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Monitoring educational choices in Europe: An analysis of EU-SILC data

Exploring EU-SILC data to monitor Educational Systems in EU

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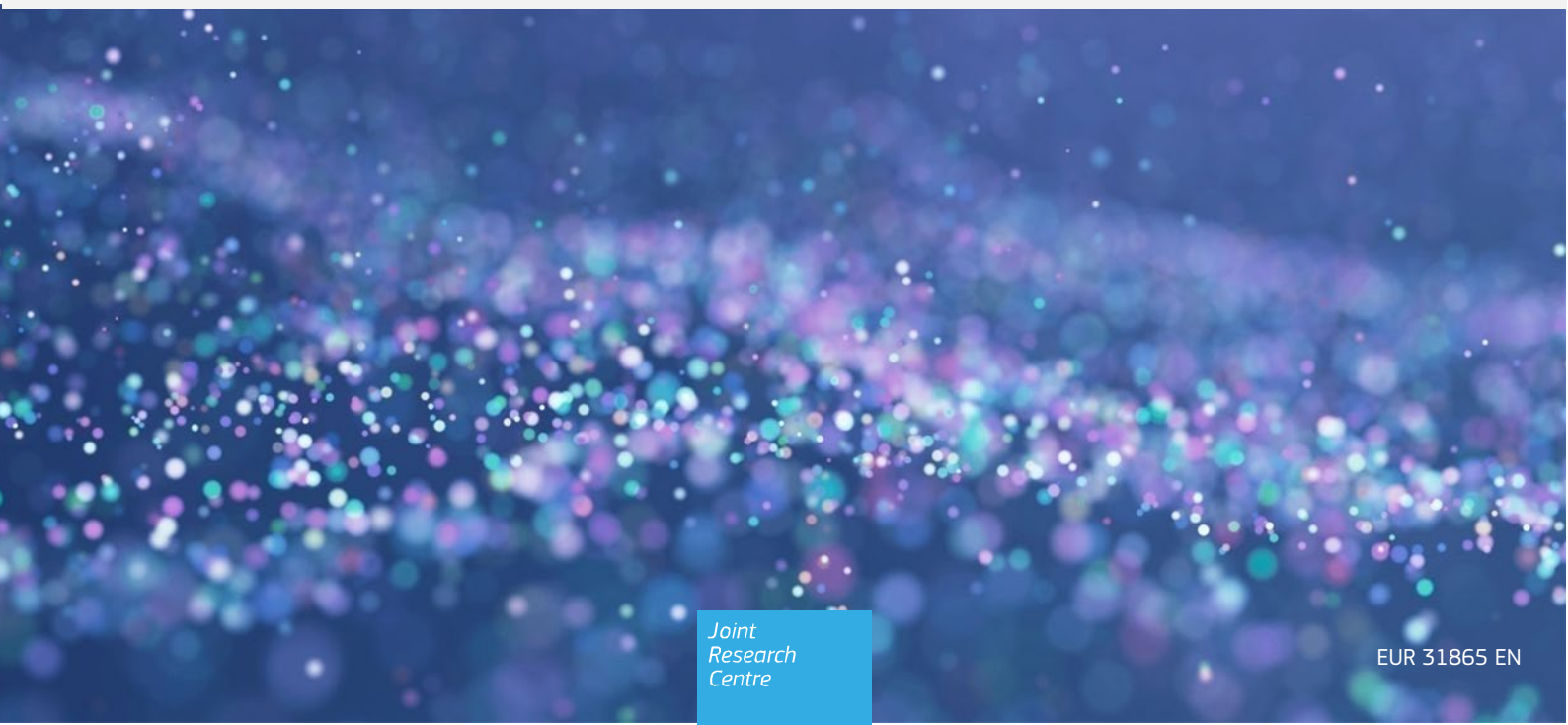

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Contents

Abstract

The European Education Area aims to support Member States' efforts in enhancing the educational attainment of younger generations. In this policy context, there is a need for an objective tool to assess the educational outcomes of EU countries. The present report addresses this need by pursuing two objectives: (1) providing a comprehensive method for using EU-SILC data to build relevant indicators for monitoring educational systems; (2) investigating the factors that explain variations in educational indicators across EU countries, with a particular focus on the influence of family inputs and personal characteristics. The empirical analysis is conducted using EU-SILC data from the 27 EU countries, employing various methodologies, including cluster analysis, principal component analysis, and correlational analysis. The results of this report demonstrate the potential of EU-SILC data in assessing educational systems in Europe. Furthermore, the findings offer valuable insights in support of the European Commission's objective of establishing a European Educational Area. The results also raise concerns, suggesting that education in Europe may not act as a universal equaliser. Instead, educational systems continue to exhibit social selectivity in influencing individuals' prospects for future careers.

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Executive summary

Acknowledging the pivotal role of education in the advancement of their Member States, the European Commission has introduced the concept of a European Education Area (EEA). The EEA is designed to reinforce member States' efforts in enhancing the educational attainment of younger generations by expanding pre-primary education, reducing early school dropout rates, enhancing fundamental skill proficiency, and facilitating access to tertiary education. Given this policy context, it becomes of paramount importance to have an objective tool to monitor the educational outcomes of EU countries, with the aim of unveiling the underlying factors that contribute to (or limit) the achievement of educational objectives.

The report illustrates the significant role of the EU-SILC survey in analysing educational choices across 27 EU countries. More specifically, this report aims to provide comprehensive method for using EU-SILC data to build relevant indicators assessing educational systems in EU countries. As a secondary objective, our work is to investigate the factors explaining the variations in educational indicators across EU countries, with particular attention to the influence of family inputs and personal characteristics.

We address the research objectives by analysing data from the EU-SILC survey in 2019. This year serves as a valuable reference point, being the last complete year prior to the start of the COVID-19 pandemic. Furthermore, the 2019 dataset includes a special module addressing "Intergenerational transmission of disadvantages, household composition, and evolution of income," providing an additional layer of insight into educational dynamics. On the other hand, the empirical approach outlined in this report can be easily replicated for other years.

By employing cluster and factor analysis as descriptive tools, we have identified three distinct country clusters (i.e., Nordic, Continental, Mediterranean) and studied them at the pivotal moments of the students' career (i.e., pre-primary, upper secondary, tertiary education and not in education, employment, or training). In addition, the report presents a correlational analysis to investigate the factors contributing to variations among EU educational systems.

Our findings highlight the commonalities and differences among EU educational systems on the basis of seven indicators. In particular, the "Nordic" cluster comprises educational systems characterised by delayed start of schooling, longer mandatory education duration, and prevalent tracking in secondary and tertiary education. Our research reveals that these countries demonstrate the highest levels of educational achievement among adults, particularly in tertiary education completion.

The "Continental" countries, forming the second cluster, are depicted as making progress. These educational systems feature widespread utilization of pre-primary education, high secondary education attendance, and an increasing number of higher education graduates. Family support, both financially and culturally, sustains student careers.

In contrast, the "Mediterranean" countries lag behind due to limited access to early childcare, shorter mandatory education duration, significant dropout rates in secondary and tertiary education, and lower tertiary education enrolment. These countries also display a stronger link between parental education and educational outcomes, indicating challenges in addressing social disparities.

The report provides evidence of several significant advantages in using EU-SILC data. Indeed, three primary benefits are associated with this data source. Firstly, the dataset facilitates a precise examination of educational outcomes in European countries by allowing the generation of timely and accurate indicators of educational attainment. Secondly, it provides household-level information, enabling the assessment of the influence of family characteristics on educational attainment. Lastly, it permits an investigation of educational indicators across all levels of education. This aspect is particularly relevant in the context of monitoring EU-level targets, as these targets typically concern specific educational stages. Overall, the report demonstrates that the EU-SILC survey serves as a reliable source of information for monitoring the effectiveness of educational systems in Europe.

While our analysis offers valuable insights, it has some limitations. Firstly, it relies on cross-sectional data, treating adjacent birth cohorts as having experienced the same educational environment. A longitudinal study would be preferable, but it would provide insights only later in the process, as individuals concluding their education at age 25 would reflect the effectiveness of educational systems from 10 to 20 years earlier. Secondly, our analysis is purely descriptive and does not seek to establish causal relationships. Our aim is to provide a comprehensive comparative analysis of educational systems without focusing on specific policies reliant on single instruments. Thirdly, when interpreting the results, potential limitations regarding

comparability between different EU countries due to variations in education quality should be considered, especially for pre-primary services, which typically vary significantly across countries.

The insights provided by this report hold significant relevance in supporting the European Commission's pursuit of establishing a European Educational Area. However, the findings also bring forth concerns regarding the efficacy of educational systems in Europe as equaliser of opportunity. Rather than serving as a tool accessible to all, education systems across the region appear to perpetuate social selectivity, exerting a pronounced influence on individuals' future careers. This observation underscores the persistent challenge of ensuring equitable access to education and highlights the need for targeted interventions to address disparities and foster inclusive educational environments across Europe.

1 Introduction

Understanding the educational choices made by individuals holds paramount importance. Gaining a clear comprehension of the factors and mechanisms influencing educational attainment throughout students' careers empowers policymakers and stakeholders to design evidence-based strategies and initiatives that promote educational excellence, social cohesion, and economic growth.

Recognising the pivotal role of education in the development of their Member States, the European Commission has introduced the concept of a European Education Area (EEA). The EEA aims at sustaining the efforts of member States in enhancing the educational achievements of young generations by expanding pre-primary education, reducing early school leaving, improving basic skill levels, and facilitating access to tertiary education.

Members States have agreed that, by 2030, at least 96% of children aged three to the starting age for compulsory primary education should participate in ECEC (Early Childhood Education and Care), the share of early leavers from education and training should be less than 9%, and at least 45% of 25-34 year-olds should have completed a tertiary educational degree (Council of the European Union, 2021). The EEA initiative uses quantitative indicators collected for all Member States to monitor how the latter are moving towards the set goals. However, there is still limited knowledge about why some educational systems are more successful than others.

In this report, we examine educational choices in EU countries at pivotal stages in life, aiming at uncovering the underlying factors that contribute to the attainment of educational objectives. Following this purpose, we propose a novel method for monitoring European educational systems using data from the European Union Statistics on Income and Living Conditions (EU-SILC)[1].

Specifically, this report has two main objectives:

1. To provide comprehensive methods to use EU-SILC data for building relevant indicators assessing educational systems in EU countries.
2. To investigate the factors explaining the variations in educational indicators across EU countries, with a particular attention on the influence of family inputs and personal characteristics.

The attainability of our second objective is facilitated by the detailed granularity of the EU-SILC data, which offers insights at the household level. This granularity enables us to conduct in-depth analyses and consider a wide spectrum of individual and family characteristics.

In terms of geographical coverage, this study is concerned with the educational systems of EU-27 countries. Specifically, we concentrate on data from the EU-SILC survey in 2019. This year is a valuable reference point, being the last complete year prior to the start of the COVID-19 pandemic. Furthermore, the dataset includes a special module addressing "Intergenerational transmission of disadvantages, household composition and evolution of income"[2], which offers an additional layer of insight into educational dynamics. On the other hand, the empirical approach outlined in this report can be easily replicated for other years, thereby providing a roadmap for future investigations in this field.

In our empirical analyses, we employ the number of years of schooling as a proxy for educational achievement, essentially measuring the quantity of human capital. Indeed, while more complex measures of achievement (such as the quality of human capital) exist, they may not cover the entire spectrum of educational levels within a longitudinal framework. Alongside quantitatively oriented measures, by utilising EU-SILC data, we can build indicators that assess several aspects of the equity and inclusivity of education in the Member States.

The report provides evidence of several significant advantages in using EU-SILC data. Indeed, three primary benefits are associated with this data source. Firstly, the dataset facilitates a precise examination of educational outcomes in European countries by allowing the generation of timely and accurate indicators of educational attainment. Secondly, as already mentioned, it provides household-level information, enabling the assessment of the influence of family characteristics on educational attainment. Lastly, it permits an

[1] More details at: https://ec.europa.eu/eurostat/web/microdata/european-union-statistics-on-income-and-living-conditions.

[2] This module provides information on the parents of the household heads and spouses. This module is also available in EU-SILC 2011 and 2005. For additional details, see https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32018R0174.

investigation of educational indicators across all levels of education. This aspect is particularly relevant in the context of monitoring EU-level targets, as these targets typically concern specific educational stages. To be more precise, among the 2030 targets, the analyses focus on tertiary educational attainment, early school leavers, and participation in early childhood education, recognising their importance in shaping educational outcomes. Overall, the report demonstrates that the EU-SILC survey serves as a reliable source of information for monitoring the effectiveness of educational systems in Europe.

In addition, the work presented here offers valuable insights into identifying distinct patterns within EU educational systems. Specifically, our findings provide evidence of the presence of three clusters of EU countries, for which we have explored the role of family inputs and personal characteristics in determining educational attainment at various pivotal stages in students' careers. These insights are particularly relevant for monitoring EU-level targets and can be beneficial in supporting the strengthening of the European Educational Area.

The report is structured as follows. The Section 2 comprises a review of studies utilising EU-SILC data to address education-related issues, offering an overview of pertinent research into the factors that influence educational attainment. Subsequently, Section 3 briefly outlines the key trends and policy context within the EU, presenting the primary statistics concerning the educational targets set by the European Commission. Section 4 provides an in-depth examination of the EU-SILC survey data, elucidating our approach for building the indicators to monitor and assess EU educational systems. Following that, Section 5 presents an overall analysis of the educational systems in the EU, followed by an analysis of educational achievements at various relevant educational stages. Lastly, Section 6 summarises our findings, highlights the report's contributions, and offers concluding remarks.

2 Reference Literature

2.1 Assessing Educational systems and the use of EU-SILC data in education

The comprehensive information on income, living conditions, and demographics provided by EU-SILC makes it a valuable resource for studying various aspects of European societies and economies.

For instance, Palmisano et al. (2022) examine EU-SILC waves from 2005 to 2011 with a focus on tertiary education. Their study specifically delves into investigating the inequality of opportunity among students in this last stage of their educational career.

Checchi et al. (2016) also explore the topic of inequality of opportunity in Europe, using data from the EU-SILC waves (i.e., 2005 and 2011). Specifically, the authors leverage EU-SILC data to estimate inter-country disparities in traditional indicators of opportunity inequality across the 30 European countries.

Similarly, Bernardi and Ballarino (2014) employ EU-SILC 2010 and 2002 data for 23 EU countries to examine the effect of higher education expansion on the equality of educational opportunities and on the matching of labour supply and demand.

Furthermore, using the "Intergenerational Transmission of Disadvantages" modules from EU-SILC in 2005 and 2011, Palomino et al. (2019) investigate the extent to which the educational attainment of parents can explain the inequality of opportunities in education in 26 European countries.

Other papers examine EU-SILC data to provide evidence on the return to education for adults. Vilerts et al. (2017) analyse this matter with particular attention to the economic crisis in Latvia, while Högberg (2019) is interested in the transition from unemployment to education across European countries. Additionally, Mysíková & Večerník (2019) use EU-SILC to study the return to tertiary education in Eastern Europe.

Finally, the report by Villalba et al. (2012) is using EU SILC to monitor one of the EU targets, more specifically the share of participation in early childhood education and care. The authors highlight as the advantages of using EU-SILC for this purpose, emphasizing its capability for complex analyses of educational outputs in relation to family and household characteristics and its precision in capturing the educational participation decisions of individuals.

While there are studies using EU-SILC data in the field of education, their focus tends to be on particular stages of education and specific topics, providing only a partial understanding of how educational systems in Europe are performing overall.

As a result, the full potential of EU-SILC in comprehensively study educational performance along educational stages has not yet been fully exploited yet. In this report, we aim to address this gap by proposing a novel approach to use EU-SILC for monitoring educational systems in Europe. As emphasised in subsequent sections of the report, EU-SILC data presents significant advantages for this purpose. It not only can provide detailed information about specific educational stages, but also integrates micro-level data about the individual, such as family income, parental education, gender, and migratory origin—factors often overlooked in the more commonly used macro-indicators defining the educational targets. Finally, this data source allows the consideration of indicators that reflect the current level of education (accordingly to the year of data collection), rather than being tied to cumulative measures that strictly reflect past educational attainments.

2.2 Evidence on the determinants of educational attainment

In this report, we aim to analyse educational systems going beyond the limits of a purely quantitative perspective, which typically focuses on metrics like the percentage of the population reaching specific educational levels. Instead, we also aim to offer an assessment of educational systems that delves, at least partially, into the processes implemented by these systems. In other words, we want to examine how various factors exert more or less influence in determining the educational achievement of the individuals in different countries. Given this purpose, in this section we provide a brief overview of the determinants of educational attainment, summarising what has been studied and discovered on this matter.

Being aware that the literature on this topic is extensive, in this section, we aim at offering a general view on the relevant streams of literature. In the following paragraphs, we highlight the determinants of educational attainment most commonly studied, aiming to assist the reader in understanding our choices in terms of indicators and interpreting the results presented in the subsequent sections. On the other hand, we do not aim

at providing a comprehensive and exhaustive review of the determinants of educational attainment, which, in itself, would require a separate study.

Various types of factors influencing the educational attainment of the population have been identified in the literature. From a macro perspective, educational policies and characteristics of national and sub-national educational systems can exert a significant influence on the participation in education among younger citizens (Woessmann, 2016). Examples include public funding dedicated to education (for instance, Hanushek, 2006; Alegre & Benito, 2014), the years of compulsory education (for instance, Angrist & Krueger, 1991), the presence of tracking systems (for instance, Hanushek & Woessmann, 2006) and vocation education (for instance, Agodini & Deke, 2004; Bishop & Mane, 2004).

Moving to the institutional level, several factors have been shown to play a relevant role in explaining differences in educational attainments. These determinants represent, for example, the characteristics of schools or universities (for instance, Card & Krueger, 1992; Dearden et al., 2002), the class size and its composition (for instance, Finn et al., 2003; Woessmann & West, 2006), and the characteristics of teachers along with their teaching methods (for instance, Nye et al. 2004; Campbell & Mayer, 2009).

While policy and institutional factors undeniably exert significant influence in explaining educational attainments, this report focuses on the influence of individual characteristics and family inputs. This emphasis stems from the limitation in the available information within EU-SILC, as it relies on surveys conducted with individuals. However, this approach suits particularly the cross-country perspective adopted in this study. Family and individual characteristics are universal factors that can influence the educational attainment of youngsters across all countries. In this study, our aim is indeed to explore educational systems without delving into the specifics of individual country policies. Instead, we adopt a more broad perspective that enables the comparison of different educational systems based on common features. Nevertheless, significant cross-country differences in how these factors influence educational attainments may provide insights into the effectiveness of educational systems, and their respective policy instruments.

Family inputs have been extensively explored by intergenerational mobility studies, which examine their impact on the educational choices. Two primary mechanisms have been identified to account for intergenerational persistence in education: direct resources and genetic transmission. Direct resources encompass various forms of support provided by parents, including economic, human, social, or cultural capital (see, for instance, Checchi et al., 2013; Møllegaard and Jæger, 2015). In this report, given the available information and its relevance, we specifically focus on this channel of intergenerational persistence. However, it is worth mentioning that some studies provide evidence that genetic factors, transmitted from parents to their children, can explain a significant part of the observed differences in academic performance (see, for instance, Liu, 2018; Byrne et al., 2019).

Intergenerational mobility studies have consistently observed a strong association between parents' educational levels and their children's educational attainment, indicating a high persistence of educational outcomes (Checchi et al., 2013; Bukodi & Goldthorpe, 2013, for Italy and the UK, respectively). Similarly, research in this field has also examined the influence of family income and occupation on the educational decisions made by children, generally finding it to be an important factor (Aakvik et al., 2005; Belley and Locher 2007). Additionally, Shumba & Naong (2013) found that inadequate family income is a common obstacle for students in pursuing their preferred career choices.

Looking at the topic from a wider perspective, a relevant part of the literature has studied the relationship between family background and social position, i.e. social mobility. The early studies by Erikson & Goldthorpe (1992) and Shavit & Blossfeld (1993) have claimed the existence of a “persistent inequality”, which has been partially confirmed by more recent works (Breen, 2004; Ballarino & Bernardi, 2016). However, the results remain controversial; in an analysis of seven European countries, Breen et al. (2007) found a decreasing pattern in social inequality. Moreover, many scholars claimed that the influence of social origin on educational attainment and social position has decreased over time in Scandinavian countries (Jæger & Holm, 2007; Esping-Andersen & Wagner, 2012). A greater emphasis on academic attainment has been given by social stratification research that identifies education as a mediator between social background and social status (Blau & Duncan, 1967). For example, a cross-countries analysis of eleven European countries proposed by Triventi (2013) reported that family background seems to strongly affect the probability of graduation of students, especially in countries with higher tertiary attainment rates (i.e. higher labour market competition). In particular, social conditions seem to influence both the transition from secondary to tertiary education and the probability to drop from tertiary studies in the early years (Argentin & Triventi, 2011).

Furthermore, additional family factors have been identified as influencing educational participation. For example, Ermisch & Francesconi (2000) document that having a mother with a full-time job during early childhood has a negative impact on a child's educational attainment. Nevertheless, the causal effect appears to be somewhat limited. Schildberg-Hörisch (2016) concluded that increasing a mother's weekly workload by 1 hour decreases the likelihood of secondary track attendance by 0.1% at most. Additionally, the literature explores the role of immigrant background in educational attainment, generally finding a penalising effect for those born outside the country (see, for instance, Portes & MacLeod, 1999; Cobb-Clark & Nguyen, 2012). However, it appears that this effect is significantly influenced by the individual's social class and socioeconomic status, with evidence suggesting that immigrant students perform similarly to native-born students when considering these contextual factors (Silveira et al., 2019).

