

Educational trajectories in Austria: A descriptive longitudinal sequence analysis of a full student cohort

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Abstract This study provides a comprehensive longitudinal description of educational trajectories in Austria, using administrative data for an entire student cohort. This offers new insights into how early social differences translate into divergent pathways. Since education both shapes lifetime outcomes and reproduces persistent inequalities along dimensions of social origin, gender, ethnicity, and geography analysing educational trajectories is central to understanding social mobility.

We follow a full cohort of students in Austrian schools who were 13 years old on 1 September 2011 ($N=85,535$). School, higher education, labour market, migration, and residence data are combined to map trajectories across stages of education and labour market entry from age six to 23. Sequence analysis is applied to visualise trajectories, identify the most common pathways, and examine variation by sociodemographic and structural characteristics.

Results show that social inequalities emerge early and widen across educational stages, with the largest differences observed by parental education: students from highly educated families more often follow academic pathways while those from less educated families are more likely to enter vocational tracks. Variation is also observed by gender, migration background and place of residence. Overall, these findings provide a population-level perspective on the early emergence and persistence of educational inequalities in Austria.

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1 Introduction

The centrality of educational trajectories and their social selectivity is well-documented in empirical educational research, particularly given the widely held view of education as a key factor in social mobility (Breen and Jonsson 2005; Edler and Hadjar 2025). Education not only shapes lifetime outcomes such as work, health, and wealth, but also reflects and reproduces persistent inequalities, most strongly along lines of social origin, and to varying degrees by gender, migration background, and geography (Farquharson et al. 2024). Against the backdrop of ongoing educational policy debates on equity and access, understanding how early social differences shape the course of educational trajectories is crucial for both research and policy.

This study adopts a longitudinal perspective to map the educational trajectories of an entire student cohort in Austria from childhood to early adulthood. Using linked administrative data and sequence analysis, we provide a descriptive overview of how students move through the education system and transition into higher education or the labour market. We visualise overall patterns and the most frequent pathways while examining variation across sociodemographic and structural characteristics. By combining full-cohort longitudinal data with trajectory-based methods, we offer a population-level perspective that goes beyond analyses of isolated transitions or cross-sectional approaches and contributes to the descriptive study of educational inequality in Austria.

2 Theoretical background and previous findings

The present study is grounded in a life course perspective, which views educational trajectories as sequences unfolding over time, where earlier transitions structure later opportunities (Elder 1998). We focus on individual, empirical trajectories shaped by circumstances, choices and resources, not on typical pathways shaped by institutional structures (Pallas 2003). Individuals' early decisions and institutional placements shape subsequent trajectories by opening or closing options and by influencing aspirations and expectations. These decisions and trajectories are shaped by social background, migration-related inequalities and gendered expectations as well as institutional opportunities and constraints exerting a significant influence on the educational career young people pursue and the qualifications they attain (e.g. Bodi-Fernandez et al. 2023; Fessler et al. 2012; Mandl and Haag 2025; OECD 2023).

Social disparities emerge because educational decisions at key transition points are systematically shaped by family background, resources and aspirations. Depending on different cost-benefit assessments, a disadvantaged background can lead to lower educational attainment or dropping out of school earlier, resulting in an earlier entry into the labour market. This may reflect an overestimation of the costs and an underestimation of the benefits of further schooling. Conversely, people with more privileged backgrounds tend to extend their educational careers and are more likely to enter higher education as they are less risk-averse and fear social demotion of their children (Boudon 1974; Breen and Goldthorpe 1997).

In systems with early school tracking, stratification processes emerge particularly early. In Austria, a key transition decision has to be taken at age nine, when students enter either the general academic track (*Allgemeinbildende höhere Schule*—AHS) or the compulsory lower secondary track (*Hauptschule/Neue Mittelschule*—HS/NMS) at lower secondary level. Since the AHS typically leads to higher education and the latter typically to vocation education, parental influence on this decision is among the strongest (Bacher 2025). Early placements channel students into different learning environments and opportunity structures, contributing to the accumulation of inequalities across transitions (Blossfeld et al. 2019).

