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## HIGHER EDUCATION AND REGIONAL ECONOMIC INEQUALITY IN POLAND AND ROMANIA, 2000–2023

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**Abstract:** The study examines the relationship between higher education expansion and economic development in Poland and Romania between 2000 and 2023. It takes into consideration both national and regional contexts, based on the study case of less and more developed regions. Higher education is often presented as one of the most reliable factors associated with regional convergence and social mobility. Nevertheless, evidence from post-socialist contexts leads to the suggestion that economic effects could be uneven. Our purpose is to assess whether tertiary education has functioned rather as a spatial equaliser (convergence) or coincided with the reinforcement of existing regional disparities (divergence).

As an exploratory study, the analysis highlights patterns and associations rather than establishing causal relationships. It draws on national and regional level data on higher education attainment, GDP per capita, sectoral employment structure or early leaving from education and training. The methodology provides a statistical approach with correlations, regression and cross-regional combined comparisons. These bivariate analyses do not account for additional variables, and the results should be interpreted cautiously given the small sample size.

Findings indicate that higher education attainment has not been significantly linked to regional convergence. Despite the robust relationship between higher education attainment and GDP per capita, the relationship was fluid and subject to substantial time and regional variation. Tertiary education coincided with widening income gaps, increasing dispersion in education attainment and growing advantages for regions that had pre-existing capacities. Less developed regions showed weaker associations between higher education expansion and economic upgrading.

Further highlights underline the role of demographic dynamics, labour market structures and early leaving from education and training in shaping development regional trajectories. All factors combined favour the extent to which cumulative causation prevails over homogenous “catch-up”. The paper contributes to debates on human capital and regional development, underlining that higher education acts less as an equalising force and more as a factor co-evolving with existing regional inequalities, based on examples in Central and Eastern Europe. Findings should be interpreted in light of the study’s bivariate design, limited causal identification, and constraints related to regional data consistency.

**Keywords:** higher education expansion; regional economic divergence; post-communist transition; human capital; Poland; Romania

## 1. INTRODUCTION

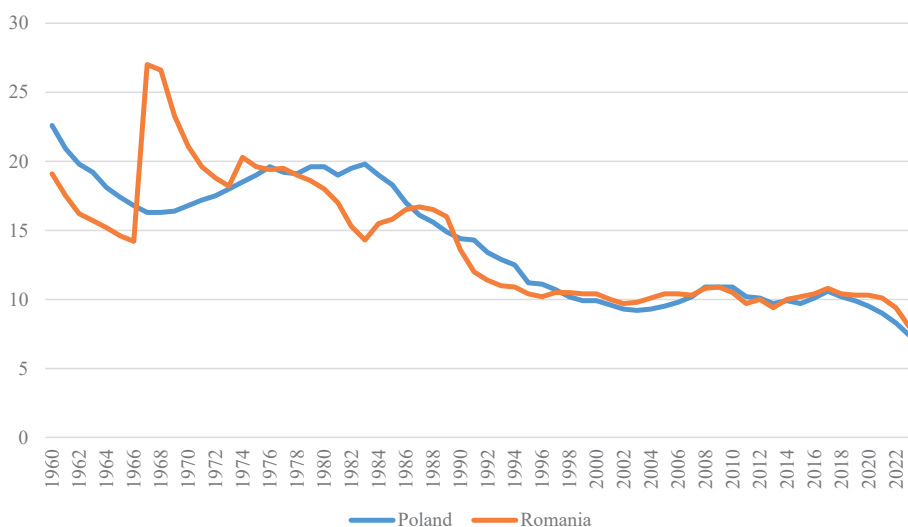
The post-communist transition had mixed outcomes for the East-Central European countries. After a severe transition crisis caused by the disruption of the socialist economic networks, under the combined impact of foreign direct investments and the integration into the European Union, these countries experienced significant economic growth and converged towards the level of economically developed countries. Yet, even if at national level the progress is impressive, the post-communist EU member states arriving (2024) in a range between 66% of EU average of per capita GDP at PPS (Bulgaria) and 91% (Czechia), with a catching-up of 30–50% since the 1990s, regionally the benefits were uneven distributed, leading to disparities and thus to economic divergence inside these countries.

At the same time, post-communist countries experienced an expansion of higher education. This was mainly determined by the shift from a system of strictly controlled access to higher education, with a severely limited number of study-places allocated through centralized planning mechanisms (Sadlak, 1988) to a liberalized system of expanding autonomous universities, both public and private, which recruited for a diversified number of study programs an increasing numbers of students, either funded by the state or paying tuition fees. The impact of the system change was increased by the fact that in the 1970s and 1980s the communist regimes had limited the expansion of higher education (Reisz and Stock, 2007: 55–64), and thus had frustrated the aspirations of large numbers of young people who wanted to complete their studies at tertiary level; these unfulfilled aspirations coincided with an increased social demand

for higher education in the 1990s and 2000s. Accordingly, after the demise of communism the number of higher education institutions and that of registered students increased several fold.

The expansion of higher education enrolment after 1990 was not driven solely by policy liberalisation. Demographic dynamics also played a significant and often underappreciated role. As shown in the figure below, Poland experienced a sustained decline in birth rates from the early 1980s onward, after the high-fertility cohorts of the 1960s and 1970s. In Romania the decline in birth rates has been temporarily reversed in 1966 by Ceaușescu's prohibition of abortion, so birth rates were relatively high from 1967 to 1989. The large cohorts born in those decades entered higher education in the late 1980s, in the 1990s and early 2000s. This generated a demographic wave that amplified institutional expansion. In Poland, enrolment growth began to reverse around 2008–2009, consistent with the arrival of smaller cohorts born after the sharp fertility decline of the mid-1980s. Romania displayed a similar long-run trajectory, with a small delay in comparison with Poland. After 2010, both countries had shrinking pools of traditional-age students. This reframed part of what appears in the data as higher education "expansion". In fact, much of the growth in attainment rates reflected increased participation among smaller cohorts, resulting in a proportional increase in absolute graduate numbers.

Figure 1. Birth rate, crude (per 1,000 people) in Poland and Romania, 1960–2023



Source: Data processed by authors from 'Population Estimates and Projections' (2026).

In our paper we intend to focus on Poland and Romania, the two being the most populous post-communist countries which have become EU member states. We intend to explore the relationship between higher education and economic growth not only at national but also at regional level, as well as the main patterns in the evolution of tertiary education attainment in the two countries. Therefore, our main research question is:

- To what extent has higher education been associated with regional economic convergence or divergence in Poland and Romania between 1990 and 2023? (RQ1)

Additionally, we will also try to answer the following questions:

- Is there a measurable correlation between levels of higher education attainment and regional GDP per capita in the two countries? (RQ2)
- Do disparities in higher education attainment and employment at a regional level indicate patterns consistent with time-lagged convergence, or do they reflect the accumulation of structural and persistent inequalities in human capital development and labour market performance? (RQ3)

## 2. LITERATURE REVIEW

### 2.1. Higher Education and Economic Growth

Schultz (1961) was among the first scholars to contend that human capital accounted for the increase in employees' earnings, as it grew in Western societies at a much faster pace than conventional capital, becoming the most distinctive dimension of the economic system. Furthermore, Becker (1964) outlined the importance of human capital for economic growth. There are controversies regarding the measurement of human capital, with different streaks of scholarship favouring either educational attainment / years of schooling or recognition by the labour market (level of earnings). The years of schooling perspective relies heavily on a cross-country educational attainment panel developed and interpreted by Barro and Lee (2015), a standard data source for empirical growth studies using schooling quantity as a human capital proxy, as well as both a methodological approach on the topic. Research such as that of Hanushek and Woessmann (2008) has addressed the importance of cognitive skills rather than years

of schooling in relation to individual earnings, income distribution, and economic growth.

Higher education plays a distinct role within the broader concept of human capital because, unlike lower and compulsory levels, it also involves a voluntary choice. Individuals can significantly influence the timing of this investment, making real options relevant (Jacobs, 2007). Higher education is particularly relevant to regional economic growth in the age of knowledge-intensive and innovation-driven economies because of its contribution to advanced skills, research capacity, or innovation potential (Hoenack, 1993; Stock and Reisz, 2013).

Endogenous growth models posit that human capital and knowledge spillovers led to increased returns (Romer, 1986; 1990; Lucas, 1988). Therefore, regions with higher initial human capital can exploit spillovers and technology diffusion more effectively to sustain higher growth. Although human capital can lead to catch-up, these dynamics often generate divergence, as already advanced regions pull further ahead (Barro and Sala-i-Martin, 1992; 1995), consistent with Myrdal's (1957) cumulative causation.