Most of these factors (family income, parental education and occupation, parental country of birth) are to be considered in the empirical analysis that follows.

3 Education participation in Europe: key trends and policy context

The importance of increasing participation and completion rates across all educational levels has been widely acknowledged by the EU policies. The *Council Resolution on a strategic framework for European cooperation in education and training towards the European Education Area and beyond* (2021-2030), adopted in February 2021, set key targets to raise participation in early childhood education and care (ECEC), reduce early school leaving, and increase tertiary educational attainment. This initiative aims to enhance the overall quality of education and training systems in the EU and promote lifelong learning opportunities.

Establishing targets for educational indicators is crucial to ensure that young people acquire the necessary skills and qualifications to thrive in today's job market and to increase the number of individuals with higher education degrees. By the year 2030, the EEA has set five targets to be achieved: (1) less than 15% of 15-year-olds should be low-achievers in reading, mathematics, and science; (2) less than 15% of eighth-graders should be low-achievers in computer and information literacy; (3) at least 96% of children between 3 years old and the starting age for compulsory primary education should participate in early childhood education and care; (4) early leavers from education and training[3] should be less than 9%; (5) at least 45% of 25-34 year-olds should have a higher education qualification[4].

Examining the trends in these indicators reveals a general improvement, with significant heterogeneity across countries and indicators. Specifically, on average, Early Childhood Education and Care (ECEC) participation for children aged 3 and above in the EU reached 91.8% in 2021, showing an increase of approximately 2 percentage points from 2013[5] (see Figure 1). Countries like Ireland, Croatia, Cyprus, Luxembourg, and Poland have made notable improvements. However, the situation remains diverse, with Greece and Romania reporting ECEC participation below 80%, revealing a gap compared to other EU countries.

As depicted in Figure 2, the rate of early leavers shows a more remarkable improvement. The EU-27 average value has steadily declined from 16.9% in 2002 to 9.6% in 2022. Nevertheless, significant differences persist among countries, with rates ranging from 2.3% in Croatia to 15.6% in Romania and 16.5% in Iceland (referring to 2022, the last available data).

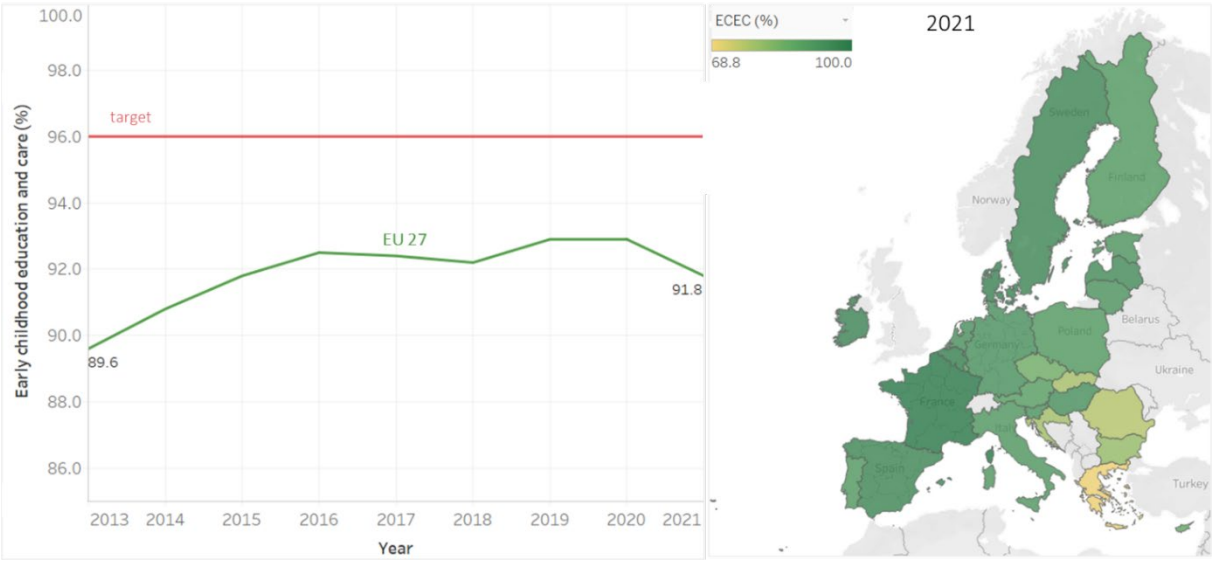
Figure 3 reports that during the period 2005 – 2022, the percentage of individuals aged 25-34 with a tertiary education degree increased from 23.1% (in 2005) to 39.4% (in 2022) across the EU-27 countries. Once again, substantial disparities exist between countries, with rates ranging from 25.5% in Romania to 60.3% in Cyprus (referring to 2022, the last available data).

[3] Early leavers from education and training are defined as individuals aged 18-24 who have completed no more than lower secondary education and were not in further education or training during the four weeks prior to the labour force survey (LFS).

[4] Tertiary educational attainment refers to the proportion of the population aged 25-34 who have completed tertiary education (ISCED levels from 5 to 8)

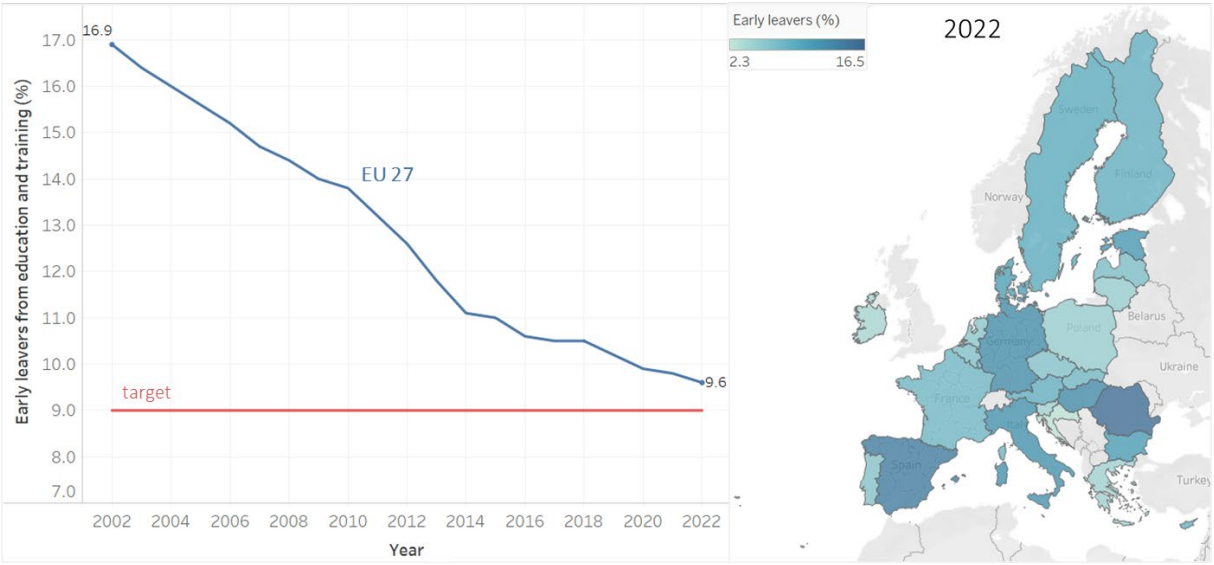
[5] Eurostat has data available for this indicator starting from 2013, marking it as the initial year of record, up until 2022, which is the last year available (data retrieved on August 2023).

Figure 1. Participation in early childhood education and care (ECEC)



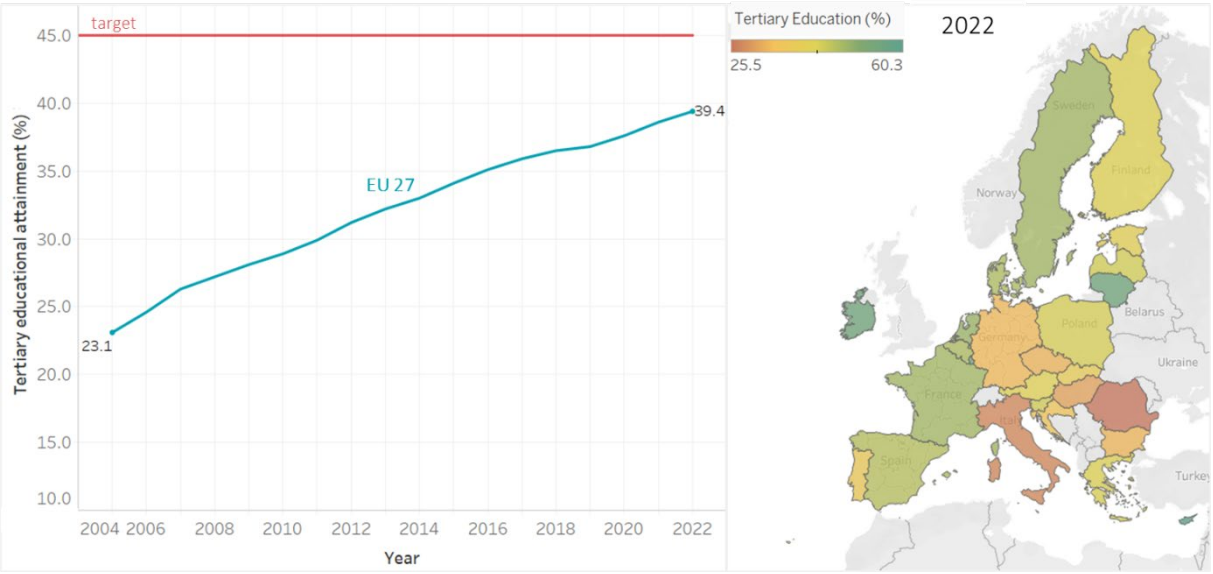
Note: The graph on the left depicts the trend over time for the EU-27 average, while the red constant line represents the EU target. The map on the right side of the figure illustrates the indicator's status for each country in the last available year. Source: Eurostat, 2022 - Online data code: educ_uoe_enra22, https://ec.europa.eu/eurostat/databrowser

Figure 2. Early leavers from education and training



Note: The graph on the left depicts the trend over time for the EU-27 average, while the red constant line represents the EU target. The map on the right side of the figure illustrates the indicator's status for each country in the last available year. Source: Eurostat, 2022. Online data code: edat_lfse_14. https://ec.europa.eu/eurostat/databrowser

Figure 3. Tertiary educational attainment



Note: The graph on the left depicts the trend over time for the EU-27 average, while the red constant line represents the EU target. The map on the right side of the figure illustrates the indicator's status for each country in the last available year. Source: Eurostat, 2022. Online data code:edat_lfse_03. https://ec.europa.eu/eurostat/databrowser

4 Data and Educational indicators

4.1 Data source: EU-SILC

One of the novelties of this report lies in the use of EU-SILC (European Union Statistics on Income and Living Conditions) data to analyse the educational systems of EU countries.

We chose to focus on the survey year 2019 due to the availability of additional information regarding the parental background of the household head and spouse. Furthermore, as the year preceding the COVID-19 emergency, this choice ensures that our results are not confounded by the disruptive impact of the pandemic, which cannot be attributed to the normal functioning of educational systems[6]. Nevertheless, the empirical strategy and the analyses reported in this report for the 2019 data, can be easily replicated for other years[7].

The EU-SILC 2019 survey comprises three primary files: a household file (H-file), a respondent file (R-file), and a person file (P-file). The household file provides data on household income and potential deprivation, while the respondent file includes basic information on all cohabiting individuals within the surveyed unit, including whether the youngest members are attending school. The person file, limited to individuals aged 17 or older, contains information on educational attainment, occupational status, health, and parental background. Sample sizes for 2019 EU-SILC data are reported in Table A1 in Annex 1[8].

To monitor educational attainment, our interest extends to two specific groups of individuals. First, particularly for lower education levels, we focus on young people still residing with their parents. The necessary information for this group is available in the respondent file. It is important to note that this information can also be retrieved from the person file, but only once the child turns 17. Consequently, information regarding the educational background of cohabiting children is directly sourced from the respondent file, irrespective of the child's age. Furthermore, the respondent file provides essential details about the mother and father of the household.

Second, for students who have already left their parental homes, the required information is directly collected from the respondent file. Upon leaving their households, these individuals form new households. In this case, identifying the educational attainment of their parents is only possible in few EU-SILC surveys, such as the 2019 one, which include a special module on "Intergenerational transmission of disadvantages, household composition, and evolution of income".

The richness of the EU-SILC data enables the examination of attendance rates of all educational stage, from early childcare services and pre-primary education to tertiary education. It also facilitates the analysis of the proportion of young individuals who are not engaged in education and are not participating in the labour market. Exploring the potential to comprehensively track students' entire educational journeys is especially intriguing, as it is difficult to achieve through conventional educational data sources such as large-scale assessment surveys (e.g., PISA, PIRLS, TIMSS, etc.).

To cover all educational levels, one should rely on longitudinal data, which however are difficult to collect[9] and less useful to obtain updated information on the effect of an educational system, since it takes almost 20 years to complete a schooling career. For this reason, we prefer relying on a pseudo panel assumption, namely using cross-sectional data as if each birth-cohort were representative of the same age-cohorts that were born in different years. Said in different words, we are assuming that the population (and educational choices) does not change along time, such that adjacent cohorts attended the same type of education. More specifically, we examine each birth cohort observable in 2019 survey[10] to gather information about all the educational stages. In simple terms, we assume that the group of students currently in secondary education faced a similar chance of attending pre-primary education as the group that is presently attending. Although this assumption certainly simplifies the complexity of educational systems, it is worth noting that in the last

[6] The rationale for opting to employ a single cross-section is elucidated in the subsequent sections.

[7] While the intergenerational transition model is also present in the 2005 and 2011 EU-SILC waves, in other years, due to the lack of background information on the parents of householders, the analyses can be replicated without including variables regarding parental background in the tertiary education stage for individuals who have already left their homes.

[8] Relevant statistics are weighed by personal weights (variable PB020).

[9] Indeed, when using EU-SILC data as a conventional panel, the longitudinal component suffers from high and varying attrition rates across different countries.

[10] We refrain from employing repeated cross-sections due to the limitation that family background information, including information about the householder's parents, is only available at given years, specifically in 2005, 2011, and 2019. For this reason, we use the latest available cross-section with parental information, which is the 2019 dataset.

15 years, prior to the COVID-19 disruption, there have not been significant disruptions or major policy reforms that could radically alter the educational policy landscape in EU countries. We term this assumption “the contemporaneous assumption”, and despite its seeming simplification of reality, it is crucial for determining the likelihood of transitioning from one educational stage to the next. Subsequently, these probabilities are aggregated to derive the final distribution of educational achievements.

EU-SILC can offer insights into the educational choices of young individuals as long as they reside within their parents' households. However, once children leave their parental homes, the information regarding parental education is no longer accessible under the category of "children” of the household. Instead, it may theoretically be found under the education of a member of another household. For this reason, to facilitate precise analysis of the highest level of educational achievement, we divide respondents into two distinct groups: cohabiting children and non-cohabiting individuals (while for earlier educational stages we can consider all the individuals as cohabiting with their parents). However, we should consider that there is significant variability in the age at which individuals leave their parents' homes across different countries. Focusing on individuals aged 19-25, we observe that 81% of the overall sample consists of cohabiting children (see Table A9 in Annex 2). Nonetheless, this percentage varies considerably, ranging from as low as 51.6% in Denmark to over 90% in countries such as Cyprus, Croatia, Italy, Luxembourg, Malta, Portugal, and Slovakia. Notably, many of these countries are located in the Mediterranean region. This particular aspect is extensively explored and discussed in Annex 2, where we provide a comprehensive breakdown of the average age at which individuals leave their parents' homes in each country, employing EU-SILC data with two distinct methodologies.

EU-SILC presents a significant criticality for educational analyses due to the absence of information pertaining to children aged between 13[11] and 16, who are typically enrolled in (lower) secondary education. The lack of these data is due to the survey design and, therefore, cannot be solved by considering other waves or improving data quality. To address this limitation, we have imputed these data by estimating the probability of school attendance on a country-by-country basis, employing data from nearby age groups as reference (ages 10-12 and age 17). A comprehensive description of this imputation process can be found in Annex 3.

4.2 Building educational indicators from EU-SILC data

This section aims at proposing a methodology to build indicators to assess education systems across EU countries using EU-SILC data. It is important to note that the indicators described here are, in our opinion, the best proxies that can be derived from EU-SILC data. However, there are certainly other relevant aspects to consider when monitoring educational systems that cannot be accounted for because the necessary information is not included in EU-SILC.

In total, we propose 7 indicators that are in details described in the following subsection. As better described in the following paragraphs, the first two indicators represent measures of educational attainment and can be directly related to the EU educational targets described in Section 3. The remaining five indicators represent different dimensions of the educational systems, which are more related to the equality of education and could not be performed using the macro-data indicators, such as the ones employed for the EU targets.

The seven indicators represent the key variable of our empirical analysis, while other variable in EU-SILC have been used as a controls. These control factors include gender, age, parental education, household income, foreign-born parent status, ability to make ends meet, father/mother's employment status, and single father/mother. Detailed definitions of these variables can be found in Table A2 of Annex 1.

[11] The data related to age 13 is not entirely absent, but the substantial presence of missing data also makes the age of this child critical to include in the analyses.

4.2.1 Average educational attainment in the young population, based on enrolments

The first indicator we consider is a measure of the average educational attainment based on the actual enrolments. The primary rationale for adopting this approach to calculate the educational attainment lies in its timeliness and precision (i.e., the ability to refer to individuals who are currently enrolled in education at the time of the survey). In contrast, when evaluating an EU target framed in stock terms, such as achieving "at least 45% of 25-34 year-olds with a higher education qualification", we essentially evaluate the educational system's performance over the previous two decades. Instead, by consolidating current enrolment rates through the method described below, we can determine whether the goal is currently attainable or not. In other words, given the sequential nature of schooling, if the outflow of the previous educational stage is inadequate, it will become impossible to raise the inflow/outflow of the next stage at the level set by the EU target. Moreover, an important advantage of using the enrolments to measure the expected attainment is the possibility to calculate the indicator for each educational level and by age cohort. Since we use data on the enrolments, the indicator is particularly suited for monitoring the educational attainment of the youthful population. In this report, we use this indicator to measure the educational achievement of individuals aged between 0 and 30.

As described in Section 4.1, we can directly measure from EU-SILC data the enrolment rate at a given educational level (i.e., the number of individual currently attending a specific ISCED level, question PE020 in EU-SILC questionnaire[12]). Thus, from this information, we can derive the average educational attainment of the population, under the pseudo-panel assumption discussed earlier.

The enrolment rates are flow variables, whereas attainment rates are stock variables. These two concepts are evidently interconnected, as stocks represent the accumulation of flows over time. To illustrate this relationship, we consider $\bar{y}_{jt}$ the average educational attainment in country *j* during year *t*. This measure could represent various aspects, such as the average years of schooling, the proportion of the population with tertiary education, or conversely, the percentage of the population without secondary education (commonly referred to as drop-outs). Now, if we define p_{ijt} as the enrolment rate at grade *i* in country *j* during year *t*, and $\bar{y}_{jt}$ the average educational attainment as share of the population, we can establish a relationship between these two variables as follows:

$$\bar{y}_{jt} \leq \sum_{i=1}^{K} \sum_{l=1}^{m} p_{ij(t-l)} \quad (1)$$

where *m* indicates the number of years required to complete a specified educational stage (say primary, lower secondary, upper secondary or tertiary), and *K* represents the educational stages considered in a specific indicator. If $\bar{y}_{jt}$ it the fraction of population attaining a tertiary degree, then *K* will include *i*=primary, secondary, tertiary. If $\bar{y}_{jt}$ it the fraction of dropout (population not attaining a secondary degree), then *K* will only consider primary education, excluding those who have progressed further.

In a broader context, when utilising the pseudo-panel approach outlined in Section 4.1 (specifically, the contemporaneous assumption), we can consider the cumulative sum of enrolment rates at each age up to an arbitrary age by which we presume the conclusion of educational careers (30 year old in the subsequent analysis) as a proxy for educational attainment:

$$\bar{y}_{jt}^{(1)} \cong \sum_{i=1}^{30} p_{ijt} \quad (2)$$

This indicator captures the maximum potential attainment offered by the educational system of a country, and as such can be interpreted as the effectiveness of one country's educational system: when the sum of the enrolment rates in one country dominates the sum of another, one can infer that the former obtains a higher attainment ($\bar{y}^1$) than the latter.

[12] PE020 variable is defined in EU-SILC 2019 as "ISCED level currently attended". For additional details see: https://circabc.europa.eu/sd/a/b862932f-2209-450f-a76d-9cfe842936b4/DOCSILC065%20operation%202019_V9.pdf.

4.2.2 Average educational attainment in the adult population, based on years of education

In addition to the first indicator, it can be valuable to incorporate stock measures of adult educational attainment to evaluate the current EU targets (which are indeed framed in stock terms). Consequently, we introduce a measure that quantifies educational attainment based on the average duration of education in years. Precisely, this indicator assesses the average years of education of the adult population aged 31 to 40, aiming to enhance our comprehension of educational attainment within the adult population, thus complementing the evaluation of the attainment in the younger population offered by the first indicator. This indicator mirrors the country-level information of the EU target available from Eurostat, while also incorporating individual-specific details, made possible by micro-level data.

