aspects of individuals' identities interact with each other to create inequalities that cannot be understood by separate analysis of the dimensions. Taking into account sample size limitations we study inequality in educational achievement at the intersection of parental education and gender in addition to parental education and urbanisation.

Chapter 3 provides an overview of reforms and policy initiatives targeting equity and inclusion in early childhood education and care across Europe during the past 25 years. Focusing on reforms at ISCED 0[2] is particularly justified due to the robust

[1] Parts of analyses in this report were presented at conferences "Using PISA evidence to inform education policies and practices", OECD PISA Conference Dubrovnik (29-30 November 2024), at IEA Research Conference, Roma Tre University (25-27 June 2025) and at Work in Progress seminar of TARKI Social Research Institute, Budapest (11 March 2026). We thank for all valuable comments and suggestions for improvement given by the kind audiences.

[2] **ISCED** is the reference international classification for organising education programmes and related qualifications by levels and fields. ISCED 2011 (levels of education) has been implemented in all EU

body of scientific evidence demonstrating that early childhood education and care can substantially contribute to children's cognitive, social and emotional development (Burger 2010; Melhuish 2011; Lazzari & Vandenbroeck 2012). In other words, ISCED 0 is the stage where education systems have the greatest potential to reduce inequalities before they become structurally embedded. At the same time, the influence of social class, ethnicity, poverty, disability and socio-economic status is already partly visible at this early stage. High-quality and inclusive early childhood provision is widely recognised as one of the most effective policy levers for narrowing socio-economic gaps, supporting children with special educational needs, and compensating for resource disparities in the home environment (Bellour et al. 2017). In this sense, reforms at ISCED 0 carry a long-term significance: they not only influence immediate developmental outcomes but also condition the effectiveness of subsequent interventions.

In Chapter 4, we apply multilevel modelling to the re-analysis the data following the 'quasi-experiment' timeline of policy change /reforms described in Chapter 3. Specifically, the analysis examines whether early childhood (ISCED 0) access regulation reforms are associated with changes in educational inequality using PIRLS and TIMSS data[3]. We compare 21 countries that implemented reforms between 2006–2018 with 6 countries that did not, tracking inequality ratios by parental education, gender, immigrant background, and urbanicity at three points: five years before, the reform year, and five years after. After describing trends in inequality by SES, migrant background, and gender in reform countries and non-reform countries we conduct multilevel models (students within schools within countries) to uncover the difference in average scores between reform and non-reform countries and to study whether the difference between reform and non-reform countries varies by level of parental education.

In Chapter 5, we summarise the analysis results on inequalities in education achievement in Europe obtained in the previous chapters using data from large-scale educational assessment studies. In addition, we summarise insights from additional analyses carried out in Work Package 3[4] of the STRIDE project that were presented at various conferences.

data collections since 2014. It has nine education levels, from level 0 to level 8. ISCED 0 refers to Early Childhood Education (ECE) - https://ec.europa.eu/eurostat/statistics-explained/).

[3] PIRLS: Progress in International Reading Literacy Study, and TIMSS: Trends in International Mathematics and Science Study, are large-scale, competency-based international assessments. See STRIDE Working Paper on data and methodology "Key indicators of mapping inequalities in educational achievements in Europe", December 2025

[4] A Work Package (WP) is a part of the project work breakdown. It represents a group of project activities aimed at specific common objectives. WP 3 of the STRIDE project focuses on trends in inequalities in educational achievement.

2. Descriptives of trends in educational inequalities

In this chapter we describe trends in inequalities of educational achievement using data from international large-scale assessment studies. Inequalities in educational achievement can be measured from several perspectives (see e.g. Ferreira and Gignoux 2014, Enchikova et al. 2024). One perspective assumes that the mere existence of variation in achievement constitutes inequality and measures inequality of achievement outcomes with indices of dispersion (e.g. Gini index, standard deviation). Another perspective focuses on inequality between groups and looks at how achievement correlates with the grouping variable in question. We adopt this latter perspective and analyse differences in educational achievement between students with different parental education, gender, immigrant status and urbanisation. When the grouping variables represent pre-determined personal characteristics, the analysis is said to study inequality of educational opportunities (Ferreira and Gignoux 2014).

The importance of these dimensions of inequality has been demonstrated by the literature. The evidence regarding the importance of the socioeconomic status (SES) of the family of origin has been reviewed by Blanden et al. (2023) and Enchikova et al. (2024). In a recent comparative study Chmielewski (2019) found strong evidence of increasing SES achievement gaps over the past 50 years across the majority of countries. Gender inequalities of educational achievement have been studied by Hermann and Kopasz (2019) and Perez-Felkner at al. (2024). Alieva et al. (2024) demonstrated that children with immigrant background show significantly lower achievement compared to native children in European countries, even after controlling for differences in socioeconomic status. Differences between students in urban and rural schools have also been studied before (see e.g. Echazarra and Radinger 2019) as urbanisation level can correlate –not only with the socioeconomic status of the families– but also with the quality of educational institutions. Our aim here is to review the trends in the past two decades using the most recent waves of ILSA data.

We also assess whether inequalities observed in primary school tend to widen or narrow down by the time students attain secondary education. This is allowed by the quasi-longitudinal design of TIMSS study, which is conducted every four years, with the fourth-grade student cohort assessed four years later at grade eight. We present such comparisons for the cohort in grade 4 in 2019 and grade 8 in 2023 in case of the countries who participated in both studies necessary to conduct the analysis.

In addition to the sequential analysis of dimensions of inequality, we are also applying an intersectional lens, looking at how different aspects of individuals' identities interact with each other to create inequalities that cannot be understood by separate analysis of the dimensions (Varsik and Gorochovskij 2023). However, due to sample size limitations, we are not able to study every possible combination of the grouping variables. Therefore, we have limited our analysis to the study of the intersection of parental education and gender and also the intersection of parental education and urbanisation.

In the following analysis we present inequality in mathematics and reading test scores. We measure inequality between groups by the ratio of means of achievement scores of the subgroups. Achievement scores in ILSA data are calculated from raw test scores using Item Response Theory and are than standardised to a suitably selected mean and standard deviation. Ferreira and Gignoux (2014) argue that this standardisation is a monotone rank-preserving transformation, therefore test score means and measures of inequality such as the inter-quartile ratio, or the absolute inter-decile difference calculated before and after standardisation are ordinally equivalent. This means that such inequality measures rank distributions before and after standardisation similarly, even though their numeric value will be different. Ratio indices can therefore only be used to detect changes in inequality and differences between countries, but are not suitable to study the rate of change or the extent of between-country differences.

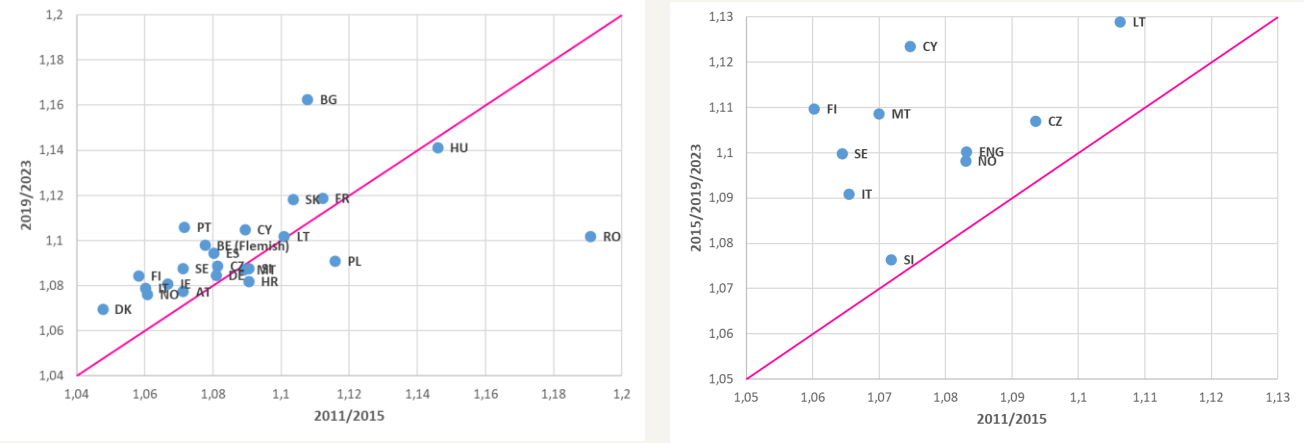
2.1. Inequality in educational achievement by parental education

In this section we use parental education as the measure of socioeconomic status. Although arguments have been made in the literature to use information on books in the home for such purposes (see Zuschlag et al. 2024) we opted for parental education because it is consistently available across our datasets. The sample is divided in two groups: the first group includes students with at least one parent/guardian with a higher education (HE) degree, while students in the second group have no parent/guardian with a higher education degree.

Figure 2.1 shows how inequality in mathematics test scores (by parental education level) changed over time, using data for Grade 4 and Grade 8 from TIMSS. The measure used is the ratio of average mathematics scores of students with highly educated parents to the average of those with no parent with tertiary diploma. Therefore, the higher the ratio, the greater the inequality in educational achievement

in mathematics. The comparison is made between the first and the last year when the given country participated in the data collection. Inequality increased in countries situated above the diagonal line.

Figure 2.1: Ratio of mathematics test scores, high/low parental education for students in Grade 4 (left panel) and Grade 8 (right panel)



Source: own calculation, based on TIMSS data.

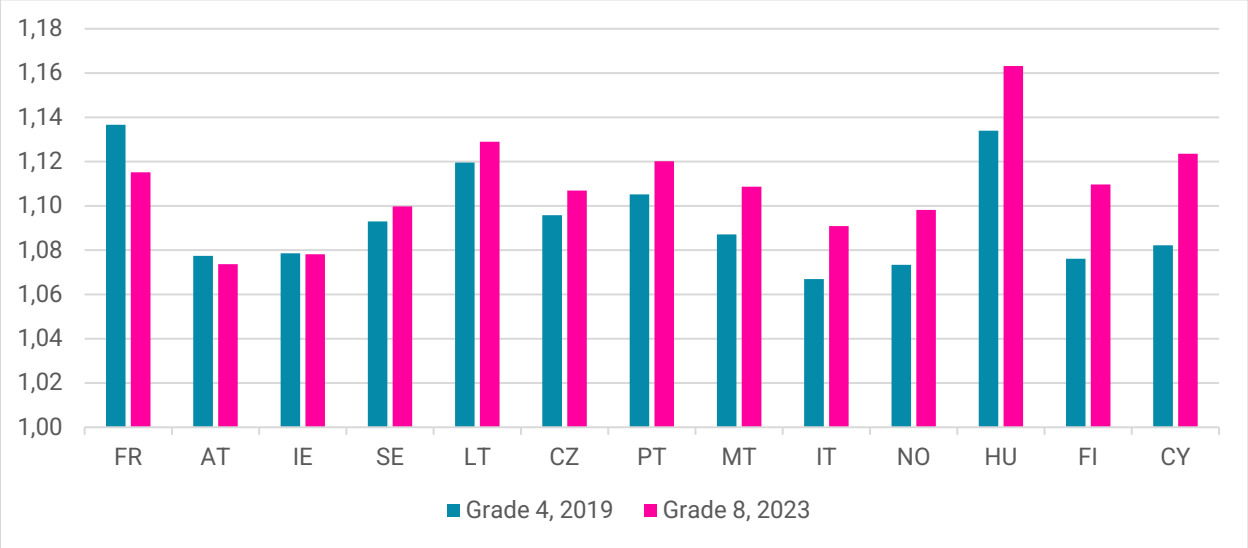
As ratios shown on Figure 2.1. are all above unity, this indicates that inequalities in mathematics achievement by parental education remain substantial across countries. According to the data from TIMSS study, in both Grade 4 and Grade 8 most countries are positioned above the diagonal, meaning that the ratio of average scores between students with high and low parental education was higher in 2019/2023 than in 2011/2015, suggesting a general widening of socioeconomic achievement gaps.

In Grade 4, changes are typically moderate, but still visible across several systems. Countries such as Hungary and Bulgaria stand out with relatively high overall levels of inequality in 2019/2023. Bulgaria, in particular, appears to show a noticeable upward shift over time. More important increases in inequality can also be observed in case of Portugal, while in Romania and Poland inequality has been declining over the period. In Grade 8, the pattern is even more pronounced as several countries display clearer increases and there are no countries where inequality seems to be declining. For example, Hungary, Cyprus and Finland are positioned well above the diagonal, indicating comparatively large growth in the achievement gap.

Using the quasi-longitudinal nature of the TIMSS data, we looked at whether disparities observed in Grade 4 tend to intensify as students' progress through schooling. The comparison of inequality measured through the schooling career are shown on Figure 2.2 in case of the cohort in Grade 4 in 2019. The analysis shows that in half of the countries that participated in both studies, inequality increased

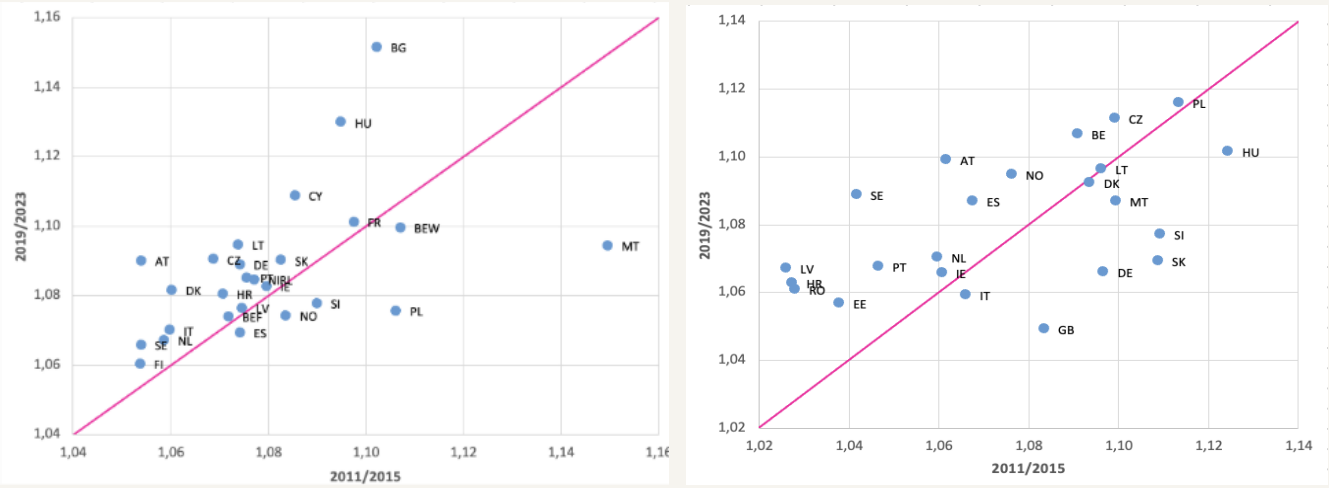
from Grade 4 to Grade 8, being most accentuated in Cyprus, Finland and Hungary. In contrast, France saw inequality between students with high and low educated parents narrowing as this cohort progressed through the education system.