Evidence from Austria shows that the influence of parental education on children's educational participation has increased over time, indicating a growing intergenerational persistence of educational attainment (Bacher 2025). Parental education shapes not only students' educational but also their occupational aspirations, with higher parental education associated with higher career goals (Astleithner et al. 2023). At the same time, research on educational transitions indicates that boys and girls may follow different pathways already at early stages of schooling. For example, boys are more likely to experience early downward placements such as preschool retention, which are associated with less favourable later educational outcomes, while girls more often pursue academic tracks and longer educational routes (Bacher 2025; Steiner 2025). However, these differences do not translate into uniform advantages for women, as gender roles, gendered patterns in field-of-study choice and labour market outcomes continue to shape later opportunities and earnings (e.g. Ransmayr and Weichselbaumer 2024). These patterns can be understood considering gendered norms and expectations that structure educational decision-making and transition processes (Thompson 2003).

Inequalities in educational trajectories are thus structured along multiple dimensions and extend beyond socioeconomic background, as children with a migration background often face disadvantages linked to additional, ethnic-specific challenges (e.g. Heath and Brinbaum 2014; OECD 2023). In Austria, early selection functions as a further structural barrier that limits immigrant youth's chances to enter higher education, despite its seemingly meritocratic character (Pásztor 2016), a dynamic that has become increasingly relevant given the growing share of the population with a migration background (BMBWF 2024).

The supply and structure of educational institutions in rural and urban areas differ substantially. The higher the level of education, the lower is the density of institutions in rural areas, resulting in a more dense supply of higher education institutions in urban areas; this also entails, for example, differences in programme variety, apprenticeship availability, travel time and costs, and access to counselling. As a result, educational opportunities and the pathways students follow differ across regional contexts, reflecting broader regional opportunity structures (e.g. Binder et al. 2025; Boone and Van Houtte 2016). In addition to differences in opportunity structures, differences in residents' educational composition and in the share of the population with a migration background further amplify regional differences in educational trajectories (Statistik Austria 2025, 2026).

Although previous research has identified key factors shaping inequality in education, much of this work relies on cross-sectional data or examines isolated educa-

tional transitions. Register-based longitudinal work tracing educational trajectories across multiple stages of the life course is well established in countries such as the Netherlands (Labussière et al. 2021) and the Nordic countries (Lorentzen et al. 2019) but remains limited for Austria. This limits our understanding of how social inequalities accumulate across stages in the Austrian context. Our study addresses this gap by providing, to our knowledge, the first comprehensive longitudinal examination of an entire Austrian student cohort, offering new insights into how social inequalities unfold across educational and early labour-market trajectories.

In light of Austria's early tracking and the theoretical considerations and empirical evidence outlined above, we expect educational trajectories to diverge early and differences to accumulate across stages. Specifically, we anticipate pronounced social-origin gradients, with higher parental education associated with longer and more academic routes. We also expect lower rates of academic-track entry and persistence among students with a migration background relative to native peers. Gender differences are likely to emerge early, with boys more often experiencing downward moves and shorter schooling, and girls more frequently following longer, academic pathways. Finally, we expect an urban advantage in access to and persistence in academic routes relative to rural contexts.

3 The Austrian education system

Before turning to data and methods, we briefly outline the key institutional features that structure the trajectories analysed in this study. Austria provides a particularly interesting context, primarily due to early tracking and a highly differentiated upper secondary sector (Salchegger and Hirczy 2026; Strello et al. 2021) alongside several opportunities of second-chance education allowing revisions of educational choices later on. In the Austrian education system, students are typically divided into different school types at the age of ten, when they enter either the general academic track (*Allgemeinbildende Höhere Schule*—AHS respectively Gymnasium) or the more vocationally oriented, compulsory lower-secondary track (*Hauptschule/Neue Mittelschule*—HS/NMS) after four years of primary education.