The indicator is derived from the responses to the question concerning the "Year when the highest level of education was achieved" (question PE030). More precisely, we compute this indicator by subtracting the respondents' age at the time of attaining their highest educational level from the standard number of years for pre-primary education, which is 6. The calculation is straightforward and is described by the following equation.

$$\bar{y}_j^{(2)} = \frac{\sum_z^Z y_{jz}^2}{Z} = \frac{\sum_z^Z a_{jz} - k_{jz} - 6}{Z} \quad (3)$$

Where *z* denote the specific individual in the country *j*, *a* is the year when the individual achieved the highest level of education (question PE030), and *k* is the year of birth of the individual.

Similarly to the first measure of educational attainment, the effectiveness of an educational system can be considered greater than another, if the former is associated with a higher average number of years of schooling in the population aged 31 to 40 ($\bar{y}^2$) compared to the latter.

4.2.3 Dispersion of educational attainment in the adult population

We are also interested in measuring the dispersion of educational attainment across the population (*d*), as a measure of inclusivity. When considering the educational attainment of adult population ($y^{(2)}$) for individual *z* in country *j*, we can define the dispersion of educational attainment indicator as follows:

$$d = SD\left(y_{jz}^{(2)}\right) \quad (4)$$

Where *SD* represents the standard deviation of the educational attainment ($y^{(2)}$), as calculated from equation (3), across the population of a given country, *j*. Therefore, this indicator is null when all individuals in the country complete the same number of years of schooling and has a high value when large differences among individuals exist. However, it does not convey whether the years of schooling in question are low or high. Therefore, it is important to complement the indicator with measures of average educational achievement.

It is worth noting that there is no predetermined optimal direction for this indicator, as it can reflect various educational policy strategies. However, if we view this indicator as a measure of inclusivity, it becomes evident that a more equitable educational system is achieved when the variability is minimal.

4.2.4 Further measures of the equity of educational systems

In addition, we can identify four further indicators to assess the equity of educational systems, taking into account certain characteristics of children and family inputs. Specifically, we examine the impact of gender, parental education, family income and parental foreign origin.

Specifically, the four indicators are derived from the estimates of the coefficients of an ordered probit model, which estimates the probability of obtaining a certain educational level (question PE040 in the EU-SILC survey). This model can be represented as follows:

$$EC = f(X\beta) + \epsilon \quad (5)$$

Where *EC* is an ordered categorical variable that denotes the highest level of education obtained by individuals aged 31 to 40 in country *j*. This information is extracted using equation PE040 in EU-SILC, which uses ISCED classification to indicate the level of education achieved[13]. *X* represents the matrix of independent variables, which includes as key variables of interest: gender, the natural logarithm of household income, parental education, and the status of having foreign-born parents. The vector *X* also incorporates the individual's age . All the covariates in the model are described in Table A2 in Annex 1.

The consideration of gender is essential to determine whether disparities exist in educational achievement between boys and girls. This is particularly crucial in some EU countries where there is a consistent gender gap in the labour market and, consequently, in the socio-economic status of women. Ideally, this indicator denotes an equal state of the educational system when the gender coefficient is statistically insignificant. Nevertheless, in countries where a significant gender gap exists, favouring, for instance, boys over girls, a positively significant coefficient for female children (in equation 5) may aim to rectify this structural disparity - being, thus, a good signal for the country.

Examining family inputs is also central to evaluate intergenerational persistence in education. This involves understanding the extent to which educational levels are transmitted across generations, investigating the degree to which children 'inherit' their parents' educational attainment. In theory, the absence of persistence would be desirable, indicating that family income, parental education and their immigrant background have no influence on their children's educational attainment, thereby signifying a fairer educational system. However, in some cases, negative effects of these factors could indicate an intention to move towards reducing intergenerational persistence within the country.

Given the model in equation (5), we can then define 4 indicators:

- *Gender fairness.* The assessment of gender equity in the acquisition of educational certificates is measured as in the following equation.

$$Eg_j = \hat{\alpha}_j \quad (6)$$

where $\hat{\alpha}$ indicates the estimated coefficient of the ordered probit model in equation (5) associated with being female (set to zero when statistically insignificant), estimated for the population aged 31-40 of a country *j*.

- *Inclusiveness in educational careers.* The assessment of persistence of children education in the acquisition of educational certificates is measured as in the following equation.

$$Ee_j = -\hat{\beta}_j \quad (7)$$

where $\hat{\beta}$ indicates the estimated coefficient of the ordered probit model in equation (5) associated with parental education[14] (set to zero when statistically insignificant), estimated for the population aged 31-40 of a country *j*. To maintain consistency with indicators that are positive when indicating a positive effect we consider as indicator the opposite in sign of the coefficient $\hat{\beta}$.

- *Equity in educational careers.* The assessment of influence of family income in the children acquisition of educational certificates is measured as in the following equation.

$$Ei_j = -\hat{\gamma}_j \quad (8)$$

where $\hat{\gamma}$ indicates the estimated coefficient of the ordered probit model in equation (5) associated with family income (set to zero when statistically insignificant), estimated for the population aged 31-40 of a country *j*.

[13] The following levels are considered: 0 pre-primary education, 1 primary education, 2 lower secondary education, 3 (upper) secondary education, 4 post-secondary non tertiary education, 5 first stage of tertiary education (not leading directly to an advanced research qualification) or second stage of tertiary education (leading to an advanced research qualification).

[14] We consider the highest educational attainment among the parents, ensuring that the measure remains available in the case of single-parent families.

To maintain consistency with indicators that are positive when indicating a positive effect[15], we calculate the opposite in sign of the coefficient $\hat{\gamma}$.

- *Openness in educational careers.* The assessment of influence of parental foreign origin in the acquisition of educational certificates is measured as in the following equation.

$$Eo_j = \hat{\delta}_j \quad (9)$$

where $\hat{\delta}$ indicates the estimated coefficient of the ordered probit model in equation (5) associated with the variable indicating a foreign-born parent (set to zero when statistically insignificant), estimated for the population aged 31-40 of a country *j*.

Finally, it is worth noting that the indicators Ee, Ei and Eo all represent measures of inclusiveness. We have assigned distinct names to them, aligning with their specific characteristics, to facilitate their reference throughout the document. However, these names are not strictly exclusive and may theoretically be associated with more than one specific measure.

[15] Theoretically, a null effect is desirable also in this case, while a negative impact of this variable on the attainment level is considered undesirable. However, by using the opposite of the actual sign of the value rather than its absolute value, we aim to give a positive connotation to those systems where lower family income is associated with higher attainment in young individuals. This assumes that these countries are catching up compared to a previous situation where higher family income was linked to higher child attainment. Nevertheless, in practical terms, as indicated by Table 1 in Section 5.1, this coefficient consistently takes a positive sign. Therefore, there is almost no difference from a potential alternative approach that considers the absolute value of this term.

5 Results and discussion

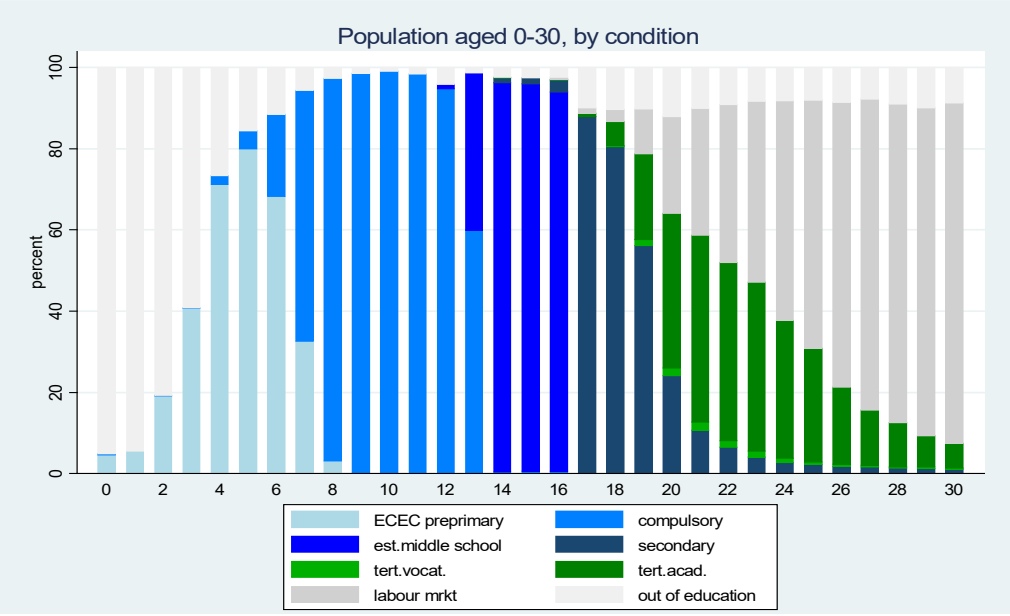
5.1 Estimates of Educational indicators

Using the data imputation method (see Annex 3), we can estimate the attendance rates of population of a country across various age groups, spanning from early childcare services and pre-primary education to tertiary education. Additionally, we can determine the proportion of young individuals who are not enrolled in education and are not participating in the labour market. The results are presented in Figure 4, which illustrates the distribution of the population among different education levels (based on EU-SILC question PE020) and their status in terms of employment (based on EU-SILC question RB210).

Figure 4 provides a valuable tool for monitoring of the effectiveness of EU educational systems. It is worth to notice that this representation may be imperfect due to data collection issues in certain countries, such as Germany (where the vocational track in secondary education appears to be missing) and Malta (where interviewee ages are grouped in 5-year intervals). However, even with this criticalities, these data still serves as a promising starting point.

A simpler representation of the attendance rates of the population is reported by country in Figure 5. This representation is particularly useful to show how the educational attainment of the young (i.e. 0-30) population, $\bar{y}^1$, is build. More specifically, by adopting the approach outlined in Section 4.2.1, indicator $\bar{y}^1$ is computed by calculating the sum of the heights of the bars representing the various attendance rates, as shown in Figure 4[16]. In this way, we derive an estimation of the average years of schooling among the young population who is currently enrolled in educational programs – therefore the measure of educational attainment as expressed in equation (2). The way we build the indicator implies, therefore, the use of the contemporaneous assumption. Also, it might be argued that this population is still in the process of attending school, making it seemingly impossible to predict their final educational achievements. However, working under the assumption that observed attendance rates remain consistent, we attain a timely measure of an educational system's performance.

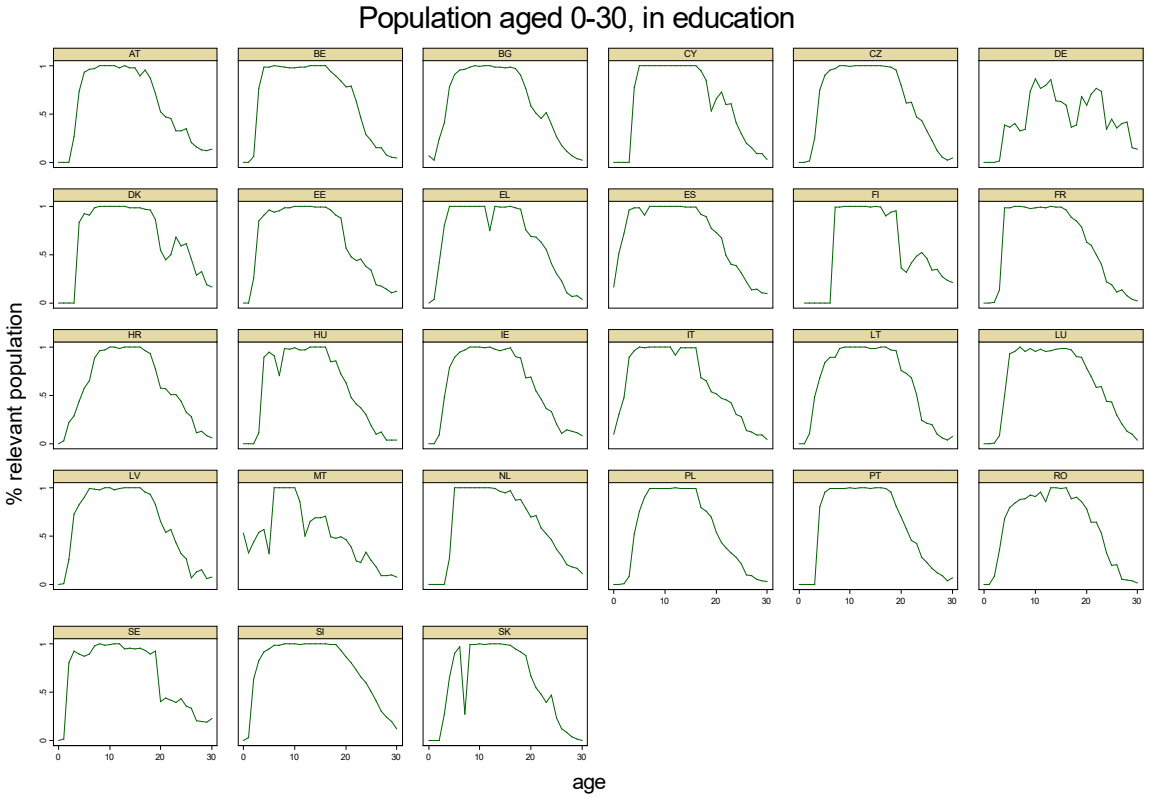
Figure 4. Educational and labour status stage by age, after imputation, EU- SILC 2019



Note: The figure depicts the population's distribution based on the educational stage currently attended (question PE020) or their labour status (question RB210), with percentages provided for each age group spanning from 0 to 30 years old. Notably, data for individuals aged 14, 15, and 16 have been imputed using the procedure outlined in Annex 3. Source: Authors' elaboration conducted using Stata, based on data from EU-SILC 2019.

[16] Technically, this corresponds to calculating the integral of the heights defined by the bars presented in Figure 4.

Figure 5. School attendance rates, EU-SILC 2019



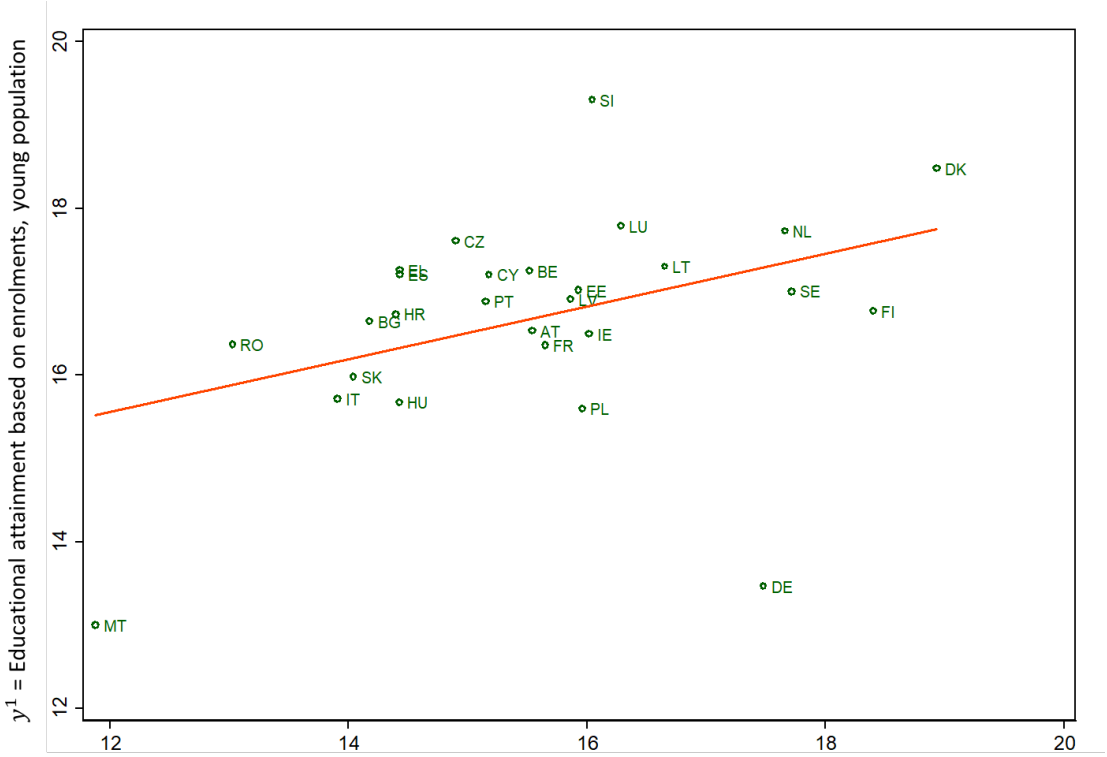
Source: Authors'elaboration of EU-SILC 2019 data using Stata.

Then, we have calculated the educational attainment of adult population, $\bar{y}^2$, based on the information on the year in which individuals have obtained the highest level of education (question PE030), as depicted in equation (3).

In Table A3, reported in Annex 1, we present the specific values for the two measures of educational attainment for each country, i.e. $\bar{y}^1$ and $\bar{y}^2$. Additionally, in Figure 6, we compare the educational attainment from attendance rates ($\bar{y}^1$, displayed in the vertical axis) with the one obtained from the years of education ($\bar{y}^2$, displayed in the horizontal axis). In general, the country rank correlation between these two estimates is statistically significant, although not high (0.444). Examining the figure, it seems that for the majority of the countries, educational systems with higher (lower) level of educational attainment of young population present also a high (low) level in educational attainment of adult population. This relationship has two main outliers: Germany (DE)[17] and Slovenia (SI). However, it is important to note that these estimates relate to different population groups: the estimate based on attendance rates in the population aged from 6 to 30 pertains to individuals born between 1990 and 2013, while the estimate based on the age at leaving school pertains to individuals born between 1979 and 1988. Consequently, these two proxies for assessing the effectiveness of national educational systems correspond to different time periods and are not strictly comparable.

[17] In the case of Germany, the absence of a large correlation between the two indicators may also be attributed to the data quality, which is characterised by a significant number of missing entries concerning individuals in the secondary education age group. Further details regarding this issue are provided in the following sections.

Figure 6. Correlation between the two measure of educational attainment, $\bar{y}^1$ and $\bar{y}^2$, EU-SILC 2019



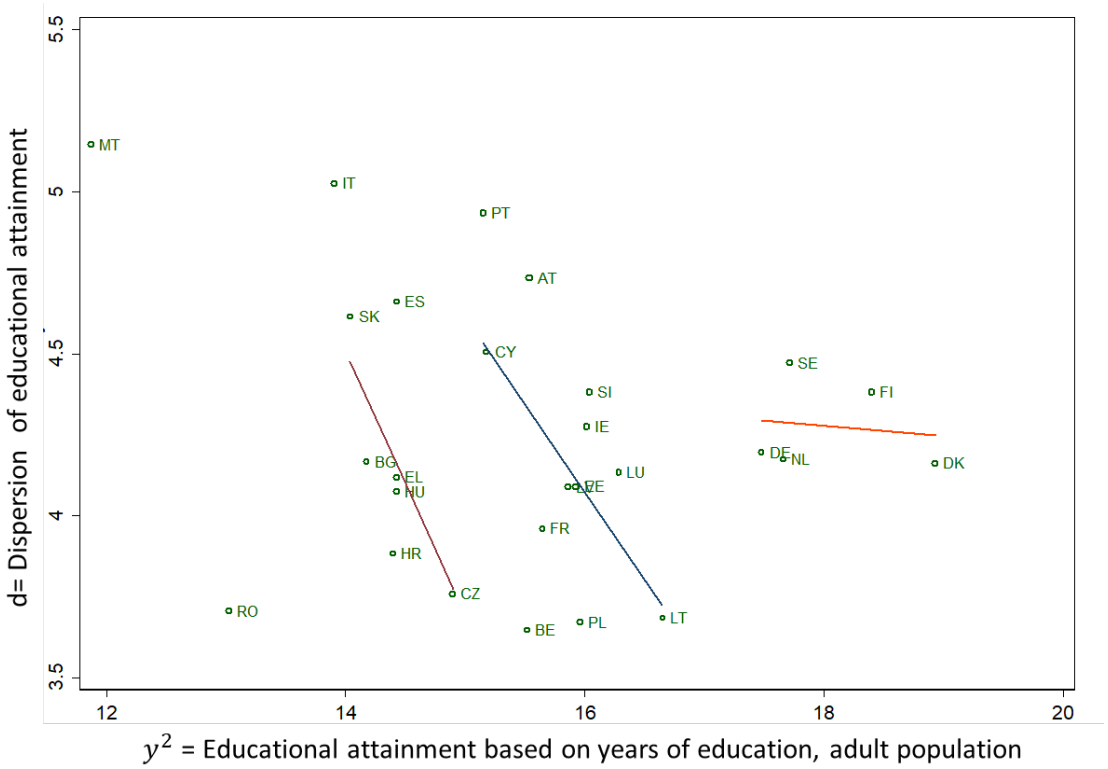
Source: Authors'elaboration of EU-SILC 2019 data using Stata.

The advantage of using EU-SILC data for measuring years of schooling is that, since we employ an aggregation of household-level data, it becomes possible to calculate its dispersion by country. As mentioned in Section 4.3, the standard deviation of the educational attainment of adult population ($\bar{y}^2$) can be employed as a measure of dispersion of education (*d*). The values for this indicator are reported for each country in Table A3 in Annex 1.

