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Exploring the Link Between Education Length and Employment Outcomes among Youth in Europe: A Hierarchical Clustering Approach

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Abstract

Background: As the world rapidly evolves, digitalisation continues, and artificial intelligence is used, it is crucial to understand how education systems are preparing future generations to succeed in this very dynamic environment where there is a tremendous demand for skilled workers. **Objectives:** This paper analyses similarities and differences between European Union Member States regarding the educational attainment of young adults and their performance in the labour market. **Methods/Approach:** Ward's cluster method in hierarchical cluster analysis for output and outcome indicators of young adult education systems is used for two selected years: 2012 and 2021. **Results:** Belgium, Cyprus, Denmark, France, Ireland, Latvia, Lithuania, Luxembourg, and the Netherlands have the highest average percentage of young adults with tertiary education in 2021. On the other hand, Belgium, Bulgaria, Hungary, Ireland, Lithuania, Malta, Poland, and Romania have the highest average employment and income benefits of tertiary education for young adults. **Conclusions:** The average share of 25-to 34-year-olds with tertiary education increased significantly in the EU-27 between 2012 and 2021, partly due to higher demand for skilled workers in labour markets. Higher levels of education are generally associated with better employment opportunities and higher wages. However, there are large differences across EU economies. The results can help governments and education policymakers design future policies and provide insights into cross-country comparisons.

Keywords: cluster analysis; educational attainment; labour market outcomes; tertiary education; young adults

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Introduction

With the huge influx of new technologies and the emergence of artificial intelligence, it is important to understand how different industries and sectors see the need for change in education systems and what their expectations are in this regard. We see that the world is rapidly evolving, digitalisation is advancing, and AI is coming into play and replacing some jobs. The skills people need to master to be successful are changing, and the demand for manual and routine cognitive skills is decreasing. Can education systems prepare future generations to succeed in this dynamic environment with a massive demand for skilled workers?

Data show that the average share of 25-to 34-year-olds with tertiary education in the EU-27 increased from 36.2% in 2012 to 44.4% in 2021 (Eurostat, 2023a). It is critical that higher education is of high quality and relevance and that it provides students with knowledge and skills that will enable them to succeed upon graduation.

In this paper, we were interested in trends related to the higher education of young adults in EU member states and the economic benefits of higher education. In this study, these economic benefits are limited to labour market outcomes. Using a cluster analysis for 2012 and 2021, this paper examines how countries in the EU cluster with respect to the educational and labour market status of young adults with higher education. Higher levels of education are generally associated with better employment opportunities and higher wages.

The OECD's Education Glance 2022 report inspired this study, providing a wide range of indicators on the current state of education systems in member and partner countries, looking at outcomes, the impact of education systems, participation and progress within education institutions, and inputs into education systems or learning environments. The focus is on the rise of tertiary education and its associated benefits (OECD, 2023).

We were interested in analysing the similarities and differences among EU member states in terms of output and outcome indicators of their education systems. According to the OECD report, output indicators examine the characteristics of those who leave the education system, such as their educational attainment. In contrast, outcome indicators examine the direct effects of the output of the education system, such as employment and income benefits that result from continuing higher education (OECD, 2012). For this reason, we applied Ward's cluster method in hierarchical cluster analysis to two groups of variables in two selected years. To our knowledge, this is the first work to group EU economies using the chosen indicators linking educational attainment and economic opportunities for young adults with actual data, including trends. Unlike OECD's Education Glance 2022 report (2023), our study covers all EU member states using a hierarchical cluster analysis approach.

The first group of indicators provides information on the characteristics of young adults from the perspective of educational attainment through the indicators that measure their educational attainment and trends in tertiary education. This group of indicators includes the ratio between the share of graduates in business, administration, and law and the share of graduates in STEM to track the development of tertiary education. According to human capital theory (Becker, 1962; Rosen, 1976), higher levels of education improve status in the labour market and lead to greater wealth. Therefore, we also include an indicator that measures the proportion of 15-29-year-olds who are still in education. Young people who are neither in education nor employment and training (NEETs) are of great policy importance for many reasons, which is why two indicators for NEETs were selected.

Depending on the available data, a second set of indicators was selected to provide information on the participation of young people with tertiary education in

the labour market and to identify similarities and differences across EU-27 countries in analysing the benefits of higher levels of education in terms of better labour market performance. The idea of conducting a cluster analysis in two years stems from the objective of identifying trends in selected indicators and the movement of countries from one cluster to another.

Using cluster analysis for the years 2012 and 2021, this paper examines how countries in the EU cluster are concerned with the educational and labour market status of young adults with tertiary education. Considering the already mentioned background, the following reasons also speak for the choice of these two years. Raising the educational attainment of the workforce was one of the priorities of the 2020 targets of Europe, as the EU considers a highly skilled European workforce essential to maintaining global competitiveness and fostering economic growth and prosperity (Cedefop, 2013). On average, the EU has met its target, but there are significant discrepancies between countries, as noted and predicted by Dragomirescu-Gaina et al. (2015), Rodríguez-Pose et al. (2009), and Vandeplas (20121). Moreover, in 2000, the European Union set itself a new strategic goal under the Lisbon Strategy, namely, to make the Union the most competitive and dynamic knowledge-based economy in the world - an economy capable of sustainable economic growth. One of the prerequisites for achieving the goals the EU set itself in Lisbon is certainly investment in education and training. We thought that the 10-year period would be sufficient to identify trends. However, because some data for the indicators we selected were not available in 2011 due to the specific age group we studied, 2012 was selected. During this period, most countries implemented certain education reforms.

The remainder of the paper is organised as follows. The second section reviews previous studies on the relationship between educational attainment and the labour market. The third section presents the data and methods used, and the fourth section provides insight into the main results of the empirical research. The final section is the conclusion.

Literature review

Trends in European Union countries indicate an increase in the length of education. The average share of 25-to 34-year-olds with tertiary education in the EU-27 increased from 36.2% in 2012 to 44.4% in 2021 (Eurostat, 2023a). The OECD (2023) emphasises that labour market outcomes by educational attainment are among the most important measures that link education to individuals' economic opportunities and help answer the question of how educational attainment affects labour market participation. While human capital theory explains that higher levels of education improve labour market status and lead to greater prosperity, developing countries show that they are unable to absorb larger numbers of highly skilled workers, leading to higher unemployment and higher employer expectations. So, is promoting higher education always the best policy for increasing economic growth in every country? The COVID-19 pandemic has shown that adults with higher levels of education are more resilient to change, especially changes that include digitalisation (OECD, 2023; Pejic Bach et al., 2023). Furthermore, Zeqiri et al. (2022) surveyed student satisfaction and gender-related anxiety during the COVID-19 pandemic. It has been shown that the interaction between student and teacher, technology use, and student engagement has a positive influence on student satisfaction.

The relationship between education and labour market outcomes has been studied before but from different perspectives. There is evidence in the literature of positive and negative correlations between educational attainment and labour

market status in different countries. Several hypotheses explain why both positive and negative correlations occur. The human capital theory, originally developed by Becker (1962) and Rosen (1976), assumes that individuals have certain productive skills that are used to generate income, and education and training are investments that can increase productivity. Higher productivity leads to higher wages, higher labour supply, and thus better health for individuals (Meara et al., 2007) and consequently economic growth.

In contrast, the signalling theory (Spence, 1973) states that highly educated individuals have higher wages because educational attainment creates credentials that employers view as a good sign of employees' abilities rather than actual skills acquired. Opportunity cost theory states that in times of higher unemployment, the opportunity cost of further education is low, and the level of education increases. Similarly, the 'parking lot' hypothesis states that in times of economic stagnation and recession, when there is a lack of employment opportunities, education serves as a 'parking lot' for students to continue their education with a higher degree or qualification. The term was originally coined by Barbagli (1982) and further elaborated by Ballarino et al. (2013).