Around age 14, the transition into upper secondary school marks another key transition: students either continue in the general academic track (AHS) or enter one of several types of upper secondary vocational education and training (VET). At the age of 15, compulsory education ends and early school leaving can occur from that point onward. Upper secondary VET is also highly differentiated, featuring a strong dual system of apprenticeships (*Lehre*) as well as fully school-based vocational programmes leading to different levels of education, namely the higher vocational schools (*Berufsbildende Höhere Schule*—BHS) and vocational middle schools (*Berufsbildende Mittlere Schule*—BMS). Subsequent transitions include entry into the labour market or higher education. In the Austrian context, the latter is considered broadly accessible, since eligibility for admission is largely determined by a recognized higher education entrance qualification, most commonly the *Matura*, earned in AHS or BHS.

Although the Austrian educational system is highly tracked, it allows a certain extent of upward and downward mobility between tracks. Instead of dropping out and ending educational careers early pupils can, for example, easily change from higher vocational schools (BHS) to vocational middle schools (BMS). The other way round advancing courses (*Aufbaulehrgänge*) provide the opportunity of upward mobility from BMS to BHS. Additionally, the Austrian system offers a range of second-chance programmes for adults and employed persons (including evening AHS/Gymnasium) that enable the acquisition of credentials later in one's career. However, these mobility opportunities are used by relatively few individuals and therefore, in the aggregate, do not substantially reverse traditional trajectories (Statistik Austria 2026). Like mobility between tracks may partly offset the stratifying effect of early tracking also standardization in education which are common in Austria (like standardized curricula and central exams) may have a similar effect and decrease educational inequalities (Bol and van de Werfhorst 2016; Zapfe 2025).

4 Data and methods

4.1 Data and cohort

This study draws on linked administrative data provided by the Austrian Micro Data Center (AMDC).¹ We combine school and higher education statistics, register-based labour market data, as well as migration and residence records to capture educational and transition trajectories from childhood to early adulthood.

Our analytical cohort includes all individuals who were 13 years old on 1 September 2011 and enrolled in any school in Austria at that time ($N=85,535$). This cohort definition is due to background data availability. Our observation window spans from the school year 2004/05 to 2021/22, corresponding to ages 6 to 23. Given that school statistics start in 2006/07, statuses at ages 6–7 are imputed. Pupils observed in primary school at age 8, without earlier in-migration, are assumed to have attended primary school at ages 6 and 7. Individuals who died before 2022 are excluded.

4.2 Construction of yearly statuses

Based on school and higher education enrolment records and labour market data, we assign one mutually exclusive status to each individual for every school year. The status reflects the individual's main educational or labour market activity. For those with records of multiple activities (e.g., higher education enrolment combined with employment), we always apply a decision hierarchy that prioritises education over labour market participation regardless of age. Within the education domain, school status is prioritised over higher education status up to the age of 15; thereafter, higher education status is prioritised. The final classification comprises 15 status categories that capture the main tracks of the Austrian education system, the higher education

¹ The AMDC is a research data infrastructure facility of Statistics Austria that enables research on micro data processed in compliance with data protection regulations (Fuchs et al. 2023).

Table 1 Grouping variables used for descriptive analyses

Variable	Operationalisation
Gender	Gender (binary: female/male), as recorded in the administrative register
Migration background	Categorised based on individual's and parents' country of birth: – First-generation immigrant: born abroad with two foreign-born parents (or one foreign-born parent + missing information on the other) – Second-generation immigrant: born in Austria with two foreign-born parents – Native: individual and both parents born in Austria
Parental education	Highest educational attainment of either parent, with four categories: no more than compulsory education; vocational qualifications (dual VET/BMS); <i>Matura/Kolleg</i> ; tertiary education
Urban/rural residence	Based on the registered residence in 2011: – Urban: large urban centres with $\geq 100,000$ inhabitants (urban-rural typology code 101) – Rural: all other areas

sectors, and labour market activities, as well as a distinct category for military/civil service and an 'abroad' status for individuals not residing in Austria. Further details on status assignment are provided in Appendix A.