The result is depicted in Figure 7, where we represent the relationship between the standard deviation (*d*, on the vertical axis) and the mean years of education ($\bar{y}^2$, on the horizontal axis). The graph suggests the existence of three groups of countries, which are qualitatively associated with different trade-offs between achievement and dispersion. The first group of countries, primarily comprising Nordic regions, shows the highest levels of educational achievement alongside an intermediate level of educational inequality in the population. A similar negative trade-off characterises a second group of countries, primarily from continental Europe, with a lower level of attainment and an equivalent level of inequality. The third cluster of countries, corresponding to Eastern Europe and the Mediterranean area, is marked by significantly lower levels of educational attainment (around four years less in schooling) and a high level of inequality.

The three trends in the trade-offs between achievement and dispersion cannot fully explain the behaviours of all the EU countries. In fact, there are some outliers in the graph, such as Malta and Romania. However, this qualitative analysis of Figure 7 seems to indicate the presence of certain patterns in the educational systems of the Member States, which motivated our cluster analyses in the following sections.

Figure 7. Mean and dispersion in educational attainment of adult population, EU-SILC 2019



Note: Sample restricted to population between 31 and 40 years old. Source: Authors'elaboration of EU-SILC 2019 data using Stata

To offer policymakers more valuable insights, it is crucial not only to assess the effectiveness of educational systems but also to elucidate the factors contributing to these results and why, for instance, one country outperforms another. Given that EU-SILC provides data at the household level, we can examine key variables such as family income, parental education and foreign origin, as well as subjective assessments of well-being from the primary respondent (including their ability to meet financial needs, overall health, and ownership of durable goods).

Specifically, we adopt the methodology outlined in Section 4.2.4 to compute indicators for evaluating education quality. The empirical model, detailed in equation (5) in Section 4.2.4, assesses the impact of key personal and family factors on the highest educational attainment of individuals aged 31 to 40, as indicated by question PE040. This approach allows for a comprehensive assessment of their educational journey, taking into account the completion of their educational careers.[18]

Table 1 provides an overview of the results from the ordered probit model. The estimates show that women are associated with a statistically significant positive coefficients across most countries, even if to a different extent. The individual age seems less relevant, and is somehow expected given that we are focusing on people from 30-41 years old. Furthermore, family background plays a pivotal role in supporting educational attainment. Family income[19] exhibits a consistently positive and statistically significant association in nearly all countries studied; while the association with maximal parental education[20] when statistically significant bears a positive sign. Finally, while a migration background weakly correlates with educational attainment,

[18] We have also considered other information related to family background, like ability to make ends meet or grandparent educational attainment (which is available only for cohabiting children, since it is referred to the parents of the household head), without finding significant results. For this reason we stick to simplest version.

[19] It is important to note that family income pertains to the time of the survey and does not reflect older information regarding when the individual made the educational decision.

[20] Parental education is included as a continuous variable in the model, assuming values ranging from 0 to 5. Specifically, 0 corresponds to pre-primary education, 1 to primary education, 2 to lower secondary education, 3 to (upper) secondary education, 4 to post-secondary non-tertiary education, and 5 to tertiary education (see Table A2 in Annex 1 for supplementary details on the variable).

when it does show significance, it tends to bear a negative sign. Unfortunately, for a group of country the survey does not collect this information on parent birth place.

The final row presents the estimation of the model for the full sample for the EU27 sample. The estimates confirm that European women are in an advantaged position with respect to educational attainment, but family income and parental education constitute a positive input for educational advancement. The opposite sign is found for family size and foreign origin.[21]

Table 1. Ordered probit correlation between maximal educational attainment, gender and family background, population, aged 31-40, EU-SILC 2019

	Female	age	(log) Household income	Parental education	Foreign-born parent	Observations	Pseudo R^2
AT	0.035	-0.02	0.382***	-0.107*	-0.946***	1565	0.0313
BE	0.307***	0.015	1.093***	0.095**	-0.196	1915	0.1130
BG	0.436***	0.037***	1.076***	0.218***	2.079***	1716	0.2040
CY	0.358***	-0.028*	1.039***	0.206***	-1.212***	1267	0.1050
CZ	0.374***	0.019	0.839***	0.089	-0.206***	2139	0.0820
DE	0.163***	-0.032***	0.631***	0.053	-0.364	2204	0.0521
DK	0.318***	-0.054***	0.786***	0.102	0.503	1045	0.0715
EE	0.614***	0.021*	0.640***	0.100*	-0.470**	1656	0.0857
EL	0.325***	-0.016*	0.820***	0.221***	-0.335	3596	0.0872
ES	0.363***	0.003	0.626***	0.117***	-0.508***	4154	0.0750
FI	0.455***	0.005	0.683***	0.014		2365	0.0603
FR	0.142**	0.003	1.054***	0.004	-0.014	2681	0.0998
HR	0.401***	-0.006	0.921***	0.225***	-0.215	1682	0.1500
HU	0.393***	-0.032**	0.667***	0.191***		1292	0.0627
IE	0.417***	0.001	1.204***	-0.045	0.482	1263	0.1230
IT	0.236***	0.006	0.445***	0.344***	-0.316**	4291	0.0667
LT	0.513***	-0.013	0.674***	0.098	-0.607**	1058	0.1020
LU	0.222***	-0.017	0.894***	0.147**	0.137	1309	0.1070
LV	0.652***	-0.007	0.859***	0.037	-0.291*	1151	0.1250
MT	0.340***	-0.033*	0.831***	0.069	-0.047	999	0.0968
NL	0.160***	-0.045***	0.818***	0.08	-0.616*	2511	0.0692
PL	0.470***	-0.023***	0.952***	-0.044	-0.498***	5179	0.1060
PT	0.541***	-0.014	0.873***	0.133***	-0.241	3128	0.1040
RO	0.065	-0.006	0.941***	0.061		1872	0.1770
SE	0.370***	-0.007	0.497***	0.112***	-0.877***	1309	0.0493
SI	0.485***	-0.007	0.856***	0.041	-0.388***	2929	0.0907
SK	0.405***	-0.009	0.856***	0.352***		1771	0.1020
EU 27 countries	0.262***	-0.010*	0.691***	0.099***	-0.365***	58 047	0.0847

Note: This table presents coefficient estimates for a specific covariate within an ordered probit model, which was estimated on a country-by-country basis and for the overall sample of EU-27 countries (with country dummies). In Column 6, the value for EU-27 does not include Finland, Hungary, Romania, and Slovakia. Robust standard errors were employed, and sample weights were applied. The dependent variable the maximal level of education (ISCED classification) obtained by the respondent (question PE040). *** p<0.01, ** p<0.05, * p<0.1.

[21] In the subsequent model we do not use the information on age, for is it is often not statistically significant.

5.2 Overall analysis of EU educational systems: cluster of countries and trends

Drawing from the seven indicators outlined in Section 4.2 and their corresponding estimates in Section 5.1, we can aggregate them to offer a comprehensive analysis of the educational systems. To enhance clarity, we provide a summary of these indicators below:

a) *Average educational attainment in the young population aged 0-30,* $\bar{y}^1$

This indicator is derived from the cumulative enrolment across cohorts, reflecting the present status of school attendance, as explained in Section 4.2.1. The (standardised) values for this indicator in each country are reported in column 2 of Table A4 in Annex 1.

b) *Average educational attainment in the adult population aged 31-40,* $\bar{y}^2$

This indicator is derived from the years of education from school leaving age, as explained in Section 4.2.2. The standardised values for this indicator in each country are reported in column 3 Table A4 in Annex 1).

c) *Dispersion of educational attainment in the adult population aged 31-40, d*

This indicator is calculated as the standard deviation of the average educational attainment in the adult population, as explained in Section 4.2.1. The standardised values for this indicator in each country are reported in column 4 of Table A4 in Annex 1. To ensure consistency with the positively oriented indicators used in our analysis, we take the opposite in sign of its value (- *d*) in the subsequent analyses.

d) *Gender fairness in attaining educational certificates in the adult population aged 31-40,* Eg

This indicator represents the ordered probit estimated coefficient associated to being female, set to zero when statistically insignificant. The model is described in equation (5) in Section 4.2.4 and the values of the estimated coefficients are reported in column 2 of Table 1 and the corresponding standardised values in column 5 of Table A4 in Annex 1

e) *Equity in educational careers in the adult population aged 31-40,* Ee

This indicator represents the ordered probit estimated coefficient associated to the logarithm of family income, set to zero when statistically insignificant. The model is described in equation (5) in Section 4.2.4 and the values of the estimated coefficients are reported in column 5 of Table 1. To ensure consistency with the positively oriented indicators used in our analysis, we consider the opposite in sign of its value. The corresponding standardised values in column 6 of Table A4 in Annex 1.

f) *Inclusiveness in educational careers in the adult population aged 31-40,* Ei

This indicator represents the ordered probit estimated coefficient associated to parental education, set to zero when statistically insignificant. The model is described in equation (5) in Section 4.2.4 and the values of the estimated coefficients are reported in column 6 of Table 1. To ensure consistency with the positively oriented indicators used in our analysis, we consider the opposite in sign of its value. The corresponding standardised values in column 7 of Table A4 in Annex 1.

g) *Openness in educational careers in the adult population aged 31-40,* Eo

This indicator represents the ordered probit estimated coefficient associated to parental foreign origin, set to zero when statistically insignificant. The model is described in equation (5) in Section 4.2.4 and the values of the estimated coefficients are reported in column 7 of Table 1. The corresponding standardised values in column 8 of Table A4 in Annex 1.

To provide a summarised overview of the EU educational systems, we have conducted a cluster analysis that takes as input the scores of the seven indicators reported in Table A4 in Annex 1. Moreover, in order to avoid potential biases arising from scale differences among the seven indicators, we have standardised these variables by subtracting the mean and dividing the result by the standard deviation. The standardisation provides transformed variables with a mean of zero and a standard deviation of one.

Clusters have been estimated over the 31 countries available in EU-SILC in order to maximize the mean Eucledean distance across groups. The existence of three clusters is suggested by the maximal Calinski/Harabasz pseudo-F test, as reported in Figure A1 in Annex 1. The list of EU-27 countries belonging to each of the three cluster are reported in the first column of Table 2.

To provide a more comprehensive characterisation of these clusters, we employed a factor analysis to derive principal components from the underlying scores. The results indicate the presence of three factors, which collectively explain two-thirds of the total variance. The factor loadings for each component can be found in Table A5 in Annex 1. Thus, we can use the three principal components to describe the three clusters in effective way. In columns 2 to 5 of Table 2, we have associated mean values of the three principal components with each cluster, along with their respective mean scores calculated from the original scores (see column 8 of Table A5). Additionally, the last three columns of Table 2 display the average values per cluster for the first three indicators of educational attainment.

The first cluster of countries contains three Nordic Member States (Denmark, Finland, and Sweden) and the continental countries that adopt a dual secondary school system (Germany, Austria and the Netherlands). The countries of this cluster exhibit the highest levels of educational attainment among their adult populations, averaging 17.6 years of education[22]. Additionally, they score the highest on the primary factor, associated with a reduced impact of parental education but a significant disadvantage for children from foreign-born parents.

The second group comprises several continental countries (Belgium, France, Luxembourg), along with Eastern European nations (Bulgaria, Croatia, Czechia, Estonia, Lithuania, Poland, Romania and Slovenia), plus Cyprus and Ireland. In these countries, active enrolment rates are higher compared to the first group, but the average educational achievement in the adult population is lower and less varied. This group strongly aligns with the second factor, which is primarily associated with family income and gender. These national education systems appear to be in a transitional phase where family financial resources still play a significant role, and girls tend to outperform boys.

The third group includes most Mediterranean countries (Greece, Spain, Italy, Malta, and Portugal), along with Hungary and Slovakia. In terms of educational achievement, this cluster falls behind the other two groups, trailing by 3.5 years of schooling compared to the first group and 1.3 years compared to the second group. Additionally, they exhibit the lowest level of inclusiveness, experiencing the greatest dispersion across clusters. These countries rank highest on the third factor, indicating a significant reliance on educational resources from the families of origin, with the influence of parental education being the most pronounced.

For the sake of clarity in our subsequent analysis, we will refer to the first pattern as "Nordic," the second pattern as "Continental" and the third pattern as "Mediterranean".

Table 2. Patterns in educational systems, EU-SILC 2019

Group of countries	Principal component 1	Principal component 2	Principal component 3	Average score	Years of schooling from attendance (population aged 6-30)	Years of schooling from school leaving age (population aged 31-40)	SD of years of schooling from leaving age (population aged 31-40)
GROUP 1 (AT, DE, DK, FI, NL, SE)	0.634	-1.292	-0.381	0.220	16.66	17.62	4.35
GROUP 2 (BE, BG, CY, CZ, EE, FR, HR, IE, LT, LU, LV, PL, RO, SI)	0.373	0.597	-0.072	0.060	17.04	15.40	4.00
GROUP 3 (EL, ES, HU, IT, MT, PT, SK)	-1.289	-0.087	0.472	-0.309	15.96	14.04	4.65

Source: Authors' elaboration of EU-SILC 2019 data.

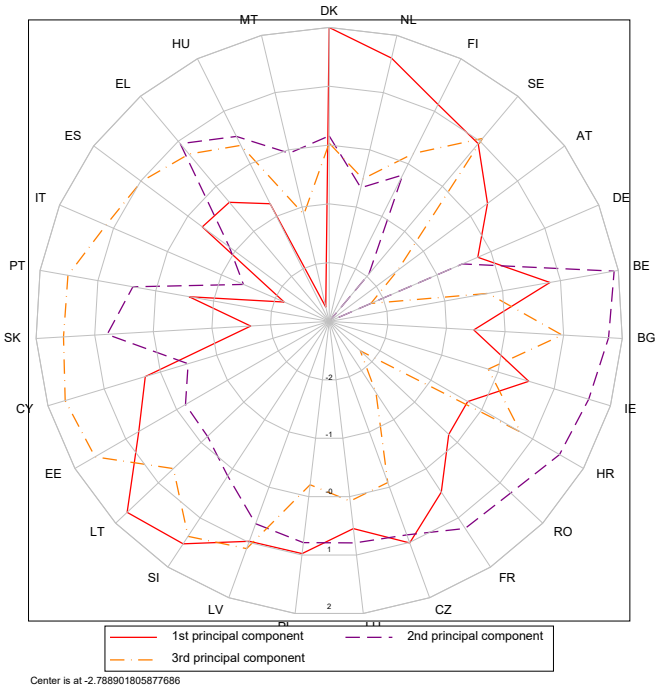
[22] Interestingly, compared to the other clusters, this group of countries exhibits a higher educational attainment among individuals aged 31 to 40 years old compared to those aged 6 to 30. This may suggest that these countries have historically performed well in educational attainment, even for older generations. However, these results should be interpreted with caution due to missing data for Germany in some age groups.

It is important to highlight that there is still significant heterogeneity within these clusters. This becomes evident in Figure 8, where we rank the countries based on their cluster assignments and the factors within those clusters. The figure displays a radar chart plotting the values of the principal components for each country. While the plot indeed confirms that each cluster aligns with one of the principal components, there is also noteworthy evidence suggesting that certain countries exhibit values of principal components similar to those in other clusters. Sweden (SE), for instance, is assigned to cluster 1, and Estonia (EE) to cluster 2, but they display values resembling those of other clusters. However, when we set these exceptions aside, the three clusters appear sufficiently distinct in terms of educational outcomes and the impact of family inputs. This signals the need for a more comprehensive investigation into the effectiveness of each cluster.

In Figure 9, all countries are plotted against different educational indicators, with distinct colours representing their respective clusters. These plots showcase the relationship between maximal educational attainment in years of schooling ($\bar{y}^2$) and the indicators on the equity of education, as derived from the estimated coefficients in Table 1 (i.e., $Eg,\ Ei,\ Ee,\ Eo$).

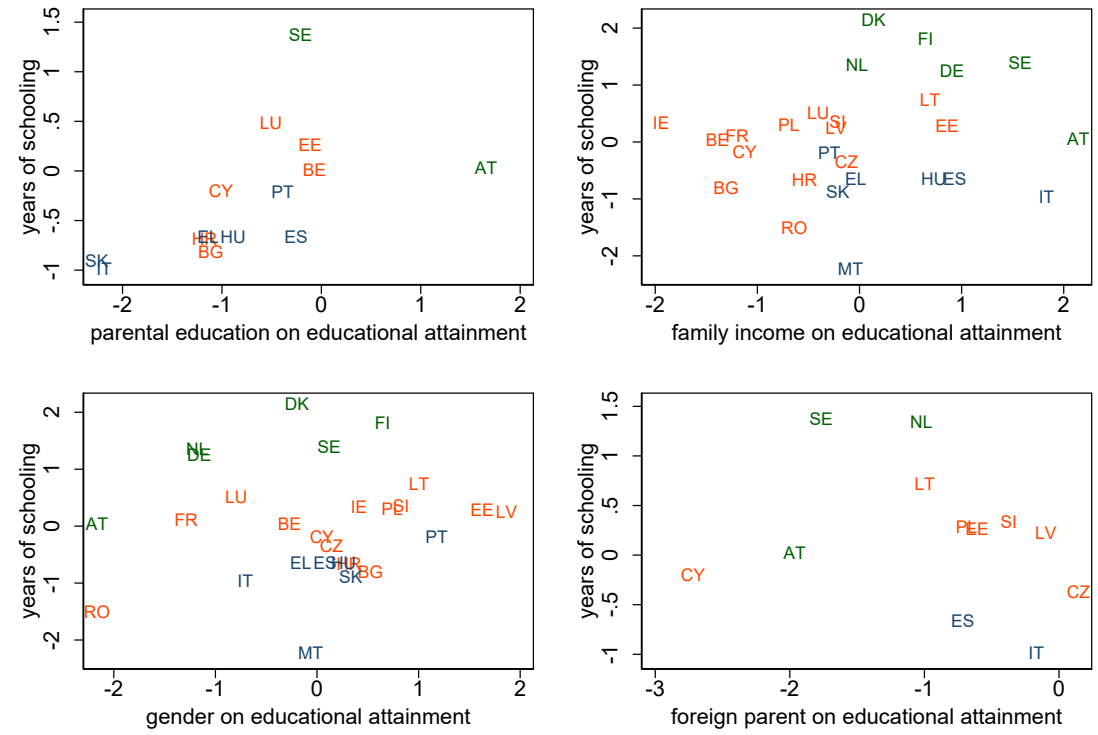
Examining patterns among clusters, the Nordic cluster stands out as having the highest achievements. This cluster, along with the continental one, seems generally associated with a limited importance of family resources (note that Figure 9 plots the standardised scores from Table 1, reversing the sign for parental education and family income). The penalty associated with foreign origin is also lower (less negative) in the Continental cluster. On the contrary, the Mediterranean cluster appears to be primarily affected by the (lack of) economic resources.

Figure 8. Countries according to principal components and clusters, EU-SILC 2019



Source: Authors' elaboration of EU-SILC 2019 data, using Stata.

Figure 9. Patterns of effectiveness in educational clusters, EU-SILC 2019



Nordic=green; Continental=red; Mediterranean=blue

Source: Authors' elaboration of EU-SILC 2019 data, using Stata.

Following our analysis of the disparities among groups of countries, we present in Table 3 an estimation of the ordered probit model of equation (5) by cluster. The first rows of the table illustrate the marginal distribution of educational attainments within the adult population (i.e., the dependent variable, question PE040). Looking at the results, the Nordic countries excel in tertiary education, primarily attributed to the availability of post-secondary non-academic tracks. Conversely, the Continental countries demonstrate remarkable achievements in terms of secondary degrees. In contrast, the Mediterranean countries face a significant proportion of early school leavers, corresponding to the segment of the population that stops education at the lower secondary school. Examining the correlation with observable characteristics (i.e., the independent variables), we observe that in the Nordic and Continental countries, educational trajectories are less associated to family financial resources in comparison with the other clusters. Furthermore, foreign origins have a detrimental impact in the Nordic countries but not in the Continental group. On the other hand, the Mediterranean countries exhibit a stronger relationship between parental education and children's educational attainment. Additionally, these countries, stemming from more traditional societies, are also experiencing the emerging role of women in educational careers.

Table 3. Ordered probit correlation between maximal educational attainment, gender and family background, by country patterns (population aged 31-40), EU- SILC 2019

Variables	All EU-27 countries	Nordic (6 countries)	Continental (14 countries)	Mediterranean (7 countries)
Dep. variable: % of maximal attainment				
Pre-primary	*0.97*	*0.13*	*1.23*	*1.47*
Primary	*2.61*	*2.05*	*2.26*	*3.56*
Lower secondary	*12.16*	*8.30*	*7.80*	*21.25*
Upper Secondary	*37.75*	*32.25*	*42.93*	*36.66*
Post-secondary non-tertiary	*5.51*	*13.91*	*1.69*	*2.11*
1st & 2nd tertiary	*41.00*	*43.37*	*44.08*	*34.94*
Female	0.241***	0.185***	0.236***	0.308***
	[0.035]	[0.028]	[0.073]	[0.045]
Age	-0.009	-0.029***	-0.002	0.004*
	[0.006]	[0.004]	[0.005]	[0.002]
(log) Household income	0.475***	0.608***	0.541***	0.472***
	[0.043]	[0.035]	[0.034]	[0.077]
Parental education	0.109*	0.045*	0.049	0.217***
	[0.065]	[0.024]	[0.055]	[0.065]
Foreign-born parent	-0.431***	-0.470***	-0.228*	-0.486***
	[0.090]	[0.102]	[0.131]	[0.096]
Observations	58 047	10 999	27 817	19 231
Pseudo R^2	0.0599	0.0484	0.0785	0.0569

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in brackets and errors clustered at country level. The model includes country fixed effects. Source: Authors' elaboration of EU-SILC 2019 data using Stata.