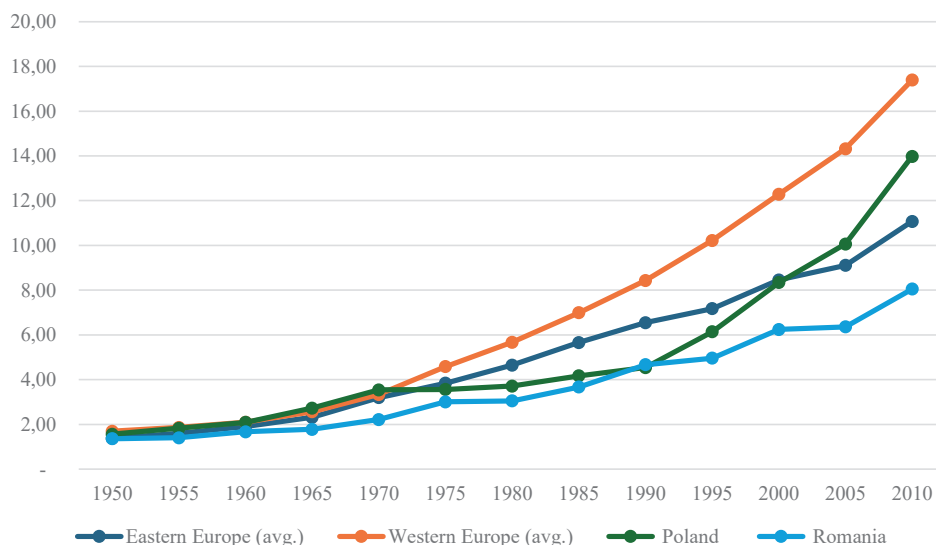
The relationship between higher education attainment and economic growth has been highly debated in recent decades. Against overoptimistic assessments, more sophisticated analyses which combine human capital theories with measurements of various types of skills relevant to economic performance are rather sceptical that enlarged access to higher education and/or expansion of schooling years have a strong association with economic growth (Hanushek, 2016; Woessmann, 2025).

## **2.2. Post-Communist Transformation and Higher Education Expansion in Central and Eastern Europe**

The long-run perspective offered by Figure 2 helps us contextualise the post-1989 expansion period within a broader historical context. In the communist period, both Poland and Romania had consistently lagged behind Western Europe in tertiary education. Romania remained below the Eastern European average for most of the period (Bajerski, 2011). The 1970s and 1980s were decades of relative economic stagnation and tightening of political control in much of the region (Janc, Czapiewski and Bajerski, 2012). This can be associated with a particular slow growth in both countries, with Romania showing quasi-stagnation between 1975 and 1985 (3.01% to 3.67%). Nevertheless, Poland followed a similar pat-

tern, with attainment remaining between 3.56% and 4.17% over the same decade. These constraints on expansion reflect deliberate limitations on access to higher education under late communism. It also helps us to explain the scale of massive demand that drove rapid enrolment growth after 1989. By 2010, for example, Poland had largely closed the gap with the average of other Eastern European countries and was converging toward Western European levels. Romania remained considerably below both benchmarks—(8.05% compared to 11.07% for Eastern Europe and 17.39% for Western Europe. It should be noted that the persistent gap between the two countries, already visible in the communist period, was relevant to interpreting the divergent patterns in education and economic reform observed during the study period.

Figure 2. Share of population with completed tertiary education in Eastern Europe, Western Europe, Poland and Romania, 1950–2010



**Source:** Data processed by the author from Barro and Lee (2013).

**Note:** Western European countries include Austria, Belgium, Cyprus, Denmark, Finland, France, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. Eastern European countries comprise Albania, Bulgaria, Czechoslovakia, Hungary, Poland, and Romania. In the case of Yugoslavia, data for Croatia, Serbia, and Slovenia was utilised. Similarly, for Czechoslovakia, data from the Czech Republic and Slovakia were combined.

Higher education in Central and Eastern Europe has undergone a significant quantitative transformation since 1989. However, these countries primarily implemented sectoral reforms on an organisational level,

maintaining elements of their previous communist structures. The nature of these changes was more of “transition” than “transformation” due to their limited process of change (Scott, 2002). The massification of higher education was a common pattern, as student enrolment in the region increased by two-thirds between 1989 and 1996 and had almost doubled by 2002 (Scott, 2007).

The governments set several other goals, including (1) establishing a non-state (private) sector; (2) introducing student fees at public state universities; (3) applying new funding formulas based mainly on per capita funding; (4) introducing a different differentiation of higher education institutions; and (5) expanding research at universities, as this was traditionally concentrated in institutes (Silova, 2009; Froumin and Smolentseva, 2014; Dobbins, 2017). Another common feature was the alignment of the post-communist countries within the Bologna Process. Poland, Romania, Czechia, Hungary, and Slovenia were among the first to join in 1999. The transition of academic systems in this region from elite, highly bureaucratic, and politically orientated to mass and less politically orientated structures did, however, occur (Kwiek 2008, Dobbins and Kwiek, 2017).

In spite of various differences (Dobbins, 2011; Gheboianu 2023; 2024; Murgescu, 2024: 12), Poland and Romania “converged” towards a new hybrid governance model of higher education, prompted by the new economic conditions within the European Union and the belief that national competitiveness needed to be enhanced. Public discourse also focused on international rankings, particularly the fact that neither country could have world-class capabilities at home, which jeopardised the possibility of promoting economic growth through home-grown innovation (Dobbins and Kwiek, 2017). The transition could have been characterised by the emergence of the “entrepreneurial university”, which sought to diversify funding and enhanced a “developmental periphery” of outreach and commodification (Arbo and Benneworth, 2007). This shift marked a departure from the “Cartesian” paradigm, where problems were solved solely based on the purpose of the interests of the academic community, towards a “post-Cartesian” model where knowledge production became increasingly interdisciplinary and accountable to both social and market applications. This was particularly evident in Poland, where hybridisation was obvious in the non-public sector, with over 150 HEIs established to respond to market demands (Jałowiecki, 2001).

For both Poland and Romania, accession to the European Union in 2004 and 2007, respectively, represented a significant step forward, as public discussion on education reform was already orientated towards EU-based reforms (Tarlea, 2017). Nevertheless, despite the increasing similarities and synergies between EU policies on higher education and the Bologna Process, the two should not be confused. Due to the timeline of EU accession, public opinion in Romania and other Central and Eastern European countries has often conflated the two processes within broader governmental discourse on compliance requirements (Matei, Crăciun and Torotcoi, 2018). This conflation was often driven by “institutional isomorphism”, in which regional organisations modelled themselves after those perceived as more legitimate and successful during periods of rapid transition (Arbo and Benneworth, 2007). The implementation of these standards nevertheless introduced significant bureaucratic burdens. Just to give an example, the requirements to continuously revise syllabi and produce endless reports within the broader context of the Bologna Process were criticised for distracting academic staff. The latter would have focused more on substantive teaching and research duties (Kot and Ślusarczyk, 2014). In addition, while the Lisbon Strategy emphasized research and development investment for a competitive Europe, the focus on successful economic areas often led to a lack of support for educational infrastructure in peripheral regions (Czapiewski and Janc, 2011).

Expanding access to higher education did not reduce the inequalities between the privileged and underprivileged social groups. As the communist regime coincided with equal access to higher education across social classes, these inequalities worsened dramatically in the decades of expansion after 1989. For instance, rural-urban disparities are a significant source of inequality in Romania and Hungary and are prevalent throughout Central and Eastern Europe, albeit with specific national variations (Hatos, 2013). In Romania, for example, only 4.62% of state-budgeted students received need-based aid in the mid-2010s (Alexe, Hâj and Murgescu, 2015). In Poland, long-term data indicated that while intergenerational educational mobility increased temporarily after the Second World War, it decreased once the socialist social system stabilised (Wroński, 2023). The result was a persistent “paradox” in which children from affluent urban backgrounds dominate the “free” state universities due to the competitive entrance exams. On the other hand, those from less privileged areas, such as rural areas, were often forced to pay for education at private institutions, effectively paying “twice” through both taxes and tuition fees

(Jałowicki, 2001). By the 2000s, students from rural areas in Poland still accounted for only 22% of those enrolled in full-time studies. This reflected a deep-seated gap: only one in twenty rural inhabitants had a higher education degree, compared to one in five in urban areas (Czapiewski and Janc, 2011). The constant development in Poland led to a majority of female students being reached (even among academic employees; Popiński, 2019).

While in some countries in the region access to higher education had caught up with that of Western Europe, equity remained problematic, as demonstrated by pre-university learning outcomes measured by the PISA survey (Halász, 2015). The uneven effects of human capital accumulation have been amplified by differences in higher education infrastructure, the spatial distribution of universities, and the capacity of regional labour markets to absorb highly educated graduates. This was associated with spatially differentiated growth trajectories, even at the end of the first decade of post-socialism, with capital regions and western border regions in Central and Eastern Europe emerging as the main winners (Heidenreich, 2003). In this regard, regional universities struggled to maintain their social relevance and economic adaptability, as well as to embrace new fields of study and various forms of tertiary education (Deaconu, 2024). But high PISA scores do not always translate directly into regional GDP growth, suggesting a less cohesive relationship between educational output and the specific needs of the national economy (Biernacki, 2011). The latter is further exacerbated by brain drain, in which prestigious academic cities such as Warsaw and Krakow have successfully retained graduates, while peripheral regional centres act rather as “producers” of human capital for these major agglomerations (Janc, Czapiewski and Bajerski, 2012). On the other hand, “intra-regional peripheries” developed, where poor access to academic centres and a lack of job opportunities for the highly educated lead to a cycle of progressive peripheralization (Czapiewski and Janc, 2011).