Figure 2.2: Change in the ratio of mathematics test scores, high/low parental education for students in Grade 4 in 2019 and Grade 8 in 2023



Source: own calculation based on TIMSS data.

Figure 2.3: Ratio of reading test scores, high/low parental education for students in Grade 4 (left panel) and at age 15 (right panel)



Source: own calculation based on PIRLS (left panel) and PISA data (right panel)

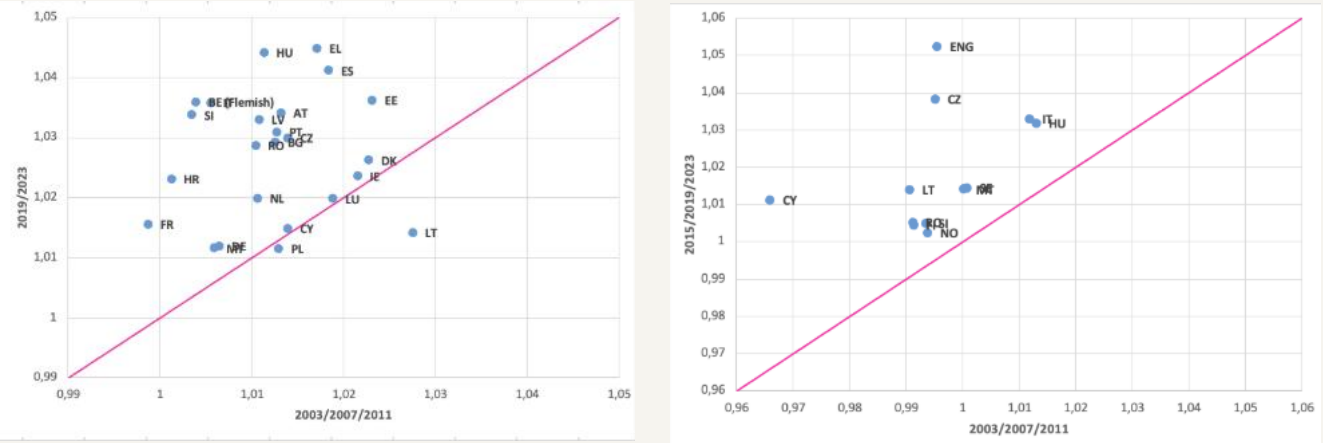
Figure 2.3 shows changes in the ratio of reading test scores between students with high and low parental education from 2011/2015 to 2019/2023, with the diagonal line indicating no change over time. In Grade 4 (left panel), most countries are clustered close to the diagonal, suggesting relatively stable levels of inequality. However, several countries exhibit noticeable increases. Bulgaria stands out with

one of the largest upward shifts, moving to a clearly higher ratio in 2019/2023, indicating a widening gap. Hungary also shows a marked increase, remaining among the countries with the highest inequality levels in both periods. Cyprus and Austria also appear above the diagonal, suggesting a moderate rise. In contrast, countries such as Malta or Poland show declines relative to their earlier levels. Among student of 15 years of age (right panel), the pattern of change is somewhat more dispersed. Sweden, Austria and Latvia display noticeable increases, moving further above the equality line, while Slovenia, Slovakia, Germany and Great Britain lie further below the diagonal, indicating reductions in the relative achievement gap. Overall, the graph (Figure 2.3) suggests that while inequality in reading achievement by parental education remains persistent across countries, countries show mixed trends during the period studied.

2.2. Inequality in educational achievement by gender

In this section, we study gender differences in educational achievement, measured as the ratio of boys' to girls' average scores in mathematics and reading. Figure 2.4. shows changes in gender inequality in mathematics test scores, where values above one indicate that boys outperform girls, while values below unity indicate a female advantage.

Figure 2.4: Boys/girls ratio of mathematics test scores, Grade 4 TIMSS (left panel) and Grade 8 (right panel)



Source: own calculation based on TIMSS data.

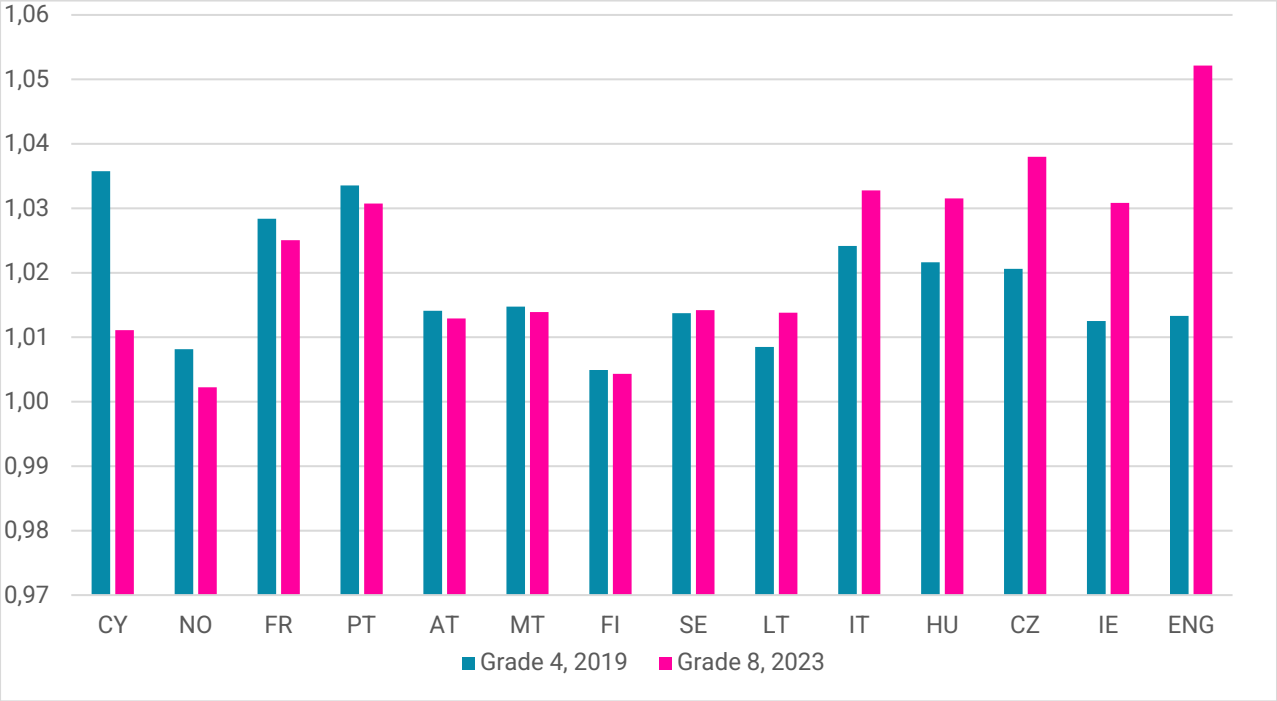
In Grade 4, gender gaps are generally small, showing a moderate advantage of boys in mathematics test scores. However, many countries lie slightly above the diagonal, suggesting a modest increase in boys' advantage in recent years. For example,

countries such as Hungary, Greece, Spain, Belgium, Italy and Slovenia appear above the line, indicating some widening of the gender inequality. Also, a few countries remain close to the diagonal, pointing to relative stability of inequality over time.

In Grade 8, gender inequalities tend also to be generally moderate. Several countries — notably England, the Czech Republic and Cyprus — are clearly positioned above the reference line, indicating that the boys' advantage in mathematics performance has increased over time. Overall, the findings indicate that while gender differences in mathematics remain moderate compared to socioeconomic gaps, there is evidence in several countries of a growing gender inequality in favour of boys.

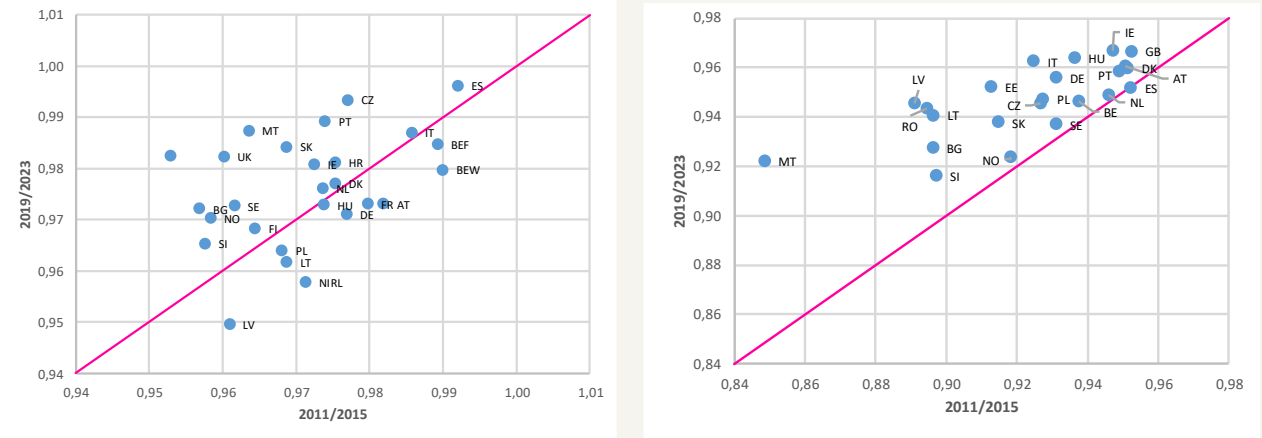
Figure 2.5. shows changes in inequality as students' progress through schooling using the quasi-longitudinal nature of the TIMSS data. The 2019 Grade 4 cohort the advantage of boys in mathematics test scores widened from primary to secondary education in England, Ireland and the Czech Republic, while in Cyprus gender inequality declined.

Figure 2.5: Change in the boys/girls ratio of mathematics test scores for students in Grade 4 in 2019 and Grade 8 in 2023



Source: own calculation based on TIMSS data.

Figure 2.6: Boys/girls ratio of reading test scores for students in Grade 4 (left panel) and at age 15 (right panel)



Source: own calculation based on PIRLS (left panel) and PISA data (right panel).

Figure 2.6. presents changes in the boys/girls ratio of reading test scores between 2011/2015 and 2019/2023. Because the ratio is below unity in almost all countries—especially at age 15—it confirms that girls outperform boys in reading across systems. In Grade 4 (left panel), most countries lie close to the diagonal, suggesting relatively small changes in gender inequality over time. However, some countries show more noticeable shifts. Countries such as Czechia, Malta, UK and Cyprus show some narrowing of the inequality, as boys' performance improved relative to girls. In contrast, in case of Latvia and Northern Ireland a slight decline in the ratio can be observed indicating a widening inequality in favour of girls.

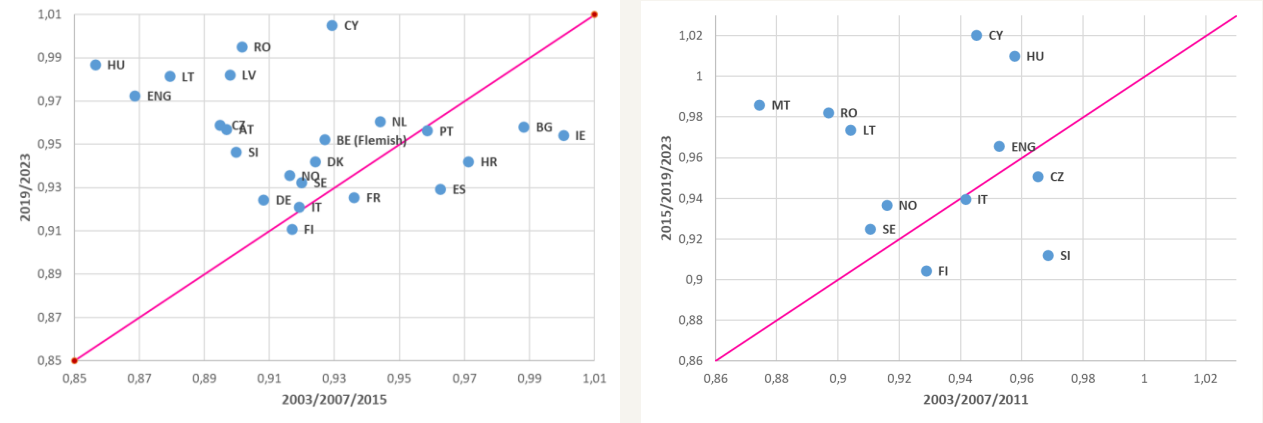
In the age-15 panel, the pattern of change in gender inequality is somewhat more varied. Malta is a clear outlier indicating a sizeable narrowing of the gender gap over time. The Baltic States, Italy and Romania also lie above the diagonal line, suggesting modest narrowing of the gender gap. Overall, the graph indicates that the gender inequality in reading is moderate and larger at age 15 than in Grade 4. Changes over time are generally moderate, with only a few countries exhibiting more pronounced shifts.

2.3. Inequality in educational achievement by migration status

In this section we study inequality in educational achievement by migrant status, measured as the ratio of migrant to non-migrant students' average test scores. Immigrations status is defined based on country of birth to maximise comparability

between studies and years. The focus is therefore on first-generation migrant children and the compared groups are those students not born in country (migrants) and students born in the given country (non-migrants).A value below unity indicates that migrant students score lower on average than non-migrant students, while values closer to one indicate smaller inequality.

Figure 2.7: Migrant/non-migrant ratio of mathematics test scores, Grade 4 TIMSS (left panel) and Grade 8 (right panel)



Source: own calculation based on TIMSS data.