5.3 Results by educational level

Another advantage of EU-SILC data is its capacity to provide a high level of detail, enabling analysis to be conducted based on educational levels. This capability proves particularly valuable when considering that the EU's educational objectives are tied to specific educational levels. In line with these EU targets, we can dissect and examine the mechanisms that explain educational participation within four primary education segments:

1. Participation in pre-primary education (for children aged 3-5)
2. Participation in upper secondary education (for individuals aged 17-19)
3. Participation in tertiary education (for individuals aged 20-22)
4. Exclusion from both education and the labour market (for individuals aged 18-30), i.e. NEET.

The results and their discussion are presented in the following sections.

5.3.1 Pre-primary education

Although pre-primary education is not mandatory in over half of the countries, there is a growing incentive to embrace this stage due to its positive impact on subsequent educational achievements. In Table 4, we offer a descriptive overview of the legal frameworks present in our sample.

Our clusters are ordered according to the average number of years of compulsory pre-primary education specified in their legal frameworks: one year for the Nordic countries, half a year for the Continental countries,

and none for the Mediterranean nations. Notably, these statistics are only partly aligned with the distribution of free provision, which varies across the different groups.

Table 4. Institutional differences in compulsory and freely provided pre-primary education (UNESCO 2019)

	Pre-primary education				
	Years of compulsory education (median)	Years of compulsory education (mean)	Years of compulsory education (max)	Years of free education (mean)	Years of free education (max)
Nordic	1.00	0.75	2.00	0.88	2.00
Continental	0.50	0.71	2.00	2.15	6.00
Mediterranean	0.00	0.50	3.00	1.63	3.00
Total	0.00	0.67	3.00	1.66	6.00

Source: UNESCO SDG database - downloaded on 31/8/2023 from https://apiportal.uis.unesco.org/bdds

Therefore, to effectively analyse the attendance in pre-primary education, it is essential to determine the appropriate age range during which children can enrol in institutions providing pre-primary education. Given the absence of detailed information on various institutional arrangements, we rely on observed behaviour. We define the potential age range as the age at which we observe attendance rates exceeding 10% of the relevant age cohort in the specific country, while still preceding the start of compulsory education.

In Table 5, we calculate the attendance rates over the relevant age range for each cluster of countries and for the total sample. On average, three out of four children participate in some form of pre-primary education, with an average attendance of 24 hours per week. However, it is crucial to bear in mind that these attendance rates are calculated on the basis of the availability of the pre-primary education service, as inferred from actual use. If we were to compute the same rates for the entire population (regardless of actual use), the attendance rate within the 0-7 age range would decrease to 0.45 for the entire sample and, respectively, to 0.40, 0.43, and 0.50 for the Nordic, Continental, and Mediterranean clusters.

Table 5 also presents an interesting representation of differences among clusters of countries regarding pre-primary education attendance. In Nordic countries, pre-primary attendance typically begins later, at the ages of 5 or 6, as compulsory education starts at older ages (typically 7, but now anticipated to begin at 6 in Scandinavian countries)[23]. Conversely, continental countries make more extensive use of pre-primary education in the age range of 4-6, with all of them providing access, albeit not always free of charge. Surprisingly, nearly all Mediterranean countries offer access to pre-primary education to a significant majority of children in the age range of 4-5, immediately preceding the commencement of compulsory education.

[23] It is worth noting that the decrease in average attendance rate and average hours of attendance in the first years in the Nordic cluster should be interpreted together with information about the countries involved. Indeed, this decrease is primarily due to the increasing number of countries that offer pre-primary education for the specific child age, which could decrease the average values if these countries have a lower attendance rates compared to the ones already included.

Table 5. Attendance pattern in pre-primary education, EU-SILC 2019 (weighed)

		Child Age								
		0	1	2	3	4	5	6	7	Total
Nordic	attendance rate			0.8	0.6	0.61	0.94	0.94	0.51	0.75
	average hours of attendance			25.68	18.64	25.41	27.34	27.36	21.43	25.11
	countries involved			1	2	4	4	4	3	6
Continental	attendance rate			0.31	0.29	0.81	0.86	0.9	0.77	0.73
	average hours of attendance			15.92	8.73	24.61	28.1	29.17	30.51	23.82
	countries involved			6	11	14	14	13	8	14
Mediterranean	attendance rate	0.14	0.44	0.64	0.82	0.94	0.93	0.97	0.4	0.77
	average hours of attendance	2.87	11.92	18.67	26.27	29.45	30.86	33.29	15.36	24.33
	countries involved	2	3	4	6	7	7	4	3	7
Total	attendance rate	0.14	0.44	0.6	0.53	0.83	0.9	0.92	0.63	0.75
	average hours of attendance	2.87	11.92	19.16	16.86	26.6	29.04	29.43	25.51	24.18
	countries involved	2	3	11	19	25	25	21	14	27

Note: Due to missing data, Germany is not included in the Nordic cluster

By conditioning on the age range described in Table 5, which varies across countries, we can estimate a probit model that explores which factors are associated with a higher probability of attending pre-primary education. Similarly, through an Ordinary Least Squares (OLS) model, we can estimate to what extent potential relevant factors are linked to a higher number of weekly hours in pre-primary education.

The estimates of both models are presented in Table 6, revealing two common patterns. Firstly, children exhibit a higher likelihood of attending pre-primary education when they are older and/or when their mother is employed. Additionally, family income and parental education seem to correlate with increased attendance in certain countries. The results of the OLS model on the average weekly hours spent in pre-primary education show qualitatively similar patterns.

Delving into the specifics of these two patterns, we can notice that the demand for childcare is higher in the case of working mothers. However, the causality can go in both directions: working mothers demand more childcare, or childcare availability may facilitate female participation in the labour market. Additionally, demand is also higher among couples with higher levels of education, even with a subtle positive correlation associated with the education of at least one grandparent[24]. Furthermore, the demand for childcare rises with household income. This implies that access to childcare and pre-primary education is not uniformly distributed in the population, with economically disadvantaged families, characterised by fewer working members and lower educational attainment, often excluded.

Finally, there is a discernible custodial element in the demand for childcare, as evidenced by the number of hours attended. On average, a working mother is linked to an additional number of hours of childcare or preschool attendance for the child, ranging from 2 in Nordic countries to almost 7 in Continental countries.

Overall, our findings suggest that early childcare seems not universally accessible to all children. Only half of children are found to attend such programs, and they tend to come from more affluent families, often associated to a working mother.

[24] In the 2019 survey, there is information available regarding the parents of the respondent and their spouse. Consequently, it is possible to incorporate control for the education of grandparents into this model. Unfortunately, in Nordic countries, the question regarding grandparental education is answered either by the household head or the spouse, thus preventing the simultaneous inclusion of the education levels of all four grandparents. We have explored the use of the highest available data on grandparental education, which indicates whether at least one grandparent has attained secondary or tertiary education. This variable yields a positive and weakly statistically significant result at the 10% level (these results are available upon request to the authors).

Table 6. Probability of attendance (probit model: columns 2-4) and weekly hours attended (OLS model: columns 5-7) in pre-primary education by cluster, EU-SILC 2019

Variables	(1) EU-27	(2) Nordic	(3) Continental	(4) Mediterranean	(5) Nordic	(6) Continental	(7) Mediterranean
Dependent variable	*% of attendees on potential users*				*weekly hours of attendance*		
	75.51	*79.74*	*72.37*	*77.96*	*25.53*	*23.23*	*24.59*
Female	0.014	-0.140**	0.064**	-0.002	-0.599	0.197	-0.2
	[0.038]	[0.060]	[0.027]	[0.075]	[0.480]	[0.337]	[0.312]
Age	0.628***	0.446	0.640***	0.668***	2.198	4.675***	4.566***
	[0.099]	[0.370]	[0.174]	[0.109]	[1.232]	[0.693]	[0.463]
(log) Household income	0.142***	0.084**	0.107**	0.176***	2.691**	1.049*	0.780**
	[0.038]	[0.033]	[0.043]	[0.058]	[0.780]	[0.496]	[0.291]
Father employed	-0.102***	-0.054	-0.069	-0.119***	-3.273*	-0.666	-0.237
	[0.038]	[0.094]	[0.062]	[0.031]	[1.048]	[0.612]	[0.489]
Mother employed	0.320***	0.126***	0.310***	0.397***	2.088*	6.968***	3.938**
	[0.066]	[0.020]	[0.103]	[0.111]	[0.720]	[1.237]	[1.462]
Parental education	0.039	0.043*	0.018	0.071***	0.298	0.377	0.501*
	[0.027]	[0.025]	[0.043]	[0.019]	[0.260]	[0.415]	[0.212]
Foreign-born parent	0.090*	0.115	0.042	0.131*	1.167	0.920*	0.249
	[0.052]	[0.162]	[0.076]	[0.070]	[1.523]	[0.492]	[0.844]
Observations	17 750	2 311	9 457	5 982	2 108	8 667	5 698
pseudo R^2 and R^2	0.266	0.148	0.234	0.342	0.086	0.217	0.278
Number of countries	25	4	14	7	4	14	7

Notes: Germany and Finland excluded for limited number of observations. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in brackets and errors clustered at country level. The model includes country fixed effects. Source: Authors' elaboration of EU-SILC 2019 data using Stata.

5.3.2 Upper secondary education

After pre-primary education, all European countries provide a varying number of years of compulsory education, ranging from 8 years (in Croatia) to 13 years (in Germany). As described in Table 7, the median duration is 10 years, encompassing both primary and lower secondary education. Attendance rates are notably high, reaching 98.3% within the age range of 7 to 13, where we possess direct information from the interviewees. This rate slightly declines to 97.8% in the subsequent age interval (14-16), where information is missing and has been imputed (as described in Annex 3).

The EU-SILC survey does not yield additional information concerning non-compliance with compulsory schooling, making it challenging to investigate the underlying reasons for this phenomenon.

The analysis becomes more intriguing when examining attendance in the final age range (17-19). At this stage, young individuals face alternative options, including continuing or completing their secondary education, enrolling tertiary education (when already available in the country), leaving school, and/or seeking or securing employment[25]. This explains why the attendance rate drops to 83.8%, with a significant disparity between the first two clusters and the Mediterranean cluster (see Table 7).

[25] The attendance rates in Table 7 are net of alternative educational choices, due to differences in the timing of curricula across different countries. Germany has been omitted from the analysis due to an excessive number of missing data, as it would otherwise lead to an overestimate of school dropouts. When included, the attendance rates for the first cluster decrease to 0.958, 0.883, and 0.811.

Table 7. Institutional differences in compulsory and freely provided primary and secondary education, 2019

Clusters	Years of compulsory education (min)	Years of compulsory education (median)	Years of compulsory education (mean)	Years of compulsory education (max)	Years of free education (mean)	Years of free education (max)	Attendance rate (7-13)	Attendance rate (14-16) estimated	Attendance rate (17-19)
Nordic	9.00	10.00	10.50	13.00	11.25	13.00	0.997	0.968	0.859
Continental	8.00	9.00	9.50	12.00	11.86	13.00	0.987	0.984	0.864
Mediterranean	8.00	10.00	10.25	12.00	11.50	13.00	0.967	0.976	0.777
Total	8.00	10.00	9.97	13.00	11.60	13.00	0.983	0.978	0.838

Note: Data on attendance are sample means from EU-SILC 2019. Germany is excluded from first cluster due to missing data. Source: UNESCO SDG database – downloaded on 31/8/2023 from https://apiportal.uis.unesco.org/bdds

In Table 8, we examine the correlation between observable factors and the likelihood of attending upper secondary education by employing a probit model. First, the estimates present evidence indicating that girls are more inclined to enrol in secondary education. This trend is particularly pronounced among Mediterranean countries, where girls are narrowing the educational gender gap, aligning with the rest of Europe. Additionally, children from affluent families, characterised by both parents being employed and possessing higher levels of education, also exhibit a higher probability of attending secondary education. Notably, background factors exert a more pronounced influence in Mediterranean countries. This suggests the presence of social selection at this stage of the educational career, in line with the fact that it is no longer compulsory in many countries.

In addition, the negative association with age suggests that the likelihood of dropping out of secondary school increases in the later years of schooling. Dropping out is evidently linked to cumulative disadvantage, as implied by the negative association with the absence of the mother is the households[26]. This factor is strongly associated with lower rates of secondary education enrolment in Mediterranean and Continental countries. Interestingly, the Continental cluster with foreign-born parents shows a statistically significant positive association with upper secondary school attendance. For a better interpretation of this finding, we should consider the estimated coefficient as the net effect after accounting for parental education and family income.

[26] We consider the absence of the father and mother separately. The descriptions of these two variables are reported in Table A2 in Annex 1.

Table 8. Probability of upper secondary school attendance (age 17-19), EU-SILC 2019

Variables	EU-27 (without DE)	Nordic (without DE)	Continental	Mediterranean
Dependent variable: *% secondary enrolled*	84.50	89.30	86.39	77.67
Female	0.079**	-0.077	0.086*	0.153**
	[0.037]	[0.069]	[0.049]	[0.060]
Age	-0.401***	-0.144	-0.406***	-0.557***
	[0.070]	[0.142]	[0.087]	[0.115]
(log) Household income	0.051**	0.022	0.06	0.054
	[0.026]	[0.065]	[0.042]	[0.040]
Ability to make ends meet	0.031**	0.060**	0.001	0.049***
	[0.013]	[0.025]	[0.018]	[0.015]
Father employed	0.155***	0.111*	0.192**	0.121
	[0.053]	[0.063]	[0.092]	[0.088]
Mother employed	0.145***	0.143*	0.168***	0.115
	[0.042]	[0.083]	[0.053]	[0.088]
Parental education	0.132***	0.044*	0.149***	0.162***
	[0.020]	[0.023]	[0.030]	[0.028]
Foreign-born parent	0.035	-0.158	0.187***	0.028
	[0.056]	[0.125]	[0.058]	[0.072]
Absence of father	0.034	0.025	0.069	-0.014
	[0.052]	[0.098]	[0.072]	[0.104]
Absence of mother	-0.216***	-0.191	-0.177	-0.322**
	[0.082]	[0.181]	[0.110]	[0.126]
Observations	16 356	3 543	8 088	4 725
Pseudo R^2	0.185	0.0625	0.161	0.258
Countries	26	5	14	7

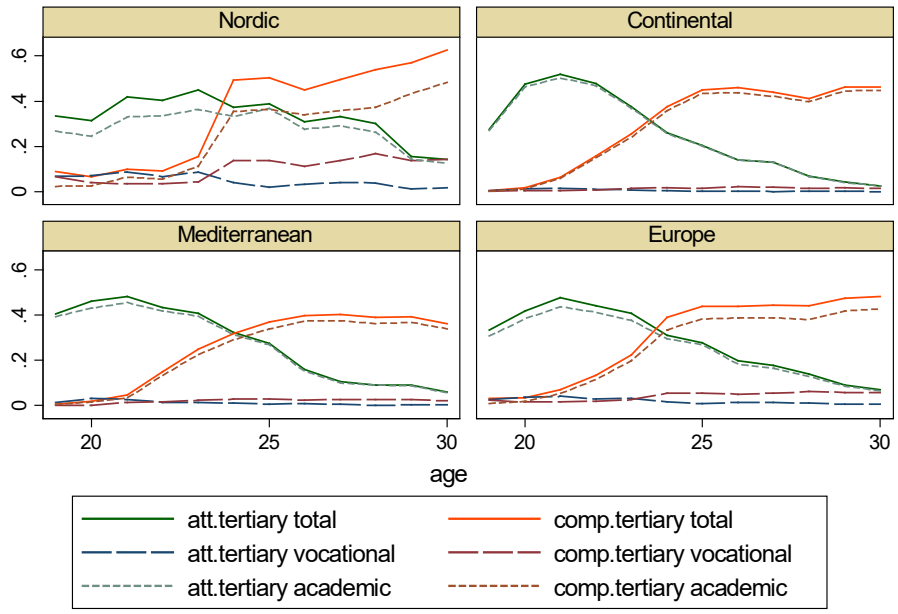
Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in brackets and errors clustered at country level. The model includes country fixed effects. Source: Authors' elaboration of EU-SILC 2019 data using Stata.

5.3.3 Tertiary Education

To analyse attainment in tertiary education, we must consider that national systems differ in terms of framework (e.g., presence/absence of non-academic tertiary education), starting age (e.g., corresponding to the age of completion of secondary education), and efficiency (e.g., inversely related to dropout rates). To represent these differences across our three clusters of countries, in Figure 10, we plot the enrolment rates (namely, the fraction of individuals who declare to be attending a tertiary education course) and the completion rates (namely, the fraction of individuals who indicate tertiary education as their maximal educational certificate), by type of tertiary education, age of the respondent, and cluster of countries. The plots in Figure 10 are also summarised in Table 9, and reported separately by age in Tables A6 and A7 in Annex 1.

The graph and table indicate that the three clusters exhibit similar enrolment rates (green line in Figure 10), with all of them exceeding 40% of the relevant age cohorts (i.e., 20-23 years old). However, in the Nordic group, the enrolment period remains high across a more extended time span, suggesting that attending tertiary education remains a viable option even into adulthood in these countries. This prolonged enrolment duration is reflected in higher attainment levels, as evident in the last column of Table 9. When turning thirty, nearly 60% of the population in the Nordic countries hold a tertiary degree, in contrast to the Mediterranean countries where less than 40% do, with Continental countries occupying an intermediate position.

Figure 10. Attendance and completion rates in tertiary education, EU-SILC 2019 (weighted)



Note: the plots represents the actual enrolment and completion relative to the age cohort, using EU-SILC 2019 data with sample weights. Source: Authors' elaboration using Stata

Table 9. Tertiary education: attendance and attainment, EU-SILC 2019 (weighed)

	Enrolment 18-25	Enrolment 26-30	Attainment 30-35
Nordic	0.348	0.242	0.602
Continental	0.327	0.079	0.461
Mediterranean	0.374	0.100	0.379
EU-27	0.348	0.133	0.480

Source: Authors' elaboration of EU-SILC 2019 data.

Two additional factors may contribute to these differences across clusters. Firstly, as observed in Figure 10, the Nordic countries prominently feature a significant vocational pathway within tertiary education, contributing to approximately one-fourth of tertiary enrolment and one-fifth of the corresponding attainment. In contrast, such alternatives are nearly absent in the other clusters. Secondly, the effectiveness of higher education institutions varies across different countries. Employing a panel approach, the OECD has recently released data on completion rates in academic tertiary education (the data are reported in Table 10). While not all countries are included in the dataset, it is noteworthy that Nordic countries report the highest completion rates, even though this may not be immediately apparent at the conclusion of the official course duration (where Continental countries hold a dominant position). This discrepancy could be attributed to factors such as the official duration of courses, admission selection processes, exam administration, student support policies, and more. In any case, the existence of an alternative pathway to academic education and lower dropout rates collectively explain three-fifths of the attainment gap between the Nordic and Mediterranean clusters.

Table 10. Completion rates in tertiary education, 2017-2020, OECD

Clusters and countries	Completion rates of students who entered a bachelor's (or equivalent) programme and completed any tertiary level						
		By the end of the theoretical duration of the programme			By the end of the theoretical duration of the programme plus three years		
	theoretical duration	men	women	total	men	women	total
Nordic	**3.33**	**31**	**42**	**37**	**63**	**76**	**70**
Austria	3	21	29	26	54	65	60
Finland	4	32	56	46	66	80	74
Netherlands	3 – 4	22	36	29	64	78	71
Sweden	3	28	37	33	49	69	61
Continental	**3.58**	**34.3**	**49.7**	**43.0**	**57.5**	**72.2**	**65.5**
Belgium	3 – 4	26	37	32	62	72	68
Estonia	3 – 4	31	52	43	53	73	64
France	3	31	40	36	67	74	71
Lithuania	3 – 4	49	67	59	56	73	65
Poland	3 – 4	39	58	50	60	77	69
Slovenia	4 – 5	30	44	38	47	64	56
Mediterranean	**3.33**	**26**	**37**	**32**	**59**	**71**	**66**
Italy	3	19	22	21	50	56	53
Portugal	3	32	43	38	63	79	72
Spain	4	27	46	37	64	79	72

Source: Table B-5.1 in OECD (2022), Education at a Glance (https://www.oecd-ilibrary.org/education/education-at-a-glance-2021_b35a14e5-en)

A third factor contributing to the explanation of differences across clusters relates to distinct patterns of leaving home, as previously discussed in Annex 2. Examining the first column of Table 11, we can observe that in Nordic countries, half of young people leave their parental home within the age range when tertiary education typically occurs, whereas in Mediterranean countries, this happen only for one fifth the youngers.