### 3. METHODOLOGY

This study employs an exploratory research design to identify patterns and associations between higher education attainment and regional economic performance, rather than establishing causal relationships, in Poland and Romania. At this stage of our research, we decided to limit

ourselves to data regarding two NUTS2 regions in each of the two countries. We have avoided the two capital cities, which would have provided extreme results due to their strong concentration of economic output and higher education institutions, and chose for each country one region which is relatively developed (Dolnośląskie in Poland and Nord-Vest in Romania) and one which is relatively underdeveloped (Lubuskie in Poland and Nord-Est in Romania); if the results of our analysis prove helpful, the investigation can be extended to all Polish and Romanian regions and also to other post-communist countries. The four regions followed two main criteria. Firstly, capital regions were deliberately excluded – specifically Mazowieckie in Poland and București-Ilfov in Romania. We have realised that the argument regarding the exclusion of capitals is recurring. In this comment, we have highlighted the section of the text that should be removed. However, we are aware that this would lead to a significant change in pagination, and we believe that it can only be changed to the extent possible. The second criterion was that among the remaining regions, one was selected from the wealthiest (in terms of GDP per capita) and one from the least wealthy in each country. This aims to maximise the observable contrast in both economic performance and educational attainment while remaining within a range representative of the wider landscape. The temporal scope of the analysis covers the period 2000–2023,<sup>1</sup> focusing thus on the European integration of both countries.

Given the relatively short time series, the period was split into three sub-periods to assess the temporal dynamics: (1) continued expansion before the economic crisis (2000–2008), (2) post-crisis adjustments (2009–2015) and (3) period of recovery and restructuring (2016–2023). Phenomena such as EU accession and post-accession effects or the global financial crisis of 2008–2009 did not occur at equal intervals.

The primary data source is Eurostat (2026). Although national statistical data also exist for the 1990s, differences in definitions and limited comparability led us to select the present time series, as the reliability of the results is more important than expanding the series to cover a longer period in the post-socialist era. Economic performance is measured using GDP per capita in purchasing power standards (PPS), as

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<sup>1</sup> Data on economic output (GDP per capita in EU purchasing power standards) is available from 2000 to 2023. Data on educational attainment is available from 2000 to 2024, provided in Appendix: (table 4).

the method ensures comparability across regions and countries. Higher education attainment is measured as the percentage of the 25–34 age group with tertiary education (ISCED levels 5–8). The 25–34 age group was chosen because it is most closely linked to (1) recent higher education expansion and (2) early labour market integration.

Our empirical strategy covers three main dimensions: (1) the relationship between GDP per capita and higher education attainment; (2) measuring absolute regional disparities in economic performance; (3)  $\sigma$ -convergence analysis in higher education attainment. Additional insights from sectoral employment (NACE rev. 2) and the share of early leavers from education and training will provide valuable background information for our analysis.

The research initially focused on analysing the relationship between economic development and higher educational attainment. For this purpose, ordinary least squares regression (OLS) was employed. These regressions were used to estimate changes in the strength of the relationship between the aforementioned variables for the full period and sub-periods. This approach allowed us to assess whether regions with higher income levels could be systematically linked to regions with more university students. It should be noted that regressions are bivariate in nature, and the examination of each pair of variables is conducted without additional controls. This emphasises the limitation of isolating the independent association between higher education and economic performance.

The differences between less and more developed regions were assessed using absolute regional disparities in economic performance ( $D_{i,j,t}$ ). The aim was to understand the magnitude of regional economic divergence or convergence. This economic gap was measured by the difference in GDP per capita between regions  $i$  and  $j$  at time  $t$  as defined below:

$$D_{i,j,t} = |Y_{i,t} - Y_{j,t}|$$

$D_{i,j,t}$  = absolute economic gap between region  $i$  and region  $j$  at time  $t$ .

$Y_{i,t}$  = GDP per capita (PPS) of region  $i$  at time  $t$ .

$Y_{j,t}$  = GDP per capita (PPS) of region  $j$  at time  $t$ .

$i, j$  = index regions within the same country, defined as (1) Poland ( $i$ =Dolnośląskie,  $j$ =Lubuskie) and (2) Romania ( $i$ =Nord-Vest,  $j$ =Nord-Est).

$t$  = time index (year), for the 2000–2023 period.

Regional disparities in higher education attainment will be measured through the  $\sigma$  convergence method. The variable accounts for the reduction or expansion of the standard deviation at each time point for all regions considered, as described below:

$$\sigma_t = \sqrt{\frac{1}{N} \sum_{i=1}^N (H_{i,t} - \bar{H}_t)^2}$$

Notes:

$H_{i,t}$  = higher education attainment (percentage of population aged 25–34 with ISCED 5–8) in region  $i$  at year  $t$ .

$\bar{H}_t$  = arithmetic mean of higher education attainment across the four regions at year  $t$ .

$N$  = number of regions (4).

$\sigma_t$  = standard deviation of educational attainment at time  $t$ .

The coefficient of variation, which is calculated by dividing the standard deviation by the mean, will be used to show the level of inequality. In this sense, cross-time comparisons could be made to assess the evolution of overall attainment levels. Although relative measures such as regional GDP as a share of the national average are also commonly used, absolute differences are retained as they capture the magnitude of economic distance between regions. This is central to understanding the intensity of regional inequality.

## 4. FINDINGS

### 4.1. Relationship between GDP per capita and Higher Education Attainment

At the regional or national level, there is a strong and positive association between GDP per capita in purchasing power standards (PPS) and higher education. Poland exhibits a stronger association ( $R^2 = .754$ ) than Romania ( $R^2 = .661$ ). It should be noted that the strength of the relationship varies across regions and seems to co-vary with the level of development.

Table 1. GDP per capita (PPS) and higher education attainment (ISCED 5–8, population aged 25–34): full period and split period OLS regressions

| Panel A. Full period (2000–2023)                          |    |         |                |        |                |                     |      |
|-----------------------------------------------------------|----|---------|----------------|--------|----------------|---------------------|------|
| Unit                                                      | N  | B (GDP) | $\beta$ (std.) | t      | R <sup>2</sup> | Adj. R <sup>2</sup> | Sig. |
| Poland                                                    | 24 | .001    | .868           | 8.205  | .754           | .742                | .000 |
| Romania                                                   | 24 | .001    | .813           | 6.553  | .661           | .646                | .000 |
| PL – Lubuskie                                             | 24 | .001    | .821           | 6.739  | .674           | .659                | .000 |
| PL – Dolnośląskie                                         | 24 | .002    | .935           | 12.375 | .874           | .869                | .000 |
| RO – Nord-Est                                             | 24 | .001    | .752           | 5.356  | .566           | .546                | .000 |
| RO – Nord-Vest                                            | 24 | .001    | .809           | 6.454  | .654           | .639                | .000 |
|                                                           |    |         |                |        |                |                     |      |
| Panel B. Period before economic crisis (2000–2008)        |    |         |                |        |                |                     |      |
| Unit                                                      | N  | B (GDP) | $\beta$ (std.) | t      | R <sup>2</sup> | Adj. R <sup>2</sup> | Sig. |
| Poland                                                    | 9  | .003    | .979           | 12.705 | .958           | .952                | .000 |
| Romania                                                   | 9  | .001    | .996           | 27.967 | .991           | .990                | .000 |
| PL – Lubuskie                                             | 9  | .003    | .969           | 10.429 | .940           | .931                | .000 |
| PL – Dolnośląskie                                         | 9  | .002    | .958           | 8.866  | .918           | .907                | .000 |
| RO – Nord-Est                                             | 9  | .002    | .991           | 20.080 | .983           | .980                | .000 |
| RO – Nord-Vest                                            | 9  | .001    | .989           | 17.525 | .978           | .975                | .000 |
|                                                           |    |         |                |        |                |                     |      |
| Panel C. Post-crisis adjustment period (2009–2015)        |    |         |                |        |                |                     |      |
| Unit                                                      | N  | B (GDP) | $\beta$ (std.) | t      | R <sup>2</sup> | Adj. R <sup>2</sup> | Sig. |
| Poland                                                    | 7  | .002    | .969           | 8.761  | .939           | .927                | .000 |
| Romania                                                   | 7  | .002    | .955           | 7.194  | .912           | .894                | .001 |
| PL – Lubuskie                                             | 7  | .002    | .938           | 6.048  | .880           | .856                | .002 |
| PL – Dolnośląskie                                         | 7  | .002    | .857           | 3.721  | .735           | .682                | .014 |
| RO – Nord-Est                                             | 7  | .001    | .264           | .612   | .070           | –.116               | .567 |
| RO – Nord-Vest                                            | 7  | .004    | .953           | 6.999  | .907           | .889                | .001 |
|                                                           |    |         |                |        |                |                     |      |
| Panel D. Period of recovery and restructuring (2016–2023) |    |         |                |        |                |                     |      |
| Unit                                                      | N  | B (GDP) | $\beta$ (std.) | t      | R <sup>2</sup> | Adj. R <sup>2</sup> | Sig. |
| Poland                                                    | 8  | .000*   | .079           | .194   | .006           | –.159               | .853 |
| Romania                                                   | 8  | .000    | –.727          | –2.596 | .529           | .451                | .041 |
| PL – Lubuskie                                             | 8  | .000    | –.199          | –.497  | .040           | –.120               | .637 |
| PL – Dolnośląskie                                         | 8  | .000    | .325           | .843   | .106           | –.043               | .432 |
| RO – Nord-Est                                             | 8  | .000    | .536           | 1.557  | .288           | .169                | .170 |
| RO – Nord-Vest                                            | 8  | .000    | –.597          | –1.823 | .357           | .249                | .118 |