4.3 Sequence construction and analytical approach

We apply sequence analysis (SA) to study how educational pathways and subsequent transitions into higher education and the labour market unfold over time. Since its introduction to the social sciences (Abbott 1983), the approach is widely used to analyse life courses, social processes, and educational or labour market trajectories longitudinally (Haas and Hadjar 2024; Labussière et al. 2021). SA conceptualises trajectories as series of temporally ordered categorical states (Raab and Struffolino 2023). In our application, each individual contributes a sequence capturing their educational trajectory from ages 6 to 23.

Our descriptive analysis relies on two types of visualisations:

- State distribution plots, showing how the cohort or subgroup is distributed across the 15 educational or labour market statuses in each school year, and
- Sequence frequency plots, displaying the ten most common trajectories observed over the 18-year observation period for the full cohort or relevant subgroup.

To explore heterogeneity in trajectories, we stratify results by key socio-demographic and contextual characteristics conducting bivariate analyses. Stratification categories include gender, migration background, parental education, urban/rural residence and province of residence. All grouping variables are summarised in Table 1. All sequence analyses and visualisations are conducted in R (v. 4.4.3) using the TraMineR package (Gabadinho et al. 2011).

5 Results

In this section, we present descriptive findings on the educational and labour market trajectories of the full cohort, grouped by their socioeconomic background and

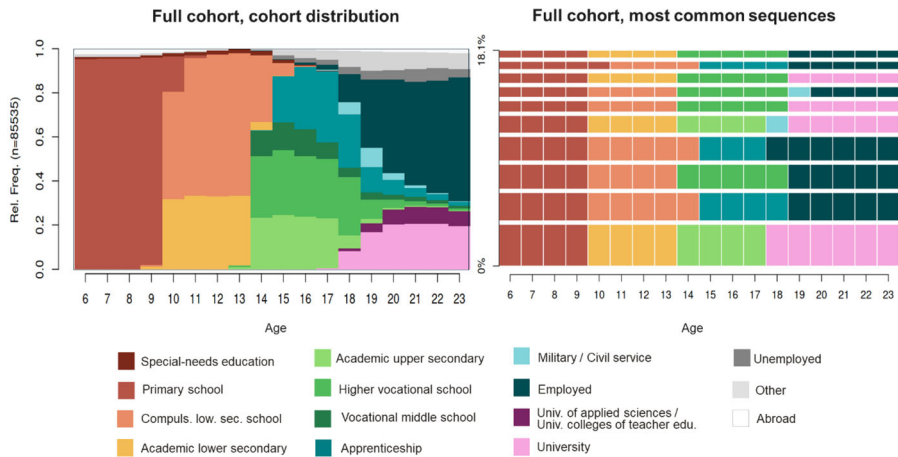


Fig. 1 State distribution and most common sequences of the entire cohort

structural characteristics. With regards to socio-economic characteristics, we discuss differences by gender, migration background, and parental education. In terms of structural characteristics, we focus on place of residence (big towns versus rural areas).

To provide a baseline for the discussion of differences between groups, we first describe the state distribution and most common sequences for the entire cohort (Fig. 1). From ages six to nine, the vast majority of our cohort is in elementary school. During lower secondary education (age 10 to 14), roughly two thirds of pupils attend the compulsory lower secondary school track (HS/NMS), while about one third follow the general academic track (AHS). At both the primary and lower secondary levels, small shares of pupils attend special-needs education (*Sonderschule*).