Leaving home tends to make life more challenging, as indicated by the disparity in enrolment rates between columns 4 and 5 of Table 11. When considering the entire European sample, the average enrolment in higher education is 19.8% among those living independently, compared to 37.3% among young individuals still residing with their parents. However, this differential is less pronounced in the Nordic cluster (30% compared to 45%), and is more substantial in the Mediterranean cluster (9% compared to 37%). This suggests that parental resources have varying impacts across different countries, emphasizing the need for multivariate analysis (as conducted in

Table 12). On the other hand, it is worth noting the possibility of a mechanism of reverse causality. It may be the case that young individuals who start working after completing their secondary education are the ones with a higher likelihood of achieving financial independence and subsequently choosing to live on their own.

Table 11. Tertiary education enrolment by pattern of cohabitation, age 18-30, EU-SILC 2019 (weighed)

	Pattern of cohabitation (%)			Tertiary enrolment rates (%)		
	Independent (non-cohabiting with parents)	Cohabiting with parents	Total	Independent (non-cohabiting with parents)	Cohabiting with parents	Total
Nordic	48.12	51.88	100	0.312	0.454	0.374
Continental	38.73	61.27	100	0.137	0.354	0.259
Mediterranean	20.85	79.15	100	0.094	0.351	0.293
Total	35.93	64.07	100	0.196	0.373	0.302

Note: The group of independent individuals, who are not cohabiting with their parents, is identified as youths aged 18-30 who are classified as household heads or spouses in the EU-SILC survey. Source: Authors' elaboration using Stata. EU-SILC 2019 data with sample weights.

Employing a probit model, we calculate the likelihood of enrolment in higher education institutions, conditional on demographic factors and family resources. The results are detailed in Table 12. In column 1, we examine the entire relevant population (EU-27 countries), comprising individuals aged 18 to 30 years who are not currently enrolled in secondary education. For each cluster, we further categorise the samples into two groups: those children still living with their parents (i.e., cohabiting), and those children who have already left home (i.e., non-cohabiting). The non-cohabiting group refers to individuals aged 18-30 classified as household heads or spouses in the EU-SILC survey.

The findings in Table 12 reveal that women are more inclined to progress with tertiary education, particularly when residing with their parents. Conversely, age exerts a detrimental influence, as the opportunity costs tend to rise with increasing age. Family financial resources are accounted for through the (log of) family income, the ability to meet financial needs, and the number of children. For young individuals cohabiting with their parents, these variables are referred to their parents, whereas for those not cohabiting, they relate to the individuals themselves[27]. Financial conditions exhibit a positive correlation with enrolment, as evidenced by the favourable association with the ability to meet financial needs and parental employment. However, for non-cohabiting individuals, the negative correlation with their personal income suggests that higher-earning youths are less likely to enrol in tertiary education, possibly due to increased opportunity costs. Indeed, individuals who choose to become independent and leave home are also more likely to have a job. Therefore, those with higher earnings face a higher opportunity cost when considering leaving their employment to enrol in tertiary education. Moreover, it's noteworthy that parental education continues to exert influence during

[27] This explains why we can only control for the presence or absence of parents, their employment status, and origin for cohabiting children. In contrast, parental education is available for both types of children, thanks to the retrospective module in the 2019 wave of EU-SILC.

cohabitation, as cultural ties appear to dissipate once a child leaves home. Lastly, it is important to highlight that cohabiting individuals in the Nordic cluster with foreign-born parents show a statistically significant positive association with tertiary education attendance. For better interpretation of the finding, we should consider the estimated coefficient as the net effect after controlling for parental education and income. Moreover, to interpret these result in comparison to other clusters more accurately, we should consider differences in the composition of the foreign population in their respective countries.

Table 12. Probability of tertiary education attendance, age 18-30, EU-SILC 2019

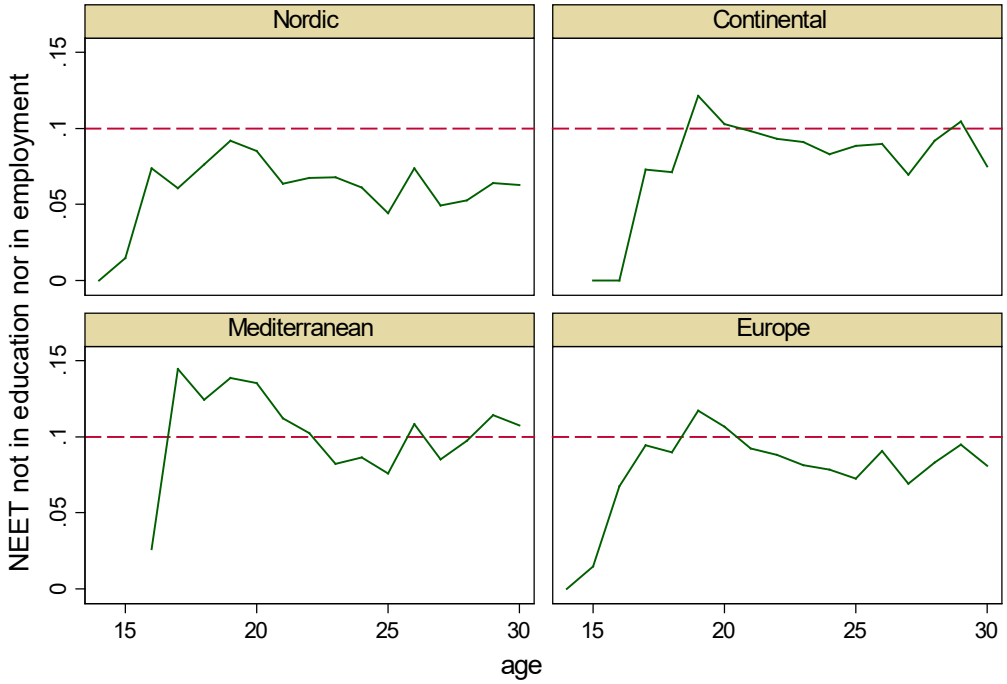
Variables	EU-27	Nordic cohabiting with parents	Nordic non-cohabiting with parents	Continental cohabiting with parents	Continental non-cohabiting with parents	Mediterranean cohabiting with parents	Mediterranean non-cohabiting with parents
Dependent variable: *% Tertiary enrolled*	30.79	35.02	30.17	37.85	13.99	34.78	14.27
Female	0.238***	0.283***	0.012	0.396***	0.044	0.271***	0.006
	[0.022]	[0.039]	[0.045]	[0.036]	[0.049]	[0.013]	[0.110]
Age	-0.133***	-0.03	-0.090***	-0.153***	-0.161***	-0.159***	-0.196***
	[0.014]	[0.036]	[0.019]	[0.019]	[0.014]	[0.023]	[0.056]
(log) Household income	-0.190***	-0.044	-0.638***	-0.058	-0.246***	-0.041	-0.11
	[0.048]	[0.074]	[0.035]	[0.057]	[0.053]	[0.036]	[0.084]
Ability to make end meet	0.075***	0.030*	0.036	0.058***	0.134***	0.054***	0.165***
	[0.012]	[0.017]	[0.034]	[0.022]	[0.022]	[0.020]	[0.048]
Parental education	0.106***	0.058		0.112**		0.078	
	[0.036]	[0.055]		[0.046]		[0.062]	
Father employed	0.153***	0.134***		0.179***		0.089	
	[0.036]	[0.023]		[0.036]		[0.058]	
Mother employed	0.305***	0.217***	0.043	0.323***	-0.03	0.302***	-0.159
	[0.015]	[0.029]	[0.072]	[0.024]	[0.079]	[0.031]	[0.125]
Foreign-born parent	0.012	0.211***		0.096		-0.172*	
	[0.071]	[0.062]		[0.102]		[0.091]	
Absence of father	0.017	0.063		0.056		-0.074	
	[0.045]	[0.054]		[0.047]		[0.062]	
Absence of mother	0.064	0.264*		0.096		-0.101	
	[0.077]	[0.143]		[0.064]		[0.063]	
Observations	58 531	4 971	5 565	19 124	8 750	15 922	4 199
Pseudo R^2	0.186	0.103	0.166	0.214	0.15	0.209	0.295

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in brackets and errors clustered at country level. Constant and country fixed effects included in the probit model. The group of independent individuals, who are not cohabiting with their parents, is identified as youths aged 18-30 who are classified as household heads or spouses in the EU-SILC survey.
Source: Authors' elaboration of EU-SILC 2019 data using Stata.

5.3.4 Not in Education, Employment, or Training (NEET)

In the final section of this study, we turn our attention to individuals who are out of the educational system, specifically focusing on those who are inactive – neither enrolled in any educational activity nor actively seeking employment, neither working. These individuals are referred as NEETs and account for 9.4% of the European population aged between 18 and 30, with their share rising to 11.1% among those aged 18 to 20. Figure 11 illustrates their proportion for each cluster, while country-specific statistics are provided in Table A8 of Annex 1. Notably, the Nordic countries exhibit lower NEET rates, which can be attributed to their higher participation in tertiary education. For Continental countries, the critical age range is 19-20 years old, as this is when young individuals typically complete secondary education and do not immediately enter the labour market. In contrast, within the Mediterranean cluster, exclusion from education and the labour force begins two years earlier due to a higher incidence of early school leaving in this cluster.

Figure 11. Incidence of NEETs by age of population (14-30), EU-SILC 2019 (weighed)



Notes: The plots depict the percent incidence on the relevant age cohort, using sample weights. The cluster "Europe" refers to the total sample of EU-27 countries. Source: Authors' elaboration of EU-SILC 2019 data using Stata.

In line with our previous regression results, we conducted a probit model to estimate the likelihood of an individual between the ages of 18 and 30 being classified as a NEET. This estimation takes into account the highest educational attainment level of the individual together with several family factors. The results are presented in Table 13 and reveal a notable correlation between NEET status and the educational attainment of the young individuals. Interestingly, it is noteworthy that simply completing secondary education (relative to completed tertiary, the excluded case) is insufficient to prevent entry into the NEET category in Nordic and Continental clusters, although the sign of this association reverses when considering Mediterranean countries.

The NEET status is also linked to family-related factors, such as low family income, the inability to cover basic expenses, and family size. Furthermore, this association is strengthened by the positive correlation with the absence of parents and parental foreign origin. A rather interesting finding is the relationship with mother employed[28], which is negatively associated with the NEET status in the Mediterranean cluster (consistent with the positive association with educational attainment), but positively associated in the Nordic cluster.

[28] See Table A2 in Annex 1 for more details on this variable.

Table 13. Probability of NEET condition (age 18-30), EU-SILC 2019 (weighed)

Variables	EU-27	Nordic	Continental	Mediterranean
Dependent variable: *% NEET*	7.92	6.08	7.15	10.54
Female	0.359***	0.282***	0.488***	0.317***
	[0.041]	[0.069]	[0.097]	[0.032]
Age	0.011	0.014*	0.043***	-0.02
	[0.016]	[0.008]	[0.013]	[0.021]
Max education attainment: *illiterate*	1.243***	1.737***	1.332***	1.007***
	[0.177]	[0.020]	[0.201]	[0.261]
Max education attainment: *primary*	0.807***	0.673***	1.162***	0.559***
	[0.114]	[0.044]	[0.114]	[0.104]
Max education attainment: *lower secondary*	0.382***	0.483***	0.546***	0.083
	[0.102]	[0.045]	[0.059]	[0.091]
Max education attainment: *upper secondary*	0.123	0.301***	0.280***	-0.228**
	[0.114]	[0.030]	[0.062]	[0.108]
(log) Household income	-0.160***	-0.059	-0.286***	-0.155***
	[0.025]	[0.038]	[0.033]	[0.009]
Ability to make end meet	-0.076***	-0.089***	-0.111***	-0.026
	[0.022]	[0.021]	[0.041]	[0.017]
Parental education	0.12	-0.007	-0.008	0.229***
	[0.074]	[0.029]	[0.115]	[0.064]
Father employed	0.009	-0.112	0.003	0.055
	[0.071]	[0.099]	[0.112]	[0.084]
Mother employed	0.029	0.100***	0.046	-0.025***
	[0.020]	[0.014]	[0.040]	[0.009]
Foreign-born parent	0.163**	0.13	0.095	0.166
	[0.068]	[0.099]	[0.065]	[0.145]
Absence of father	0.106	-0.119	0.08	0.223***
	[0.078]	[0.083]	[0.121]	[0.051]
Absence of mother	0.087	0.005	0.022	0.169**
	[0.068]	[0.056]	[0.106]	[0.069]
Observations	67 217	13 270	31 277	22 670
Pseudo R^2	0.0943	0.0523	0.131	0.105

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in brackets and errors clustered at country level. Constant and country fixed effects included in the probit model. Source: Authors' elaboration of EU-SILC 2019 data using Stata.

6 Conclusions

This report contributes to the ongoing monitoring of educational systems within the European Educational Area in two significant ways. Firstly, it emphasises the valuable role of microdata contained in the EU-SILC survey for monitoring school attendance and providing current estimates of contemporary educational attainment among the most recent age cohorts. While SILC data exhibit certain limitations, particularly the lack of information on individuals aged 13-16, these limitations can be mitigated through appropriate data imputation methods. On the other hand, our work also sheds a light on the benefits of using EU-SILC data. This data source allows for a precise examination of educational outcomes in European countries, enabling to account for household-level information. This information is particularly important as it facilitates the assessment of the impact of family characteristics on educational attainment and also allows for consideration of aspects related to educational equity. Finally, EU-SILC permits an investigation of educational indicators across all levels of education. Therefore, the report demonstrates that the EU-SILC survey serves as a relevant source of information for evaluating the effectiveness of educational systems in Europe.

Secondly, the report employs correlation analysis to characterise differences across EU educational systems. By employing cluster and factor analysis as descriptive tools, we have identified three distinct clusters of countries and studied them at critical moments of the educational path. The “Nordic” cluster include educational systems with late start of schooling, longer compulsory education duration, and the presence, in general, of tracking in secondary and tertiary education. Our findings show that this group of countries are associated with the highest educational attainment in their adult population - particularly in tertiary education completion.

The second cluster, identified by the “Continental” countries, appears as catching up. Indeed, the empirical results suggest that these educational systems are associated with an extensive use of pre-primary education, high secondary education attendance, and a rising proportion of higher education graduates. Student careers are supported by family resources, both financial and cultural.

In contrast, the "Mediterranean" countries lag behind the other two clusters due to limited access to early childcare, shorter compulsory education duration, significant dropout rates during secondary and tertiary education, and lower tertiary education enrolment. These countries also exhibit a stronger correlation between parental education and educational outcomes, suggesting limited effectiveness in mitigating social disparity.

In addition, one particularly interesting aspect pertains to the investigation of tertiary enrolment in relation to the home leaving behaviour of young individuals. This exploration reveals that home leaving does not prevent tertiary graduation, especially when it is facilitated by good financial conditions.

While our analysis provides valuable insights, it presents three main limitations. Firstly, it relies on cross-sectional data, interpreting adjacent birth cohorts as exposed to the same educational environment. A longitudinal study would be preferable; however, it would provide insights later in the process, as individuals concluding their educational careers at the age of 25 would reflect the effectiveness of educational systems from 10 to 20 years earlier. Secondly, our analysis is purely descriptive and does not attempt to establish causal relationships. From this perspective, our aim is to provide a comprehensive comparative analysis of educational systems without delving into specific policies that hinge on single instruments. Thirdly, when interpreting the results, potential limitations regarding comparability between different EU countries due to variations in the quality of education should be considered. This is especially true for pre-primary services, which traditionally exhibit significant differences across countries.

The findings discussed in the report shed light on the commonalities and differences of the EU educational systems. These insights could be especially useful in supporting the European Commission's objective of strengthening the European Educational Area. While we cannot definitively infer causation from these associations, the results raise an alarm. Based on our results, education in Europe does not seem a tool that everyone can benefit from; rather, it continues to be socially selective shaping individuals' prospects for their future careers.

The COVID-19 crisis has heightened the urgency of addressing these challenges, particularly as its repercussions has predominantly impacted socioeconomically disadvantaged students. Several studies suggest that the pandemic, along with the resulting prolonged physical school closures, has hindered learning progress and amplified the risk of disengagement from school, potentially leading to higher dropout rates among less-advantaged students (Di Pietro et al. 2020; Blaskó et al. 2021; Cachia et al. 2021; Carretero et al., 2021; Bertoletti et al., 2023; Di Pietro, 2023). Thus, without appropriate interventions, educational inequalities are likely to worsen further.

The Next Generation EU programme, facilitated by its Recovery and Resilience Facility, has the potential to exert significant changes in the medium-to-long term. It stimulates structural reforms and facilitates increased investments in education throughout the European Union. Within their respective national Recovery and Resilience Plans, Member States have made explicit commitments to enact substantial reforms and allocate financial resources to various stages of the education sector[29]. These encompass early childhood education and care, primary and secondary school education, initial vocational education and training, and higher education – with significant variations across countries, aligning with their distinct national priorities and challenges (European Commission, 2021b). The comprehensive realisation of these proposed reforms and investments would represent a substantial step towards making education in Europe successful for all.

[29] Based on the 22 national Recovery and Resilience Plans approved in 2021, the European Commission estimated that measures containing investments relevant for education amounted to EUR 45.55 billion, representing approximately 10% of the total budget of the plans (European Commission, 2021).

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List of abbreviations and definitions

ECEC	Early Childhood Education and Care
EEA	European Education Area
EU-SILC	European Union Statistics on Income and Living Conditions
LFS	Labour Force Survey
OLS	Ordinary Least Squares

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Annex 1. Additional tables and figures

Table A1. Sample sizes (unweighted) EU-27 countries, EU-SILC 2019

		Household File	Respondent file						Person File
country	country code	households	aged 0-18	aged 19-25 cohabiting	aged 19-25 living alone	% 19-25 cohabiting	coded as "children"	respondents	persons
Austria	AT	5983	2212	524	227	69.80%	3084	12357	10351
Belgium	BE	6787	3268	1058	193	84.60%	4846	15516	12590
Bulgaria	BG	7340	2310	701	116	85.80%	5053	17012	14980
Cyprus	CY	4211	1941	892	75	92.20%	3634	10974	9295
Czech Republic	CZ	8707	3367	843	188	81.80%	5241	19150	16127
Germany	DE	12350	3216	996	280	78.10%	4681	23925	20854
Denmark	DK	5817	1996	386	362	51.60%	2468	12038	10291
Estonia	EE	6265	3114	905	272	76.90%	4917	15126	12424
Greece	EL	17914	5522	1741	416	80.70%	10649	39803	34836
Spain	ES	15887	7338	2482	295	89.40%	13106	39852	33376
Finland	FI	9646	5260	1119	609	64.80%	6723	23164	18720
France	FR	11737	5786	1487	480	75.60%	7829	26484	21421
Croatia	HR	7880	2835	1435	93	93.90%	6428	19569	17121
Hungary	HU	6911	2358	812	139	85.40%	4339	15141	12980
Ireland	IE	4183	2867	581	112	83.80%	3902	10809	8217
Italy	IT	20831	5797	2295	186	92.50%	11749	43400	38327
Lithuania	LT	5131	1665	613	76	89.00%	3281	11360	9906
Luxembourg	LU	3842	2291	954	92	91.20%	3717	10520	8505
Latvia	LV	5279	2030	434	124	77.80%	3374	11394	9578
Malta	MT	3785	1616	544	24	95.80%	3112	9557	8351
Netherlands	NL	13764	5466	1947	439	81.60%	7934	29899	25378
Poland	PL	19874	9367	2910	669	81.30%	16917	50788	42377
Portugal	PT	13570	5016	2289	246	90.30%	10223	33081	28783
Romania	RO	7282	1736	948	169	84.90%	4481	16791	15314
Sweden	SE	5621	3270	708	290	70.90%	4126	13461	10660
Slovenia	SI	8590	4484	2213	159	93.30%	9586	25253	21370
Slovakia	SK	5591	2208	1089	103	91.40%	5190	14654	12719
EU-27 Total		244778	98336	32906	6434	82.76%	170590	571078	484851

Note: Relevant statistics are weighed by personal weights (variable PB020). Source: Authors' elaboration.

Table A2. Description of the control variables, EU-SILC 2019

Variable name	Reference to EU-SILC 2019 original variable	Description
Female	RB090	A binary variable equal to 1 for females and 0 for males
Age	RB080	The variable indicates the child's age and is constructed by subtracting their year of birth from the year 2019, which is the year of the survey.
Child	RB220, RB230	This variable is used to identify children since they indicate the existence of father (RB220) or mother (RB230) - including step/adoptive/foster parents. By aggregation on children identifiers at household level, we obtain the number of siblings. However this variable is multicollinear with the number of family members, which is used in the equalisation of family income, and therefore it has been abandoned in the empirical analysis.
Parental education	PE040/ PT110, PTPT120	Available in special 2019 module on "Intergenerational transmission of disadvantages, household composition and evolution of income". It contains information on the household situation when the interviewee was 14 year old, and is answered by the household head and spouse (in the case of Nordic countries it is either one or the other who responds). If a child is cohabiting, this information refers to grandparents, while if the child is living alone (as in the case of many respondents older than 20 year old) the information is referred to their own parents. We have considered the highest level of education achieved by either parent, in order to ensure a reliable measure, even when dealing with single-parent households; alternative methods such as calculating the average parental education might produce misleading results. The following educational levels are considered: 0 pre-primary education, 1 primary education, 2 lower secondary education, 3 (upper) secondary education, 4 post-secondary non tertiary education, 5 first stage of tertiary education (not leading directly to an advanced research qualification) or second stage of tertiary education (leading to an advanced research qualification).
Household income	HY010	This variable indicate the household gross income, which encompasses all income sources and is adjusted for equivalency dividing it by the square root of the number of family members living together. In the regression models, this variable is included in logarithmic form.
Foreign-born parent	PB210	This binary variable equals 1 if at least one of the parents has specified "other" as their country of birth (PB210), and it equals 0 otherwise.
Ability to make ends meet	HS120	This is an ordinal variable corresponding to the answer to the question "A household may have different sources of income and more than one household member may contribute to it. Thinking of your household's total income, is your household able to make ends meet, namely, to pay for its usual necessary expenses?" The answer ranges from 1 "with great difficulty" to 6 "very easily" and is usually interpreted as proxy for the financial situation of the household.
Father employed	RB210	This binary variable is set to 1 when the father is currently employed, which corresponds to the label "1 At work" in the RB210 - BASIC ACTIVITY STATUS variable. Conversely, it is assigned a value of 0 when the RB210 variable reports "2 Unemployed," "3 In retirement or early retirement or has given up business," or "4 Other inactive person."
Mother employed	RB210	This binary variable is set to 1 when the mother is currently employed, which corresponds to the label "1 At work" in the RB210 - BASIC ACTIVITY STATUS variable. Conversely, it is assigned a value of 0 when the RB210 variable reports "2 Unemployed," "3 In retirement or early retirement or has given up business," or "4 Other inactive person."
Absence of father	RB220	This variable is a binary dummy, taking the value of 1 when the Father ID (RB220) is missing and 0 otherwise.
Absence of mother	RB230	This variable is a binary dummy, taking the value of 1 when the Mother ID (RB230) is missing and 0 otherwise.