Kodde (1988) analysed Dutch data and showed that high unemployment does not induce young people to pursue additional education but motivates them to continue their education to improve their skills and employment prospects. A brief literature review on the relationship between education and labour market outcomes is provided by Ionescu (2012). The mechanisms by which education affects labour market outcomes are as follows: the number of years of schooling (positively related to higher earnings), educational attainment (higher educational attainment leads to better occupational status than lower educational attainment), attainment of a particular degree (higher educational attainment improves a worker's impression and employability), involvement of the education system in the school-to-work transition, Investment in education (increases human capital), quality of schooling, individual educational pathway, parents' educational pathway, type of curriculum (the presence of apprenticeships increases graduates' employability), and sector (in the private sector, education is more strongly related to productivity than in the public sector).

A further overview of the relationship between education and the labour market can also be found in (Masárová et al., 2022). The work of Ionescu (2012) further focuses on the study of access to education and labour market outcomes in 32 European countries, including the United States and Japan. The author found that higher levels of education increase the chance of finding and keeping a job in times of crisis but that higher participation in education is not necessarily associated with higher employment rates. The author concludes that investment in education primarily promotes positive labour market outcomes (employment, earnings) rather than reducing negative ones (unemployment). These results are also found in Diaconu (2014) for the case of Romania. The author found that higher levels of education lead to better employment opportunities and higher incomes. The study on the employability of graduates in Latvia (Jaunzeme and Busule, 2022) showed that a high percentage of graduates are employed within one year after graduation (88%) and that 80% are employed in highly skilled positions. Employability increases with years after graduation. This motivated us to detect countries with similar labour market outcomes and find similarities between their policies and socioeconomic development.

However, many determinants may play a role in the relationship between educational attainment and labour market status. Iannelli (2002) found a positive

impact of parental education on the higher education and labour market outcomes of young people in Eastern European countries, which is less pronounced in Western European countries and almost absent in Nordic countries. Oswald-Egg and Renold (2021) found that university graduates with work experience have better labour market prospects. They found that university graduates with work experience gained through vocational training earn significantly better starting salaries and find their first job more quickly. The results of Masárová et al. (2022) show the regional differences in the analysis of the educational level and employment status but highlight that the employment rate of individuals with higher education is higher than that of individuals with lower educational level.

Developing countries, however, are a special case in terms of the relationship between education and labour market outcomes. Although these countries should promote higher education to drive economic growth, their markets cannot absorb the increasing number of highly skilled graduates, leading to higher unemployment among higher-skilled workers and lower wages. This shows that education needs to be controlled for the sake of countries' development. In connection with this finding, Jovović et al. (2017) confirmed that a mismatch between education supply and labour market demand can have a significant impact on economic growth. The need to integrate education and economic policies is also highlighted by Erdem and Tugcu (2012), as their research shows that a higher rate of college graduates in Turkey increases unemployment because the labour market is unable to absorb a larger number of highly skilled workers. Success in the labour market also depends on the field of study. A study by Żyra and Shevchuk (2012) showed that in Poland, the expansion of students in humanities, economics and business, and engineering could be one of the reasons behind the higher unemployment rate, which was not the case for science/mathematics studies. The importance of the fields of study on labour market success was confirmed by Hojda et al. (2022).

Andrejević Panić and Lozanov-Crvenković (2019) investigated higher education indicators coherency in Central and Eastern Europe. They have observed the relationship between the average number of years of schooling that the education system offers to the eligible population and government expenditures on research and development in higher education, government expenditures on higher education, and government expenditures on higher education institutions. The unbalanced panel analysis included data for those variables for five countries (Bulgaria, Hungary, Romania, Slovakia, and Serbia) in the period from 2002 to 2012, resulting in models that show functional links between government expenditure and efficiency.

Tudor et al. (2023) chose cluster analysis and the OLS method between clusters to investigate the influences between education and labour market outcomes in the EU in the context of sustainable development and investment in education at the country level in 2000 and 2021. The empirical results show that a cluster of countries with the lowest investment in education is characterised by a negative impact of educational dropouts on employee compensation, the number of hours worked by each employee, and labour productivity. In contrast, the group of countries with high levels of investment in education shows that a university degree and participation in vocational training programs lead to higher wages and higher productivity. At the same time, government financial support for students reduces the number of hours worked, lowers unemployment among those with primary and secondary education, and increases the employment rate among university graduates. An average level of investment in education led to negative influences between workers' wage levels and real labour productivity, while participation in educational activities and vocational

training programs increased wage rates and real productivity. This approach is similar to ours, but Tudor et al. (2023) use different years for cluster analysis and other variables, including macroeconomic indicators such as education investment and GDP, while we focus only on the education variables identified and systematically tracked in the OECD Education Study.

Regarding the earning premium of tertiary education, the OECD data shows that in 22 EU countries that are OECD members - the premium for tertiary education in 2020 was about 38% (OECD, 2023). In 2020, 14 out of 22 EU OECD members (including the UK) were below the OECD average, while Hungary, Germany, the Czech Republic, Slovakia, Austria, the UK, Portugal, and Ireland were above the OECD average. On the EU level, the largest wage premium for a tertiary degree was observed in a set of Central and Eastern European countries (Romania, Hungary, Bulgaria, Poland, and Lithuania), as well as in Cyprus and Portugal. It appears that higher education pays off more in countries with relatively lower levels of tertiary education, where earning premium is more pronounced (Vandeplas, 2021).

This paper analyses the similarities and differences among EU member states in terms of output and outcome indicators of their education systems from the perspective of young adults. Additionally, it identifies similarities and differences across EU-27 countries in analysing the benefits of higher educational attainment in terms of better labour market performance for young adults. For this reason, we applied Ward's cluster method in hierarchical cluster analysis to two groups of variables in two selected years. The idea of conducting a cluster analysis in two years stems from the goal of identifying trends in selected indicators and the movement of countries from one cluster to another to provide the basis for future comparisons and more detailed analyses of education systems.

Data and methods

Data sources

Following the literature review conducted and based on the indicators proposed in the OECD report Education at a Glance 2022 (OECD, 2023), a careful selection of variables was made for the analysis. The full list of observed variables can be found in Table 1.

Data for all variables are collected for 27 European Union Member States: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

Educational attainment refers to the highest level of education completed by an individual field of study and is categorised according to ISCED Fields of Education and Training. According to the International Standard Classification of Education (Eurostat, 2023b), levels 0-2 include less than primary, primary, and lower secondary education, levels 3 and 4 include upper secondary or post-secondary non-tertiary education, and levels 5-8 include tertiary education.

The variables are divided into two groups: variables related to education and employment (Table 1).