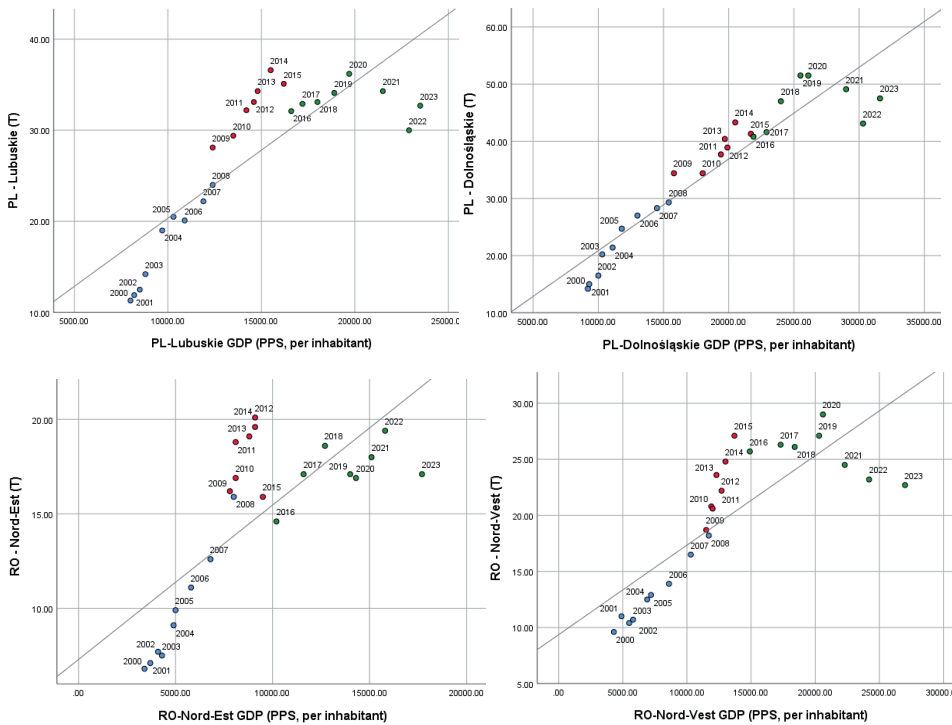
**Note:** Dependent variable = Higher education attainment (total population, 25–34 years, %); Independent variable = GDP per capita (PPS, per inhabitant); Method = OLS regression, annual observation.

\*) Coefficient rounds to zero at the displayed precision.

**Source:** Data processed by authors from Eurostat (2025; edat\_ifse\_04: Population in private households by educational attainment level and NUTS 2 region, nama\_10r\_2gdp: Gross domestic product (GDP) at current market prices by NUTS 2 region).

One of the most important findings resides in Panel B, the pre-crisis period between 2000 and 2008. This period demonstrates the strongest observed link between higher education attainment and economic performance. There are uniform, high  $R^2$  values and near-unity standardised coefficients across both countries and all 4 regions, suggesting that the two variables are moving closely together in post-socialist period. This pattern aligns with a period during which the expansion of tertiary education and economic growth co-evolved, although the direction of this relationship cannot be determined from the current analysis.

Figure 3. Relationship between GDP per capita (PPS) and higher education attainment (ISCED 5–8, population aged 25–34) in selected regions of Poland and Romania, 2000–2023



**Source:** Data processed by authors from Eurostat (2025; edat\_lfse\_04: Population in private households by educational attainment level and NUTS 2 region, nama\_10r\_2gdp: Gross domestic product (GDP) at current market prices by NUTS 2 region).

After the Great Recession, as shown in Panel C, the link between higher education and economic performance became both uneven and more conditional. For instance, in Poland there is a persistence of statistically

significant relationships at the national level ( $p = 0.000$ ,  $R^2 = 0.939$ ) and in both regions, despite the reduced intensity. Nevertheless, this pattern aligns with a weakening of the observed association rather than a complete decoupling of the two variables. Romania, by contrast, has mixed evidence. While the relationship at the national level remained both strong and statistically significant ( $p = 0.001$ ,  $R^2 = 0.912$ ), the loss of significance in Nord-Est ( $p = 0.567$ ) indicated that higher education was no longer significantly associated with GDP levels in that region. Nord-Vest retains both a strong and statistically significant association ( $p = 0.001$ ,  $R^2 = 0.907$ ).

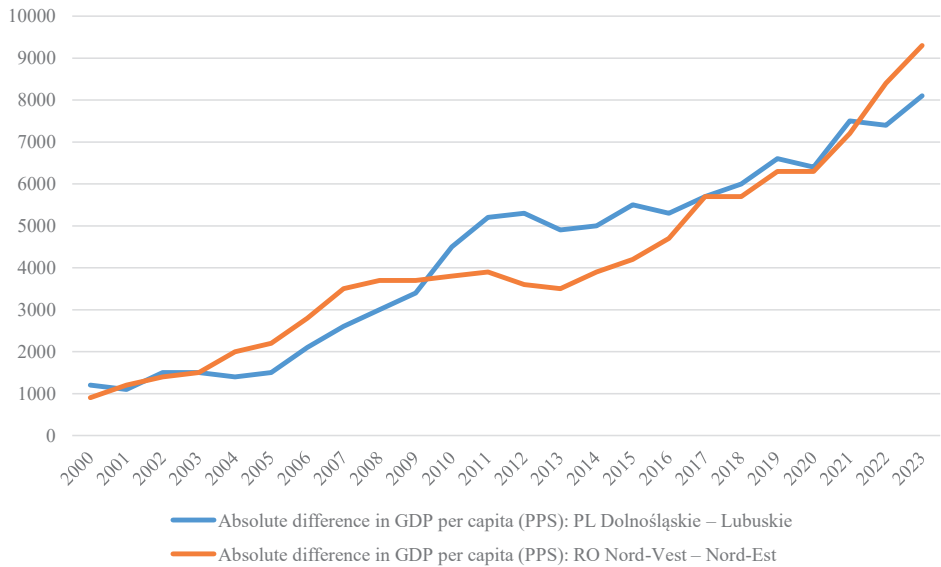
There is a relevant weakening in the relationship between human capital and economic growth as perceived from data in Panel D (2016–2023). This pattern is especially evident at the regional level. For example, in Poland, the relationship between higher education attainment and GDP per capita became statistically insignificant and shows negligible explanatory power ( $p = 0.853$ ,  $R^2 = 0.006$ ). Both Lubuskie ( $p = 0.637$ ) and Dolnośląskie ( $p = 0.432$ ) display statistically insignificant results, suggesting that higher education attainment and GDP per capita were not significantly associated in either Polish region. In Romania, the relationship is both statistically significant and relevant ( $p = 0.041$ ,  $R^2 = 0.529$ ), but it has an unexpected direction ( $\beta = -0.727$ ), suggesting that the relationship between the expansion of higher education and economic performance may have reversed direction during this period.

#### **4.2. Absolute Regional Disparities in Economic Performance**

The results highlight a pattern of regional economic divergence between less developed and more developed regions in Poland and Romania. Furthermore, the absolute income gap between these selected regions increased substantially after 2000. This pattern reflects geographically uneven economic growth, with the increases primarily concentrated in already advantaged regions.

Absolute differences, as those in Figure 3, are used in order to capture the magnitude of the economic distance between regions. This is particularly relevant for understanding the lived intensity of regional inequality independent of overall growth trends. Our results are consistent with expectations derived from new economic geography theories and cumulative causation frameworks. For example, Krugman (2009) suggests that regions with an initial advantage tend to attract a disproportionate share of capital and skilled labour relative to their less-developed counterparts. In

Figure 4. Absolute regional disparities in economic performance between selected regions in Poland and Romania



**Source:** Data processed by authors from Eurostat (2025; nama\_10r\_2gdp: Gross domestic product (GDP) at current market prices by NUTS 2 region).

addition, the theories of cumulative causation, according to Myrdal (1957: 11–22), suggest that economic growth can generate self-reinforcing dynamics. According to this framework, more developed regions gain further advantages, while less developed areas struggle to close the gap.