Source: Authors' elaboration

Table A3. Values of educational attainment (young and adult population) and respective dispersion, EU-SILC 2019 [weighed]

	Average educational attainment in the young population, $\bar{y}^1$	Average educational attainment in the adult population, $\bar{y}^2$	Dispersion of educational attainment, d
AT	16.53	15.54	4.74
BE	17.25	15.52	3.65
BG	16.65	14.17	4.17
CY	17.21	15.18	4.51
CZ	17.62	14.90	3.76
DE	13.47	17.48	4.20
DK	18.48	18.93	4.16
EE	17.02	15.93	4.09
EL	17.26	14.43	4.12
ES	17.21	14.43	4.66
FI	16.77	18.40	4.38
FR	16.36	15.65	3.96
HR	16.73	14.40	3.88
HU	15.68	14.43	4.07
IE	16.49	16.02	4.28
IT	15.71	13.91	5.03
LT	17.30	16.65	3.68
LU	17.79	16.28	4.13
LV	16.91	15.86	4.09
MT	13.00	11.88	5.15
NL	17.73	17.66	4.17
PL	15.60	15.96	3.67
PT	16.89	15.15	4.94
RO	16.37	13.03	3.71
SE	17.01	17.72	4.47
SI	19.31	16.04	4.38
SK	15.98	14.04	4.62
SILC 2019 average	16.68	15.54	4.25

Note: Source: Authors' elaboration of EU-SILC 2019 data.

Table A4. Standardised country scores along different educational dimensions, EU-SILC 2019

Country code	SCORE 1 (Average educational attainment in the young population, $\bar{y}^1$)	SCORE 2 (Average educational attainment in the adult population, $\bar{y}^2$)	SCORE 3 (opposite of dispersion of educational attainment, -*d*)	SCORE 4 (Gender fairness, *Eg*)	SCORE 5 (Equity in educational careers, *Ei*)	SCORE 6 (Inclusiveness in educational careers, *Ee*)	SCORE 7 (Openness in educational careers, *Eo*)	AVERAGE SCORE
AT	-0.114	0.000	-1.179	-2.166	2.144	1.656	-1.964	-0.232
BE	0.446	-0.014	1.443	-0.269	-1.391	-0.068	0.732	0.126
BG	-0.026	-0.847	0.190	0.529	-1.307	-1.111	0.732	-0.263
CY	0.412	-0.225	-0.625	0.048	-1.124	-1.010	-2.720	-0.749
CZ	0.729	-0.397	1.178	0.144	-0.127	0.742	0.145	0.345
DE	-2.496	1.202	0.120	-1.158	0.906	0.742	0.732	0.007
DK	1.402	2.104	0.204	-0.198	0.138	0.742	0.732	0.732
EE	0.266	0.240	0.376	1.628	0.860	-0.112	-0.607	0.379
EL	0.454	-0.689	0.308	-0.158	-0.036	-1.136	0.732	-0.075
ES	0.415	-0.688	-1.001	0.081	0.933	-0.252	-0.715	-0.175
FI	0.070	1.774	-0.326	0.647	0.646	0.742	0.732	0.612
FR	-0.247	0.067	0.691	-1.287	-1.197	0.742	0.732	-0.071
HR	0.041	-0.708	0.877	0.315	-0.538	-1.174	0.732	-0.065
HU	-0.779	-0.690	0.414	0.263	0.729	-0.887	0.732	-0.031
IE	-0.143	0.296	-0.070	0.414	-1.941	0.742	0.732	0.004
IT	-0.750	-1.012	-1.878	-0.706	1.831	-2.185	-0.168	-0.695
LT	0.486	0.689	1.354	1.005	0.691	0.742	-0.999	0.567
LU	0.864	0.462	0.272	-0.795	-0.402	-0.506	0.732	0.089
LV	0.180	0.199	0.378	1.866	-0.228	0.742	-0.098	0.434
MT	-2.859	-2.272	-2.172	-0.062	-0.088	0.742	0.732	-0.854
NL	0.817	1.316	0.176	-1.178	-0.025	0.742	-1.022	0.118
PL	-0.841	0.261	1.388	0.740	-0.690	0.742	-0.687	0.130
PT	0.161	-0.242	-1.661	1.178	-0.297	-0.388	0.732	-0.074
RO	-0.241	-1.559	1.301	-2.166	-0.638	0.742	0.732	-0.261
SE	0.254	1.349	-0.545	0.121	1.575	-0.209	-1.768	0.111
SI	2.043	0.312	-0.323	0.830	-0.213	0.742	-0.374	0.431
SK	-0.544	-0.930	-0.890	0.335	-0.212	-2.258	0.732	-0.538

Source: Authors' elaboration of EU-SILC 2019 data.

Table A5. Principal component analysis on the standardised country scores, EU-SILC 2019

Standardised country scores	Factor 1	Factor 2	Factor 3	Uniqueness
SCORE 1 (Average educational attainment in the young population, y_1)	0.689	0.071	0.446	0.322
SCORE 2 (Average educational attainment in the adult population, y_2)	0.788	-0.249	-0.005	0.316
SCORE 3 (opposite of dispersion of educational attainment, *-d*)	0.587	0.557	-0.229	0.293
SCORE 4 (Gender fairness, *Eg*)	0.144	0.247	0.747	0.360
SCORE 5 (Inclusiveness in educational careers, *Ei*)	0.567	-0.158	-0.605	0.288
SCORE 6 (Equity in educational careers, *Ee*)	-0.095	-0.849	0.028	0.269
SCORE 7 (Openness in educational careers, *Eg*)	-0.296	0.693	-0.233	0.377
Variance explained	0.268	0.238	0.176	

Source: Authors' elaboration of EU-SILC 2019 data, using Stata.

Table A6. Tertiary education attendance rates, by cluster, age and type of tertiary education, EU-SILC 2019 (weighed)

						Age								
Cluster	18	19	20	21	22	23	24	25	26	27	28	29	30	**Total**
						Nordic								
tertiary vocational	0.79	6.8	7.02	8.77	6.7	8.72	4.01	1.98	3.36	4.1	3.83	1.14	1.64	**4.58**
tertiary academic	3.88	26.75	24.53	33.08	33.58	36.4	33.19	36.86	27.64	29.16	26.29	14.45	12.6	**25.88**
tertiary	4.67	33.55	31.55	41.85	40.28	45.12	37.2	38.84	31	33.26	30.12	15.59	14.24	**30.46**
						Continental								
tertiary vocational	0.42	0.54	1.15	1.58	1.05	0.75	0.35	0.22	0.2	0.06	0.1	0.18	0.02	**0.49**
tertiary academic	2.39	27.02	46.35	50.29	46.87	36.94	25.68	20.13	13.9	13.07	6.69	4.09	2.43	**21.97**
tertiary	2.81	27.56	47.5	51.87	47.92	37.69	26.03	20.35	14.1	13.13	6.79	4.27	2.45	**22.46**
						Mediterranean								
tertiary vocational	0.38	1.29	3.08	2.69	1.44	1.37	1.09	0.56	0.89	0.51	0.05	0.28	0.29	**1.05**
tertiary academic	18.54	39.36	43	45.59	41.87	39.51	31.38	26.85	15.09	9.99	8.98	8.7	5.63	**25.4**
tertiary	18.92	40.65	46.08	48.28	43.31	40.88	32.47	27.41	15.98	10.5	9.03	8.98	5.92	**26.45**
						EU-27								
tertiary vocational	0.5	2.73	3.61	4.06	2.89	3.22	1.56	0.81	1.35	1.31	1.1	0.51	0.59	**1.85**
tertiary academic	8	30.69	38.32	43.73	41.24	37.61	29.48	26.85	18.33	16.45	12.76	8.64	6.42	**24.17**

tertiary	8.5	33.42	41.93	47.79	44.13	40.83	31.04	27.66	19.68	17.76	13.86	9.15	7.01	**26.02**

Source: Authors' elaboration of EU-SILC 2019 data with sample weights, using Stata.

Table A7. Tertiary education completion rates, by cluster, age and type of tertiary education, EU-SILC 2019 (weighed)

	Age													
Cluster	18	19	20	21	22	23	24	25	26	27	28	29	30	**Total**
							Nordic							
tertiary vocational	0	6.67	3.96	3.44	3.55	4.35	13.81	13.88	11.15	13.66	16.77	13.68	14.27	9.28
tertiary academic	0.04	2.35	2.55	6.47	5.51	11.17	35.44	36.5	33.96	35.87	37.3	43.34	48.43	23.34
tertiary	0.04	9.02	6.51	9.91	9.06	15.52	49.25	50.38	45.11	49.53	54.07	57.02	62.7	32.62
							Continental							
tertiary vocational	0.04	0.3	0.52	0.54	0.76	1.35	1.76	1.5	2.21	1.87	1.49	1.66	1.37	1.19
tertiary academic	0.03	0.16	1.19	5.85	15.1	24.16	35.77	43.5	43.75	42.18	39.8	44.55	44.83	26.65
tertiary	0.07	0.46	1.71	6.39	15.86	25.51	37.53	45	45.96	44.05	41.29	46.21	46.2	27.84
							Mediterranean							
tertiary vocational	0	0.14	0.2	1.35	1.62	2.3	2.78	3.01	2.36	2.66	2.76	2.53	2.14	1.85
tertiary academic	0	0.42	1.58	3.24	13.37	22.52	29.07	33.91	37.42	37.53	36.26	36.8	34.01	22.31
tertiary	0	0.56	1.78	4.59	14.99	24.82	31.85	36.92	39.78	40.19	39.02	39.33	36.15	24.16
							EU-27							
tertiary vocational	0.02	2.27	1.54	1.68	1.91	2.54	5.39	5.46	5	5.43	6.16	5.73	5.62	3.8
tertiary academic	0.02	0.94	1.75	5.21	11.54	19.83	33.5	38.32	38.75	38.85	37.98	41.83	42.67	24.28
tertiary	0.04	3.21	3.29	6.89	13.45	22.37	38.89	43.78	43.75	44.28	44.14	47.56	48.29	28.08

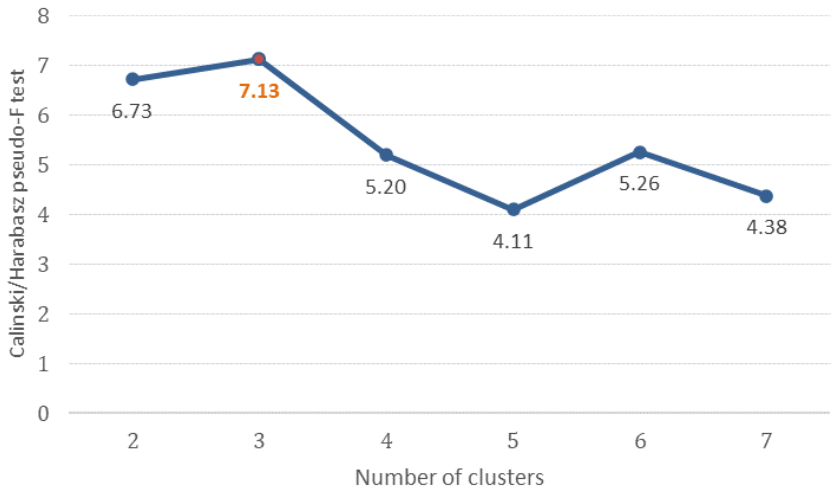
Source: Authors' elaboration of EU-SILC 2019 data with sample weights, using Stata.

Table A8. NEET rates by country and age (cohabiting children), EU-SILC 2019

Country	Population age																	Total
	14	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	
AT	0.026	0.020	0.000	0.000	0.092	0.081	0.110	0.075	0.024	0.065	0.056	0.044	0.115	0.018	0.076	0.059	0.185	0.065
obs	*94*	*91*	*145*	*106*	*124*	*140*	*88*	*151*	*115*	*120*	*102*	*98*	*138*	*126*	*143*	*144*	*156*	*2082*
BE	0.000	0.000	0.000	0.068	0.105	0.118	0.094	0.076	0.122	0.119	0.080	0.057	0.117	0.097	0.139	0.105	0.062	0.080
obs	*164*	*146*	*173*	*150*	*131*	*168*	*143*	*154*	*150*	*156*	*139*	*137*	*152*	*165*	*171*	*182*	*186*	*2669*
BG	0.012	0.017	0.010	0.017	0.098	0.074	0.144	0.125	0.114	0.060	0.063	0.152	0.079	0.096	0.076	0.071	0.055	0.072
obs	*90*	*86*	*78*	*86*	*84*	*83*	*63*	*86*	*57*	*83*	*75*	*83*	*95*	*107*	*88*	*113*	*121*	*1476*
CY	0.000	0.000	0.000	0.042	0.133	0.419	0.141	0.005	0.087	0.014	0.012	0.062	0.014	0.059	0.094	0.086	0.056	0.073
obs	*11*	*12*	*10*	*11*	*14*	*13*	*16*	*14*	*17*	*15*	*15*	*20*	*18*	*18*	*19*	*17*	*22*	*263*
CZ	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.029	0.044	0.036	0.072	0.044	0.097	0.103	0.165	0.138	0.115	0.057
obs	*124*	*117*	*96*	*140*	*134*	*140*	*105*	*127*	*99*	*111*	*96*	*105*	*172*	*166*	*171*	*170*	*136*	*2210*
DE	0.358	0.349	0.408	0.593	0.582	0.088	0.069	0.04	0.082	0.071	0.027	0.035	0.038	0.034	0.07	0.041	0.058	0.162
obs	*904*	*850*	*844*	*938*	*980*	*1367*	*1217*	*1016*	*1198*	*980*	*867*	*818*	*1067*	*950*	*1036*	*1233*	*1134*	*17398*
DK	0.021	0.004	0.004	0.027	0.022	0.062	0.196	0.205	0.145	0.105	0.086	0.046	0.154	0.114	0.068	0.094	0.031	0.085
obs	*91*	*78*	*63*	*83*	*81*	*67*	*85*	*84*	*97*	*103*	*100*	*113*	*107*	*92*	*85*	*110*	*87*	*1526*
EE	0.003	0.009	0.000	0.021	0.049	0.022	0.136	0.142	0.100	0.075	0.133	0.134	0.043	0.150	0.098	0.135	0.074	0.079
obs	*16*	*18*	*16*	*15*	*17*	*16*	*13*	*14*	*18*	*17*	*18*	*15*	*19*	*18*	*25*	*22*	*24*	*299*
EL	0.001	0.006	0.000	0.011	0.012	0.050	0.077	0.048	0.043	0.045	0.037	0.045	0.043	0.036	0.080	0.108	0.079	0.042
obs	*136*	*132*	*116*	*133*	*157*	*110*	*120*	*126*	*123*	*116*	*114*	*118*	*144*	*141*	*140*	*122*	*131*	*2181*
ES	0.005	0.005	0.005	0.053	0.033	0.045	0.076	0.056	0.116	0.059	0.076	0.063	0.059	0.062	0.075	0.104	0.055	0.056
obs	*537*	*609*	*549*	*556*	*543*	*698*	*517*	*521*	*624*	*585*	*551*	*560*	*607*	*579*	*623*	*646*	*658*	*9965*
FI	0.006	0.000	0.002	0.128	0.087	0.034	0.195	0.223	0.125	0.094	0.088	0.064	0.065	0.088	0.079	0.111	0.068	0.084
obs	*77*	*79*	*73*	*89*	*80*	*71*	*52*	*78*	*70*	*82*	*68*	*93*	*83*	*66*	*87*	*94*	*103*	*1345*
FR	0.006	0.000	0.004	0.104	0.127	0.126	0.138	0.122	0.068	0.085	0.057	0.080	0.068	0.040	0.066	0.069	0.048	0.071
obs	*877*	*908*	*885*	*827*	*979*	*938*	*906*	*798*	*755*	*788*	*880*	*792*	*840*	*873*	*939*	*865*	*913*	*14764*
HR	0.000	0.000	0.000	0.025	0.010	0.013	0.024	0.017	0.021	0.033	0.018	0.038	0.058	0.017	0.039	0.053	0.037	0.024
obs	*56*	*45*	*50*	*49*	*45*	*61*	*52*	*61*	*65*	*66*	*56*	*50*	*53*	*65*	*58*	*68*	*53*	*953*
HU	0.000	0.000	0.000	0.117	0.125	0.170	0.140	0.144	0.083	0.090	0.096	0.080	0.145	0.128	0.085	0.097	0.069	0.096
obs	*118*	*91*	*124*	*150*	*145*	*118*	*177*	*144*	*164*	*168*	*145*	*116*	*128*	*106*	*98*	*116*	*118*	*2227*
IE	0.038	0.021	0.009	0.061	0.039	0.177	0.052	0.052	0.049	0.092	0.085	0.035	0.062	0.060	0.205	0.044	0.176	0.068
obs	*93*	*97*	*99*	*90*	*124*	*87*	*84*	*84*	*69*	*57*	*59*	*59*	*70*	*60*	*68*	*55*	*46*	*1301*
IT	0.010	0.005	0.018	0.287	0.265	0.263	0.245	0.195	0.134	0.129	0.113	0.099	0.187	0.119	0.132	0.136	0.169	0.148
obs	*711*	*696*	*673*	*742*	*695*	*788*	*656*	*740*	*801*	*714*	*714*	*736*	*712*	*866*	*828*	*827*	*746*	*12645*
LT	0.006	0.006	0.000	0.000	0.020	0.006	0.079	0.013	0.060	0.098	0.056	0.121	0.078	0.046	0.174	0.056	0.065	0.058
obs	*28*	*32*	*35*	*31*	*30*	*40*	*38*	*37*	*36*	*43*	*35*	*45*	*49*	*42*	*50*	*42*	*51*	*665*
LU	0.022	0.008	0.008	0.025	0.094	0.063	0.110	0.138	0.152	0.116	0.161	0.098	0.105	0.069	0.067	0.102	0.061	0.085
obs	*8*	*8*	*6*	*9*	*9*	*9*	*8*	*7*	*8*	*10*	*11*	*8*	*11*	*11*	*9*	*8*	*9*	*149*
LV	0.000	0.000	0.000	0.047	0.061	0.155	0.090	0.132	0.138	0.112	0.111	0.109	0.174	0.118	0.081	0.108	0.093	0.089
obs	*26*	*22*	*22*	*23*	*21*	*24*	*25*	*20*	*22*	*17*	*18*	*23*	*18*	*27*	*33*	*36*	*39*	*416*
MT	0.232	0.319	0.364	0.453	0.504	0.494	0.435	0.292	0.079	0.188	0.170	0.200	0.119	0.077	0.056	0.079	0.113	0.210
obs	*4*	*6*	*6*	*6*	*5*	*6*	*5*	*7*	*7*	*10*	*6*	*8*	*9*	*10*	*11*	*10*	*12*	*129*
NL	0.051	0.064	0.045	0.123	0.097	0.142	0.135	0.098	0.107	0.130	0.134	0.091	0.096	0.067	0.079	0.072	0.057	0.094
obs	*216*	*230*	*237*	*255*	*274*	*256*	*263*	*262*	*230*	*288*	*271*	*281*	*253*	*247*	*284*	*306*	*292*	*4447*
PL	0.003	0.004	0.001	0.202	0.225	0.276	0.229	0.232	0.185	0.157	0.143	0.131	0.119	0.096	0.079	0.138	0.111	0.138
obs	*402*	*385*	*364*	*390*	*434*	*473*	*414*	*470*	*576*	*446*	*487*	*441*	*614*	*504*	*621*	*690*	*642*	*8354*
PT	0.006	0.000	0.000	0.005	0.009	0.053	0.036	0.024	0.022	0.026	0.038	0.040	0.023	0.016	0.022	0.026	0.051	0.023
obs	*147*	*136*	*121*	*148*	*130*	*137*	*141*	*144*	*134*	*146*	*128*	*120*	*135*	*135*	*145*	*127*	*140*	*2315*
RO	0.000	0.009	0.000	0.143	0.038	0.055	0.103	0.107	0.108	0.095	0.147	0.154	0.124	0.086	0.215	0.177	0.112	0.093
obs	*390*	*322*	*330*	*272*	*243*	*266*	*285*	*272*	*273*	*259*	*267*	*203*	*250*	*227*	*250*	*271*	*318*	*4698*
SE	0.046	0.053	0.052	0.069	0.093	0.032	0.066	0.063	0.053	0.045	0.053	0.052	0.037	0.022	0.027	0.081	0.01	0.05
obs	*174*	*143*	*134*	*183*	*181*	*153*	*160*	*130*	*149*	*95*	*120*	*130*	*214*	*159*	*180*	*194*	*166*	*2665*
SI	0.000	0.000	0.000	0.001	0.000	0.007	0.010	0.005	0.003	0.019	0.011	0.014	0.002	0.016	0.008	0.011	0.029	0.008
obs	*26*	*24*	*22*	*24*	*23*	*23*	*27*	*25*	*25*	*29*	*22*	*28*	*29*	*26*	*24*	*25*	*28*	*431*
SK	0.000	0.008	0.004	0.045	0.065	0.050	0.076	0.037	0.047	0.071	0.087	0.098	0.064	0.078	0.108	0.143	0.165	0.071
obs	*67*	*64*	*69*	*54*	*58*	*70*	*92*	*72*	*78*	*70*	*68*	*73*	*102*	*92*	*88*	*96*	*82*	*1296*
EU-27	0.064	0.061	0.071	0.197	0.194	0.124	0.125	0.109	0.099	0.09	0.079	0.078	0.089	0.068	0.089	0.091	0.082	0.101
obs	*5873*	*5690*	*5580*	*5838*	*5981*	*6614*	*6027*	*5901*	*6226*	*5874*	*5763*	*5565*	*6406*	*6203*	*6599*	*6907*	*6758*	*103804*

Source: Authors' elaboration using Stata, data from EU-SILC 2019.