Table 1
List of Observed Variables

Variable group	Variable	Variable code	Observed period	Source
Education-related variables	Tertiary educated population (25-34), in %	TEduc	2012, 2021	Eurostat (2023a)
	Educational attainment of 25- to 34-year-olds with tertiary education (in %) in relation to upper secondary or post-secondary non-tertiary education	EducA	2012, 2021	Eurostat (2023a)
	% of graduates in business, administration and law compared to STEM	BStem	2013, 2020	Eurostat (2023a)
	The participation rate of young people in education and training 15-29 (inc. NEETs)	PRate	2012, 2021	Eurostat (2023b)
	NEET rates, tertiary educated, age 15-29	NEETRate	2012, 2021	Eurostat (2023b)
	NEETs 15-29, unemployed/inactive	NEETUn	2012, 2021	Eurostat (2023b)
Employment-related variables	Inactivity rate of tertiary educated 30-34	IRate	2012, 2021	Eurostat (2023)
	Unemployment rates of 25- to 39-year-olds with tertiary education	URateT	2012, 2021	Eurostat (2023b)
	Unemployment rate of 25- to 39-year-olds with upper secondary or post-secondary non-tertiary education relative to those with tertiary education	URateTL	2012, 2021	Eurostat (2023b)
	Relative income of 18- to 64-year-olds with tertiary education in relation to upper secondary or post-secondary non-tertiary education	Earn	2013, 2021	Eurostat (2023a)
	The employment rate of 30-34-year-olds with tertiary education	ERateT	2012, 2021	Eurostat (2023a)
	The employment rate of 30- to 34-year-olds with tertiary relative to those with upper secondary or post-secondary non-tertiary education	ERateTL	2012, 2021	Eurostat (2023a)

Source: Authors' work

Education-related variables

Variables related to education represent the output indicators of the education system for young adults (25-34 years old) (OECD, 2023). In case we could not find data for 25-34-year-olds for the European Union Member States, we chose the age group that is closest and for which data are available. Selected variables are:

- The variable TEduc is the percentage of the population aged 25-34 with completed tertiary education.
- The EducA variable is the ratio of the percentage of 25-34-year-olds with tertiary education to the percentage of individuals with upper secondary and post-secondary non-tertiary education in the same age group.
- The BStem variable is the ratio of the percentage of graduates in business, administration, and law compared to graduates in STEM. It is used to observe similarities between countries with similar BStem rates.
- The PRate variable indicates the percentage of 15- to 29-year-olds still in education and training as a percentage of all 15- to 29-year-olds, including those not in education, training, or employment (NEETs). This is an indicator of

the percentage of people continuing their education above the secondary level.

- However, young people aged 15 to 29 who are not in education, employment, or training (NEETUn) are of great policy concern (OECD, 2023), as this occupational status can have several long-term consequences. The status of a NEETUn has a negative impact on labour market prospects and social outcomes, even in the long run.
- The NEETRate variable shows the percentage of NEETs with tertiary education in the 15-29 age group. Although NEET has negative consequences regardless of the reasons that led to it, one can become NEET due to inactivity or lack of opportunities (employment and education), which makes a difference in economic policies. The large differences between the percentage of unemployed and inactive NEETs in the analysed EU countries are captured by the variable NEETRate, which measures the ratio between the percentage of unemployed and inactive NEETs in the population aged 15-29.

Employment-related variables

Variables related to employment refer to the labour market outcomes of the education system for young adults. The OECD (2023) emphasises that labour market outcomes by educational attainment are among the most important measures that link education to individuals' economic opportunities and help answer the question of how educational attainment affects labour market participation. Depending on the available data, the following three indicators were selected to provide information on the labour market participation of young people with tertiary education in the EU-27 in 2012 and 2021. Variables are as follows:

- The inactivity rate of 30-34-year-olds with tertiary education (IRate) is the proportion of persons neither working nor actively looking for a job among 30-34-year-olds with tertiary education.
- The unemployment rate of 25-39-year-olds with tertiary education (URateT) as the ratio of unemployed 25-39-year-olds with tertiary education to the labour force of 25-39-year-olds with tertiary education.
- The employment rate of 30-34-year-olds with tertiary education (ERateT) as the ratio of employed 30-34-year-olds with tertiary education to the working age population of 30-34-year-olds with tertiary education.

Three additional indicators were added to identify similarities and differences across EU-27 countries in analysing the benefits of higher educational attainment in terms of better labour market performance:

- The analysis of the relationship between individuals' education and their labour market outcomes is concluded with the most recent indicator, which examines the income benefits of education by comparing and relating the mean net income of 18- to 64-year-olds with tertiary education to that of the same age group with upper secondary or post-secondary non-tertiary education (Earn).
- The variable compares the employment rates of 30-34-year-olds with tertiary education with those of 30-34-year-olds with upper secondary or post-secondary non-tertiary education and reports their ratio (ERateT).
- The indicator completes the analysis by relating the unemployment rate of 25 to 39-year-olds with upper secondary or post-secondary non-tertiary education to the same age group with tertiary education (URateTL).

Statistical analysis

First, the statistical descriptive analysis of the observed variables is performed separately for each observed year, and the results are compared. After the initial insight into the variables, all variables are standardised, and the hierarchical cluster analyses are performed. The hierarchical cluster analysis is based on Ward's cluster method or Ward's minimum variance cluster method. In Ward's cluster method, all objects, in this case, the observed countries, represent a cluster. In each subsequent step, Ward's cluster method searches for a pair of clusters so that the increase in total variance within the cluster is minimised after the merger (Murtagh & Legendre, 2014). Hierarchical cluster analysis also uses squared Euclidean distances as a measure of distance or dissimilarity (Hossain & Abufardeh, 2019). Two hierarchical cluster analyses are performed for each variable group. One hierarchical cluster analysis is performed for the year 2012, while the second analysis is performed for the year 2021. The optimal number of clusters and cluster memberships will be determined based on the dendrograms created. However, to compare cluster memberships and hierarchical cluster analysis results between two observed groups of variables and two observed periods, the dendrograms are used to determine only an optimal number of clusters in all hierarchical analyses performed. Finally, parallel coordinate plots are used to compare cluster properties using the mean values of the observed variables.

Due to some missing data, the values of the corresponding variables for the closest year were used as approximations. However, we believe that such an approach did not significantly affect the structure of the clusters.

Results

Education-related variables

Table 2 shows the descriptive statistics results for the education-related variables. The results are based on data from 2012 and 2021, although it should be emphasised that due to the lack of data in 2012 and 2021 for the variable BStem, data from 2013 and 2020 were used as estimates for those years.

According to the results presented in Table 2, the average share of 25-34-year-olds with tertiary education in the EU-27 increased from 36.2% in 2012 to 44.4% in 2021. This increase was highest in Austria, from 22.8% to 42.4%. Countries with a larger increase are Portugal, Croatia, Malta, and Slovakia, while only Romania shows a slight decrease. In 2021, Luxembourg and Ireland stand out with over 60%, Cyprus, Lithuania, and the Netherlands with over 50% of the share of 25-34-year-olds with tertiary education. The lowest share of 25-34-year-olds with tertiary education in 2021 was recorded in Romania and Italy, with less than 30%. The ratio between the percentage of 25-to 34-year-olds with tertiary education and the percentage of the same age group with completed upper secondary or post-secondary non-tertiary education (EducA variable) recorded the strongest increase among the observed variables.

The BStem variable, which tracks trends in tertiary education, also shows a slight increase in the percentage of graduates in business, administration, and law relative to the percentage of graduates in STEM in the EU average (from 98 to 102) despite the increasing global popularity of STEM in recent years. About the same proportion of students, on average, graduate with degrees in business, administration and law, and STEM. There are significant differences between countries, however, with this share varying from 34% in Cyprus in 2021 to 172% in Sweden. The increase in popularity of STEM compared to business, administration, and law was most pronounced in Malta, Cyprus, and Greece in 2021 compared to 2012. Cyprus, Malta, and Luxembourg

recorded almost twice as many STEM graduates as graduates in business, administration, and law in 2021, while the share of graduates in business, administration, and law was highest in Sweden, Slovenia, and Finland in 2021 compared to STEM. Croatia recorded the largest increase in graduates in business, administration, and law compared to STEM.