At the upper secondary level (typically starting from age 15 until the age of 17 to 19 depending on educational form chosen), the distribution becomes more differentiated: roughly one quarter each attend the general academic track (AHS), higher vocational schools (BHS) and apprenticeship training (*Lehre*), while the remaining quarter is distributed across the vocational middle schools (BMS), unemployment, and an ‘other’/inactive status. Moving on to the post-secondary level (from the age of 19 onwards), we find roughly half of the cohort in employment, a quarter in tertiary education and a remaining quarter predominantly in unemployment or other inactivity. The most common trajectory, which is realised by 3.4% of the entire cohort, leads from elementary school to the general academic track and ends up in tertiary education. Looking at the second and fourth most common trajectories (which differ only in the duration of apprenticeship by one year), we can identify an even more frequent sequence: starting from elementary school, moving into compulsory-education on lower secondary level leading into apprenticeship and employment, which accounts for roughly 4% of the cohort.

5.1 Gender

As a starting point for discussing differences in educational trajectories by sociodemographic characteristics, we focus on gender. We observe the first notable differences at the age of ten, with 19% of boys still attending elementary school compared to 13% of girls. At lower secondary level, girls are overrepresented in the general academic track (AHS) and boys in compulsory ones (HS/NMS). At the upper secondary level, female overrepresentation in the general academic track continues (28% of girls versus 20% of boys at the age of sixteen), whereas more boys choose a vocational track (72% versus 64% of girls at the age of sixteen). At tertiary level, young women continue to be strongly committed to academic education, with 32% of them attending an Austrian university (in one form or another) at the age of twenty-two, compared to 24% of males. Conversely, at this level and age, more young men are employed (55% among the male versus 47% among the female group).

These longitudinal gender-based distributions are also reflected in the most common trajectories (sequences) among girls and boys. Girls most frequently commence their educational pathways in elementary school, switch to the academic track in lower secondary education, and remain there in upper secondary education, before entering university at eighteen, where they remain until the end of the observation period at twenty-three. The most common male trajectory (out of ten displayed in the graph in Fig. 2) also starts in elementary school but then continues to compulsory education on the lower secondary level and an apprenticeship on the upper secondary level, before entering the labour market at the age of nineteen. However, these prototypical sequences cover only 6% of female and 4% of male trajectories in the cohort, highlighting the considerable heterogeneity within both groups.

5.2 Migration background

When we compare trajectories by migration background, we find differences, but the overall structure remains broadly comparable across natives and first- and second-generation immigrants (Fig. 3). The greatest variation emerges between natives and first-generation immigrants, with second-generation immigrants positioned between these two groups. The most notable difference concerns the status 'abroad'. At the age of eight, nearly a third of first-generation immigrants have not yet moved to Austria, which limits meaningful comparisons before the age of thirteen, when the full cohort is present in the data. At the lower secondary level, we observe notable differences in academic-track participation and special-needs education. By age thirteen, 32% of natives attend general academic secondary school, compared to only 28% of second-generation and 23% of first-generation immigrants. Conversely, 4% of first-generation immigrants, compared to 2% of natives, are enrolled in special-needs education.

These differences in educational tracks become more pronounced as students advance to higher levels of education. By the age of sixteen, 29% of the native cohort is enrolled in higher vocational schools (BHS), whereas this is the case for only 17% of first-generation and 25% of second-generation immigrants. Finally, at