Figure 2.7. shows the migrant/non-migrant ratio of mathematics test scores at the first and last year of observation. In Grade 4, most countries have ratios below one, confirming that migrant students tend to underperform relative to their non-migrant peers. However, many countries are positioned above the diagonal, suggesting some improvement over time. For example, countries such as Cyprus, Romania, Hungary, England, Lithuania and Latvia appear in the top left part of the graph, indicating a decline of migrant disadvantage. At the same time, other systems, like Ireland, Bulgaria, Croatia and Spain remain below the diagonal line implying slight widening of the disparities. Overall, while disparities persist, there is evidence of moderate convergence in several countries at the primary level.

In Grade 8 most countries still show migrant students scoring below non-migrant peers and there seems to be considerable dispersion around the diagonal line. Some countries, such as Cyprus, Hungary, Malta, Romania and Lithuania appear above the line, suggesting improvements in migrant students' relative position. Although most of the countries we see stability over time in the relative mathematics performance of migrant students, in case of Finland and Slovenia the figure shows a widening gap in recent years. Overall, the findings suggest that while some education systems have reduced migrant–non-migrant achievement gaps over time, substantial disparities remain.

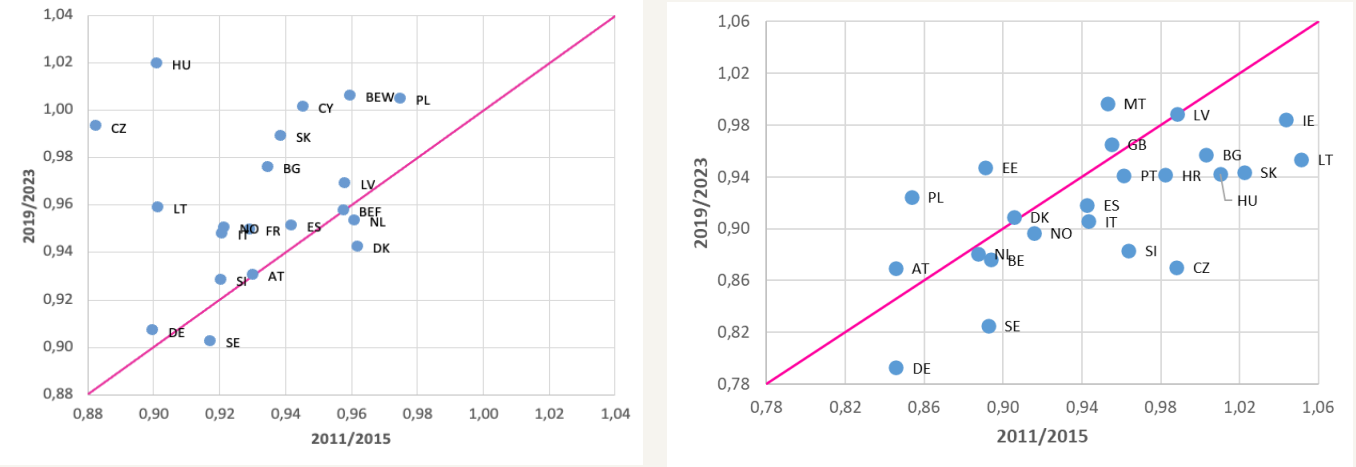
Figure 2.8. shows changes in inequality as students' progress through schooling using the quasi-longitudinal nature of the TIMSS data. Migrant disadvantage increased the most in Lithuania, England and Portugal. In contrast migrant disadvantage seems to be declining as students progress from Grade 4 to Grade 8 in Cyprus and Hungary.

Figure 2.8: Change in the Migrant/non-migrant ratio of mathematics test scores for students in Grade 4 in 2019 and Grade 8 in 2023

Source: own calculation based on TIMSS data.

Figure 2.9. displays changes in the migrant/non-migrant ratio of reading test scores between 2011/2015 and 2019/2023. Since most ratios are below one, migrant students generally score lower than non-migrant students in reading across countries, particularly at age 15. In Grade 4 (left panel), the majority of countries cluster around the diagonal, indicating relatively modest changes in migrant disadvantage in reading achievement. However, some notable shifts are visible. In Hungary and the Czech Republic a decline in migrant disadvantage can be observed over time, with migrant students improving relative to non-migrants. Similar trends can be observed in Belgium (Wallonia), Cyprus, Slovakia, Bulgaria and Lithuania, albeit to a lesser extent. By contrast, Denmark and Sweden fall slightly below the diagonal, pointing to a widening inequality in favour of non-migrant students.

Figure 2.9: Migrant/non-migrant ratio of reading test scores for students in Grade 4 (left panel) and at age 15 (right panel)



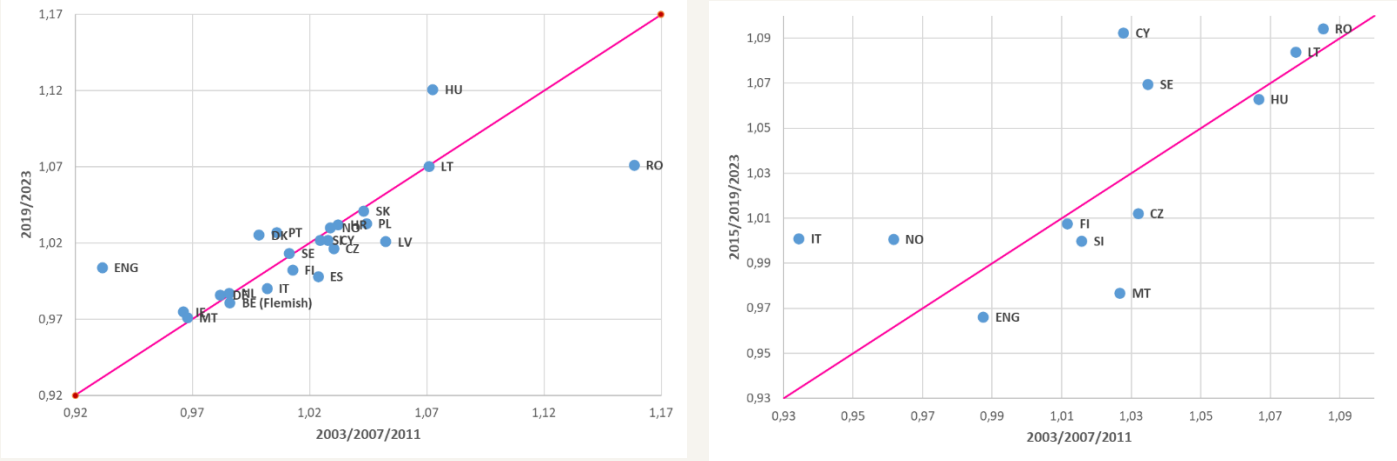
Source: own calculation based on PIRLS (left panel) and PISA data (right panel).

In the age-15 panel (right), inequality levels are generally larger and the dispersion across countries is more pronounced. A number of countries show a marked decline in the ratio, indicating a substantial widening of the migrant gap: Germany, Sweden, Slovenia, Czechia, Hungary, Slovakia, Lithuania and Ireland show notable downward shifts. In contrast, in Malta, Poland and Estonia a narrowing of disparities can be observed at age 15. Overall, the graph suggests that migration-related inequality in reading achievement remain persistent and often sizeable, especially at age 15. The direction of change differs between the Grades, as there are more countries showing declining inequality in Grade 4, while the majority in Grade 8 recorded increasing inequality between migrants and non-migrants.

2.4. Inequality in educational achievement by urbanisation

This section describes inequalities in educational achievement by school location, measured as the ratio of average scores in urban versus rural areas. We defined urban areas as those areas, where more than 15,000 live in area, and rural where up to 15,000 live in the area. This was decided in order to ensure a sufficient sample size for the calculation of the indicators. A value above one indicates that students in urban schools outperform those in rural schools, while values below unity indicate a rural advantage. Countries above the diagonal line experienced an increase in the urban–rural inequality over time, while those below the line saw a reduction.

Figure 2.10: Urban/rural ratio of mathematics test scores, Grade 4 TIMSS (left panel) and Grade 8 (right panel)



Source: own calculation based on TIMSS data.

As Figure 2.10. shows most countries have ratios slightly above one, indicating that students in urban schools tend to outperform students in rural schools in mathematics achievement. In Grade 4 most countries are positioned close to the diagonal line, suggesting that the urban-rural inequality in mathematics achievement has only moderately changed over time. Exceptions to this trend are Hungary and England, which are clear cases of a growing disadvantage of students in rural schools. In contrast, urban advantage has been declining in Romania.

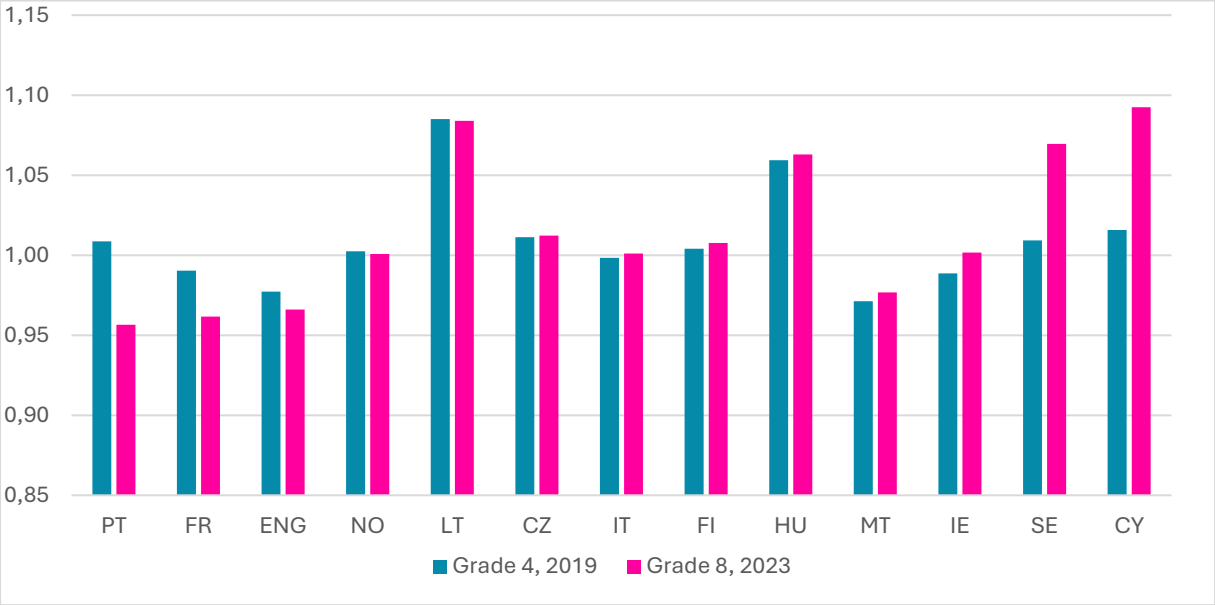
In Grade 8, the pattern is somewhat more dispersed. While the disadvantages of students in rural schools remain visible in many systems, several countries are close to the diagonal, indicating relative stability. However, countries such as Cyprus, Italy, Sweden and Norway show an increasing urban–rural divide at lower secondary level. At the same time, in countries such as Malta or England a reduction in the urban–rural inequality can be detected over time. Overall, the findings suggest that urban–rural disparities in mathematics achievement are moderate and stable in primary education, while somewhat larger in secondary education.

The quasi-longitudinal nature of the TIMSS data allow to follow the progression of a cohort in the education system. Figure 2.11. shows changes in inequality between Grade 4 and Grade 8 in case of the student cohort who was in Grade 4 in 2019. According to the results the advantage of urban students increased in Cyprus and Sweden, while it decreased in Portugal and to some extent in France.

Figure 2.12. presents changes in the urban/rural ratio of Grade 4 reading test scores between 2011/2015 and 2019/2023. In case of reading performance, no data is available for Grade 8, as PISA does not provide information on school location. Most countries cluster around the diagonal, suggesting broadly stable urban–rural

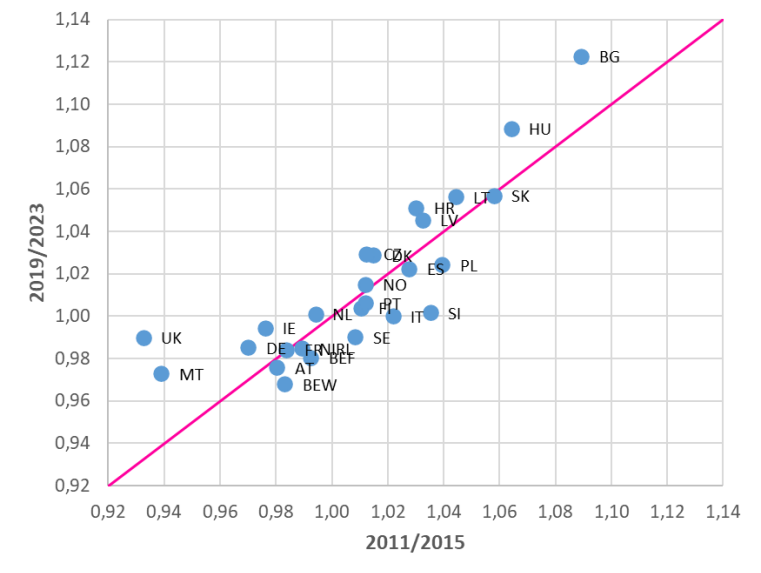
disparities over the period. However, some countries exhibit more pronounced shifts. Bulgaria, Hungary, Malta and the UK stand out clearly, showing an increase in the ratio and thus an increasing relative performance of students from urban schools. In contrast, in a few countries – most notably in Slovenia – a decline of urban advantage has been observed. Overall, the graph suggests that while urban students continue to outperform their rural peers in most systems, changes over time have generally been moderate.

Figure 2.11: Change in the urban/rural ratio of mathematics test scores for students in Grade 4 in 2019 and Grade 8 in 2023



Source: own calculation based on TIMSS data.