Table 2
Descriptive Statistics of education-related variables A, n=27 European Union Member States

Statistics	Year	Variable					
		TEduc	EducA	Bstem*	PRate	NEETRate	NEETUn
Average	2012	36	85	98	52	13	120
	2021	45	113	102	54	9	65
Standard deviation	2012	9	38	38	7	7	69
	2021	10	50	35	7	5	33
Coefficient of variation	2012	25	44	39	14	56	58
	2021	22	44	34	13	54	50
Minimum	2012	23	35	39	41	4	56
	2021	23	40	34	42	3	25
Maximum	2012	54	166	172	71	38	283
	2021	63	237	172	66	27	152

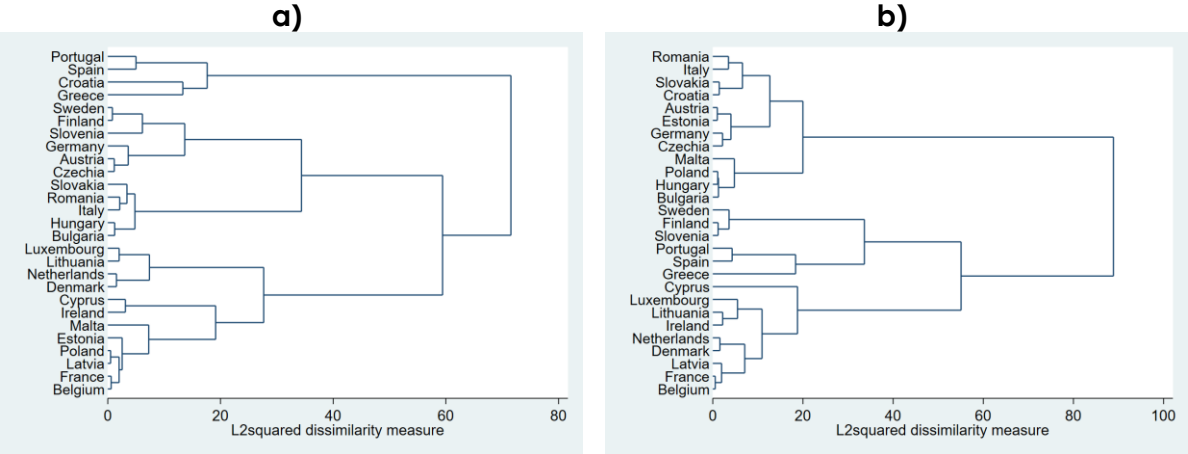
*Note: * Data from 2013 and 2020 were used.*
Source: Authors' work

The participation rate of young people aged 15-29 still in education and training (variable PRate) increased by 2 percentage points on average in the EU between 2012 and 2021, reaching 54% in 2021. Thus, slightly more than half of young people aged 15-29 participated in education and training in both years. In 2021, compared to 2012, the largest increases were in Ireland (37%), Greece (20%), Bulgaria, and Spain (19%), while the largest decreases were in Lithuania. Some positive trends can also be observed in the statistics from NEETs. The percentage of tertiary educated NEETs (NEETRate) decreased by an average of 4 percentage points in the EU between 2012 and 2021 and was 9% on average. The ratio between the percentage of unemployed and inactive NEETs (NEETUn) also decreased significantly over the observed period, indicating that more young people are 'NEET' because they are inactive rather than because they cannot find a job. It can also be observed that the highest data variability is in 2012 for the variable NEETUn, while the situation changes completely in 2021, where the highest variability is found for the variable EducA, indicating changing trends and the popularity of tertiary education in EU Member States. On the other hand, the lowest data variability in both years seems to be for the variable NEETRate.

The dendrograms of the performed hierarchical cluster analyses, using Ward's clustering method, and squared Euclidean distances, based on the variables related to employment in 2012 and 2021, are shown in Figure 1. A comparison of the two resulting dendrograms showed that the optimal number of clusters in both cases should be 4.

Table 3 provides cluster averages for various education-related variables across two time points (2012 and 2021) within the European Union member states. It employs hierarchical clustering using Ward's method and squared Euclidean distances.

Figure 1
Dendrograms, Hierarchical Clustering, Ward's Method, Squared Euclidean Distances, n = 27 European Union Member States, k = 6 Variables related to employment A: **a)** 2012 **b)** 2021



Source: Authors' work

Table 3
Cluster Averages, Hierarchical Clustering, Ward's Method, Squared Euclidean Distances, n = 27 European Union Member States, k = 6, education-related variables

Year	Cluster	Variable					
		TEduc	EducA	Bstem*	PRate	NEETRate	NEETUn
2012	1	32	94	130	50	24	270
	2	33	61	134	57	8	89
	3	26	46	86	45	17	84
	4	43	109	74	52	11	100
2021	1	47	143	123	59	16	137
	2	46	102	154	65	5	69
	3	36	73	105	49	10	50
	4	55	160	73	55	8	60

*Note: * Data from 2013 and 2020 were used.*
Source: Authors' work

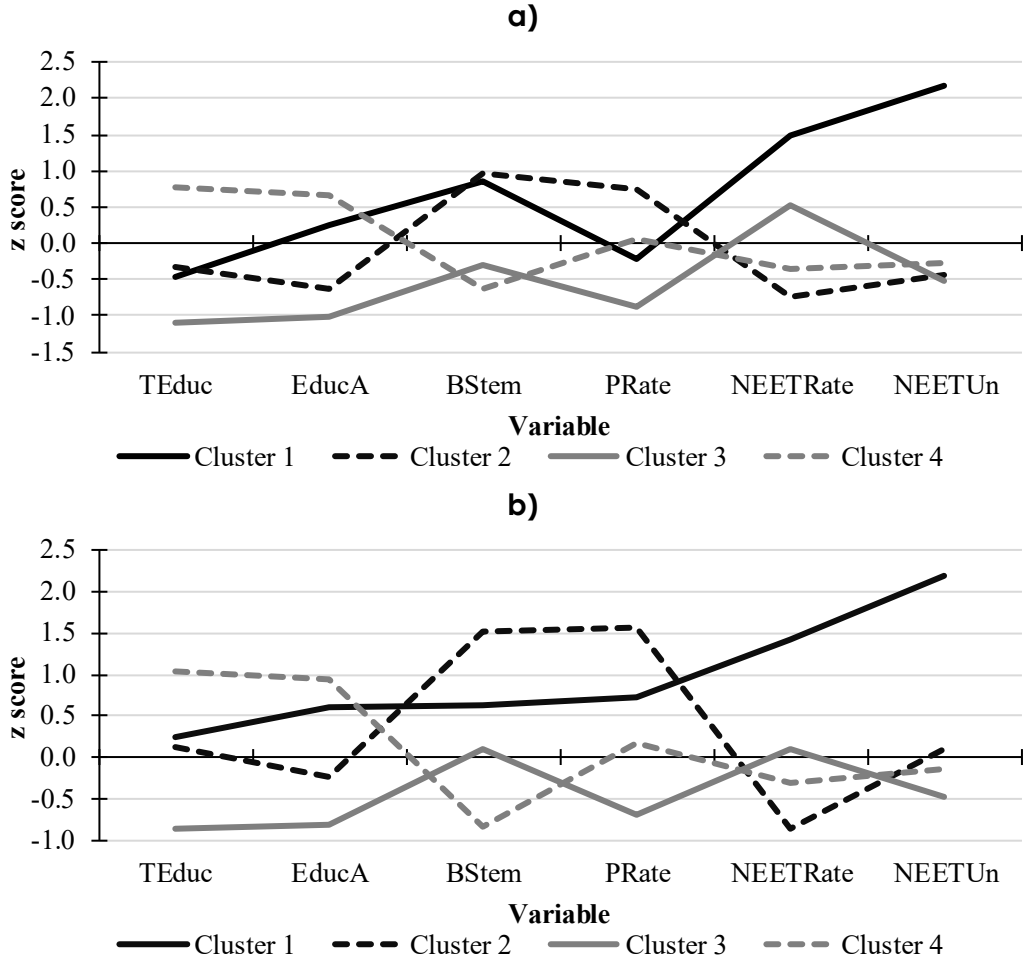
Figure 2 shows parallel coordinates plots for the hierarchical cluster solutions with four clusters in 2012 and 2021. Each line represents an average standardised value of countries that are placed in the same cluster for all observed education-related variables.