### 4.3. $\sigma$ -Convergence Analysis in Higher Education Attainment

Table 2 presents data on the evolution of  $\sigma$ -convergence in higher education attainment across selected regions of Poland and Romania between 2000 and 2024. The findings indicate that there is no persistent  $\sigma$ -convergence, as a growing disparity between regions over time is evident in both countries. The average share of the 25–34 years age group with completed tertiary education increased from 10.48% (2000) to 31.33% (2024)—a growth in terms of access for both countries. In addition,  $\sigma$  (standard deviation) increased notably over time, from 2.69 in 2000 to values that exceeded 11 in the early 2020s. This upward trend was accompanied by the increase of the coefficient of variation (CV). The latter variable measures the relative dispersion of educational attainment by normalising the standard deviation with respect to the mean.

Table 2.  $\sigma$ -convergence in higher education attainment (ISCED 5–8, population aged 25–34) across selected regions in Poland and Romania, 2000–2024

| Year | Mean educational attainment (%) | Standard deviation ( $\sigma$ ) | Coefficient of variation (CV) |
|------|---------------------------------|---------------------------------|-------------------------------|
| 2000 | 10.48                           | 2.685                           | 0.256                         |
| 2001 | 11.25                           | 2.818                           | 0.251                         |
| 2002 | 11.78                           | 3.215                           | 0.273                         |
| 2003 | 13.15                           | 4.710                           | 0.358                         |
| 2004 | 15.50                           | 4.925                           | 0.318                         |
| 2005 | 17.00                           | 5.890                           | 0.346                         |
| 2006 | 18.03                           | 6.120                           | 0.340                         |
| 2007 | 19.90                           | 5.931                           | 0.298                         |
| 2008 | 21.85                           | 5.217                           | 0.239                         |
| 2009 | 24.35                           | 7.304                           | 0.300                         |
| 2010 | 25.38                           | 6.899                           | 0.272                         |
| 2011 | 27.33                           | 7.895                           | 0.289                         |
| 2012 | 28.58                           | 7.739                           | 0.271                         |
| 2013 | 29.35                           | 8.437                           | 0.287                         |
| 2014 | 31.08                           | 9.368                           | 0.301                         |
| 2015 | 29.85                           | 9.498                           | 0.318                         |
| 2016 | 28.30                           | 9.554                           | 0.338                         |
| 2017 | 29.48                           | 8.972                           | 0.304                         |
| 2018 | 31.20                           | 10.464                          | 0.335                         |
| 2019 | 32.45                           | 12.549                          | 0.387                         |
| 2020 | 33.40                           | 12.521                          | 0.375                         |
| 2021 | 31.48                           | 11.714                          | 0.372                         |
| 2022 | 28.93                           | 9.022                           | 0.312                         |
| 2023 | 30.00                           | 11.546                          | 0.385                         |
| 2024 | 31.33                           | 11.094                          | 0.354                         |

**Source:** Data processed by authors from Eurostat (2025; edat\_ifse\_04: Population in private households by educational attainment level and NUTS 2 region).

**Note:** Regional values are annual mean values computed for all NUTS2 analysed. Educational attainment = share of population aged 25–34 that has completed tertiary education (ISCED 5–8).

All these results portray increased differences in higher education access in the selected regions. After declining briefly from 2006 onwards, marking the temporary convergence at the end of the initial phase of higher education expansion, the CV increased steadily, reaching consistently high levels – exceeding 0.35 – and peaking at 0.387 in 2019 and 0.385 in 2023. These values are considerably higher than previous ones. Therefore, these patterns suggest a persistent tendency towards divergence in regional educational outcomes within the studied period.

The results offer further insight into how the massification of higher education, despite historical increases in student enrolment, has coincided with a standardisation of educational attainment in Central and Eastern Europe. Regions with stronger institutional capacity and better labour market opportunities, as well as other advantages brought by urban agglomeration, appear to have captured a disproportionate share of tertiary education expansion.

#### 4.4. Sectoral Employment (NACE rev. 2)

We further engaged with employment dynamics as a structural mechanism that could outline some growth and convergence patterns identified earlier. Based on the statistical classification of economic activities (NACE Rev. 2), and in order to facilitate interpretation, NACE categories were aggregated into broader analytical sectors as described below. Full data on employment in structural NACE Rev. 2 categories can be found in Appendix (table 5–7).

Table 3. Aggregation of NACE Rev. 2 sectors into broader analytical categories

| Aggregated sector            | Included NACE categories                                                                                                                                                                                                                           |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Agriculture                  | Agriculture, forestry and fishing [A]                                                                                                                                                                                                              |
| Industry and construction    | Industry (except construction) [B–E]; Construction [F]                                                                                                                                                                                             |
| Market services              | Wholesale and retail trade; transport; accommodation and food service activities [G–I] Real estate activities [L] Arts, entertainment and recreation; other service activities; activities of households and extra-territorial organizations [R–U] |
| Knowledge-intensive services | Information and communication [J] Financial and insurance activities [K] Professional, scientific and technical activities; administrative and support service activities [M–N]                                                                    |
| Public and social services   | Public administration, defence, education, human health and social work activities [O–Q]                                                                                                                                                           |

**Source:** own study. **Note:** The aggregation represents the authors' proposal based on a functional principle concerning economic activities. The scope is to have a clearer assessment of structural transformation.

## 5. DISCUSSION

Our findings suggest that higher education did not appear to function as a spatial equaliser. There was a correlation between higher education attainment and economic performance that was robust yet variable over time. This was mainly contingent on the regional configuration. Both Poland and Romania had experienced (1) expansion of tertiary attainment concurrent with (2) widening absolute income gaps and (3) rising dispersion between regions in educational attainment. This outcome aligns with a developmental trajectory that emphasises cumulative causation over uniform catch-up.

Higher education attainment was associated with economic divergence inside both Poland and Romania between 2000 and 2023. Despite the fact that there is a strong relationship between tertiary education attainment and GDP per capita over the full period (2000–2023)—Poland ( $R^2 = .754$ ) and Romania ( $R^2 = .661$ )—our evidence indicates that it was primarily associated with growth in regions where existing capacities for structural upgrading were already pronounced.

The difference is relevant, as, for instance, Wrocław of Dolnośląskie managed to grow in the 2000s into an economic powerhouse in Poland. The case of Dolnośląskie particularly illustrates how the conditions identified in the literature as enabling a closer education-growth relationship are fully present in already advantaged regions. The association between tertiary education and economic performances has been theorised to operate through several mechanism (*Higher Education...*, 2013: 17–20, 53; Salmi, 2017: vii, xii, 1–2, 33–39):

1. A qualified and adaptable labor force that includes professionals and scientists that can implement new technologies into the workplace, including steps forward to move up the value chain and enhance the competitiveness.
2. Regions and countries without effective secondary institutions are “left behind” in terms of the global knowledge economy and lack (a) technological progress, (b) regional spillovers and (c) economic resilience.

3. A highly skilled workforce attracts foreign direct investments (FDI).
4. Tertiary education delivers broader social and systemic benefits that traditional rate-of-return analyses fail to capture, including capacity building for social mobility.

But this coupling is not stable. The years before the economic crisis saw a near-uniform synchronization, with very high level values of  $R^2$  a fact that suggested that post-communist restructuring and the EU accession processes created conditions under which tertiary expansion and productivity growth moved together. After 2009, this coupling became uneven. Romania's least developed region (Nord-Est) lost the statistical significance in the post-crisis adjustment phase, suggesting that tertiary education expansion (mainly regarding the 25–34 years population, as the number of students catching-up mature has sharply dropped in the years of crisis) was not accompanied by economic upgrading within the least developed region.

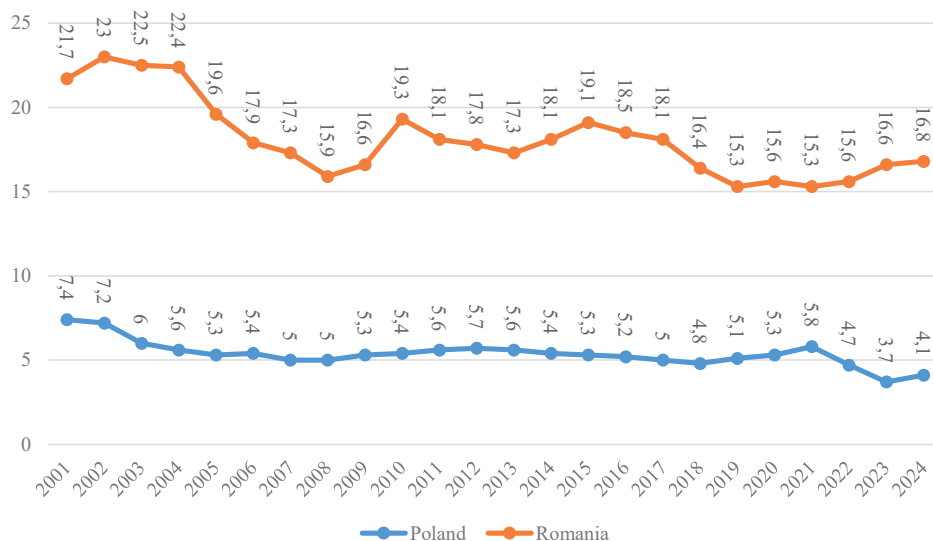
Several years later (2016–2023), Poland was in a situation where the national relationship became statistically negligible ( $R^2 = 0.006$ ;  $p = 0.853$ ), while Romania's association turned negative ( $\beta = -0.727$ ;  $p = 0.041$ ), further pointing to a broader reconfiguration of the education-growth link.