Figure 2.12: Urban/rural ratio of reading test scores for students in Grade 4

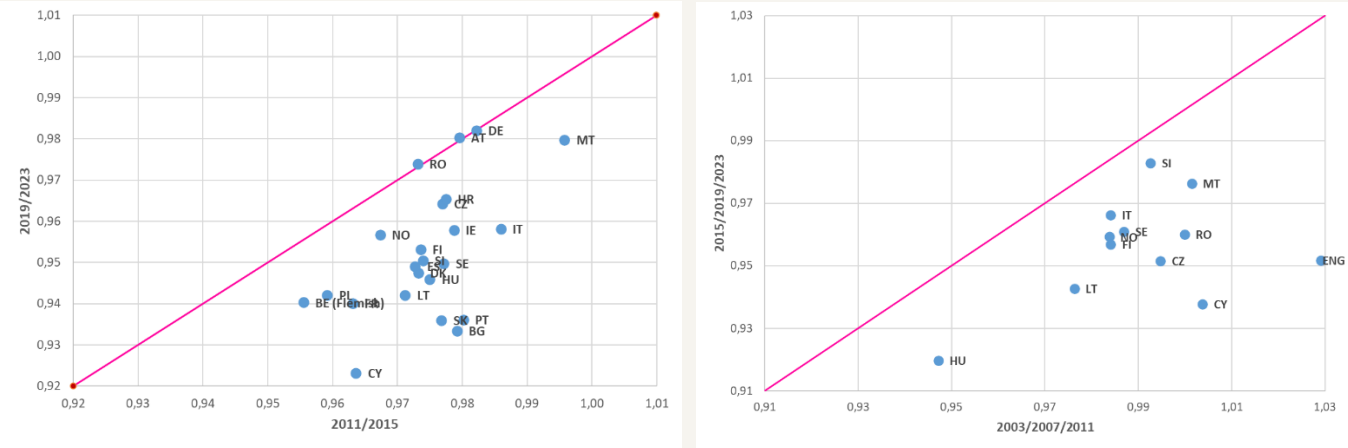


Source: own calculation based on PIRLS data.

2.5. Intersectional inequality by gender and parental education

The present section examines inequality at the intersection of gender and socioeconomic status, measured here as the education level of parents. Rather than discussing overall inequality, we focus specifically on the relative educational performance of one specific group, in this case of girls whose parents do not have higher education qualifications. The indicator (see values on Figure 2.13.) shows their average score relative to the overall mean test score, with values below one indicating a disadvantage. Countries above the diagonal line on the graphs experienced an increase in the relative score over time (a narrowing of disadvantage), while those below the line saw a decline (widening inequality).

Figure 2.13: Relative mathematics test scores for girls with no parents with higher education qualifications, Grade 4 (left panel) and Grade 8 (right panel)



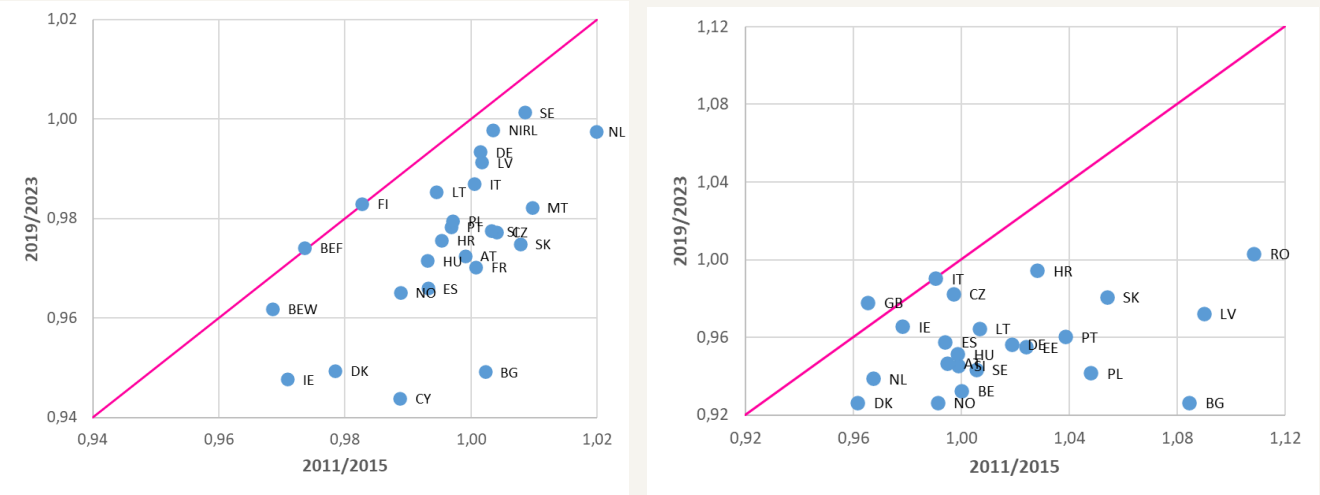
Source: own calculation based on data from TIMSS.

In Grade 4, most countries are clustered below a ratio of one in both periods, indicating that girls from lower-educated families perform below average in mathematics across systems during the period studied. Most countries tend to lie below the diagonal line, suggesting that the relative position of girls from lower—educated families has somewhat deteriorated over time. Most important decline in the relative position of this group was seen in countries such as Bulgaria, Cyprus, Slovakia and Portugal. A smaller number of countries—such as Germany, Austria or Romania — show stability of the relative performance of girls from lower-educated families. Overall, the pattern suggests that compounded disadvantage linked to both gender and low parental education remains persistent at primary level.

In Grade 8, the dispersion is somewhat greater. At the beginning of the period

England, Cyprus and Malta had relative scores higher than one, while relative scores remain below unity in all countries at the end of the period, suggesting that girls with no parents with higher education continue to perform below average in Grade 8. All countries appear below the diagonal line suggesting a growing disadvantage over time for this group in lower secondary education. The most important decline in the relative position of girls from lower—educated families was seen in Cyprus, England, and also in Lithuania, Czech Republic and Romania. Overall, the findings highlight that when gender and socioeconomic disadvantage intersect, inequalities in mathematics test scores tend to be more pronounced and, in many systems, have not diminished over time.

Figure 2.14: Relative reading test scores for girls with no parents with higher education, Grade 4 (left panel) and at age 15 (right panel)



Source: own calculation based on PIRLS (left panel) and PISA data (right panel).

Figure 2.14. presents changes in the relative reading performance of Grade 4 (left panel) and Grade 8 (right panel) girls whose parents do not have higher education qualifications. In Grade 4, at the beginning of the period average reading test scores in this group were above the overall mean for roughly half of the countries, but at the end of the period only Sweden has a relative test score higher than one among girls with lower educated parents. Regarding changes over time, there are few systems (most notably Finland and Belgium), where the relative position of girls from less-educated families remained stable or declined only slightly. By contrast, in countries such as Bulgaria, Cyprus, Denmark and Ireland data indicate a deterioration in relative outcomes for this group. Several others (e.g. France, Austria, Hungary, Spain) show small downward shifts, implying mild widening of disadvantage.

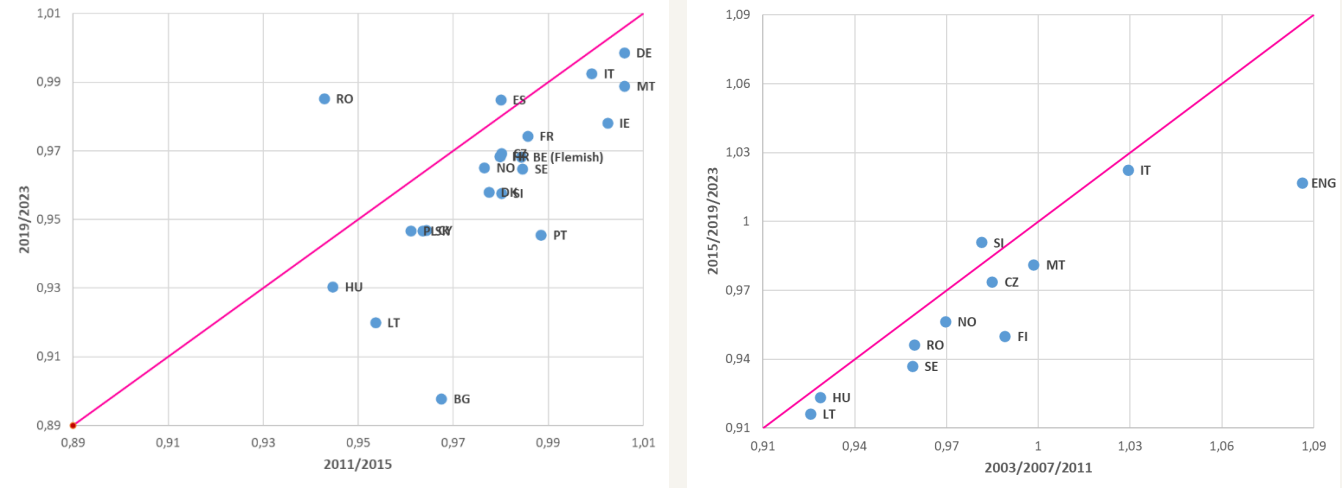
The Grade 8 pattern shows somewhat greater dispersion. While many countries (e.g. Italy, Czech Republic, Great Britain) remain close to the diagonal line, indicating

stability, a number of systems fall noticeably below it. In particular, Bulgaria, Poland, Latvia and Romania exhibit marked downward shifts, suggesting a substantial decline in the relative achievement of girls without highly educated parents. These countries had relative test scores above unity in the beginning of the period and then were below (or close to) parity at the end of the period. In sum, the figure suggests that relative inequalities for this group have been broadly stable at Grade 4 but somewhat more volatile at Grade 8, with several countries experiencing a widening disadvantage by the end of lower secondary education.

2.6. Intersectional inequality by urbanisation and parental education

In this section we examine inequality at the intersection of urbanisation and education level of parents, by focussing specifically on the relative educational performance of rural students whose parents do not have higher education. The indicator shows their average score relative to the overall mean test score, with values below unity indicating a disadvantage. The 45-degree line marks stability over time: countries above the line experienced an improvement in the relative position of this group, while those below it saw a decline.

Figure 2.15: Relative mathematics test scores for students in rural schools with no parents with higher education, Grade 4 (left panel) and Grade 8 (right panel)



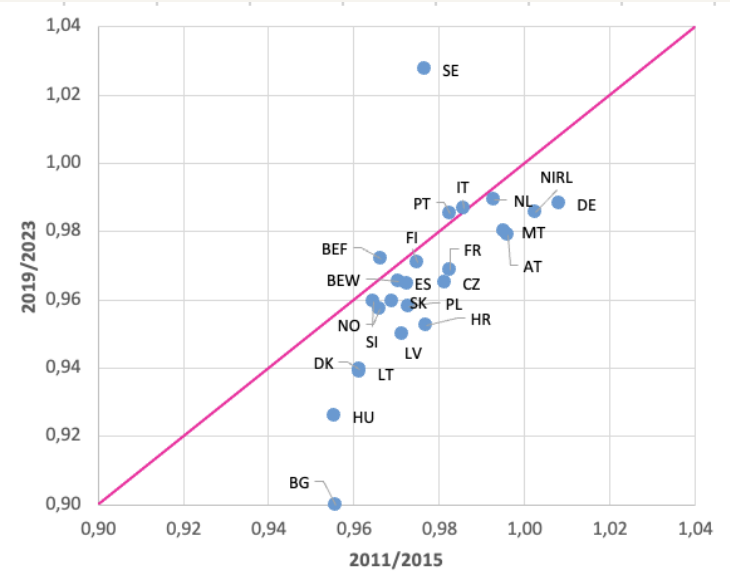
Source: own calculation based on data from TIMSS.

Figure 2.15. shows relative mathematics test scores for the group of interest. At Grade 4 (left panel), most countries have relative test scores below unity, showing that students in rural schools with no parents with higher education perform below average. It is also clear, that most countries cluster close to the diagonal line,

indicating broadly stable relative outcomes over the period. However, Bulgaria stands out clearly with a substantial downward shift, indicating a marked deterioration in the relative performance of the group. Similar changes have been detected in Lithuania and Portugal, albeit to a lesser extent. In contrast, some improvement in the relative performance of this group is observed in Romania. In most other cases (e.g. France, Germany, Italy, Belgium), changes are modest and remain within a relatively narrow band.

The Grade 8 pattern (right panel) is similar, showing disadvantage among these students as most countries (except Italy and England) are below a value of one. Most important disadvantage is recorded in Lithuania and Hungary. Disadvantage of this group seems to be broadly stable over the period, as most countries are close to the diagonal line. Most important change is seen in England, where the relative position of this group declined over time, despite a comparatively high initial ratio. Finland also shows a modest widening of disadvantage. Overall, the figure suggests that for rural students without highly educated parents, relative inequalities in mathematics have remained broadly stable in most systems but have widened in a few others.

Figure 2.16: Relative reading test scores for students in rural schools with no parents with higher education, Grade 4 (left panel)



Source: own calculation based on data from PIRLS.

Figure 2.16. presents changes in the relative reading performance of Grade 4 students in rural schools whose parents do not have higher education. In case of reading performance no data is available for Grade 8, as PISA does not provide information on school location. The relative test score in this group tends to be

below unity in the majority of countries, showing below average performance.

Most countries cluster around the diagonal, suggesting broadly stable relative test scores. An exception is Bulgaria, which stands out most clearly with a pronounced downward shift, pointing to a substantial deterioration in the relative position of this group. Hungary, Lithuania, Latvia and Croatia also show some widening of the disadvantages among students with lower educated parents in rural schools. By contrast, Sweden is clearly above the line, indicating a noticeable strengthening of the relative position of this group.

Overall, the figure suggests that while relative reading inequalities for disadvantaged rural Grade 4 students have remained broadly stable in many countries, some systems—most notably Bulgaria—have experienced a marked deterioration, whereas a smaller number have achieved modest improvements.

3. 25 years of reforms in early childhood education and care

In examining education reforms aimed at reducing inequalities, we draw attention to two key dimensions: equality and equity. These concepts are often used synonymously, yet they refer to distinct approaches to addressing educational disparities. Their interpretation varies across social, political, and cultural contexts.

Equality generally refers to offering all students the same resources, opportunities, and forms of support regardless their socioeconomic, cultural, or ethnic status (UNESCO, 2020). This understanding is grounded in a concept of universal access. However, equality cannot be reached simply by distributing resources equally; it requires proactive measures to dismantle systemic barriers so that all students can reach similar levels of achievement. This interpretation is not consistently applied in the reforms under review. In some cases, it means 'formal parity in resources' and 'the active reduction of systemic inequalities in the others (Minow 2021; Ślusarczyk et al. 2026). Equality therefore requires more than uniform distribution of resources; it also involves confronting the deep-rooted, intersecting disadvantages that prevent some groups from achieving comparable outcomes.