Figure A1. Calinski/Harabasz pseudo-F test by number of clusters, EU-SILC 2019



Source: Authors' elaboration using Stata, data coming from EU-SILC 2019.

Annex 2. Examining the home leaving age across EU countries

This section is dedicated to explore the age at which children depart from their parents' homes across the countries of our sample. In particular, we have employed two distinct methodologies to ascertain the average age at which individuals leave their parental homes in each country. The first approach is depicted in Table A9, wherein we calculate the percentage of cohabiting individuals categorised by age. The complementary fraction represents those individuals who have transitioned to independent living arrangements. Given the variance in the age at which individuals depart from their parental homes, the proportion of cohabiting children gradually or rapidly diminishes. This decline is also influenced by the structure of tertiary education at the national level. For our analytical purposes, we have established a decline of 5% or more as the threshold for identifying the average age of home leaving. Based on this, we have identified the age ranges at which children are considered to start leaving home, which are highlighted in blue colour for each country in Table A9. As notable, the age of leaving is approximately 20 years old for countries such as Denmark, Estonia, Finland, Norway, Sweden (all Nordic countries), and Greece. In contrast, the age at which individuals leave home exceeds 25 years in Cyprus and Croatia (27 years), as well as in Malta, Portugal, Slovakia (26 years).

An alternative methodology is presented in Figure A2. This approach is rooted in the rationale that when multiple children cohabit within the same family, the average age of these children steadily increases until the eldest child typically departs. Consequently, the number of cohabiting children within the household begins to decline. To explore this phenomenon, we employ a lowess estimator to plot the relationship between the number of cohabiting children and the maximum age observed within each household. If fertility patterns are consistent within a country, a deviation from the average number of children associated with a lower maximum age may indicate that one child has left the household. Thus, the inflection point in this pattern serves as an approximate estimate of the average age at which individuals leave home. The age range between 15 and 20 is demarcated, for each country, by two red vertical lines in Figure A2.

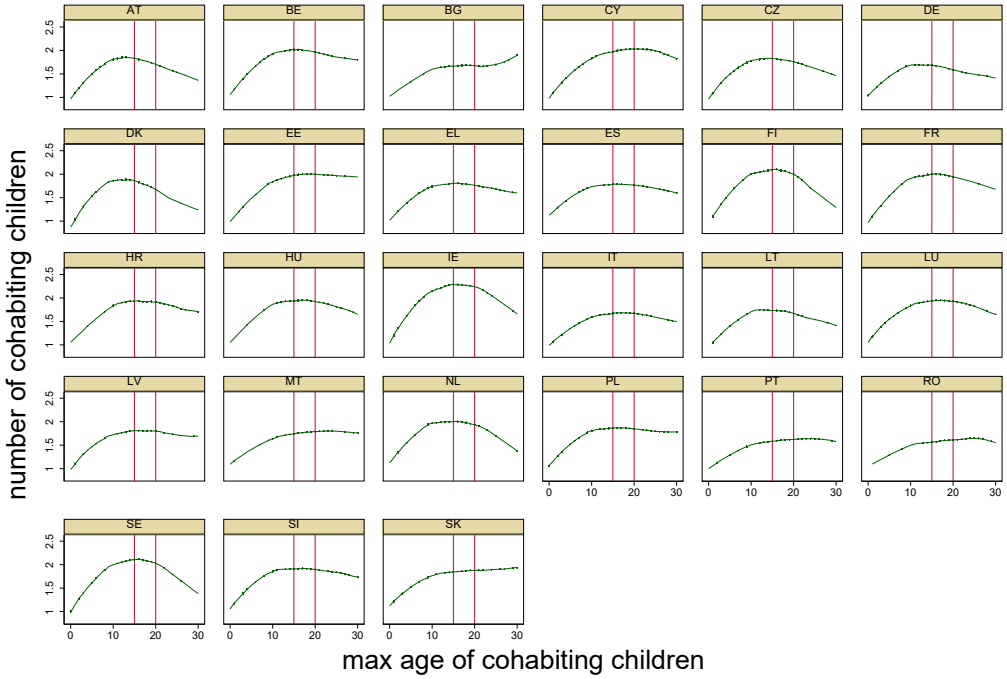
Both of these methodologies demonstrate a considerable disparity in the ages at which individuals leave their family residences across various countries.

Table A9. Fraction of children among family members, by age (17-30), EU-SILC 2019

Country code/Age	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total (19-25 years old)
AT	0.98	0.98	0.97	0.85	0.86	0.66	0.59	0.52	0.41	0.31	0.20	0.17	0.19	0.09	**0.69**
BE	0.99	0.99	0.97	0.96	0.90	0.88	0.80	0.73	0.63	0.51	0.32	0.27	0.19	0.15	**0.84**
BG	0.93	0.93	0.90	0.86	0.85	0.84	0.90	0.86	0.78	0.74	0.74	0.66	0.54	0.59	**0.86**
CY	0.99	1.00	0.98	0.96	0.98	0.93	0.89	0.88	0.85	0.82	0.72	0.72	0.57	0.41	**0.92**
CZ	1.00	1.00	0.98	0.95	0.88	0.83	0.74	0.67	0.64	0.46	0.44	0.36	0.36	0.26	**0.81**
DE	0.98	0.99	0.83	0.90	0.83	0.87	0.91	0.46	0.43	0.52	0.43	0.45	0.08	0.13	**0.75**
DK	0.97	0.95	0.90	0.88	0.65	0.47	0.20	0.22	0.12	0.17	0.12	0.05	0.03	0.06	**0.49**
EE	0.98	0.98	0.96	0.89	0.83	0.69	0.69	0.59	0.59	0.43	0.42	0.27	0.29	0.17	**0.75**
EL	0.99	0.99	0.93	0.86	0.75	0.78	0.78	0.83	0.75	0.79	0.80	0.69	0.65	0.62	**0.81**
ES	0.98	0.97	0.92	0.95	0.94	0.91	0.87	0.84	0.80	0.74	0.68	0.57	0.53	0.47	**0.89**
FI	1.00	0.98	0.94	0.89	0.66	0.57	0.41	0.33	0.25	0.22	0.17	0.13	0.11	0.07	**0.58**
FR	0.99	0.98	0.95	0.91	0.87	0.72	0.65	0.57	0.40	0.36	0.25	0.21	0.18	0.12	**0.72**
HR	0.98	0.98	0.98	0.97	0.96	0.94	0.93	0.92	0.84	0.87	0.84	0.82	0.69	0.67	**0.93**
HU	0.97	0.93	0.95	0.94	0.92	0.87	0.79	0.78	0.70	0.72	0.61	0.64	0.44	0.47	**0.85**
IE	0.99	0.97	0.91	0.92	0.91	0.86	0.82	0.75	0.58	0.62	0.60	0.42	0.49	0.29	**0.82**
IT	0.99	1.00	0.99	0.98	0.94	0.93	0.89	0.90	0.83	0.74	0.69	0.67	0.57	0.45	**0.92**
LT	1.00	0.99	0.94	0.94	0.95	0.94	0.85	0.77	0.78	0.66	0.63	0.60	0.44	0.41	**0.88**
LU	0.97	0.96	0.97	0.97	0.94	0.95	0.90	0.84	0.80	0.70	0.63	0.50	0.36	0.25	**0.91**
LV	0.95	0.93	0.91	0.93	0.81	0.69	0.67	0.77	0.57	0.55	0.38	0.34	0.28	0.29	**0.76**
MT	0.99	0.98	0.97	0.96	0.97	0.96	0.94	0.99	0.95	0.85	0.71	0.62	0.67	0.75	**0.96**
NL	1.00	0.99	0.98	0.93	0.89	0.82	0.74	0.63	0.53	0.40	0.31	0.21	0.17	0.19	**0.79**
PL	0.99	0.96	0.97	0.90	0.86	0.82	0.75	0.71	0.64	0.59	0.53	0.45	0.41	0.39	**0.81**
PT	0.97	0.98	0.95	0.94	0.94	0.92	0.88	0.86	0.80	0.76	0.73	0.64	0.63	0.55	**0.90**
RO	0.96	0.93	0.96	0.91	0.86	0.88	0.83	0.73	0.71	0.76	0.66	0.58	0.57	0.51	**0.84**
SE	0.98	0.99	0.95	0.88	0.76	0.69	0.55	0.41	0.38	0.21	0.20	0.16	0.13	0.04	**0.66**
SI	0.99	0.98	0.99	0.96	0.96	0.94	0.92	0.90	0.85	0.78	0.73	0.67	0.67	0.55	**0.93**
SK	0.96	0.97	0.96	0.96	0.95	0.91	0.86	0.90	0.84	0.82	0.71	0.60	0.61	0.55	**0.91**
Total	**0.98**	**0.97**	**0.95**	**0.92**	**0.87**	**0.82**	**0.77**	**0.72**	**0.65**	**0.60**	**0.53**	**0.46**	**0.40**	**0.35**	**0.81**

Note: "Children" are identified as respondents with a father and/or mother identifier in the household survey. Blue shading in the table indicates an average decline (computed as a moving average over 3 age intervals) of more than 5% between consecutive ages. This decline can be considered a proxy for the initiation of the process of leaving the family home.

Figure A2. Average age of cohabiting children and their number, EU-SILC 2019.

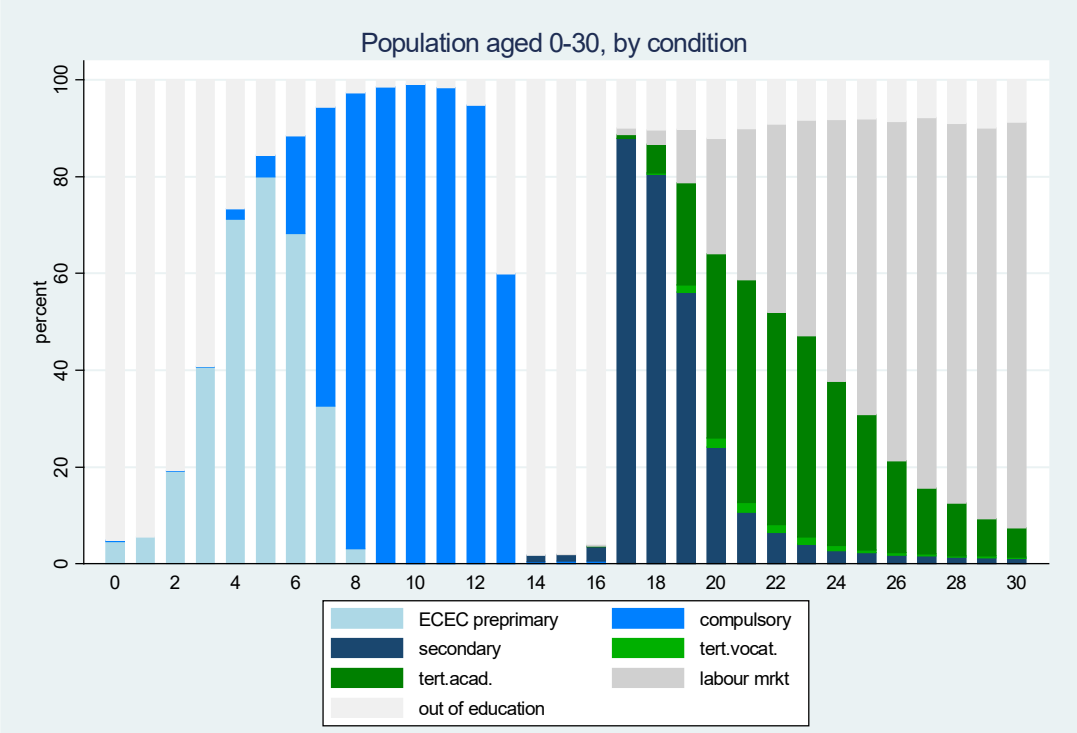


Note: The figure shows the population restricted to age lower than 30. Source: Authors' elaboration using Stata.

Annex 3. Data imputation of educational status between 13 and 16 years old

Figure A3 reports the distribution of conditions based on the type of education currently attended (question PE020) and age in the 2019 EU-SILC survey. As evident from the figure, EU-SILC presents a significant criticality for educational analyses due to the absence of information pertaining to children aged between 13 and 16. To be more precise, while data related to age 13 is not entirely absent, the substantial presence of missing data forces us to impute a significant portion of this data as well. This constitutes the primary challenge to estimate the education attainment.

Figure A3. Educational and labour status by age, EU-SILC 2019



Note: The figure illustrates the percentages of the population categorised by the educational stage currently attended or (question PE020) or their labour status (question RB210). These percentages are reported for each age group within the population, covering individuals between the ages of 0 and 30. Source: Authors' elaboration conducted using Stata, based on data from EU-SILC 2019.

To address this lack of data, we have imputed the individual probability of school attendance based on the available data. These estimates are computed on a country-by-country basis, employing data from nearby age groups as reference (ages 10-12 and age 17). We employed separate models by country for the imputation of the enrolment probability.

Equation (3) describes the model in detail:

$$\Pr(y_{ij} \neq 0 \,|x_i) = \phi(x_{ij}\beta) \quad \forall\, j \in C \quad (7)$$

Where ϕ is the standard cumulative normal and y_i is equal to 1 when the student *i* is enrolled to school. The vector of controls, x_i, encompasses several student information: gender, parental presence, parental education, occupation, citizenship, (log of) household income (aggregated across household members), and the ability to meet financial needs. As described in (3) the model is estimated for each country, *j*, in our sample.

We also considered two alternative models that do not estimate the model by country. Instead, they analyse the entire sample by employing fixed effects (the first alternative model) and random effects (the second alternative model). However, we opted for the model described in equation (3) as our preferred choice. Indeed, this model allows for a more flexible use of the available data and can provide more precise adjustments for country-specific factors and individual variations.

The results of the enrolment probability based on model described in equation (3) for ages 13, 14, 15, and 16 are presented in Table A10. The table also includes the probabilities generated by the two alternative models. Not surprisingly, there is a strong correlation between the preferred model and the alternative model using fixed effects, while a lower correlation is observed between the main model and the one employing random effects.

Table A10. Estimated attendance rates, by year and country, SILC 2019

country code	model	age group			
		13	14	15	16
	by country	**0.991**	**0.982**	**0.976**	**0.987**
AT	fixed effect	0.971	0.953	0.935	0.922
	random effect	0.957	0.941	0.922	0.904
	by country	0.965	0.97	0.971	0.97
BE	fixed effect	0.962	0.944	0.928	0.911
	random effect	0.955	0.938	0.918	0.895
	by country	0.983	0.988	0.984	0.992
BG	fixed effect	0.983	0.965	0.949	0.931
	random effect	0.944	0.924	0.9	0.872
	by country	0.979	0.991	0.988	0.99
CY	fixed effect	0.978	0.96	0.94	0.925
	random effect	0.956	0.938	0.914	0.891
	by country	0.999	0.996	0.994	0.998
CZ	fixed effect	0.986	0.968	0.951	0.935
	random effect	0.955	0.939	0.918	0.895
	by country	0.656	0.668	0.665	0.669
DE	fixed effect	0.668	0.653	0.636	0.619
	random effect	0.96	0.947	0.93	0.907
	by country		0.991	0.997	0.992
DK	fixed effect	0.985	0.968	0.95	0.934
	random effect	0.964	0.95	0.931	0.911
	by country	0.992	0.993	0.992	0.992
EE	fixed effect	0.983	0.965	0.948	0.932
	random effect	0.955	0.937	0.918	0.896
	by country	0.933	0.932	0.931	0.931
EL	fixed effect	0.925	0.906	0.891	0.872
	random effect	0.951	0.932	0.913	0.884
	by country	0.992	0.972	0.971	0.971
ES	fixed effect	0.964	0.947	0.929	0.912
	random effect	0.953	0.936	0.915	0.89
	by country		0.967	0.971	0.966
FI	fixed effect	0.968	0.951	0.935	0.917
	random effect	0.959	0.945	0.928	0.904
	by country	0.962	0.961	0.961	0.963
FR	fixed effect	0.953	0.935	0.919	0.904
	random effect	0.952	0.935	0.915	0.894
	by country	0.988	0.987	0.988	0.988
HR	fixed effect	0.984	0.966	0.948	0.932
	random effect	0.948	0.93	0.905	0.881
	by country	0.941	0.939	0.943	0.945
HU	fixed effect	0.939	0.92	0.904	0.888
	random effect	0.946	0.926	0.905	0.878
	by country	0.956	0.961	0.965	0.966
IE	fixed effect	0.961	0.944	0.928	0.91
	random effect	0.955	0.939	0.921	0.894

	by country	0.894	0.896	0.892	0.89
IT	fixed effect	0.887	0.871	0.852	0.837
	random effect	0.953	0.938	0.916	0.894
	by country	0.958	0.963	0.962	0.959
LT	fixed effect	0.99	0.974	0.957	0.94
	random effect	0.952	0.937	0.917	0.892
	by country	0.832	0.84	0.834	0.837
LU	fixed effect	0.831	0.813	0.798	0.78
	random effect	0.955	0.938	0.922	0.894
	by country	0.981	0.979	0.98	0.982
LV	fixed effect	0.972	0.953	0.937	0.917
	random effect	0.953	0.935	0.915	0.885
	by country	0.681	0.69	0.697	0.687
MT	fixed effect	0.668	0.652	0.634	0.618
	random effect	0.952	0.936	0.915	0.891
	by country	0.959	0.96	0.959	0.959
NL	fixed effect	0.959	0.943	0.924	0.909
	random effect	0.959	0.946	0.925	0.905
	by country	0.957	0.956	0.956	0.952
PL	fixed effect	0.944	0.926	0.91	0.891
	random effect	0.951	0.934	0.914	0.885
	by country	0.998	0.998	0.997	0.997
PT	fixed effect	0.995	0.976	0.959	0.941
	random effect	0.949	0.93	0.909	0.879
	by country	0.913	0.902	0.902	0.9
RO	fixed effect	0.895	0.876	0.86	0.842
	random effect	0.948	0.929	0.908	0.879
	by country	0.978	0.974	0.976	0.977
SE	fixed effect	0.972	0.955	0.939	0.922
	random effect	0.957	0.941	0.924	0.901
	by country	0.998	0.997	0.997	0.996
SI	fixed effect	0.991	0.974	0.957	0.94
	random effect	0.955	0.939	0.92	0.896
	by country	0.927	0.987	0.987	0.986
SK	fixed effect	0.977	0.958	0.944	0.925
	random effect	0.949	0.929	0.912	0.883
SILC 2019 average	**by country**	0.934	0.953	0.953	0.951
	fixed effect	0.943	0.926	0.908	0.89
	random effect	0.953	0.937	0.917	0.892

Note: the first value in bold corresponds to the estimate country by country (the one adopted in building the educational achievement); the second value corresponds to the country fixed effect and the third value to the country random effect. In all cases the probit model includes as regressors gender, age, number of children in the family, log of equivalised household market income, ability to make ends meet, whether the father and/or the mother work, whether the father and/or the mother are absent, the highest educational attainment among the parents and whether the father and/or the mother are foreign born. The estimate is restricted to the age 10-12 +17. In the case of Luxemburg it was necessary to impute the data for 12 year old children, since it was also missing: the imputed value is 0.815. In addition data for Malta provides individual age at quinquennial interval: thus the imputed value is uniformly distributed across missing years. In the case of Denmark, there is no prediction at the age of 13 because the country was reporting some information about what the children were attending at that age. The values of the first and the second models are highly correlated (0.80), while the correlation between the first and the third is much lower (0.31). Source: Authors' elaboration using Stata.

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