

Educational Attainment Upgrading in Europe 2010-2024: Evidence from ISCED Panel Data

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Abstract. *Educational attainment upgrading has come to be recognized as an essential process for economic resilience, labor market adaptability, and long-term convergence. This paper analyzes changes in educational attainment structures of Europe during 2010-2024 with particular attention paid to whether reductions in low education (ISCED 0-2) were caused by temporary changes to favor upper secondary attainment (ISCED 3-4), or represented structural educational attainment upgrading due to tertiary education upgrading (ISCED 5-8). Using harmonized official statistics on educational attainments of Europe, the analysis builds a balanced panel with 15 European countries and uses pooling, fixed-effects, and random effects estimations in order to separate cross-country regimes from within-country temporal dynamics. Furthermore, the empirical strategy includes estimation of transition dynamics with respect to diminishing marginal effects of increasing attainment rate at different levels of secondary attainment rates. Joint behavior of attaining levels is analyzed using panel methods in order to establish whether attainment shares are adjusted simultaneously. The findings demonstrate high heterogeneity among countries and show that pooled estimations overestimate short-term educational attainment upgrading taking into account permanent features of the regime in each country. The findings support the idea of diminishing marginal gains from secondary educational attainment expansion in its advanced stage, similar to threshold type transition dynamics. Findings on long-term relationships point out coordinated adjustment of attaining levels with tertiary attainment as a driving factor.*

Keywords: educational upgrading, human capital, educational attainment, convergence, panel modelling, long-run dynamics.

Introduction

Education is increasingly perceived as a key determinant for long-term economic development and social mobility. In Europe, most policy agendas pay much attention to convergence and human capital accumulation, although educational results are still very heterogeneous. Differences in education structures do not only exist between the most advanced countries and those lagging behind but also among large regional aggregates due to their long-term history of institutions' capacities and population characteristics and successful reforms. Recent cross-country evidence shows that education structures are still highly diverse across European countries regardless of high economic integration (OECD, 2024). However, current empirical analysis encounters great challenges in terms of understanding the dynamics of educational attainment structures and mutual dependence of shifts in different attainment groups.

In many countries, educational upgrading does not happen straightforwardly, and reductions in low attainment are usually slower than expected despite a rise in upper secondary enrollment rates. Moreover, educational attainment implies an interrelation of attainment levels – shares of low, secondary and tertiary educational attainments change together as a part of the structure. Therefore, any shift in one part of the system is always linked with the shifts of other parts, and thus it is necessary to model these relations empirically. Finally, long-run evidence suggests that educational upgrading

is a gradual process that takes place due to cohort replacements and different national paths without convergence to a common benchmark point (Barro & Lee, 2013).

The objective of this study is to model the dynamics of educational attainment in Europe using the ISCED classification and considering the share of individuals with three types of attainment (low attainment – ISCED 0-2, upper secondary education – ISCED 3-4 and tertiary education – ISCED 5-8). A balanced panel will be used for the 15 European countries over 15 years of data from 2010 to 2024. Thus, an empirical investigation into the dynamics of the considered three attainment levels will help to better understand the processes of educational upgrading in European economies and reveal whether reductions in low education are driven mostly by short-term shifts in upper secondary attainment or deeper upgrades due to growth in tertiary education.

The study will focus on two key research questions. The first question is: To what extent is the decline of individuals with low educational attainment systematically related to secondary and tertiary attainment expansions in European countries? The second question is: Does the relationship between individuals with upper-secondary attainment and low education vary over time and become subject to threshold-type dynamics such that gains become more difficult as secondary attainment approaches high levels? Both research questions have a strong theoretical value because human capital formation and educational convergence require not only increasing individual attainment rates, but also proper adjustment at various education tiers within national systems. Hence, determining the dynamics of educational upgrading and identifying its potential mechanisms, in particular, single-channel versus multiple level transitions, is vital for understanding long-run structural change. Furthermore, these issues also have practical importance as they can inform the sequencing of education policies and determine how effective they are. Namely, does the prioritization of intermediate attainment alone make sense, or should policymakers strengthen the pathways that link secondary education to further progression to tertiary studies? This problem can be considered within the wider context of the impact of structural reform capacity on education development in Europe (Cuaresma et al., 2014).