On the other hand, equity recognises that students face different challenges and therefore require differentiated forms of support (Minow 2021). This approach acknowledges that factors such as poverty, disability, gender, ethnicity, or place of residence may create additional obstacles to learning. Equity-oriented policies, therefore, seek to compensate for these disadvantages by tailoring and allocating proportionate resources and interventions to specific needs (OECD, 2018; Ślusarczyk et al. 2026).

The structure of this chapter reflects the dual focus of contemporary education reforms on equality and equity. We begin by examining reforms that prioritise equality, understood primarily as expanding universal access to education and ensuring that all children can participate in early childhood education and care. In the second part, we turn to policy initiatives that place stronger emphasis on equity, particularly those that develop targeted strategies designed to address the specific needs of students who face greater structural barriers. In many cases, these two dimensions overlap, as countries often combine universal measures with interventions aimed at reducing intersectional disparities. Our analysis is limited to reforms concerning access to early childhood education (ISCED 0) and covers the years 2004-2018 in total 18 reforms (see Table 3.1).

Table 3.1: ECEC reforms in Europe 2004-2018

Reform	Country	Year	Educational level[5]	Type of Reform
Obligatory and Free Kindergarten Attendence for 5-year old	Austria	2010	ISCED 0	Laws / regulation of access reform
Priority Access to ECEC	Belgium - Flemish	2009	ISCED 0	Laws / regulation of access reform
Social Inclusion Project	Bulgaria	2009	ISCED 0	Laws / regulation of access reform; Special Education Reform
Preschool Education Act	Croatia	2014	ISCED 0	Laws / regulation of access reform
The Day Care Act	Denmark	2007	ISCED 0	Curriculum; Laws / regulation of access reform
The Equality Act	England	2010	ISCED 0	Laws / regulation of access reform
Basic Education Act	Finland	2015	ISCED 0	Laws / regulation of access reform
Law on the Guidance and Planning for the Restructuring of the Republic's Schools	France	2013	ISCED 0, 1, 2, 3, 4+	Laws / regulation of access reform; Teacher Education or Employment Reform
The Children Promotion Act (KiföG)	Germany	2008	ISCED 0	Laws / regulation of access reform
Compulsory Early Childhood Education Reform	Greece	2018	ISCED 0, 3	Laws / regulation of access reform; Teacher Education or Employment Reform
Mandatory Kindergarten from the Age of 3	Hungary	2015	ISCED 0	Laws / regulation of access reform
The Early Childhood Care and Education (ECCE)	Ireland	2010	ISCED 0	Laws / regulation of access reform

[5] ISCED 2011 has nine educaion levels, from level 0 to level 8 :

- ISCED 0: Early childhood education ('less than primary' for educational attainment)
- ISCED 1: Primary education
- ISCED 2: Lower secondary education
- ISCED 3: Upper secondary education
- ISCED 4: Post-secondary non-tertiary education
- ISCED 5: Short-cycle tertiary education
- ISCED 6: Bachelor's or equivalent level
- ISCED 7: Master's or equivalent level
- ISCED 8: Doctoral or equivalent level

Poli per l'Infanzia	Italy	2017	ISCED 0	Laws / regulation of access reform
Childcare support and child-minder service	Latvia	2013	ISCED 0	Laws / regulation of access reform
National Children's Policy	Malta	2017	ISCED 0	Laws / regulations of access reform; Curriculum
Legel Right for a place in ECEC from age 1	Norway	2009	ISCED 0	Laws / Regulations of access reform
Ammendment to the School Education Act	Poland	2011	ISCED 0	Curriculum; Laws / regulations of access reform
Universal Free Early Childhood Education Reform	Portugal	2018	ISCED 0	Laws / regulations of access reform
Hot Meal Program	Romania	2016	ISCED 0, 1, 2	Laws / regulations of access reform
Expanding preschool capacity and inclusive education in kindergartens in 82 municipalities	Slovakia	2015	ISCED 0	Laws / regulations of access reform
Childminding of preschool children Program	Slovenia	2008	ISCED 0	Laws / regulations of access reform

The chapter is based on Deliverable D.2.1 STRIDE report "25 years of education policy changes for Equity and Inclusion in Europe" (Ślusarczyk et al., 2026). In addition, this chapter serves as a contextual background for the subsequent analytical sections. Its aim is to outline the key trends that have shaped early childhood education and care (ECEC) reforms in recent decades, thereby providing the conceptual and policy framework necessary to interpret the reform trajectories discussed later in the report.

3.1 Universal access to preschool education

Across Europe, reforms aimed at ensuring universal access to early childhood education and care (ECEC) have taken diverse institutional forms, yet they share a common goal of expanding entitlement and reducing socio-economic disparities in participation. Croatia, Germany, Norway, Portugal, Finland, Ireland and Hungary

illustrate different policy trajectories through which states have moved toward more comprehensive, legally anchored preschool provision.

In Croatia, universal access has been pursued primarily through the gradual expansion of compulsory participation. Since 2014, a preschool programme has been mandatory for all children in the year preceding primary school, as specified in Article 23a of the Official Gazette 94/13. The programme encompassed 250–550 hours per year, delivered from October to June. A reform, adopted in 2024, significantly broadened this provision: the new National Curriculum for Preschool Education extended the duration to 700 hours annually while retaining the compulsory character of the final pre-primary year. The reform also introduced an adapted programme for children aged four to six, thereby expanding the scope of public responsibility beyond the pre-school year alone. Still, while enrolment one year before primary school reached 100% (compared with the OECD average of 96%), younger children participated at substantially lower rates, with marked socio-economic inequalities: among 0–2-year-olds, participation was 11% in families from the bottom income tertile compared to 29% in the top tertile (OECD, 2024). For children aged three to compulsory school age, participation increased from 67.6% in 2010 to 79.4% in 2020, though it remained below the EU average of 92.8%.

In Germany, universal access has been advanced through a rights-based approach supported by large scale federal investment. The Children Promotion Act (Kinderförderungsgesetz – KiföG, 2008) established the legal and financial framework for expanding childcare provision, including the creation of a dedicated “child-care expansion” fund. Since 1 August 2013, all children, from the age of one, have held a legal right to a place in early childhood education, either in day-care centres or through childminding services. To operationalise this entitlement, the federal government has implemented five investment programmes since 2008, co-funded by Länder and municipalities. Together the fourth and fifth programmes aimed to create 190,000 additional places for children up to school entry age. The fifth programme was, supported partly by the EU’s NextGenerationEU recovery plan, that allocated a further EUR 1 billion, linked to the COVID 19 stimulus package of 2020–2021, to generate 90,000 new places.

In Portugal, the trajectory toward universal access has been linked to the expansion of free public provision for children aged 3–5. Between 2017 and 2019, the country implemented a phased reform culminating in universal, free preschool education by 2019. As of 2018, three-year-olds gained voluntary access to preschool, while coverage for four- and five-year-olds had already been fully secured. This reform situated early childhood education firmly within national education policy rather than social care, emphasising equal access and the public responsibility for early learning.

Norway represents one of the earliest and most comprehensive models of universal entitlement. In 2009, the country introduced a legal right to an ECEC place from age one, independent of parental employment status. This reform reflected a long-standing national commitment to educational equity and child development as public goods rather than commodities tied to the labour market. What is important, the reform was grounded in a concept that early education and child development should be guaranteed as a child's right and public entitlements, not shaped by labour market dynamics or parental employment status.

Ireland expanded access through three coordinated pillars: the universal Early Childhood Care and Education (ECCE) "free preschool" (from 2010; expanded 2016), the Community Childcare Subvention (CCS) for disadvantaged families, and Training and Employment Childcare/After School Childcare (ACCS/ACSS). By 2015/16, 104,441 children benefited from at least one program. These measures combined universalism (ECCE) and targeting (CCS/ACCS) to widen and equalise access.

Building on the growing recognition of preschool education as a foundation for later learning, many countries have complemented the right to access early childhood education with the introduction of partial or full mandatory participation, most often in the final year before the start of compulsory schooling. **Finland** is a notable example: through an amendment to the Basic Education Act (Perusopetuslaki), pre-primary education became compulsory in August 2015, requiring every child to complete one year of pre-primary education before entering compulsory schooling at age seven. This reform was identified as the first major reform at the preschool level and aimed to ensure equal opportunities for early learning and strengthen school readiness nationwide.

A similar rationale underpinned the introduction of mandatory kindergarten from age three in **Hungary** in 2015, established in the Act on National Public Education and aligned with the goals of the Hungarian National Social Inclusion Strategy (HNSIS, 2014). This third reform at pre-school level sought to increase preschool attendance among multiply disadvantaged children, based on evidence that more years in early education support cognitive and social development, improve later educational outcomes, and reduce early school leaving (Hódi and Tóth 2016). Following implementation, enrolment rates rose from 81% in the general population and 77% among Roma children in 2011 to 95% and 91% in 2016 (FRA 2016; Kende 2021). For 2020 95.7% of 4–6-year-olds attend kindergarten in Hungary (above the EU average of 94.8%; European Commission 2020), and participation among 3-year-olds increased from 74% in 2012 to 81% in 2015 and 85% in 2021 (OECD 2014; 2017; 2023). Despite these gains, Hungary faced significant challenges: a persistent nationwide shortage of preschool teachers driven largely by very low salaries, averaging only 60% of those of tertiary educated workers (OECD 2023). Projects

implemented under the HNSIS aimed at increasing kindergartens' capacity to compensate for disadvantage children were identified as good practices due to strong cooperation and voluntary participation (Nagy et al. 2020), yet they reached only around 3% of the target group of kindergarten teachers and did not provide evidence of child level impact (Roma Civil Monitor 2019).

Overall, while mandatory preschool policies reflect a shared commitment to strengthening early learning through universal or near universal participation, their effectiveness ultimately depends on adequate staffing and the equitable distribution of high-quality provision.

3.2 Strengthening equity in education: targeted preschool policy reforms

As a step towards equity a diverse array of policy instruments has been deployed to expand access to ECEC by reducing financial and linguistic barriers and targeting support to children in vulnerable situations. This subchapter synthesizes concrete reforms and implementation details from: Austria, Poland, the Flemish Community of Belgium, Denmark, Germany, Greece, Latvia, Malta, Norway, Slovakia, and Slovenia. Equity goals were pursued through needs-based targeting, fee regulation, capacity expansion, and language or inclusion supports.

Austria introduced obligatory and free half day kindergarten attendance (20 hours/week without lunch) for five-year-olds in 2010, under a federal–state agreement designed to eliminate economic barriers to preschool participation. A central rationale was that elementary education significantly advances psychological, cognitive, and social development and underpins school readiness. Importantly, mandatory kindergarten should also serve as a vehicle for targeted language development for children whose first language was not German. Since 2013, joint federal–provincial investment has prioritized places for children under three, longer opening hours, and quality improvements through minimum standards.

Several Länder extend free half or full day provision to younger children. Participation has remained very high: the attendance rate rose from 96.3% (2008) to 98.3% (2010), dipped to 97.2% (2013), then grew to 98.8% (2017) and 99.1% (2022). Notably, the share of five-year-olds in care with a non-German first language increased from 23.9% to 31.9% in 2021/22, underscoring the salience of the language support function. Poland chose similar way by introducing amendments to the School Education Act (2013) capped parental fees at PLN 1 (ca. 0,25 EUR) for each hour of preprimary attendance beyond the five free compulsory hours and introduced earmarked state grants to compensate local governments. The same

legislative package staged rights-based access: all four-year-olds secured a right to preprimary education from September 2015, and all three-year-olds were guaranteed a place from September 2017. These measures combine affordability regulation with a universal entitlement approach to access. Also Norway introduced (2015–2016) a national subsidy regime with fee caps (no family pays more than 6% of income), maximum national fees, sibling reductions, and additional municipal subsidies for low income families to uphold the statutory right to a kindergarten place and mitigate financial barriers, From 2016, children aged 3–5 in low income households are entitled to 20 hours per week of free preschool, which can be seen as an explicit redistributive measure to boost participation among disadvantaged children.

The Flemish Community in Belgium provided priority access to childcare for children under three from single-parent and/or low-income households, particularly where childcare facilitated employment or study and socio-economic inclusion. At the pre-primary level, schools received an additional €950 per year for each newly arrived child aged 2.5+ whose native language is not Dutch, strengthening both access and language-responsive funding. Alike, in 2015, Slovakia combined state and EU funding to expand kindergarten capacity and inclusion. With €15 million in the first round, the Ministry supported 3,600 new places across 113 municipalities, prioritizing high demand areas. EU and national projects targeted disadvantaged children (especially Roma) through inclusive curricula, teacher training, hiring assistants, and campaigns to reduce unjustified placement in special schools. EU funds also covered salaries for qualified teachers in workplace childcare and for newly hired kindergarten staff expanding capacity to serve working mothers. Subsequent reporting confirms continued use of EU funds to expand and maintain kindergarten capacity.

In **Denmark**, the Daycare Act framed ECEC as a universal and preventive service aimed at counteracting negative social inheritance and exclusion, with compulsory enrolment for children from “vulnerable residential areas” to strengthen Danish language competencies, learning readiness, and socialisation into shared norms and values. The strengthened pedagogical curriculum included explicit requirements to tailor learning environments for children in vulnerable positions. Evaluation evidence from the Danish Evaluation Institute indicated mixed but advancing implementation: by 2021, 47% of municipal daycare managers reported that “all or almost all” or “more than half” of daycare settings were close to realising intentions around children’s communities and support for vulnerable children (Danmarks Evalueringsinstitut, 2022). Similarly, Malta’s National Children’s Policy (2017) set objectives to increase accessibility of childcare and schools, support kindergarten attendance, reduce absenteeism (aligned with the 2014 Attendance in Schools Policy), and strengthen induction and inclusion supports for children from migrant families and for learners with special educational needs (including gifted). The policy

promoted diverse pedagogies and inclusive environments to ensure every learner can achieve their potential.

Germany's federal government supported Länder measures through the Act on the Further Development of Quality and Participation in Child Day Care (2019–2022), followed by the KiTa Quality Act (2023–2024). A reform introduced a nationwide obligation for socially graduated parental fees from 1 August 2019, using criteria such as parental income, number of children eligible for child benefits, and care hours. Under defined conditions, families paid no fees, particularly those receiving social assistance, housing allowance (Wohngeld), or child supplements (Kinderzuschlag). Länder have increasingly eliminated or reduced contributions, sometimes fully or for the final year of kindergarten and often leveraging federal funds.