Table 4 contains the cluster members for each formed cluster in both observed years and the country allocated to each cluster. In general, most countries remained within the same cluster in 2021 compared to 2012.

According to the hierarchical cluster analysis performed, cluster 1 in 2021 includes Greece, Portugal, and Spain, with a relatively high proportion of 25- to 34-year-olds with higher education. Almost every second citizen aged 25-34 has a tertiary education (about 47%). On average, 43% more 25- to 34-year-olds have a tertiary degree than the same age group with upper secondary or post-secondary non-tertiary education. Young people's participation rates in education and training increased on average compared with 2012, placing them among the economies with relatively higher participation rates in education and training among 15- to 29-year-olds. These countries had significantly higher shares of unemployed to inactive NEETs, averaging 137% in 2012. Members of this cluster also had a higher proportion of graduates in business, administration, and law compared to STEM. In 2020, there were,

on average, 23% more graduates in business, administration, and law than in STEM. However, the proportion of NEETs with tertiary education is relatively high in the 15-29 age group. 16% of 15-29-year-olds with tertiary education were, on average, neither in education nor in employment.

Figure 2
Parallel Coordinates Plot, Hierarchical Clustering Members, Standardised Values, k = 6 education-related variables: **a)** 2012 **b)** 2021



Source: Authors' work

Cluster 2 in 2021 consists of Finland, Slovenia, and Sweden, in contrast to 2012, when Austria, the Czech Republic, and Germany were also members. Over nine years, the share of 25-34-year-olds with tertiary education has increased significantly, averaging 46% in 2021. Almost half of the subpopulation of 25- to 34-year-olds in these countries had a tertiary degree on average. Compared to STEM, these economies had the highest proportion of tertiary graduates in business, administration, and law and had the highest participation of young people in education and training. Also, economies in this cluster were characterised by the lowest average share of NEETs with tertiary education in the 15-29 age group in 2012, averaging 5%.

Cluster 3 is characterised by the relatively lowest share of 25- to 34-year-olds with tertiary education in both years studied. Although this cluster consisted of five economies in 2012 (Bulgaria, Hungary, Italy, Romania, and Slovakia), it expanded in 2021 with the addition of Austria, Croatia, the Czech Republic, Estonia, Germany, Malta, and Poland to the existing countries. In these economies, the subpopulation of

25- to 34-year-olds with upper secondary or post-secondary non-tertiary education predominates on average compared to 25- to 34-year-olds with tertiary education. In 2021, there were about the same number of graduates in business, administration, and law as in STEM. The proportion of NEETs with tertiary education in the 15-to-29-year-old age group was relatively high on average in both years.

Table 4
Cluster Members, Hierarchical Clustering, Ward's Method, Squared Euclidean Distances, n = 27 European Union Member States, k = 6 Variables based on education-related variables

Cluster	2012		2021	
	# of countries	Cluster members	# of countries	Cluster members
1	4	Croatia; Greece; Portugal; Spain	3	Greece; Portugal; Spain
2	6	Austria; the Czech Republic; Finland; Germany; Slovenia; Sweden	3	Finland; Slovenia; Sweden
3	5	Bulgaria; Hungary; Italy; Romania; Slovakia	12	Austria; Bulgaria; Croatia; the Czech Republic; Estonia; Germany; Hungary; Italy; Malta; Poland; Romania; Slovakia
4	12	Belgium; Cyprus; Denmark; Estonia; France; Ireland; Latvia; Lithuania; Luxembourg; Malta; Netherlands; Poland	9	Belgium, Cyprus, Denmark, France, Ireland, Latvia, Lithuania, Luxembourg, Netherlands

Source: Authors' work

The results of the cluster analysis, when indicators are analysed for 2021, show that cluster 4, consisting of Belgium, Cyprus, Denmark, France, Ireland, Latvia, Lithuania, Luxembourg, and the Netherlands, has the highest average share of individuals with tertiary education aged 25-34 (55%), which is about 10 percentage points higher than the EU-27 average. The characteristics of the cluster remained relatively stable in 2021 compared to 2012, with a slight change in the structure of the cluster. In these countries, the share of unemployed to inactive NEETs is relatively lower. In 2021, there were, on average, 60% more 25-34-year-olds with tertiary education than the same age group with upper secondary or post-secondary non-tertiary education. Members of this cluster also have a higher proportion of tertiary graduates in STEM compared to business, administration, and law. In 2020, there were, on average, 27% more graduates in STEM than in business, administration, and law. The proportion of young people aged 15-29 in education and training is relatively low, averaging 55%, as is the proportion of NEETs with tertiary education in the 15-29 age group. 8% of 15-29-year-olds with tertiary education were neither in education nor training in 2021. Compared to 2012, the ratio of inactive to unemployed NEETs has increased, with inactive NEETs predominating. This is the case in all clusters except for Cluster 1, which consists mainly of economies with higher unemployment rates.

Employment-related variables

Table 5 shows the descriptive statistics results for the employment-related variables. The results are based on data from 2012 and 2021, although it should be emphasised that due to the lack of data in 2012 for the variable Earn, data from 2013 were used as estimates for those years.

Table 5
Descriptive Statistics of employment-related variables, n=27 European Union Member States

Statistics	Year	Variable					
		IRate	URateT	URateTL	Earn*	ERateT	ERateTL
Average	2012	8	7	170	141	85	110
	2021	8	5	166	138	88	109
Standard deviation	2012	5	5	59	14	6	8
	2021	4	3	43	16	4	6
Coefficient of variation	2012	62	70	35	10	7	7
	2021	45	66	26	12	5	5
Minimum	2012	3	2	95	115	74	96
	2021	5	2	73	111	76	94
Maximum	2012	23	25	333	175	95	128
	2021	22	17	240	178	94	119

*Note: * Data from 2013 were used.*
Source: Authors' work

On average, 88% of all 30-34-year-olds with tertiary education were employed in the EU-27 in 2021, ranging from 76% in Greece to 93.5% in Malta. This figure has increased by 2.5 percentage points since 2012. Compared to the employment rates of 30-34-year-olds with upper secondary, post-secondary non-tertiary education, we can see that the employment rate of 30-34-year-olds with tertiary education is higher on average by 9%, except for the Czech Republic and Luxembourg in 2021, where it is lower. This means that the subpopulation of 30-to 34-year-olds with lower educational attainment (upper secondary, post-secondary non-tertiary education) has higher employment rates in these two countries than the subpopulation with tertiary education. The difference is most significant in Italy, Ireland, and Greece. Interestingly, it was highest in Ireland in 2012, at 28%. The employment rate of 30–34-year-olds with tertiary education in 2021 compared to 2012 increased the most in Hungary (18%) and Slovakia (16%), while it decreased the most in Latvia and Luxembourg (by 3%) and Romania (by 2%).

Another important measure of labour force participation analysed is the share of 30-34-year-olds with tertiary education who are neither working nor actively looking for a job or their inactivity rate. This measure is critical when we consider, on the one hand, government spending on tertiary education and, on the other, the underutilisation of skills acquired in these subpopulations. Although the average inactivity rate of 30-34-year-olds with tertiary education has decreased from 8.42% in 2012 to 7.83% in 2021 in the EU-27 analysed, there are large differences between countries. The Czech Republic is at the top of the inactivity rates of 30-34-year-olds with tertiary education, with 22.3% in 2021, while Slovenia, Lithuania, and Malta have the lowest inactivity rates, with around 4.7%. The most significant decline from 2012 to 2021 was in Hungary, from 18.1% to 5.4%.