The cumulative causation relationship is further highlighted by cross-regional comparisons within sectoral employment. Generally, in both countries the share of employees in agriculture declined, but in this decline Romania lagged behind Poland throughout the whole period (24.41% to 13.65% in 2008 and 10.37% to 6.49% in 2024). At the same time, the share of people working in the service sector increased. We will focus more on knowledge-intensive services, which are a proxy for assessing the spillovers of higher education towards economic performance. In this respect, Romania also lagged behind Poland (5.85% to 8.89% in 2008 and 10.02% to 14.01% in 2024). Significant differences can be noticed inside the two countries, with the more developed regions having a larger share of employees in the knowledge-intensive services. While in Romania the Nord-Vest region increased its share faster than Nord-Est (4.53% in 2008 to 7.55% in 2024 compared to 3.90% in 2008 and 5.65% in 2024), in Poland the two regions analysed by us diverged even more significantly, with Dolnośląskie increasing fastest from 10.23% to 17.82% and Lubuskie declining from 7.27% to 6.23.

Higher education attainment is dependent on the number of eligible would-be students, which is influenced not only by the stock of people

coming to student age, but also by migration and by the share of early leavers from education and training, who quit school before finishing secondary education.

Figure 5. Early leavers from education and training in Poland and Romania, 18–24 years, 2001–2024



Source: Eurostat (2025; edat\_lfse\_16: Early leavers from education and training by NUTS 2 region).

Both in Poland and Romania, there is a regional divergence in higher education attainment and economic performance that correlates with early school leaving. Therefore, Dolnośląskie – the region with the strongest GDP – higher education association has consistently lower early leaving rates than Lubuskie – in 2018 early leavers accounted for 3.7% in Dolnośląskie, compared to 9.8% in Lubuskie. Similarly in Romania, as Nord-Est was among the regions with the weakest post-2009 HE-GDP linkage, it also exhibited the highest early school leaving rates despite the decline in time – from 29.0% in 2000 to 16.10% in 2024. Nord-Vest outperformed Nord-Est as it reduced early leaving from 23.7% in 2000 to 14.9% in 2024. This persistence aligns with earlier evidence of decoupling between higher education expansion and regional economic performance, limiting the broader developmental impact of higher education expansion.

## CONCLUSIONS

As the historiographical debate on the social and economic determinants of poverty is still developing (Janicki, 2025) higher education did not appear to function as an equalising force across regions, both less and more developed, in Poland and Romania. Its effects have been largely shaped by already existing regional structures, with higher education more closely associated with divergence than with convergence. Our findings challenge the assumption that expanding higher education, on its own, can reduce territorial inequalities, at least in post-communist contexts.

Higher education attainment did not appear to be associated with regional economic convergence between 2000 and 2023 (RQ1). Tertiary education expansion coincided with (1) widening income gaps and (2) growing differences between regions in educational level. Regions with an initial advantage in economic infrastructure showed a stronger association between educational growth and economic performance. On the other hand, structurally weakened regions, despite progress, remained disadvantaged. The outlined pattern is more consistent with cumulative causation than a process of uniform “catch-up”.

There is a clear relationship between higher education attainment and GDP per capita, both national and regional (RQ2). Nevertheless, this relationship is both (1) unstable and (2) highly uneven over time. We found periods of strong alignments, such as the pre-crisis period (2000–2008), as well as phases of decoupling, especially after moments of economic disruption. This relationship suggests that higher education sustains growth under specific conditions and cannot be treated as an independent or consistently reliable correlate of regional economic performance.

Regional disparities in education and employment are better explained by the persistence of structural inequalities rather than by protracted convergence (RQ3). In regions with stronger universities, the share of graduates employed in knowledge-intensive sectors increased faster, coinciding with stronger economic performance and deeper long-term regional divides. Smaller and/or lower-performing universities were found to have a more limited ability to stimulate employment in knowledge-intensive sectors, as well as overall regional economic performance.

Early leaving from education and training is associated with weaker human capital accumulation and represents a structural constraint on regional development. The strong overlap between (1) high early school leaving, (2) weaker higher education growth and (3) lower regional economic performance suggest that inequalities are rooted earlier in the educational system. In short, higher education alone cannot be expected to offset deeper structural disadvantages.

Overall, our results underline that higher education appears less as a tool of regional convergence and more as a factor co-evolving with, and potentially, reinforcing, existing divergences. Policies that aim to use higher education as a lever for convergence have to address further factors, including (1) labour market structure, (2) demographic trends and (3) early stages of pre-university education, if more balanced regional development is to be achieved in regions such as post-communist Central and Eastern Europe.

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## APPENDIX

Table 4. Higher education attainment (ISCED 5–8), population aged 25–34 years in Poland, Romania and selected regions, 2000–2024

| Year | Poland | Lubuskie (PL) | Dolnośląskie (PL) | Romania | Nord-Est (RO) | Nord-Vest (RO) |
|------|--------|---------------|-------------------|---------|---------------|----------------|
| 2000 | 14.3   | 11.3          | 14.2              | 9.2     | 6.8           | 9.6            |
| 2001 | 15.0   | 11.9          | 15.0              | 9.5     | 7.1           | 11.0           |
| 2002 | 16.8   | 12.5          | 16.5              | 10.4    | 7.7           | 10.4           |
| 2003 | 20.3   | 14.2          | 20.2              | 10.7    | 7.5           | 10.7           |
| 2004 | 23.0   | 19.0          | 21.4              | 12.6    | 9.1           | 12.5           |
| 2005 | 25.4   | 20.5          | 24.7              | 13.5    | 9.9           | 12.9           |
| 2006 | 28.0   | 20.1          | 27.0              | 14.8    | 11.1          | 13.9           |
| 2007 | 30.0   | 22.2          | 28.3              | 16.6    | 12.6          | 16.5           |
| 2008 | 32.1   | 24.0          | 29.3              | 18.8    | 15.9          | 18.2           |
| 2009 | 35.5   | 28.1          | 34.4              | 19.5    | 16.2          | 18.7           |
| 2010 | 37.1   | 29.4          | 34.4              | 20.7    | 16.9          | 20.8           |
| 2011 | 39.0   | 32.2          | 37.7              | 22.5    | 18.8          | 20.6           |
| 2012 | 40.8   | 33.1          | 38.9              | 23.6    | 20.1          | 22.2           |
| 2013 | 41.8   | 34.3          | 40.4              | 24.4    | 19.1          | 23.6           |
| 2014 | 42.6   | 36.6          | 43.3              | 25.4    | 19.6          | 24.8           |
| 2015 | 43.2   | 35.1          | 41.3              | 25.5    | 15.9          | 27.1           |
| 2016 | 43.5   | 32.1          | 40.8              | 24.8    | 14.6          | 25.7           |
| 2017 | 43.6   | 32.9          | 41.6              | 25.6    | 17.1          | 26.3           |
| 2018 | 43.5   | 33.1          | 47.0              | 24.9    | 18.6          | 26.1           |
| 2019 | 44.6   | 34.1          | 51.5              | 25.5    | 17.1          | 27.1           |
| 2020 | 43.7   | 36.2          | 51.5              | 24.9    | 16.9          | 29.0           |
| 2021 | 41.8   | 34.3          | 49.1              | 23.3    | 18.0          | 24.5           |
| 2022 | 41.7   | 30.0          | 43.1              | 24.7    | 19.4          | 23.2           |
| 2023 | 46.3   | 32.7          | 47.5              | 22.5    | 17.1          | 22.7           |
| 2024 | 45.7   | 32.9          | 48.7              | 23.2    | 19.8          | 23.9           |

Source: Data processed by authors from Eurostat (2025; edat\_ifse\_04: Population in private households by educational attainment level and NUTS 2 region).