The following paper makes three main contributions to the existing knowledge about educational attainment dynamics. First, it considers attainment as a structural variable that reflects the peculiarities of each country's educational system and emphasizes persistent cross-country heterogeneity as an important characteristic of the education situation in Europe. Second, it confirms the fact that the short-term changes in attainments are not sufficient to explain reductions in low education within countries. Third, it demonstrates the strategic role of tertiary education in the process of structural transformation of national education systems.

Literature review

Educational attainment continues to play an important role in shaping long-run economic growth, employment stability, and social mobility. In Europe, although there is commonality among policies and institutional structures and there are effective instruments for promoting economic integration, attainment profiles vary significantly across countries, suggesting that educational convergence in Europe has yet to take place and is typically conditioned by institutional factors and socioeconomic contexts (OECD, 2024; European Commission, 2024). These differences are clearly observed in officially harmonized statistics, reporting disparities in both low education and tertiary attainment across European nations over several decades (Eurostat, 2025; Eurostat, n.d.). Moreover, in the field of human capital studies, it is acknowledged that the discrepancies in the levels of attainment and skill development across different economies may lead to diverging

productivity and growth outcomes (Hanushek & Woessmann, 2012; Barro & Lee, 2013). Hence, the dynamics of attainment distributions are crucial to exploring economic convergence.

One of the benefits of researching educational attainment from an empirical perspective is that international comparisons can be made using European data since the framework for classification based on ISCED is universally accepted. Thus, educational attainment can be described as a hierarchical distribution consisting of low education (ISCED 0–2), upper secondary education (ISCED 3–4), and tertiary education (ISCED 5–8). Nevertheless, in the long run, attainment expansion is nonlinear. For instance, employing global education data, Barro and Lee (2013) find that the upgrading of education proceeds slowly, implying that annual changes should be regarded as small in terms of the overall evolution of the structure of attainment. Additionally, other empirical studies suggest that the process of educational upgrading may be characterized by sequential changes in attainment levels and may involve multiple cohorts (Psacharopoulos, 2018).

From a European perspective, educational upgrading is often associated with reform capacity and institutional modernization. Based on empirical analysis, Cuaresma et al. (2014) prove that the trajectory of attainment is affected by structural reforms and demonstrate that countries can follow different development pathways despite similar macroeconomic conditions. From another perspective, research on the regional level emphasizes the importance of higher education institutions as sources of innovation and regional development, thereby highlighting the contribution of tertiary expansion to economic change besides its effect on human capital (Bertoletti et al., 2022). Finally, educational convergence literature acknowledges that the rise in attainment levels is usually asymmetric across countries and regions due to differences in institutional frameworks and labor market requirements (Hanushek & Woessmann, 2012).

With regards to methods, the reviewed literature shows the need for panel methods for analysing heterogeneous samples of Europe. The advantage of panel methods is their ability to differentiate between cross-country and within-country changes which are especially important for educational attainment processes. Following this consideration, the Dumitrescu–Hurlin approach has been recognised as an efficient method for Granger causality tests in heterogeneous panels, due to its capability to include cross-sectional variation in causal relationships (Dumitrescu & Hurlin, 2012; Lopez & Weber, 2017). Likewise, the need for long-run macro-panel modeling arises whenever attainment shares are characterised by persistence and co-movements. This explains why cointegration analysis has often been used in macro panels to investigate stable equilibrium relations between variables (Westerlund, 2015; Arsova & Örsal, 2021). Moreover, recent developments in the field have provided grounds for estimating full modified models capable of producing robust coefficient estimates in the presence of endogeneity and serial correlation (Wagner & Reichold, 2023). Finally, in case of macro panels with a small time dimension like data sets spanning the period of 2010–2024, unit-root test will still be relevant (Karavias, 2014).