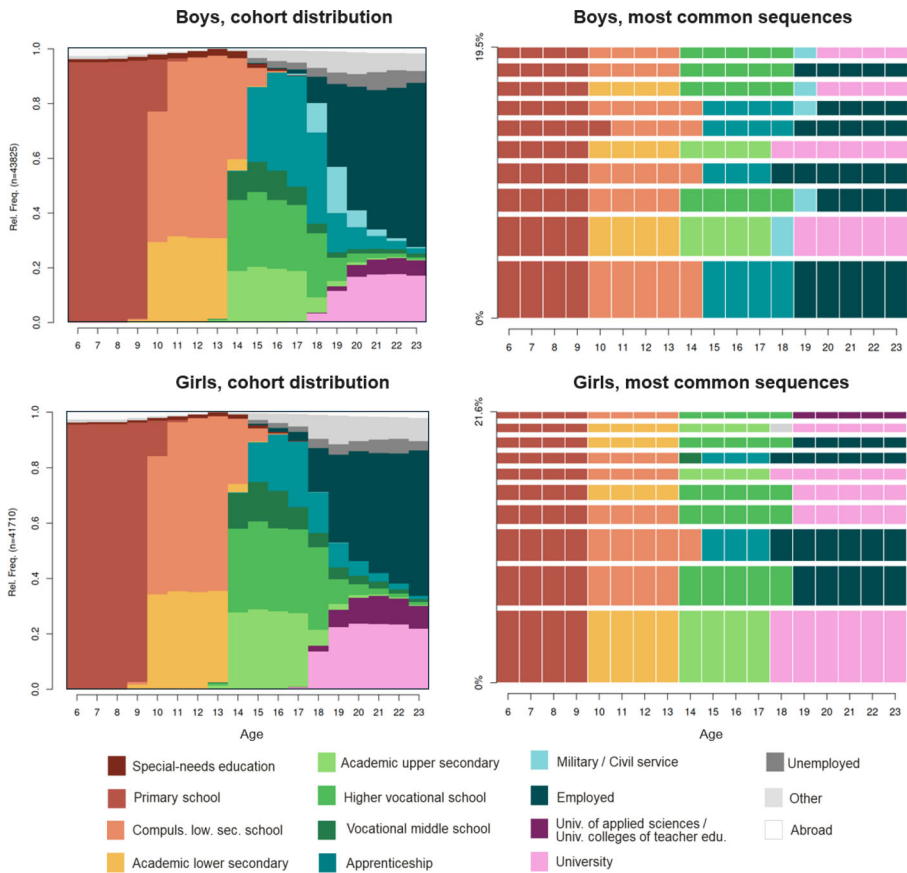


Fig. 2 State distribution and most common sequences by gender

age twenty-two, 30% of natives are enrolled in tertiary education, whereas this is true for only 17% of first-generation and 23% of second-generation immigrants. However, when interpreting this data, it is important to keep in mind that, at this age, 13% of the latter have left Austria.

The similarity in patterns by migration background is also evident when comparing the most common sequences among these three groups. The first and second most frequent sequences are almost identical and differ only in duration of apprenticeship by one year. The most frequent sequence across all three groups leads from elementary school to the academic track in lower and upper secondary education and continues into tertiary education. The second most common trajectory starts in elementary school, leading to compulsory education in lower secondary, followed by an apprenticeship and subsequent employment.