Table 5. Sectoral employment structure by aggregated NACE Rev. 2 aggregated categories in Poland, Romania, and selected regions, as a percentage of total employment, 2008–2024

| <b>Poland (%)</b>                             | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> |
|-----------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <i>Agriculture, forestry and fishing [A]</i>  | 13.65       | 13.03       | 12.85       | 12.60       | 12.27       | 11.73       | 11.41       | 11.52       | 10.57       | 10.14       | 9.56        | 8.99        | 9.35        | 8.17        | 7.98        | 7.55        | 6.49        |
| <i>Industry and construction [B–F]</i>        | 32.08       | 31.23       | 30.47       | 30.80       | 30.49       | 30.49       | 30.38       | 30.33       | 31.28       | 31.51       | 31.71       | 31.95       | 31.60       | 30.69       | 30.70       | 29.72       | 30.28       |
| <i>Market services [G–I, L, R–U]</i>          | 25.08       | 25.39       | 25.75       | 25.59       | 25.60       | 25.58       | 25.72       | 25.77       | 25.91       | 25.88       | 25.78       | 25.82       | 25.53       | 26.48       | 26.39       | 26.03       | 25.94       |
| <i>Knowledge-intensive services [J,K,M–N]</i> | 8.89        | 9.58        | 9.77        | 10.16       | 10.59       | 10.55       | 10.92       | 10.96       | 10.95       | 11.10       | 11.25       | 11.66       | 11.91       | 12.38       | 12.63       | 13.71       | 14.01       |
| <i>Public and social services [O–Q]</i>       | 20.25       | 20.72       | 21.08       | 20.82       | 21.01       | 21.59       | 21.41       | 21.11       | 20.91       | 20.99       | 21.22       | 21.04       | 21.03       | 21.68       | 21.82       | 22.36       | 22.54       |
| <b>Lubuskie (%)</b>                           | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> |
| <i>Agriculture, forestry and fishing [A]</i>  | 8.46        | 7.49        | 8.09        | 7.62        | 7.61        | 8.27        | 7.96        | 6.33        | 6.56        | 7.93        | 6.93        | 6.42        | 6.89        | 3.81        | 3.62        | 3.16        | 3.55        |
| <i>Industry and construction [B–F]</i>        | 36.30       | 35.04       | 34.03       | 34.78       | 32.95       | 33.04       | 32.80       | 34.35       | 33.19       | 32.39       | 34.62       | 36.28       | 34.60       | 33.72       | 34.70       | 32.61       | 31.60       |
| <i>Market services [G–I, L, R–U]</i>          | 25.56       | 26.49       | 26.24       | 26.49       | 28.20       | 25.86       | 26.44       | 26.98       | 28.17       | 28.00       | 27.30       | 25.82       | 25.66       | 27.44       | 28.31       | 29.54       | 29.82       |
| <i>Knowledge-intensive services [J,K,M–N]</i> | 7.27        | 6.65        | 7.37        | 7.75        | 7.77        | 6.64        | 6.95        | 6.88        | 6.82        | 7.37        | 7.66        | 8.58        | 4.97        | 6.01        | 5.51        | 5.00        | 6.23        |
| <i>Public and social services [O–Q]</i>       | 22.41       | 23.57       | 22.43       | 21.02       | 22.33       | 23.83       | 23.54       | 23.36       | 24.00       | 23.00       | 22.12       | 21.40       | 23.17       | 24.23       | 23.34       | 24.66       | 23.66       |
| <b>Dolnośląskie (%)</b>                       | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> |
| <i>Agriculture, forestry and fishing [A]</i>  | 7.10        | 7.78        | 6.73        | 6.53        | 6.72        | 5.61        | 4.75        | 4.96        | 4.20        | 4.59        | 4.90        | 3.87        | 4.36        | 4.64        | 5.02        | 4.06        | 3.19        |
| <i>Industry and construction [B–F]</i>        | 38.93       | 35.09       | 34.44       | 34.65       | 34.82       | 34.88       | 34.90       | 34.72       | 36.38       | 35.88       | 33.99       | 34.59       | 34.46       | 30.66       | 33.40       | 32.64       | 33.48       |
| <i>Market services [G–I, L, R–U]</i>          | 25.29       | 26.46       | 25.69       | 25.54       | 25.03       | 25.28       | 25.80       | 25.95       | 25.54       | 26.89       | 27.82       | 26.21       | 24.95       | 27.06       | 25.02       | 24.79       | 24.11       |
| <i>Knowledge-intensive services [J,K,M–N]</i> | 10.23       | 10.51       | 10.48       | 11.46       | 12.20       | 12.29       | 13.75       | 13.61       | 13.09       | 12.50       | 12.43       | 14.13       | 14.88       | 15.37       | 15.40       | 17.34       | 17.82       |
| <i>Public and social services [O–Q]</i>       | 18.28       | 20.04       | 22.58       | 21.69       | 21.10       | 21.80       | 20.68       | 20.55       | 20.63       | 20.02       | 20.27       | 20.67       | 20.70       | 21.37       | 20.06       | 20.57       | 20.85       |

| <b>Romania (%)</b>                            | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> |
|-----------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <i>Agriculture, forestry and fishing [A]</i>  | 24.41       | 24.93       | 26.78       | 25.12       | 25.60       | 25.13       | 24.33       | 21.91       | 19.63       | 19.26       | 18.80       | 18.08       | 17.55       | 10.80       | 10.23       | 11.00       | 10.37       |
| <i>Industry and construction [B-F]</i>        | 33.47       | 31.77       | 30.16       | 30.39       | 29.97       | 29.95       | 30.49       | 29.74       | 31.11       | 31.50       | 31.33       | 31.20       | 30.84       | 33.26       | 33.14       | 33.48       | 32.97       |
| <i>Market services [G-I, L, R-U]</i>          | 21.61       | 21.99       | 21.78       | 22.47       | 22.81       | 23.45       | 23.81       | 25.05       | 25.84       | 25.62       | 26.46       | 26.89       | 27.38       | 30.11       | 30.30       | 30.37       | 30.75       |
| <i>Knowledge-intensive services [J,K,M-N]</i> | 5.85        | 6.15        | 6.40        | 6.91        | 7.13        | 7.34        | 7.78        | 8.20        | 8.48        | 8.74        | 8.74        | 8.92        | 9.06        | 9.59        | 9.87        | 9.55        | 10.02       |
| <i>Public and social services [O-Q]</i>       | 14.66       | 15.16       | 14.89       | 15.10       | 14.50       | 14.12       | 13.58       | 15.10       | 14.93       | 14.87       | 14.67       | 14.91       | 15.17       | 16.23       | 16.46       | 15.61       | 15.88       |
| <b>Nord-Vest (%)</b>                          | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> |
| <i>Agriculture, forestry and fishing [A]</i>  | 22.23       | 23.45       | 26.15       | 22.65       | 24.87       | 24.73       | 21.77       | 17.72       | 16.44       | 16.51       | 15.34       | 15.15       | 13.89       | 8.54        | 8.26        | 9.99        | 9.42        |
| <i>Industry and construction [B-F]</i>        | 35.48       | 33.24       | 31.51       | 34.08       | 32.91       | 32.56       | 35.48       | 33.24       | 34.23       | 34.58       | 35.22       | 34.51       | 33.20       | 34.88       | 36.37       | 37.33       | 36.78       |
| <i>Market services [G-I, L, R-U]</i>          | 22.26       | 23.38       | 22.52       | 23.47       | 23.66       | 23.77       | 24.36       | 25.65       | 26.26       | 26.42       | 27.16       | 27.32       | 27.90       | 31.09       | 31.83       | 29.83       | 29.25       |
| <i>Knowledge-intensive services [J,K,M-N]</i> | 4.53        | 4.86        | 4.89        | 4.91        | 4.98        | 5.52        | 5.88        | 7.31        | 6.98        | 7.19        | 7.49        | 7.47        | 7.98        | 7.30        | 7.55        | 7.69        | 7.55        |
| <i>Public and social services [O-Q]</i>       | 15.31       | 14.97       | 14.78       | 14.68       | 13.40       | 13.20       | 12.28       | 15.75       | 15.91       | 15.13       | 14.57       | 15.19       | 16.67       | 17.81       | 15.73       | 14.95       | 16.61       |
| <b>Nord-Est (%)</b>                           | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> |
| <i>Agriculture, forestry and fishing [A]</i>  | 41.46       | 42.12       | 45.27       | 44.65       | 43.56       | 43.96       | 43.17       | 43.88       | 41.67       | 40.88       | 40.44       | 39.22       | 38.60       | 24.22       | 22.66       | 23.63       | 21.22       |
| <i>Industry and construction [B-F]</i>        | 24.31       | 23.03       | 21.00       | 21.52       | 22.56       | 21.54       | 21.17       | 21.51       | 23.13       | 23.73       | 22.64       | 23.61       | 25.17       | 30.21       | 28.81       | 29.06       | 29.16       |
| <i>Market services [G-I, L, R-U]</i>          | 16.00       | 16.33       | 16.11       | 16.75       | 17.05       | 17.70       | 19.18       | 19.12       | 19.88       | 19.94       | 20.75       | 20.73       | 20.61       | 26.98       | 28.42       | 28.26       | 29.44       |
| <i>Knowledge-intensive services [J,K,M-N]</i> | 3.90        | 4.00        | 3.78        | 3.79        | 4.25        | 4.39        | 4.13        | 3.50        | 4.03        | 4.40        | 4.31        | 4.64        | 4.27        | 5.39        | 5.22        | 5.17        | 5.65        |
| <i>Public and social services [O-Q]</i>       | 14.23       | 14.31       | 13.65       | 13.12       | 12.46       | 12.33       | 12.09       | 11.87       | 11.17       | 10.94       | 11.64       | 11.67       | 11.22       | 13.06       | 14.61       | 13.66       | 14.36       |

**Source:** Data processes and aggregated by authors from Eurostat (2025; lfst\_r\_lfe2en2: Employed persons by economic activity and NUTS 2 region (NACE Rev. 2) (2008-2024).