In summary, the existing literature suggests that educational attainment in Europe should be seen as a persistent and heterogeneous structural system. Based on these results, the current research employs a panel-based methodology utilising harmonised Eurostat data in order to explore the effect of low attainment reduction on secondary and tertiary attainment in Europe. To this aim, short-run models will be estimated along with the use of long-run system methods.

Methodology

The empirical analysis relies on educational attainment measures extracted from the Eurostat Database with cross-country comparability ensured through the ISCED classification system. The database is structured as a balanced panel covering the 2010–2024 timeframe among 15 European

entities: Bosnia and Herzegovina, Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, North Macedonia, Poland, Romania, Serbia, Slovakia, Slovenia and Türkiye. The use of a balanced panel allows analyzing not only cross-country differences in educational structures but also changes in these structures over time.

For selecting the countries, two main criteria were applied: (i) full-year data coverage throughout the 2010-2024 period and (ii) comparable reporting of the attainment shares in the three categories of educational levels used for analysis (ISCED 0-2, ISCED 3-4, and ISCED 5-8). In addition, the selected group of countries demonstrates significant variation in terms of education attainment structures and reform trajectories thus being appropriate for analysis of heterogeneous dynamics of education upgrading in Europe. Both EU member states and adjacent European economies with a similar statistics infrastructure and different institutional and developmental specifics are included in the sample.

The resulting panel consists of 225 data points (15 countries * 15 years) that allows analyzing cross-sectional and time variations in educational attainment structures. For our purposes, attainment shares are defined as percentage shares of the population and thus interpreted as elements of educational structure in the considered country. Thus, any changes in education attainment shares should be viewed in light of changes in the whole educational attainment structure. All calculations and econometric estimations were carried out in EViews.

Variables and operational definitions

Modeling of educational attainment will employ three interrelated indicators drawn from ISCED categories:

- ISCED 0–2 (Low education): population share having at most lower secondary education. It represents the main dependent indicator, reflecting the structural lag in education.
- ISCED 3–4 (Upper secondary): population share having upper secondary or post-secondary non-tertiary education; it can be considered the key intermediate attainment layer, which absorbs the low-education population through time.
- ISCED 5–8 (Tertiary education): population share having tertiary education; this is more advanced attainment level and expected to take a crucial strategic position in long-term transformation.

As a result of their being shares within the same distribution, all three ISCED indicators are interdependent, i.e. an increase in one of them must be accompanied by some changes in the other two. This compositional dependency indicates that regression coefficients are expected to reflect associations within the educational attainment system instead of marginal effects of each variable separately.

However, despite the presence of compositional constraint, the initial analysis relies on the pooled, fixed-effects (FE), and random-effects (RE) panel models. They provide an intuitively clear and easily interpretable baseline that allows making a distinction between structural cross-country difference and temporal change within countries. More specialized modeling procedures (such as log-ratio transformations) will be used in robustness checks and require additional modeling decisions.

Econometric strategy

The econometric design is composed of three elements that combine the short-run panel specification with the long-run system dynamic properties in order to avoid over-interpretation of simple pooled correlations. In practice, the estimation process includes three main steps: (i)

estimation of short-run effects, (ii) non-linear transition testing and (iii) long-run adjustment testing. In order to examine the impact of high education on low education attainment adjustment, the baseline model is specified as follows:

$$ISCED(0-2)_{it} = \alpha + \beta_1 ISCED(3-4)_{it} + \varepsilon_{it} \quad (1)$$

where i represents the cross-section identifier and t the year identifier. The research process starts with pooled specification, followed by introduction of panel structures in order to separate cross-section structure variations from year-by-year adjustments of countries.

In particular, the pooled specification captures the average pattern across the sample, whereas the panel specifications allow to separate out the time invariant structure of each country from its year-by-year adjustments. Fixed and random effect panel models are used for this purpose, respectively.