Greece reduced the starting age of compulsory education to four (Law 4521/2018, art. 33), aiming to reduce exclusion from preschool. Although there was no formal evaluation regarding its effectiveness in meeting the overall demand for preschool places, a subsequent regulation (FEK 4704/2020, art. 34) temporarily excluded some regions due to capacity constraints (facilities unable to absorb new cohorts). This implementation gap forced many urban municipalities to rely on temporary prefabricated structures (containers), raising serious concerns about the quality of the learning environment. While teacher unions have broadly endorsed the reform for its equity benefits, they continue to press for adequate infrastructure and the recruitment of permanent staff to ensure sustainable child-to-teacher ratios.

In **Latvia**, to reduce long waiting lists and facilitate parents' return to work, the authority launched a pilot childcare support and child minder service in 2013 for children aged 1.5–4 not enrolled in public childcare (municipalities were obligated to provide preschool education from age five). The program aimed to do it by co-funding private kindergartens or childminders. Child minding as a completion of public services was also introduced in Slovenia. The Childminding of Preschool Children Program (2008; amended 2012) provided municipal grants to parents unable to secure a public kindergarten place, equal to 20% of the price of the program the child would have attended. Childminders might care for up to six children at home if the place was according to equipment norms (e.g., separate playrooms and children's bathroom facilities). In 2023/24, 297 childminders were registered with the ministry. Earlier assessments (2008) flagged uneven access due to local inequalities (e.g., rapid growth areas, poorer municipalities, the capital) and insufficient integration of private childminders into the public system, constraints the 20% subsidy only partially mitigates when public places are unavailable.

3.3 Summary

Reforms across the examined countries reflect several broad types of equity-oriented action in early childhood education and care. First, many systems focus on removal of direct cost barriers, using mechanisms such as free provision, income-based fee regulation, or capped parental payments. Second, governments increasingly introduce guaranteed access towards universal provision. Third, targeted access measures aim to reduce structural disadvantages by prioritising vulnerable groups, including low-income families, children in marginalised communities, or those facing long waiting lists. Fourth, some reforms emphasize language support and integration, embedding linguistic development to promote equitable participation. Fifth, countries invest in capacity building and quality assurance, expanding places, extending opening hours, and strengthening regulatory frameworks. Finally, the landscape reveals varied approaches to monitoring and evaluation, with some systems systematically assessing the implementation of equity measures.

European evaluations of early childhood education and care (ECEC) consistently show that policy developments across the continent combine efforts to expand access with attempts to reduce persistent inequalities. Participation levels among children aged three and over remain high, reaching 93% in 2022, and the EU aims to raise this to 96% by 2030. However, access for younger children is still uneven: average participation among children under age three stands at 37.5% in 2023, and only a subset of Member States meets the revised Barcelona target of 45% attendance. Few systems guarantee an ECEC place immediately after the end of parental leave, resulting in a structural “ECEC gap” that disproportionately affects families with fewer resources (*High-Quality Early Childhood Education and Care In Europe,* 2024; *Key data on early childhood education and care in Europe,* 2025).

At the same time, European systems increasingly emphasise policies aimed at equity and inclusion. A total of 29 education systems have introduced measures to facilitate access for children facing structural barriers including children with disabilities, migrant background, and those at risk of poverty. It should be achieved through specialised staff, reduced group sizes, adapted infrastructure or targeted funding. Broader analyses underscore that effective ECEC provision depends not only on access and structural quality, but also on building strong partnerships with families and ensuring childcentred, inclusive practices (*High Quality …,* 2024).

4. Results of multi-level analysis of ECEC reforms and educational inequality

In this chapter, we will focus on the association between ECEC reforms and development in measures of educational inequality, using TIMSS and PIRLS data. We will, based on a selection of certain reforms that can be seen as comparable in goals and target groups (see chapter 3 for an overview of these), investigate the difference in development in inequality between countries which implemented such reforms during a chosen period, and countries that did not. We will first show descriptive findings showing the development in inequality between certain groups for before and after the reforms and then show multi-level models where we examine the association between reforms and the development of inequality. Despite the analysis being descriptive, it will still serve as an overview of how we can understand the implementation of reforms in different countries, and how they did, or did not, change the patterns of inequality in the respective countries.

4.1. Reforms

We have chosen to focus on reforms which target preschool children (ISCED level 0), and are aimed at granting/expanding access to ECEC, targeting inequalities explicitly. This means that we leave out reforms collected in WP2 which focus on special needs, curricula adjustments, teachers or education levels (and thus, children) above ISCED 0. Maintaining a strict focus on inequality serves to facilitate comparison between countries, as well as keeping the analysis within the focus of the STRIDE project. As inequality can be present in many dimensions, we include measures of parental education, gender, urban/rural and immigrant background in our analyses, following the focus in chapter 3. The reforms we have included in this analysis have been implemented at different time-points, and to facilitate descriptions of the different reforms and their relationships to inequality measures, we chose reforms that were introduced between 2006 and 2018, so that we have survey data on test-scores available from five years before and after the reforms, as well. In this way, we acknowledge that the rolling out, implementation and impact of a reform takes time. For our analysis, we matched the pre- and post-reform period,

as well as the year of the reform to both TIMSS and PIRLS waves. For countries that did not have any reforms in this period, we included the data from the mean years used in the countries with a reform. The countries with their corresponding reform years and waves of data are listed below, in Table 4.1.

Table 4.1: Countries, year of ECEC reform, years before and after, waves of PIRLS and TIMSS data used

Country	Year (t)	t-5	t+5	PIRLS t1	PIRLS t2	PIRLS t3	TIMSS t1	TIMSS t2	TIMSS t3
Belgium - Flemish	2009	2004	2014	–	–	–	2003	2011	2015
Bulgaria	2009	2004	2014	2006	2011	2016	–	–	–
Denmark	2007	2002	2012	–	–	–	–	–	–
Germany	2008	2003	2013	2001	2006	2016	–	–	–
Ireland	2010	2005	2015	–	–	–	–	–	–
Greece	2018	2013	2023	–	–	–	–	–	–
France	2013	2008	2018	2006	2011	2021	–	–	–
Croatia	2014	2009	2019	–	–	–	2011	2015	2019
Italy	2017	2012	2022	2011	2016	2021	2011	2015	2023
Latvia	2013	2008	2018	–	–	–	2003	2007	2019
Hungary	2015	2010	2020	2011	2016	2021	2011	2015	2023
Malta	2017	2012	2022	2011	2016	2021	–	–	–
Austria	2010	2005	2015	2006	2011	2016	2007	2011	2019
Poland	2011	2006	2016	2006	2011	2016	–	–	–
Portugal	2018	2013	2023	2011	2016	2021	2015	2019	2023
Romania	2016	2011	2021	–	–	–	–	–	–
Slovenia	2008	2003	2013	2001	2006	2016	2003	2007	2015
Slovakia	2015	2010	2020	2011	2016	2021	2011	2015	2023
Finland	2015	2010	2020	2011	2016	2021	2011	2015	2023
Norway	2009	2004	2014	2006	2011	2016	2003	2007	2015
England	2010	2005	2015	2006	2011	2016	2007	2011	2015

Note. In the case of some countries (Denmark, Ireland, Greece, Romania), even though they did have a reform in the period, it was not possible to match the time points to survey waves, due to lack of data.

Table 4.2: Selected PIRLS and TIMSS waves for countries without ECEC reform in chosen period

Country	PIRLS t1	PIRLS t2	PIRLS t3	TIMSS t1	TIMSS t2	TIMSS t3
Czech Republic	2001	2011	2016	2007	2011	2019
Spain	2006	2011	2016	2011	2015	2019
Cyprus	—	—	—	2003	2015	2019
Lithuania	2006	2011	2016	2007	2011	2019
Netherlands	2006	2011	2016	2007	2011	2019
Sweden	2006	2011	2016	2007	2011	2019

The sample of this analysis is made up of 17 countries with a relevant reform during the chosen period, and 6 countries without (see countries listed in table 1 and 2). The time of the adoption of the reforms spans from 2007 to 2018. We included test scores (and other variables) five years before and five years after the reform, in reading and mathematics. Reform implementation is shaped by multiple factors, and countries may display varying levels and trajectories of inequality that are independent of reform timing. The absence of a reform within the observed period may indicate that reforms were enacted shortly before our measurement window or that broader political preferences make reform adoption more or less likely. Changes in inequality before and after reforms do not necessarily reflect the impact of the reforms themselves. However, by presenting both descriptive trends and models that incorporate reform timing, we can identify whether any descriptive shifts in inequality follow these reforms. The insights may be relevant from a policy perspective, even if they cannot be interpreted causally.

4.2. Variables and descriptive trends

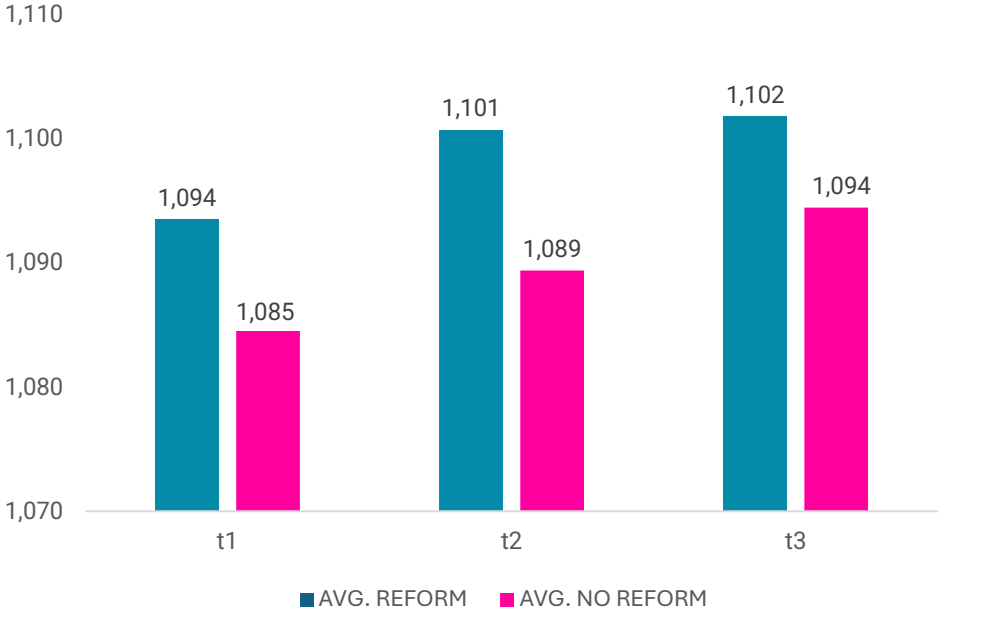
The main variables we are using are measures of reading and mathematics, based on PIRLS and TIMSS. We also use variables for gender, socioeconomic status (SES), immigration status, and school location. As addressed in previous sections, in these datasets, the gender variable has two values (i.e.boys and girls). SES is constructed based on information about parents, and has two values, one for no parents or guardians with a higher education degree and one for one or more parents or guardians with a higher education degree. Immigrant status is based on information about where the respondent is born and has the value 1 for children born in another country than the test and 0 for children born in the same country as the test. School

location measures the centrality of the school, and has the value 0 for rural, meaning up to 15,000 people live in area, and 1 for not rural, meaning more than 15,000 people live in the area. Based on these variables we used an indicator of inequality constructed for the STRIDE-project earlier, which measures the ratio of the test score means by social group breakdown categories (for more details, see Steinmann et al., 2025). The ratio reflects how much higher one group scores compared to another, on average.

All indicators were constructed accounting for the complex sampling design of the surveys by including complex weights and plausible values (the latter was done according to Rubin's (1987) rules). This enabled the computation of standard errors and confidence intervals.

First, we show some figures depicting the mean trends in inequality in all countries across the selected variables. The figures show the ratio of the test score means by social groups at three time-points: (a) the survey wave closest to five years before reform, (b) the year of reform and (c) five years after reform. As mentioned above, for countries which did not have a reform in the given time period, we used the mean year of the countries with a reform. This choice comes with its limitations, as we cannot know how using a different set of years for comparison impacts our analysis. However, we still believe the mean year is the best choice for comparison between countries, given that we use years that are not very far from each other in time. Still, this limitation should be kept in mind when analysing the results.

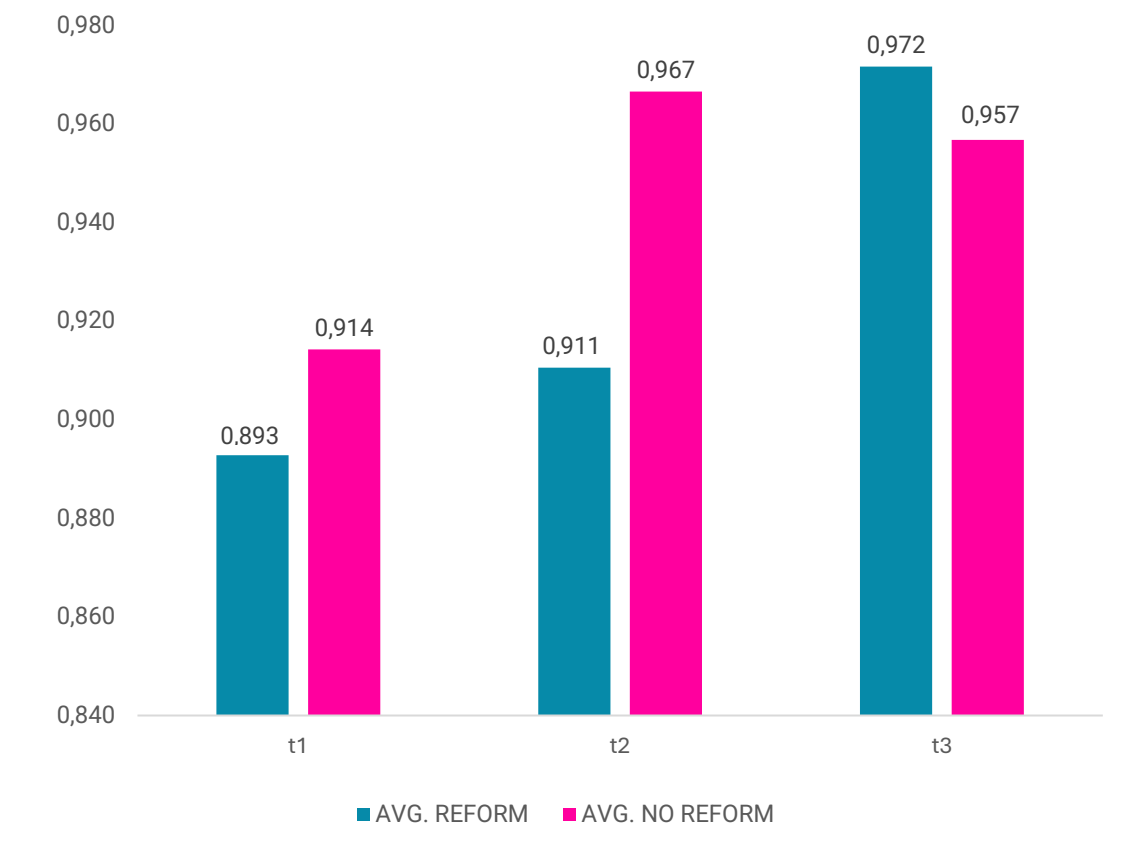
Figure 4.1: Change in inequality in mathematics test scores according to parental education in countries with and without ISCED 0-level reforms



Source: own calculations based on TIMSS G4.