In 2021, the average unemployment rate for 25-39-year-olds with tertiary education in the EU-27 was 4.88%, while the average unemployment rate for 25-39-year-olds with upper secondary, post-secondary non-tertiary education was 7.43%, more than 2.5 percentage points higher. According to the data, this labour market indicator has the most extensive dispersion in both years. The highest unemployment rate for 25-39-year-olds with tertiary education was recorded in Greece in both years studied, at 25% in 2012 and 17% in 2021. Most EU economies experienced a decline in the unemployment rate in the subpopulation studied, except Germany, Luxembourg, Austria, Finland, and Sweden. The Czech Republic recorded the lowest

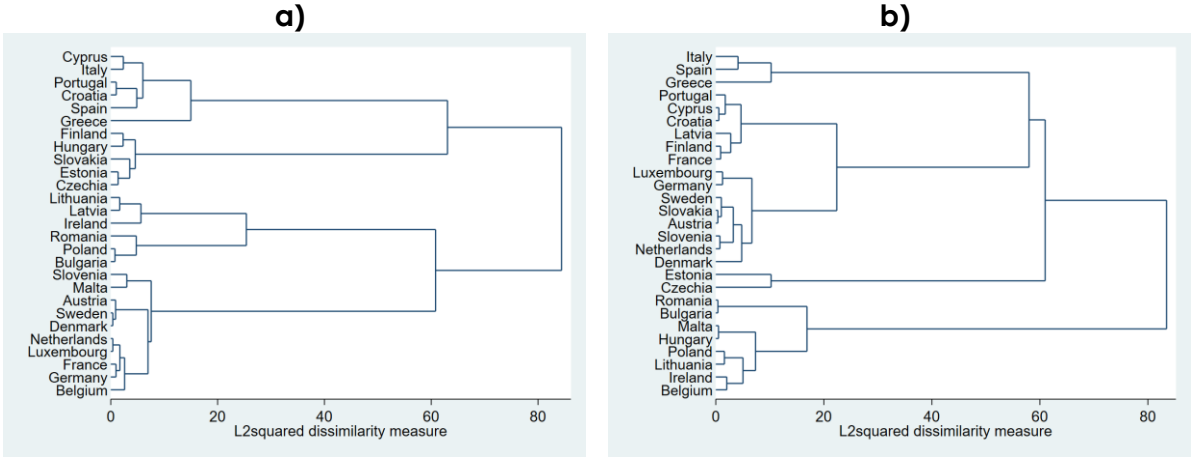
unemployment rate for the subpopulation studied, at 1.7%, Malta at 1.6%, and Poland at 2.1% in 2021.

The expectation that higher levels of education lead to better labour market outcomes is supported in part by data on the unemployment rates for 25-39-year-olds with upper-secondary or post-secondary non-tertiary education compared to the same measure for the same age group with tertiary education. These benefits of tertiary education are most pronounced in Belgium in 2021 (by 140%, or nearly 5 percentage points), Lithuania, Romania, Bulgaria, Poland, and Ireland. On the other side of the spectrum are EU economies where this difference is smallest, such as Greece, Germany, Luxembourg, and the Netherlands. Only in Denmark in 2021 was the unemployment rate higher among 25-39-year-olds with tertiary education than among the same age group with upper-secondary or post-secondary non-tertiary education.

In terms of relative earnings in 2021, 18- to 64-year-olds with tertiary education earn on average 37.69% more than the same age group with upper secondary, post-secondary non-tertiary education, ranging from 11% in Denmark to 78% in Bulgaria and Romania.

Figure 3

Dendrograms, Hierarchical Clustering, Ward's Method, Squared Euclidean Distances, n = 27 European Union Member States, k = 6, employment-related variables: **a)** 2012 **b)** 2021



Source: Authors' work

Table 6 presents cluster averages for various employment-related variables among the 27 European Union member states, analysed through hierarchical clustering using Ward's method and squared Euclidean distances.

To enrich the analysis of the results, Figure 4 shows parallel coordinate plots for the hierarchical cluster solutions with four clusters in 2012 and 2021. Each line represents an average standardised value of countries placed in the same cluster for all observed employment-related variables.

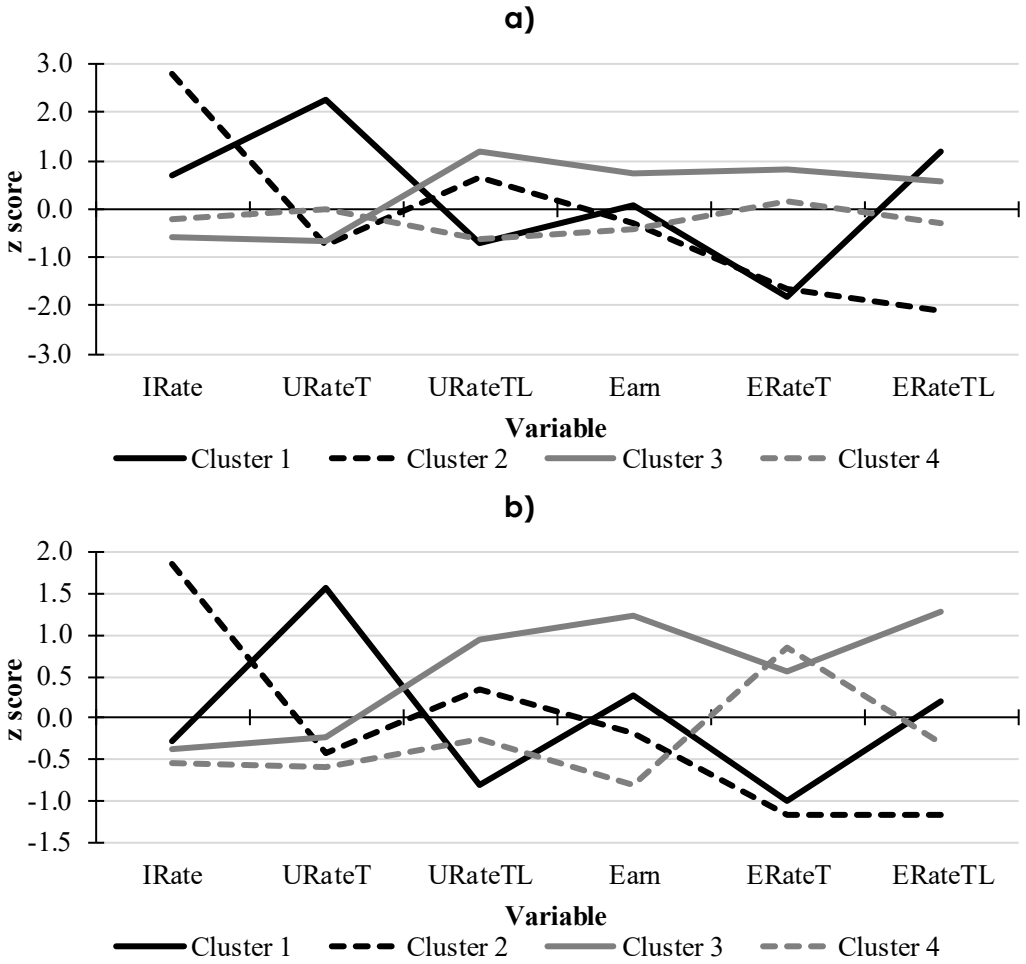
For the sake of clarity, we will first analyse the results of the cluster analysis for the year 2021, considering the employment-related variables. We will then compare these results with the cluster analysis results for 2012 to identify trends in indicators that measure young adults' labour market outcomes in terms of educational attainment. Table 6 presents the allocation of countries according to clusters in observed years.