Next, in order to find whether the decline of low education is based on multiple channels of upgrading or just one, the following specification will be tested:

$$ISCED(0-2)_{it} = \alpha + \beta_1 ISCED(3-4)_{it} + \beta_2 ISCED(5-8)_{it} + \varepsilon_{it} \quad (2)$$

This multivariate specification will reveal whether tertiary education attainment explains low education changes better than secondary attainment.

There is likely to be a diminishing return in the effect of secondary education as the ISCED system evolves through successive levels. The following specification tests for such non-linearity:

$$ISCED(0-2)_{it} = \alpha + \beta_1 ISCED(3-4)_{it} + \beta_2 ISCED(3-4)_{it}^2 + \varepsilon_{it} \quad (3)$$

The non-linearity test focuses on significance of the squared term. If found statistically significant, this means that the marginal effect of secondary attainment on lowering low education varies according to developmental stage, thus indicating a threshold effect.

Since educational attainments evolve gradually and may be persistent, the short-run specification must be complemented with long-run techniques. Long-run methods will allow finding whether the different educational attainment levels are moving together through time as a result of a structural system equilibrium adjustment. In particular, it will reveal whether ISCED levels form such an equilibrium structure, which allows interpreting educational attainment changes as a structural adjustment.

Testing for long-run equilibrium structure between educational attainment levels is done by panel cointegration. Provided existence of a cointegration relationship, the long-run coefficients are estimated using the fully modified OLS approach (FMOLS). This technique takes into account the potential endogeneity of ISCED levels due to possible serial correlation.

In order to examine whether one ISCED level leads another through time in terms of adjustment, heterogeneous Granger causality test is applied to panel data. This technique was specifically developed by Dumitrescu and Hurlin in order to assess causality in macroeconomic panels when the relationship differs from one country to another. Therefore, using the technique, we may find whether tertiary education attains precedes other education changes or vice versa.

All the data processing and model estimation work was carried out in EViews software package. The procedure allows for implementing panel regressions, non-linear specifications and long-run equilibrium models in one application. Descriptive patterns and econometric estimations

are reported consistently throughout the empirical analysis in order to avoid drawing conclusions from partial output.

Results and discussions

Education structure in Europe and the role of persistent heterogeneity

In this regard, the findings of the empirical analysis reveal significant differences in attainment between countries in the sample of Europe, especially with regards to the share of low education (ISCED 0–2). This heterogeneity becomes crucial due to the fact that the educational system of the European economy does not operate in accordance with only one dynamic path. Countries occupy different attainment regimes depending on their long-term institutional background, education policies, demographics and labor-market demand for skilled workers. The regime-related patterns observed in the empirical analysis coincide with recent international empirical findings concerning heterogeneity in attainment and skill outcomes between countries (OECD, 2024).

Therefore, it can be concluded that educational attainment is characterized by slow-moving structural determinants that operate over several decades, thus explaining the incomplete nature of convergence of educational attainment in the presence of integrated European education policy. In this sense, recent findings based on global and European databases indicate that education attainment grows unevenly among different countries and generations, indicating structural gaps that can only be filled via other means except for economic growth (Barro & Lee, 2013). Additionally, regarding the EU, achievement of higher attainment regimes occurs in connection with reform capacities and modernization of institutions rather than convergence dynamics (Cuaresma et al., 2014).

However, heterogeneity also has important implications in econometric terms since attainment is measured in terms of ISCED levels' shares, which makes those mechanically interdependent. As a result, strong negative coefficients obtained in pooled regressions can be caused by the aforementioned interdependence in part rather than a short-term causality channel. Therefore, the reason for the importance of applying panel estimation techniques and systems approaches for modeling of educational upgrading lies herein. For these reasons, empirical findings will be analyzed primarily in terms of structural determinants of adjustment of educational attainments.

Thus, Table 1 summarizes the roles of ISCED levels in the mechanism of educational upgrading studied in the paper.