Figure 4.1 shows inequality by SES before, at the time of and after reforms for countries with and without reforms. For all countries, there has been an increase in this sort of inequality, seen in the rising number across bars. This is in line with the general increasing inequality in the period (Clarke et al., 2022) and a corresponding increase in educational inequality in the same period (OECD, 2024). The ratio changes from 1,094 to 1,102 for the countries with a reform, and from 1,085 to 1,094 for the countries without a reform, translating to a between 8 and 10% difference between students with highly educated parents and students without highly educated parents in all groups. The increase thus seems to be somewhat larger in the countries without a reform, but the difference is small (the difference between t1 and t3 is 0.08 with reform and 0.09 without).

Figure 4.2: Change in inequality in mathematics test scores according to migrant background in countries with and without ISCED 0-level reforms

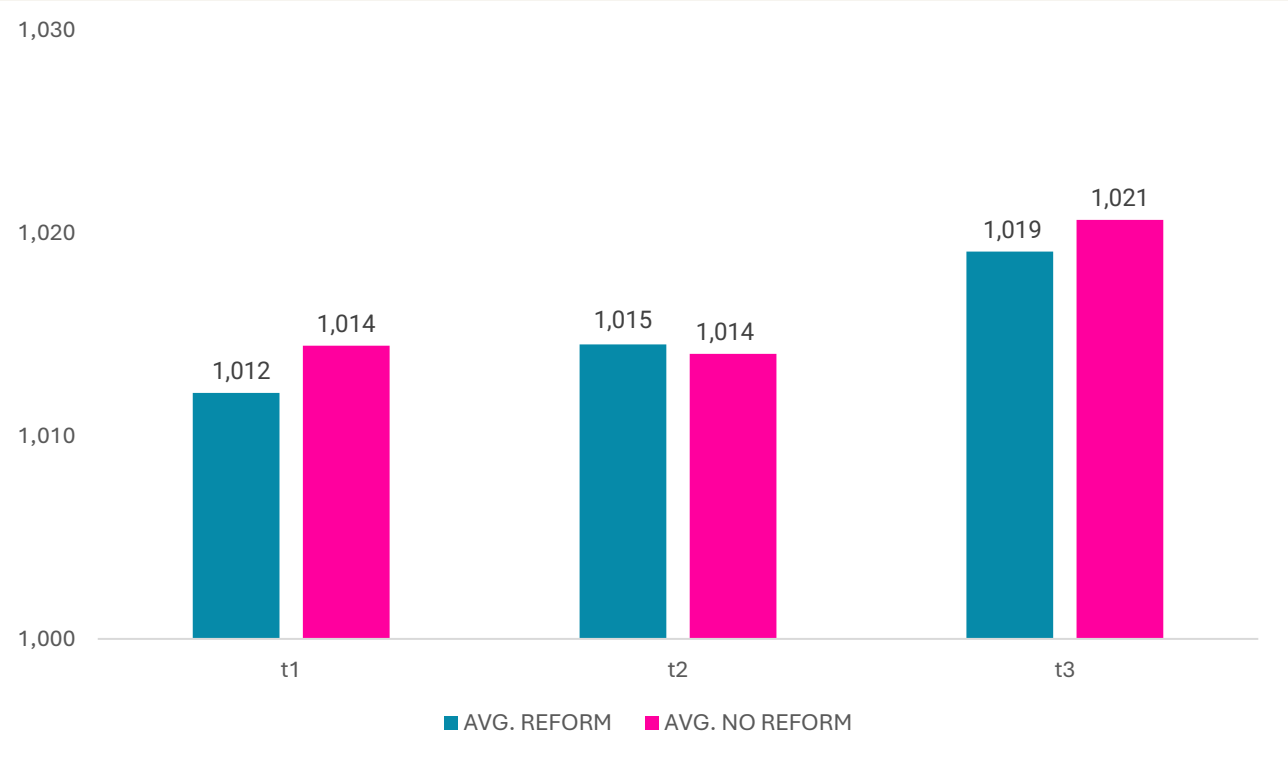


Source: own calculations based on TIMSS G4.

As for inequality according to immigrant background, Figure 4.2 shows that this has also increased in the period, but more so for the countries with a reform than the countries without a reform. The average change in ratio from t1 to t3 here is 0.79 in countries with a reform and 0.43 for the countries without. It has to be noted here,

that given the descriptive nature of the analysis, the patterns observed may arise from multiple factors unrelated to the reforms themselves; for instance, demographic shifts such as changes in the proportion/composition of immigrant students within each country.

Figure 4.3: Change in inequality in mathematics test scores according to gender in countries with and without ISCED 0-level reforms



Source: own calculations based on TIMSS G4.

Finally, the figure on gender ratios (Figure 4.3) demonstrates that gender-related inequality remains very low in all countries and rises only marginally over time, with no distinction between those that enacted reforms and those that did not. This is consistent with the fact that the reforms in question did not explicitly address gender differences.

4.3. Results of multi-level analysis

The following section presents the findings from the multi-level analysis. In model 1, we interact reform status with parental education, modelling schools as level2 units and countries as level3 units. This structure enables us to examine whether reforms correspond to distinct patterns in the development of inequality. As the data is

hierarchical in nature students are nested in schools and; in turn, schools are nested in countries we apply a multi-level model, as suggested in such instances (Gelman and Hill, 2007). We model test scores at t3 (five years after reform) as the dependent variable. Using a multi-level structure with schools as level2 units and countries as level3 units allows the intercepts to vary across both contexts. This approach estimates the individual and grouplevel components simultaneously, consistent with the "partial pooling" framework described by Gelman and Hill (2007). Although at least 25 units per level is commonly recommended, it is typical in crossnational research to have fewer units at the country level.

We include a dummy variable measuring if the country had a reform or not and interact it with parental education. We also control for gender, school location and immigrant background. We include relevant weights and first ran the model separately for the 5 plausible values, before we combined them into one model (using Rubin's rules).

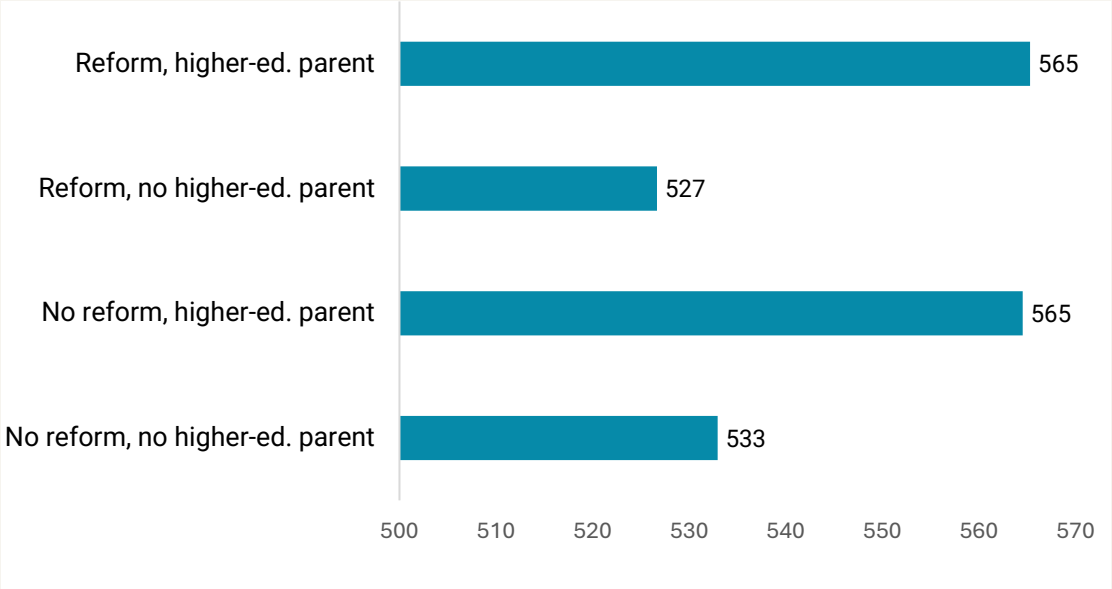
Table 4.3: Coefficients from 3-level regression model with students as level 1, schools as level 2 and countries as level 3

Variable	Coefficient	Standard error	z-statistic	p-value	95% confidence interval
Reform	-12.50*	5.45	-2.29	0.022	[-23.18, -1.82]
Parental higher education	25.47***	1.89	13.51	0.000	[21.77, 29.16]
Reform × Parental higher education	9.52***	2.37	4.01	0.000	[4.87, 14.16]
Female	10.23***	1.44	7.12	0.000	[7.41, 13.05]
Immigrant	-25.97***	2.08	-12.50	0.000	[-30.05, -21.90]
Urban	7.55*	3.62	2.09	0.037	[0.46, 14.65]
Constant	535.83***	3.39	158.19	0.000	[529.19, 542.47]

Parameter	Coefficient	Standard error	z-statistic	p-value	95% confidence interval
$\ln\sigma_1$ (constant)	2.68***	0.15	17.83	0.000	[2.38, 2.97]
$\ln\sigma_2$ (constant)	3.22***	0.08	40.95	0.000	[3.07, 3.37]
$\ln\sigma_e$ (constant)	4.10***	0.02	205.09	0.000	[4.06, 4.14]

Table 4.3 shows that, similar to the descriptive figure 1, on average, the results are lower in the countries that had a reform than those that did not, that results are higher for those with parents with higher education, that girls do better than boys, that native children get better results than those with an immigrant background and that those that go to an urban school do better than those that go to a rural school. More importantly, the interaction between reform and parents' education level is significant and positive, showing that inequality levels were higher in countries with a reform. As this model does not include any measures of student performance before and after the reforms, it is difficult to determine the underlying reasons for the observed patterns. It does, however, imply that those who have parents with higher education are not negatively affected by the reforms in the same way as those with parents without higher education.

Figure 4.4: Model 1: predicted test score values for students in countries with and without reforms, with and without parents with HE



The predicted values based on Table 4.3, shown in Figure 4.4, confirm that test scores are lower for students in countries with reforms in the period, but also show that this difference only exists for students with parents with no higher education. A possible interpretation of these results is that the inequality level is the underlying concern for implementing a reform in the first place, as inequality is higher in the countries with reforms (the gap between the predicted test scores of the two groups is 39 in the case of countries with a reform, and only 32 for countries without a reform).

In the next model (model 2), we include the time-dimension to assess how an educational reform at the pre-school level might have had an impact on the

individuals in the countries. We do this by including the three time points: before reform, at the time of reform and after reform, and interact the reform variable with parents' education level. Here, at the waves corresponding to t1 and t2, the reform dummy is set to 0 for all countries, and at t3, it is set to 1 for countries which had a reform, and to 0 for countries which did not. In this model, the dependent variable is test score in the given wave, and we include country and year fixed effects and also control for gender, school location and immigrant background. Consequently, this construct shows the differences between countries which had and did not have a reform and how it has impacted inequality according to parents' education level five years after the reform.

Table 4.4: Coefficients from linear regression model with country and year fixed effects, controlled for waves. Standard errors clustered on schools.

Term	Level	Coef.	Std. Err.	t	P-Value	95% CI (Lower)	95% CI (Upper)
Reform_t3	1	12.792	1.928	6.630	0.000	8.992	16.593
Parent HE	1	35.529	0.583	60.960	0.000	34.383	36.675
Reform_t3 × Parent_HE	1 × 1	7.909	1.205	6.560	0.000	5.536	10.282
Female	1	10.796	0.388	27.850	0.000	10.036	11.556
Immigrant	1	-29.025	0.553	-52.490	0.000	-30.116	-27.933
Urban	1	5.777	0.786	7.350	0.000	4.235	7.318
_Cons	—	517.836	2.341	221.230	0.000	513.218	522.453

Table 4.4 shows the output from the second model where we assess the differences in inequality between countries which had and did not have a reform at ISCED level 0. The output shows that when we add the time-dimension, having had a reform is positive and significant for the results. Moreover, the interaction-term between reform and parents' education is also positive and significant, implying that the lifting effect of a reform is higher for students with parents with higher education. This means that even if the reform lifts all students on average, it does not reduce social inequality in results; it rather amplifies it.