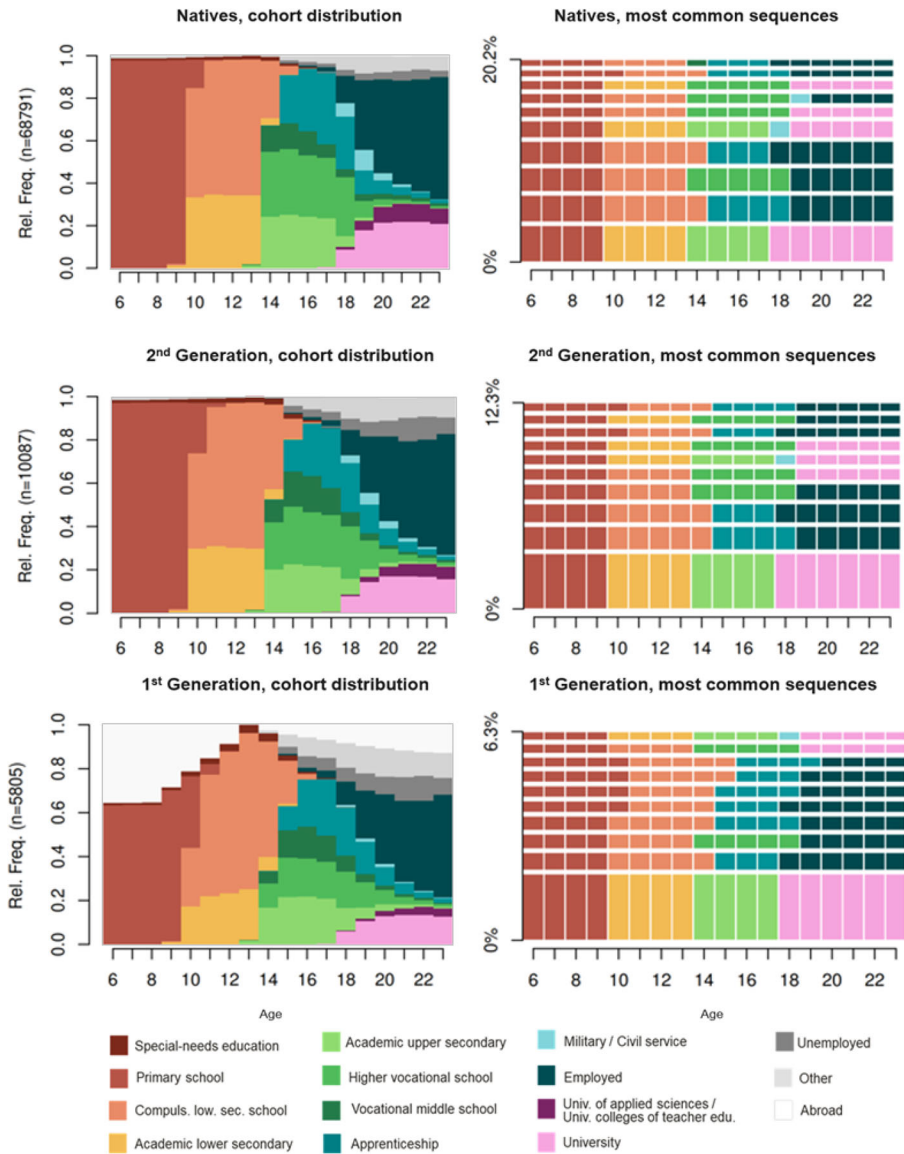


Fig. 3 State distribution and most common sequences by migration background

5.3 Parental education

Compared to the differences discussed earlier, disparities by parental education are by far the most pronounced among the characteristics we examine. Figure 4 illustrates that pupils from disadvantaged backgrounds, whose parents have completed no more than compulsory education, follow markedly different educational trajectories than pupils from privileged backgrounds, whose parents hold a tertiary degree