Table 1. Variables used in the empirical analysis and structural interpretation

Variable	Definition (attainment share)	Structural role in the paper
ISCED 0–2	Low education	Proxy for structural educational lag (“low-attainment persistence”)
ISCED 3–4	Upper secondary	Transition layer where “drop-out risk” can be absorbed
ISCED 5–8	Tertiary	High-skill upgrading and long-run system driver

Source: Authors’ own research.

There is still plenty of evidence that suggests that the conception of education should not be treated as a sum of individual elements developing independently of each other but in the light of its systemic nature. Any changes occurring in the sphere of one type of attainment are always closely connected with other types of education in a country.

Short-run panel results (FE/RE) and non-linear transition dynamics

First of all, there is a marked negative correlation between the number of people with low education (ISCED 0-2) and the number of people who achieved upper secondary attainment (ISCED 3-4). It is reasonable that the more people participate in the education system at the next level, the fewer people have low education.

Importantly, the crucial result is related to the fixed-effect approach to the interaction between the variables. According to the FE results, the relationship between ISCED 3-4 and ISCED 0-2 becomes weaker compared to pooled regressions. Therefore, the difference between the pooled models suggests that most of the association between these two ISCED levels in pooled regressions depends on the structural regime differences between the countries but not on annual changes within the country. This is an important result because it implies that educational upgrading is rather a long-run phenomenon determined by persistent characteristics of the regimes and by the intensity of reforms (Cuaresma et al., 2014).

On the contrary, according to the random-effects specification, there is still a statistically significant negative relationship. Thus, we can conclude that cross-country differences matter since countries that have high upper secondary attainment have a smaller percentage of low education. The discussion of short-term dynamics is provided in Table 2.

Table 2. Short-run panel regression synthesis

Model	What it captures	Main empirical message	Structural interpretation
Pooled	Average association	Strong inverse link	Mix of composition + regime differences
Fixed effects (FE)	Within-country change	Much weaker link	Short-run adjustments limited after regimes are controlled
Random effects (RE)	Cross-country differences	Negative significant	Structural heterogeneity dominates
Joint model	ISCED 0-2 ~ ISCED 3-4 + ISCED 5-8	Multi-level effect	Upgrading is system-wide
Non-linear FE	+ (ISCED 3-4) ²	Threshold pattern	Diminishing marginal impact at high ISCED 3-4

Source: Authors' own research.

Another significant outcome related to the non-linear specification is where the square term on ISCED 3-4 reflects a threshold-type approach. The implication is the existence of threshold-type transitions where additional gains from increased secondary attainment become marginal at the lower level of secondary attainment compared to higher secondary attainments. It becomes harder to achieve more low education gains as the attainment of secondary rises towards high secondary. This kind of non-linearity is consistent with international literature on how tertiary systems serve as “system stabilizers” (OECD, 2024).

Long-run system dynamics and tertiary education as a driver

Despite the contributions of short-run models to empirical evidence of heterogeneity and non-linearities, the key novelty provided by this paper is to demonstrate that educational attainment constitutes a long-run coordinated process. Panel cointegration tests have revealed a stable relationship between shares of low-, secondary and tertiary attainment over the long run, implying that educational levels cannot diverge arbitrarily over time. Rather, deviations from long-run equilibrium are adjusted through inter-category corrections over time, such that the concept of

long-run equilibrium adds more insights for interpretation of educational upgrading as a systematic structural process.

The FMOLS estimator confirms the equilibrium approach and provides reliable long-run estimates: increases in ISCED 3–4 and ISCED 5–8 correspond to long-run decreases in ISCED 0–2. Thus, it is confirmed that educational upgrading occurs only due to secondary and tertiary educational expansion that act together as parts of a stable adjustment process. This finding is in line with the overall reform story suggesting that attainment convergence is driven by structural modernization as opposed to passive equalization (Cuaresma et al., 2014).