Figure 4.5: Model 2: predicted test score values for students in countries with and without reforms, with and without parents with HE

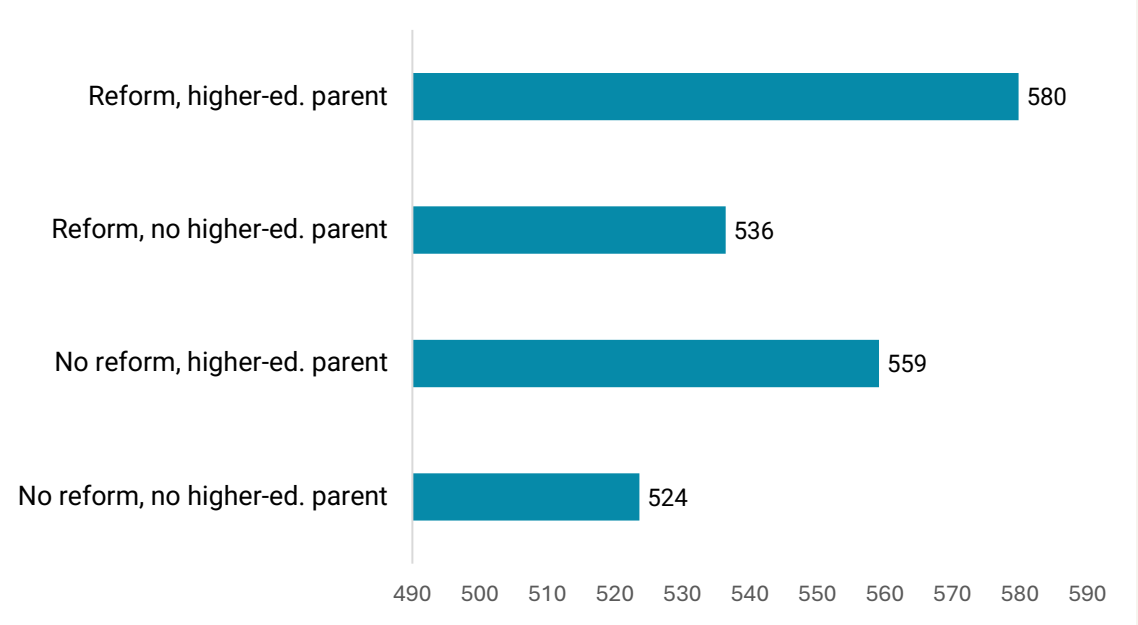


Figure 4.5 containing the predicted values for the interaction term confirms the findings in model 2, table 4.4. Having had a reform increases the results for all groups, but more so for those with parents with higher education than for those with parents without higher education. Thus, the reforms do not, in the time-perspective we apply here, decrease the inequality in results between students with and without higher-educated parents. However, we do not know whether or not a reduction of inequalities might occur at a later time point, as suggested by some studies.

Discussion of findings

A common finding in the literature on education and inequality is that increased schooling is more advantageous for children with lower SES (see e.g., Raudenbusch and Eschmann, 2015), and our findings can be interpreted to be differing from that. However, our models are not necessarily showing the impact of more years of education, as we merely measure how the implementation of reforms matter for the results of children five years after in the same country. Future research should examine how the specific reforms impact children who were affected by the reform, and how this differs by SES and other measures of inequality. We did, however, show that the reforms seem to be correlated with an improvement of results for everyone, even if somewhat more so for those with higher SES.

5. Conclusion: case analyses of inequality impact of reforms

The aim of the report was to describe the trends of inequalities in education achievement in Europe based on re-analyses of large-scale educational assessment studies. We focussed on analysing differences in educational achievement between students with different parental education, gender, immigrant status and urbanisation.

The findings show that inequality by parental education remained relatively strong compared to the other factors in case of both mathematics and reading. This aspect of inequality proved to be persistent across countries and widening of inequalities was especially seen during the period between 2011 and 2023 in case of Grade 8 mathematics results. On a similar note, gender inequality was generally small in mathematics, with boys showing higher performance, and over time a modest increase in boys' advantage has been observed during the period between 2003 and 2023. When exploring reading performance gender inequalities were also generally small, but in this case girls tended to show higher achievement. Changes over time were generally moderate, but generally boys disadvantage tends to decline.

Inequalities in educational achievement in mathematics between migrant and non-migrant students are visible; however, there is evidence of moderate convergence in several countries at the primary level and the secondary level. Inequalities in reading achievement remain persistent and often sizeable, especially at age 15. There are more countries showing narrowing gaps during the past two decades in Grade 4, while the majority in Grade 8 recorded a widening gap between migrants and non-migrants. Regarding urban–rural disparities our findings suggest that inequality in mathematics achievement is moderate and stable in primary education, while somewhat larger in secondary education. In reading urban–rural inequality is generally small.

In addition to describing trends in inequalities in educational achievement, this report also aimed at providing an analysis of the effect of certain educational policies on educational inequality using data from the international large-scale assessment studies. More specifically, we have selected early childhood education and care (ECEC) policies and examined the results in terms of inequalities in educational achievement. These studies were motivated by the widespread assumption that expanding access to early childhood education (ECE) can help equalise learning opportunities and outcomes across socio-economic groups. Over the past 25 years,

many European countries have implemented preschool expansion policies, often with dual aims: improving the compatibility of work and family life, and enhancing school readiness, particularly for children at risk of lower academic performance. These policies have resulted in rising preschool enrolment rates in most countries, including increased participation by disadvantaged children and younger age groups.

The analysis in chapter 4 examined to what extent are early childhood (ISCED 0) access regulation reforms, described in chapter 3 of the report, associated with changes in educational inequality, using multilevel models on PIRLS and TIMSS data. This analysis failed to find an equalising effect of early childhood education reforms, as it showed that the reforms were correlated with an improvement of results for everyone, and the effect of reforms was not particularly strong among children from low-SES families.

Nevertheless, other studies by members of the project team also looked at the effect of early childhood education on educational inequality, by exploiting variation in the participation rates in ECEC and inequality in access to ECEC rather than looking at the effect of specific policy reforms. In the following paragraphs, we provide a short summary of these studies and their results.

The core question posed by the first study (Steinman et al. 2024) was whether the expansion of ECEC services has led to a decrease in educational inequalities—measured specifically as the gap in test scores between high- and low-socioeconomic status (SES) students. To explore this, Steinman et al. (2024) use data from PISA (2003–2022), focusing on mean differences in reading and mathematics scores between students in the top and bottom 10% of the Economic, Social, and Cultural Status (ESCS) index. According to the findings of the study high-SES students consistently outperform their low-SES peers across countries and years, with some variation in the size of the gap but no clear trend toward convergence.

To examine the relationship between preschool enrolment and later inequalities, the authors employ a country-fixed effects regression approach. This method allows to compare each country with itself over time, thereby controlling for time-invariant national characteristics—such as structural economic differences or long-standing education policies—that could confound cross-country comparisons. Time-varying control variables were also included in the model to account for demographic or economic changes that might influence achievement gaps. The main independent variable is earlier preschool enrolment, typically lagged by about 10 years to align with the age when students are assessed in PISA.

The findings show that in simple cross-sectional comparisons, countries with higher

preschool enrolment rates tend to show greater SES-based inequalities in achievement. However, this pattern likely reflects broader inter-country differences rather than causal effects. Once country-fixed effects are introduced, a small negative association emerges between preschool enrolment and mathematics inequality, suggesting that increases in preschool enrolment may be followed by slight reductions in mathematics achievement gaps. For reading, no significant effect is found. When further controls are added to account for time-varying predictors, the effects in both subjects become statistically insignificant. In other words, the authors find no robust evidence that higher preschool enrolment rates systematically reduce SES-based achievement gaps at age 15.

Steinmann et al (2024) discuss several possible reasons for these findings. First, limited statistical power may constrain the ability to detect small effects, as each country has a maximum of only seven measurement points over time. Second, the gross enrolment ratio used as the main indicator of preschool participation may not capture relevant differences in enrolment by SES. Additionally, the long-term academic benefits of preschool attendance may vary by context and quality, limiting their equalising potential.

In their second study (Steinmann et al. 2026) the authors use PIRLS data on reading achievement in grade 4 to study the effect of preschool enrolment. Grade 4 achievement data allow a different perspective on the issue as the achievement test is temporally closer to preschool, making fade-out effects less pronounced. In addition, in the second analysis the authors take explicitly into account that increasing preschool enrolment does not necessarily lead to a more equitable access to these services among children from lower socioeconomic background.

Although disadvantaged children often benefit particularly strongly from participation in high-quality ECEC, it remains well established that socioeconomically disadvantaged children participate less frequently in universal ECEC programs than their more privileged peers in most countries (e.g., Kulic et al., 2019; OECD, 2025; Van Lancker, 2013). This participation gap represents a critical policy challenge, as it may limit the equalising potential of early education systems. Therefore, the second study by the authors directly tests whether increasing ECEC participation rates can reduce socioeconomic inequalities in educational achievement—particularly when overall expansion is accompanied by a narrowing of participation gaps between socioeconomic groups. The authors analysed data from the Progress in International Reading Literacy Study (PIRLS) study that evaluates reading achievement among fourth-grade students between 2001 and 2021. Socioeconomic status (SES) was measured using parental education information and students were classified as high SES if at least one parent or guardian had completed ISCED Level

5 or higher. This operationalization allowed to capture substantial differences in family educational background while maintaining comparability across countries and time.

Trend analysis showed that although participation in ECEC services expanded overall, the relative difference between socioeconomic groups remained largely stable. The main research question aimed to trace trends in socioeconomic inequalities in reading achievement back to trends in ECE participation rates and to inequalities in ECE participation. To test this mediation hypothesis, the authors estimated separate mediation path models using country-fixed effects regression analyses. The authors estimated the individual paths of the mediation model using separate country-fixed effects regressions. As hypothesized, they found a significant negative association between overall ECE participation rates and socioeconomic inequalities in ECE participation. In other words, as overall participation increases within a country, the participation gap between high- and low-SES children tends to decrease. They also observed a significant positive association between socioeconomic inequalities in ECE participation and inequalities in reading achievement. This suggests that larger participation gaps are associated with larger achievement gaps. However, overall ECE participation rates do not directly and significantly predict inequalities in reading achievement. Importantly, these findings remain robust after including the control variables.

Results obtained with the estimation of the full mediation model supported the hypothesised indirect pathway. Specifically, increasing ECE participation rates were indirectly associated with a small but statistically significant decrease in socioeconomic inequalities in reading achievement, but only when increases in participation were accompanied by reductions in participation gaps between SES groups. The indirect effect is negative and statistically significant, indicating that expansion may contribute to greater equity in achievement if it reduces unequal access (Steinmann et al. 2026).

Another study, by Strømme et al. (2025) analysed whether preschool attendance was an equalising factor for children with immigrant background which could reduce the reading scores gap for these children in 4th grade. Based on data from PIRLS from 2021 they defined immigrant background as speaking other language than test at home. The study showed that in all 24 European education systems participating in PIRLS 2021, children with both parents speaking a foreign language had lower percentages of preschool attendance than those with both parents speaking local language (language of test) and sequentially, these children had lower achievement in reading skills as well.

The analysis found that preschool attendance had in general a positive effect on

reading test scores in grade 4. The length of preschool attendance mattered for children with immigrant background: the positive effect of 2-3 years of preschool attendance on reading test scores was larger among children who spoke a different language at home. The analysis also showed that the equalizing effect of preschool attendance can be different in countries with different policy approach for preschool attendance. The analysis found that the larger positive effect of 3 years of preschool attendance among children with immigrant background prevailed in countries providing early guaranteed access to preschools, such as Denmark, Sweden, Norway, Finland and Germany. In case of countries with least pre-school coverage (such as Italy, Slovakia, Bulgaria, Hungary, Poland, Czech Republic) the analysis found that 3 years of preschool attendance had a stronger positive effect for children of parents with low education level.

In summary, the findings of these studies suggest that preschool attendance can play a role in reducing inequality in educational achievement for children from low socioeconomic or immigrant background. A general increase in preschool participation however is not a guarantee for the reduction of inequality. The study by Strømme et al. (2025) highlighted that length of preschool attendance also matters and the reduction of the test score gap for children with immigrant background is likely to occur after 2-3 years of preschool attendance. Steinmann et al. (2026) suggest that expanding ECE participation alone is not sufficient to reduce socioeconomic inequalities in reading achievement. However, expansion may promote greater equity when it narrows participation gaps between disadvantaged and advantaged children. These results highlight the importance of focusing not only on overall enrolment rates but also on the distribution of access across socioeconomic groups. Policies that increase participation while specifically targeting disadvantaged families may therefore hold greater potential for reducing long-term educational inequalities.

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List of acronyms and specific terms

Term	Definition
ECE	Early Childhood Education
ECEC/ECCE	Early Childhood Education and Care, or Early Childhood Care and Education (as termed by UNESCO)
EU	European Union
ISCED	International Standard Classification of Education
OECD	Organisation for Economic Co-operation and Development
REA	European Research Executive Agency
SEN	Special Educational Needs
SES	Socio-Economic Status
UKRI	UK Research and Innovation public body
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WP	Work Package - A component of the project work breakdown. It represents a group of project activities targeting common specific objectives.
D	Deliverable - a tangible output such as a report, prototype, working paper, or a dataset that demonstrates the completion of a specific task or milestone set out in the project

List of STRIDE Work Packages

WP 1	Project management and research governance
WP 2	Policy analysis and meta-analysis in Europe
WP 3	The trends of inequalities in education achievement
WP 4	A map of significant factors of inequalities in education
WP 5	Identify effective policy initiatives and interventions
WP 6	A toolbox for effective policymaking and assessment of inequalities in education
WP 7	Impact pathways, public engagement & synergy building

Project Name: Strategies for Achieving Equity and Inclusion in Education, Training and Learning in Democratic Europe (STRIDE)

Coordinator: OsloMet – Oslo Metropolitan University, Oslo, Norway - lhuang@oslomet.no

Consortium:

- Oslo Metropolitan University, NOVA, Oslo, Norway
- Jagiellonian University (JU), Poland
- National and Kapodistrian University of Athens (NKUA), Greece
- VIA University College, Denmark
- TÁRKI Social Research Institute (TÁRKI), Hungary
- Roehampton University (RU), United Kingdom
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STRATEGIES FOR ACHIEVING EQUITY AND INCLUSION IN EDUCATION, TRAINING AND LEARNING IN DEMOCRATIC EUROPE (STRIDE)

Partners	Contact Person	Contact email
P1 - Oslo Metropolitan University	Lihong Huang	lhuang@oslomet.no
P2 - National and Kapodistrian University of Athens	Dimitris Parsanoglou	dimparsa@soc.uoa.gr
P3 – VIA University College	Lillian Buus	libu@via.dk
P4 - Lifelong Learning Platform	Veronica Arduino	projects@lllplatform.eu
P5 - TÁRKI Social Research Institute	István György Tóth	toth@tarki.hu
P6 – Jagiellonian University	Magdalena Ślusarczyk	magdalena.slusarczyk@uj.edu.pl
P7 – Roehampton University	Bryony Hoskins	bryony.hoskins@roehampton.ac.uk

STRIDE

EDUCATIONAL POLICY FOR EQUITY & INCLUSION

Strategies for Achieving Equity and Inclusion in Education, Training and Learning in Democratic Europe (STRIDE)

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