Table 6. Relative differences in sectoral employment structure by aggregated NACE Rev. 2 aggregated categories between Poland and Romania, including selected regions, as a percentage of total employment, 2008–2024

| Poland – Romania (%)                          | 2008        | 2009        | 2010        | 2011        | 2012        | 2013        | 2014        | 2015        | 2016        | 2017        | 2018        | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        |
|-----------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <i>Agriculture, forestry and fishing [A]</i>  | -10.76      | -11.90      | -13.93      | -12.53      | -13.32      | -13.40      | -12.93      | -10.39      | -9.06       | -9.12       | -9.24       | -9.09       | -8.20       | -2.63       | -2.24       | -3.45       | -3.88       |
| <i>Industry and construction [B-F]</i>        | -1.39       | -0.54       | 0.32        | 0.41        | 0.52        | 0.54        | -0.12       | 0.59        | 0.17        | 0.01        | 0.38        | 0.75        | 0.76        | -2.57       | -2.44       | -3.76       | -2.69       |
| <i>Market services [G-I, L, R-U]</i>          | 3.46        | 3.41        | 3.97        | 3.12        | 2.79        | 2.13        | 1.91        | 0.72        | 0.07        | 0.26        | -0.68       | -1.07       | -1.86       | -3.63       | -3.91       | -4.34       | -4.81       |
| <i>Knowledge-intensive services [J,K,M-N]</i> | 3.04        | 3.43        | 3.38        | 3.25        | 3.46        | 3.21        | 3.14        | 2.76        | 2.46        | 2.36        | 2.50        | 2.74        | 2.85        | 2.79        | 2.76        | 4.16        | 3.99        |
| <i>Public and social services [O-Q]</i>       | 5.59        | 5.55        | 6.19        | 5.72        | 6.51        | 7.47        | 7.82        | 6.01        | 5.98        | 6.12        | 6.56        | 6.12        | 5.86        | 5.45        | 5.36        | 6.75        | 6.67        |
|                                               |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| <b>Lubuskie (PL) – Nord-Est (RO) (%)</b>      | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> |
| <i>Agriculture, forestry and fishing [A]</i>  | -33.00      | -34.63      | -37.18      | -37.04      | -35.94      | -35.69      | -35.20      | -37.55      | -35.11      | -32.95      | -33.51      | -32.80      | -31.71      | -20.41      | -19.04      | -20.47      | -17.67      |
| <i>Industry and construction [B-F]</i>        | 11.99       | 12.01       | 13.03       | 13.26       | 10.39       | 11.50       | 11.63       | 12.84       | 10.05       | 8.66        | 11.97       | 12.67       | 9.42        | 3.51        | 5.89        | 3.55        | 2.44        |
| <i>Market services [G-I, L, R-U]</i>          | 9.56        | 10.16       | 10.14       | 9.74        | 11.15       | 8.16        | 7.26        | 7.86        | 8.29        | 8.06        | 6.54        | 5.09        | 5.05        | 0.46        | -0.11       | 1.28        | 0.38        |
| <i>Knowledge-intensive services [J,K,M-N]</i> | 3.37        | 2.65        | 3.60        | 3.95        | 3.52        | 2.25        | 2.82        | 3.38        | 2.79        | 2.96        | 3.35        | 3.94        | 0.70        | 0.62        | 0.30        | -0.17       | 0.58        |
| <i>Public and social services [O-Q]</i>       | 8.18        | 9.26        | 8.78        | 7.90        | 9.87        | 11.50       | 11.45       | 11.50       | 12.83       | 12.06       | 10.48       | 9.73        | 11.95       | 11.17       | 8.73        | 11.00       | 9.30        |
|                                               |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| <b>Dolnośląskie (PL) – Nord-Vest (RO) (%)</b> | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> |
| <i>Agriculture, forestry and fishing [A]</i>  | -15.13      | -15.66      | -19.42      | -16.13      | -18.15      | -19.12      | -17.02      | -12.76      | -12.24      | -11.92      | -10.44      | -11.28      | -9.53       | -3.90       | -3.24       | -5.93       | -6.23       |
| <i>Industry and construction [B-F]</i>        | 3.45        | 1.85        | 2.92        | 0.57        | 1.91        | 2.33        | -0.58       | 1.48        | 2.15        | 1.30        | -1.23       | 0.08        | 1.26        | -4.21       | -2.98       | -4.69       | -3.30       |
| <i>Market services [G-I, L, R-U]</i>          | 3.03        | 3.08        | 3.17        | 2.07        | 1.37        | 1.51        | 1.44        | 0.30        | -0.71       | 0.47        | 0.67        | -1.11       | -2.95       | -4.03       | -6.81       | -5.03       | -5.14       |
| <i>Knowledge-intensive services [J,K,M-N]</i> | 5.70        | 5.65        | 5.59        | 6.54        | 7.22        | 6.78        | 7.87        | 6.30        | 6.10        | 5.31        | 4.94        | 6.67        | 6.90        | 8.08        | 7.85        | 9.65        | 10.27       |
| <i>Public and social services [O-Q]</i>       | 2.97        | 5.07        | 7.79        | 7.01        | 7.70        | 8.60        | 8.40        | 4.80        | 4.72        | 4.89        | 5.70        | 5.48        | 4.03        | 3.56        | 4.34        | 5.62        | 4.24        |

**Source:** Data processes and aggregated by authors from Eurostat (2025; lfst\_r\_lfe2en2: Employed persons by economic activity and NUTS 2 region (NACE Rev. 2) (2008-2024).

Table 7. Early leavers from education and training in Poland, Romania and selected regions, 18–24 years, 2000–2024

| Year | Poland | Lubuskie<br>(PL) | Dolnośląskie<br>(PL) | Romania | Nord-Est<br>(RO) | Nord-Vest<br>(RO) |
|------|--------|------------------|----------------------|---------|------------------|-------------------|
| 2000 | -      | -                | -                    | 22.90   | 29.00            | 23.70             |
| 2001 | 7.40   | 5.60             | 8.40                 | 21.70   | 26.30            | 25.00             |
| 2002 | 7.20   | 7.00             | 7.90                 | 23.00   | 29.20            | 28.00             |
| 2003 | 6.00   | 7.40             | 7.80                 | 22.50   | 28.00            | 25.30             |
| 2004 | 5.60   | 8.70             | 6.50                 | 22.40   | 25.60            | 20.40             |
| 2005 | 5.30   | 8.50             | 5.10                 | 19.60   | 21.40            | 16.50             |
| 2006 | 5.40   | 7.20             | 4.60                 | 17.90   | 19.20            | 15.30             |
| 2007 | 5.00   | 6.60             | 6.40                 | 17.30   | 19.70            | 12.50             |
| 2008 | 5.00   | 8.30             | 5.80                 | 15.90   | 18.40            | 12.20             |
| 2009 | 5.30   | 9.40             | 5.20                 | 16.60   | 19.20            | 15.10             |
| 2010 | 5.40   | 8.70             | 5.60                 | 19.30   | 24.70            | 18.20             |
| 2011 | 5.60   | 8.00             | 5.90                 | 18.10   | 22.10            | 14.90             |
| 2012 | 5.70   | 7.60             | 6.60                 | 17.80   | 22.20            | 14.90             |
| 2013 | 5.60   | 9.30             | 6.70                 | 17.30   | 22.50            | 15.40             |
| 2014 | 5.40   | 9.50             | 7.30                 | 18.10   | 21.70            | 17.70             |
| 2015 | 5.30   | 8.40             | 8.20                 | 19.10   | 25.30            | 16.90             |
| 2016 | 5.20   | 8.30             | 9.30                 | 18.50   | 24.70            | 18.30             |
| 2017 | 5.00   | 8.10             | 4.50                 | 18.10   | 23.60            | 16.30             |
| 2018 | 4.80   | 9.80             | 3.70                 | 16.40   | 19.50            | 14.90             |

Table 7. (cont.)

| Year | Poland | Lubuskie<br>(PL) | Dolnośląskie<br>(PL) | Romania | Nord-Est<br>(RO) | Nord-Vest<br>(RO) |
|------|--------|------------------|----------------------|---------|------------------|-------------------|
| 2019 | 5.10   | 9.20             | 6.80                 | 15.30   | 17.40            | 13.50             |
| 2020 | 5.30   | -                | -                    | 15.60   | 18.40            | 14.90             |
| 2021 | 5.80   | -                | 8.50                 | 15.30   | 15.30            | 16.30             |
| 2022 | 4.70   | -                | 7.10                 | 15.60   | 14.60            | 15.90             |
| 2023 | 3.70   | -                | -                    | 16.60   | 16.30            | 15.00             |
| 2024 | 4.10   | -                | -                    | 16.80   | 16.10            | 14.90             |

Source: Eurostat (2025; edat\_lfse\_16:Early leavers from education and training by NUTS 2 region).