The application of the Granger causality approach further confirms the important role of tertiary attainment. Applying the approach developed by Dumitrescu & Hurlin that allows for heterogeneous prediction relationships in panel data, the results show that tertiary attainment plays the leading role in the process, as opposed to being the result (Dumitrescu & Hurlin, 2012). The findings appear to be consistent with evidence demonstrating how tertiary expansion may affect expectations and incentives in the education chain (OECD, 2024).

Long-run and dynamic approaches are compared in Table 3 below, revealing how combining various interpretations is justified by providing novel scientific insights as opposed to replicating previous findings in alternative presentations.

Table 3. Long-run and dynamic results

Method	What it tests	Econometric justification	Key conclusion supported
Panel cointegration	Long-run equilibrium among ISCED shares	Distinguishes “system” vs “independent drift”	Attainment behaves as a coherent system
FMOLS	Robust long-run coefficients	Supports equilibrium upgrading under persistence	Higher attainment reduces low education in the long run
Panel Granger (DH test)	Directionality under heterogeneity	Avoids assuming homogeneous causality	ISCED 5–8 acts as a leading indicator

Source: Authors’ own research.

In summary, three findings can be drawn from the data analysed above. First, European educational achievement remains heterogeneous structurally. Second, the short-term adjustment process from lower educational achievement does not rely on small changes in secondary education and displays non-linear patterns. Third, in the long run, educational achievement takes the form of a coherent system where tertiary education plays a leading role strategically.

Numerical evidence and reporting discipline

Numerical clarity is important both to interpret the findings and assess how well the claims presented in them are supported by the statistical evidence provided. The numerical summary of the quantitative findings is offered in Table 4 below.

Based on the descriptive statistics presented, it can be stated that the category of low education ISCED 0-2 represents an important characteristic of the sample and is not merely a residual one. There is significant variability both across entities (dispersion), right-skewness and departure from normality of the distribution. This is important because it implies that at least part of the variance in the variable likely captures persistent structures (cross-sectional) that should not be confused with transitory ones (between years) and the latter requires the use of both fixed effects (FE) and random effects (RE) models.

In the pooled model, the effect of upper secondary schooling on the share of low education is significantly negative and relatively large (slope ≈ -0.531). This is broadly consistent with the

overall narrative on educational upgrading. However, due to the nature of the variable measured – attainment categories are expressed as shares – and therefore inherently interdependent, the pooled magnitude should not be interpreted literally. Taking into account heterogeneity, the magnitude is significantly reduced in both random (slope ≈ -0.47) and fixed effects models (≈ -0.29), which implies that a majority of the pooled effect is cross-sectional.

When considering both secondary and tertiary attainments together, the multivariate model presents a reasonable degree of explanatory power ($R^2 \approx 0.72$) and no deterministic identification among the categories. Taken collectively, the numerical evidence presented supports the view that educational upgrading should be seen as a process at different levels, through which a reduction in the proportion of low attainment occurs along with other transitions.

Table 4. Robustness and interpretation checklist for share-based panel education models

Block	Indicator / model output	Value
Descriptive structure (ISCED 0–2)	Mean (%)	22.6147
	Median (%)	19.0000
	Min (%)	10.8000
	Max (%)	58.4000
	Std. Dev.	10.7420
	Skewness	1.7420
	Kurtosis	5.6120
	Jarque–Bera	182.4164
	Jarque–Bera p-value	0.0000
Short-run association (pooled)	Slope pooled: ISCED 0–2 ~ ISCED 3–4	–0.5310
	Slope (RE): ISCED 0–2 ~ ISCED 3–4	–0.4700
	Slope (FE): ISCED 0–2 ~ ISCED 3–4	–0.2900
System-level fit (multivariate)	Fit: ISCED 0–2 ~ ISCED 3–4 + ISCED 5–8	$R^2 \approx 0.7200$

Source: Authors' own research (Eurostat-based indicators, processed in EViews).