Table 6
Cluster Averages, Hierarchical Clustering, Ward's Method, Squared Euclidean Distances, n = 27 European Union Member States, k = 6, employment-related variables

Year	Cluster	Variable					
		IRate	URateT	URateTL	Earn*	ERateT	ERateTL
2012	1	7	15	122	145	79	111
	2	18	5	191	138	78	101
	3	6	6	227	159	89	120
	4	6	4	155	129	91	108
2021	1	10	12	136	139	80	116
	2	18	2	194	133	81	97
	3	6	3	217	150	92	112
	4	7	5	139	131	89	107

Note: * Data from 2013 were used.
Source: Authors' work

Figure 4
Parallel Coordinates Plot, Hierarchical Clustering Members, Standardised Values, k = 6 employment-related variables: **a)** 2012 **b)** 2021



Source: Authors' work

Cluster 1 in 2021 consists of Greece, Italy, and Spain, countries with a relatively low share of 30-34-year-olds with tertiary education who are not in the labour force or relatively low inactivity rates for this age group, averaging 10%. These countries are

characterised by the significantly highest unemployment rates for 25-39-year-olds with tertiary education, which averaged 12% in 2021. This is not surprising, as these are also the countries with the highest average overall unemployment rates, well above the EU-27 average in 2021 (Eurostat, 2023a). At the same time, employment rates for 30-34-year-olds in these countries are relatively lower in the EU-27, at 80% in 2021. However, when analysing the advantages of tertiary education over upper secondary or post-secondary non-tertiary education in terms of labour market outcomes and income, the countries in this cluster show the lowest advantages in 2021 when analysing unemployment rates for subpopulation studied, relatively higher advantages in employment rates for the 30-34-year-olds, and relatively higher earnings premium. Measured by relative earnings in 2021, 18- to 64-year-olds with tertiary education in these countries earned, on average, 39% more than the same age group with upper secondary or post-secondary non-tertiary education. The subpopulation of 30-34-year-olds with tertiary education has 16% higher employment rates than the subpopulation with upper secondary or post-secondary non-tertiary education. The characteristics of this cluster were relatively similar in 2012, with Croatia, Cyprus, and Portugal as members of this cluster, along with Greece, Italy, and Spain. In Croatia, labour market indicators have improved for the subpopulation under study, although the inactivity rate of 30-34-year-olds with tertiary education has increased from 6.2% in 2012 to 7.7% in 2021. However, the benefits of higher education have improved in all cases except relative earnings. In terms of relative earnings in 2021, 18- to 64-year-olds with tertiary education in Croatia earn, on average, 44% more than the same age group with upper secondary or post-secondary non-tertiary education in 2021. Portugal has significantly improved the labour market situation for the subpopulation studied by reducing the unemployment rate, increasing the employment rate, and increasing the benefits of higher education with respect to the unemployment rate.

Table 6
Cluster Members, Hierarchical Clustering, Ward's Method, Squared Euclidean Distances, n = 27 European Union Member States, k = 6, employment-related variables

Cluster	2012		2021	
	Number of countries	Cluster members	Number of countries	Cluster members
1	6	Croatia; Cyprus; Greece; Italy; Portugal; Spain	3	Greece; Italy; Spain
2	5	the Czech Republic; Estonia; Finland; Hungary; Slovakia	2	the Czech Republic, Estonia
3	6	Bulgaria; Ireland; Latvia; Lithuania; Poland; Romania	8	Belgium, Bulgaria, Hungary, Ireland, Lithuania, Malta, Poland, Romania
4	10	Austria; Belgium; Denmark; France; Germany; Luxembourg; Malta; Netherlands; Slovenia; Sweden	14	Austria, Croatia, Cyprus, Denmark, Finland, France, Germany, Latvia, Luxembourg, Netherlands, Portugal, Slovakia, Slovenia, Sweden

Source: Authors' work

Cluster 2 in 2021 consists of the Czech Republic and Estonia. These are the countries with the relatively highest inactivity rates among 30-34-year-olds, averaging 18%. On average, 81% of all 30-to 34-year-olds with tertiary education were employed in these economies in 2021. When analysing the advantages of tertiary education over upper secondary, post-secondary non-tertiary education in terms of labour market

outcomes and earnings, the countries in this cluster show the lowest advantages in 2021 when analysing employment rates for the subpopulation studied, relatively higher advantages in unemployment rates for those aged 25-39, and relatively lower earnings advantages. In terms of relative earnings in 2012, 18- to 64-year-olds with tertiary education in these countries earned, on average, 33% more than the same age group with upper secondary, post-secondary non-tertiary education. The characteristics of this cluster were relatively similar in 2012, with Finland, Hungary, and Slovakia as members of this cluster, along with the Czech Republic and Estonia. Hungary has significantly improved labour market performance for the subpopulation studied. In Finland, inactivity rates have declined significantly for the subpopulation studied, as have the benefits of higher education in terms of unemployment rates.

Countries characterised by relatively best labour market outcomes in 2021 for the tertiary-educated subpopulation under study form group 3: Belgium, Bulgaria, Hungary, Ireland, Lithuania, Malta, Poland, and Romania. On average, they have the lowest inactivity rates and highest employment rates among 30-34-year-olds with tertiary education. The unemployment rates for those aged 25-39 were relatively lower. Moreover, the advantages of tertiary education over upper secondary or post-secondary non-tertiary education are most pronounced in terms of labour market outcomes and earnings. In terms of relative earnings in 2021, 18- to 64-year-olds with tertiary education in these countries earn, on average, 50% more than the same age group with upper secondary, post-secondary non-tertiary education. Unlike in 2012, in 2021, Belgium, Hungary, and Malta joined this cluster, and Latvia is no longer a member of this cluster. Malta changed the cluster membership partly due to a significant increase in the benefits from tertiary education in 2021 with respect to 2012 from the perspective of unemployment rates for the age group analysed. In Latvia, the inactivity rate for the subpopulation studied has increased, and the benefits of higher education for the age group studied have decreased slightly.

Interestingly, cluster 4 in 2021 consists of 14 EU economies: Austria, Croatia, Cyprus, Denmark, Finland, France, Germany, Latvia, and Luxembourg, that, on average, have relatively low inactivity rates (7%) and higher employment rates (89%) among 30-34-year-olds with tertiary education and relatively low unemployment rates (5%) among 25-39-year-olds with tertiary education. However, this group of economies is characterised by relatively lower benefits from tertiary education over upper secondary, post-secondary, and non-tertiary education.

When we analyse the results of the cluster analysis in relation to the variables related to education, we can see that the characteristics and structure of the cluster remained relatively stable. For some countries, the cluster membership changed.

Discussion

The cluster analysis was conducted for the years 2012 and 2021. The idea of clustering economies in two years seemed particularly interesting because it shows how the cluster structure changes over time. In addition, the cross-section of the cluster in a given year shows the characteristics of the education systems of the EU member states from the perspective of young adults and their labour market performance. Data show that although the share of young adults with tertiary education increased significantly on average between 2012 and 2021, there are still significant differences across European Union countries, ranging from below 30% in Italy and Romania to over 60% in Luxembourg and Ireland. Austria, Portugal, and Croatia stand out as the countries where the share of young adults with tertiary education has increased the most over the observed period.

Tracking trends in tertiary education, the ratio of the share of graduates in business, administration, and law to the share of graduates in STEM shows a slight increase on average despite the increasing global popularity of STEM in recent years. The increase in popularity of STEM compared to business, administration, and law was most pronounced in Malta, Cyprus, and Greece in 2021 compared to 2012. Cyprus, Malta, and Luxembourg recorded almost twice as many STEM graduates as business, administration, and law graduates in 2021, while the proportion of business, administration, and law graduates was highest in Sweden, Slovenia, and Finland in 2021 compared with STEM. Croatia recorded the largest increase in graduates in business, administration, and law compared to STEM.