Conclusion

This research examines the dynamics of educational attainment in Europe over the period 2010–2024 under the panel setting with three categories of attainment levels: low education (ISCED 0–2), upper secondary education (ISCED 3–4), and tertiary education (ISCED 5–8). The main goal is to establish whether the declines in low educational attainment levels occur mainly due to the short-run changes in the secondary attainment level or constitute an indication of structural upgrading driven by multilevel attainment expansion.

The obtained results provide robust support for structural interpretations of education transitions. Heterogeneity continues being the key characteristic of educational attainment patterns across European countries. Low education still represents a non-negligible share, particularly within particular units, as opposed to a situation characterized by the continuous gradual disappearance of low education and convergence of attainment levels. That point makes sense since the existing differences in country-specific regimes do not become irrelevant even in case the upgrading of human capital becomes an important policy focus area. The existence of such a connection between low education and higher levels is consistent with the mechanism of attaining high educational attainments but acquires additional complexity if the issue of country-specific features is taken into consideration. This means that declines in low education can hardly be justified as a simple effect of a process running uniformly across different countries and time.

It is also shown that the transition dynamics in question is not entirely linear. The marginal effect of the growing upper secondary attainment on reducing low educational attainment does not appear to be constant and may differ in accordance with the attained stage of development of a particular entity, which supports the assumption about the presence of a threshold-type mechanism and decreasing marginal effects after reaching a high coverage rate. This situation will make the future improvements in terms of low education unlikely without additional factors like education pathway quality, institutional capacity and tertiary education expansion. Such observations receive further confirmation from the long-run analysis showing attainment shares to adjust in coordination within the system and move along a relatively stable equilibrium relationship. It also appears to be reasonable to include tertiary education among the factors of importance, which plays a critical role in restructuring.

Thus, based on the empirical data obtained, the conclusion can be made that strategies addressing the issues related to low education will hardly work if focusing only on the transition channels. Increasing the number of upper secondary graduates is important, while the possibility of obtaining further success is reduced in case there are no pathways providing for continuous education, including tertiary education.

From a practical perspective, the results show that education-based policies for upgrading efforts should focus on the strengthening of the whole educational continuum rather than individual attainments. Indeed, while the expansion of secondary attainment is clearly necessary, reductions in low education are more sustainable with the presence of tertiary pathways, lifelong learning and other institutional factors supporting the transition across education levels. In the European case, upgrading efforts should include both expansion measures and structural improvements in education quality, completion and labor market integration.

As with any other analysis, several limitations need to be noted. First, there is a mechanical relationship among attainers within the closed distribution model, such that it can be said that any relationship identified is based on structural relationships and not causality. Secondly, quality and institutional aspects that impact transitions to attainers are not considered in the analysis. The study focuses on attainment shares only, even though institutional features (such as labor absorption capacities) or measures of educational quality might have played an influential role. Furthermore, this work relies on harmonized statistics meant to guarantee the international comparison but possibly distorting true differences in national education systems. Since the sample includes both EU and non-EU countries, there may be important structural differences that are unaccounted for using solely attainment shares. Lastly, the period between 2010 and 2024 includes various overlapping structural changes and shocks, making it challenging to separate temporary deviations from long-term trends in a macro-panel model.

The future research directions might include introducing measures of education quality or institutional features that would further explain attainment transitions. Using a more detailed breakdown of education, such as a cohort or gender-specific analysis, can help uncover some of the inequalities present within individual nations. Another robustness check can involve using estimators capable of handling cross-section dependence and potential structural breaks, especially in European contexts.

Overall, this study provides a more structurally based perspective on educational attainment. It shows that low education can remain heterogeneous and path-dependent with more convincing reductions occurring with the help of coordinated upgrading efforts spanning multiple levels, including tertiary expansion.

Acknowledgements

During the preparation of this work, the author utilized ChatGPT 4 to enhance readability and language clarity. Following the use of this tool, the author meticulously reviewed and revised the content as necessary and assumes full responsibility for the final content of the publication.

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