The share of NEETs with tertiary education (NEETRate) decreased by an average of 4 percentage points in the EU between 2012 and 2021. However, in many EU economies, the share of NEETs with tertiary education still exceeds 10% in 2021 (in Bulgaria, the Czech Republic, Greece (26.8%), Spain, Croatia, Italy, Romania, Cyprus, and Slovakia). Given the negative impact this status has on labour market prospects and social outcomes, this finding can guide governments and education policymakers in designing future policies to reduce this rate. NEET Rates of less than 5% are recorded in Germany, Malta, the Netherlands, Finland, and Sweden. The ratio between the percentage of unemployed and inactive NEETs (NEETUn) has also declined significantly over the period, suggesting that more young people are 'NEET' because they are not in employment rather than because they cannot find work.

On average, 88% of all 30-34-year-olds with tertiary education in the EU-27 were employed in 2021, ranging from 76% in Greece to 93.5% in Malta. This figure has increased by 2.5 percentage points since 2012. Comparing the employment rates of 30-34-year-olds with upper secondary or post-secondary non-tertiary education shows that the share of employed 30-34-year-olds with tertiary education is, on average, 9% higher, except for the Czech Republic and Luxembourg in 2021, where is lower. The difference is most pronounced in Italy, Ireland, and Greece.

Although the average share of economically inactive 30-34-year-olds with tertiary education has decreased in the EU-27, there are large differences between countries. The Czech Republic is at the top of the inactivity rates of 30-34-year-olds with tertiary education in 2021, while Slovenia, Lithuania, and Malta have the lowest inactivity rates. Hungary recorded the most significant decline. In 2021, the average unemployment rate for 25-39-year-olds with tertiary education in the EU-27 was 4.88%, while the average unemployment rate for 25-39-year-olds with upper secondary or post-secondary non-tertiary was 7.43%, more than 2.5 percentage points higher. According to the data, this labour market indicator has experienced the most extensive dispersion in both years, with Greece having the highest unemployment rate and the Czech Republic, Malta, and Poland having the lowest. The expectation that higher levels of education lead to better labour market outcomes is supported in part by data on the unemployment rates for 25-39-year-olds with upper-secondary or post-secondary non-tertiary education compared to the same measure for the same age group with higher education. These benefits of tertiary education are most pronounced in Belgium, Lithuania, Romania, Bulgaria, Poland, and Ireland in 2021. On the other side of the spectrum are EU economies where this difference is smallest, such as Greece, Germany, Luxembourg, and the Netherlands. In terms of earnings premium, 18- to 64-year-olds with tertiary education earn on average 37.69% more than the same age group with upper secondary or post-secondary non-tertiary education, ranging from 11% in Denmark to 78% in Bulgaria and Romania.

Conclusion

As the world rapidly evolves, digitalisation continues, and AI is used, it is important to understand how education systems are dealing with these challenges and whether they can prepare future generations to succeed in this dynamic environment with a tremendous demand for skilled workers. The education system must provide young people with the skills and knowledge that are in demand in the labour market. Data show that the average share of 25-34-year-olds with tertiary education in the EU-27 increased from 36.2% in 2012 to 44.4% in 2021, partly the result of higher demand for skilled workers in labour markets (OECD, 2022). Raising the educational attainment of the workforce was one of the priorities of the 2020 targets of Europe, as the EU considers a highly skilled European workforce essential to maintaining global competitiveness and fostering economic growth and prosperity.

Higher levels of education are generally associated with better employment opportunities and higher wages. Given the importance of education to a country's economic growth, policymakers around the world must be informed about the state of the education system in order to respond to current challenges.

This paper focuses on the analysis of similarities and differences among the 27 Member States of the European Union in the indicators of outcomes and outputs of their education systems from the perspective of young adults using Ward's cluster method in hierarchical cluster analysis for two groups of variables in two selected years: 2012 and 2021. The first group of variables, related to education, provides information on the characteristics of young adults from the perspective of educational attainment and trends in tertiary education. Depending on the available data, a group of indicators related to employment was selected to provide information on the participation of young people with tertiary education in the labour market and to identify similarities and differences across EU-27 countries in analysing the benefits of higher levels of education in terms of better labour market performance.

In all economies except Romania, the share of 25-34-year-olds with tertiary education increased in the analysed period. Regarding the first set of variables, Belgium, Cyprus, Denmark, France, Ireland, Latvia, Lithuania, Luxembourg, and the Netherlands have, on average, the highest percentage of young adults with tertiary education and the highest percentage of tertiary graduates in STEM compared to Business, Administration, and Law in 2021. The expectation that higher levels of education lead to better labour market outcomes is supported in part by data on the unemployment rates for 25-39-year-olds with upper-secondary or post-secondary non-tertiary education compared to the same measure for the same age group with tertiary education. In terms of relative earnings in 2021, 18- to 64-year-olds with tertiary education earn on average 37.69% more than the same age group with upper secondary, post-secondary non-tertiary education, ranging from 11% in Denmark to 78% in Bulgaria and Romania. However, over the 9 years, Denmark, Germany, Ireland, Latvia, Lithuania, Luxembourg, the Netherlands, and Finland show a decline in the benefits of higher education in terms of the unemployment rate for 25-39 year-olds. In Denmark, the unemployment rate of 25-39-year-olds with tertiary education was higher than that of the same age group with upper secondary and post-secondary non-tertiary education in 2021, raising the question of appropriate government education policies.

Belgium, Bulgaria, Hungary, Ireland, Lithuania, Malta, Poland, and Romania have, on average, the most pronounced employment and income benefits of tertiary education for young adults. These countries had, on average, the most favourable labour market outcomes for young adults with tertiary education in 2021. Although the average share of inactive 30-to 34-year-olds with tertiary education has declined

slightly in the EU-27, there are large differences across countries. The Czech Republic is at the top of the inactivity rates of 30-to 34-year-olds with tertiary education in 2021, while Slovenia, Lithuania, and Malta have the lowest inactivity rates. The countries that succeeded in significantly reducing the inactivity rate of 30- to 34-year-olds with tertiary education over the 9 years were Finland, Hungary, and Slovakia, so it would be interesting to examine the background to this trend. In Greece, on the other hand, the inactivity rate increased significantly. In terms of earnings premium, 18- to 64-year-olds with tertiary education earn on average 37.69% more than the same age group with upper secondary or post-secondary non-tertiary education, ranging from 11% in Denmark to 78% in Bulgaria and Romania. In many EU economies, the share of NEETs with tertiary education in 2021 is still above 10% (in Bulgaria, the Czech Republic, Greece (26.8%), Spain, Croatia, Italy, Romania, Cyprus, and Slovakia). The results can guide governments and education policymakers in designing future policies and provide insight into how countries compare.

However, this study has some limitations. The results depend on the choice of variables used for cluster analysis and the choice of years of observation. The analysis is limited to a very narrow but important aspect of the educational system, educational attainment, and labour market outcomes of young adults in European Union member states. Of course, the consequences of the strong growth of tertiary education can be seen not only in labour market outcomes but also beyond that as a contribution to economic growth and society as a whole. This aspect has not been taken into account. Also neglected was the very important dimension of investment in the education system, from financial resources to human and material resources. Finally, the education system was not considered from the point of view of quality. For some indicators, we did not have data for the age group we wanted to analyse to get a picture of the labour market outcomes of young adults, so we used data for a subset of that age group. In some cases, we did not have data for a subset of the age group we wanted to analyse, so we were forced to use data for the 18- to 64-year-old age group, such as relative earnings, which we considered an extremely important indicator of the benefits of tertiary education over upper secondary or post-secondary non-tertiary education. Due to some missing data, the values of the corresponding variables for the nearest year were used as approximations, although we believe that such an approach did not significantly affect the cluster structure.

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