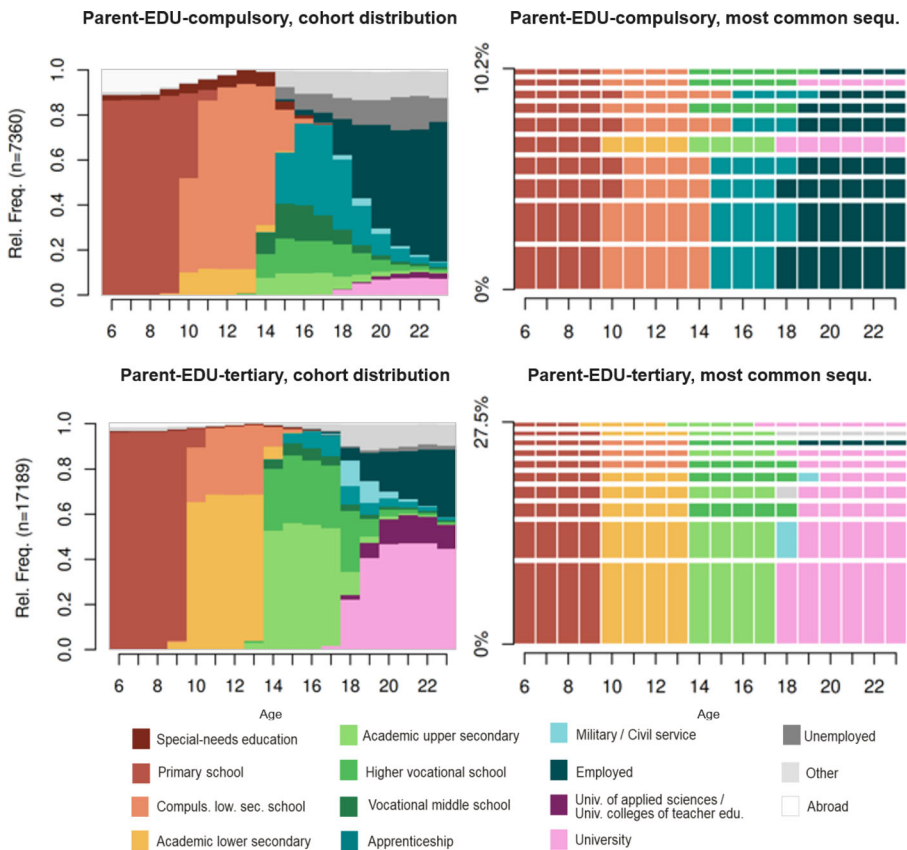


Fig. 4 State distribution and most common sequences by parental education

(see Table B.4 in the appendix for figures concerning medium parental education groups).

At age thirteen, 65% of pupils with highly educated parents attend the academic track (AHS) of lower secondary school, compared to only 11% of pupils from families with low educational attainment. Conversely, 6% of the latter attend special-needs education, a share which is six times higher than that of pupils with highly educated parents. Moving on to upper secondary education, the differences between these two groups remain largely unchanged. At age sixteen, 10% of disadvantaged pupils with low educated parents attend the general academic track (AHS), compared to 55% of privileged students with highly educated parents. Apprenticeships show the opposite pattern, with 36% of disadvantaged and 7% of privileged pupils enrolled. By age twenty-two, 59% of the privileged subgroup are in tertiary education, compared to 11% of the disadvantaged subgroup. Conversely, 56% of the disadvantaged group entered the labour market, compared to 25% of the more privileged group.

In short, our results highlight that these two groups inhabit fundamentally different educational worlds. This is also reflected in the most frequent trajectories among

the two groups. Students with a privileged educational background most commonly start in elementary school and remain on the academic track for the following eight years. They enter tertiary education at age eighteen and remain enrolled until the end of our observation period at age twenty-three. The only similarity among pupils from disadvantaged backgrounds is the fact that they also commence their education in elementary school. In lower secondary education, pupils whose parents completed no more than compulsory education most frequently continue to compulsory education (*Hauptschule*/NMS), before entering an apprenticeship and transitioning into employment by the age of eighteen. Despite these stark contrasts, it is noteworthy that, by following their most typical trajectory, students from disadvantaged backgrounds nevertheless surpass the educational attainment of their parents.

5.4 Urbanity of place of residence

Educational trajectories in urban and rural areas differ considerably (Fig. 5). At the age of thirteen, 51% of students in urban areas attend compulsory education, while 44% attend the academic track. In rural areas, only 24% of students attend the academic track, while nearly three-quarters (73%) attend compulsory education. At the upper secondary level (age sixteen), there is almost no change in the percentage of students in the general academic track (33% in urban areas and 19% in rural areas). At this level, the difference in apprenticeship attendance is also noteworthy. By this stage in their careers, only 22% of students in urban areas have entered this track, compared to 32% in rural areas. Considering different opportunity structures (distance to tertiary education institutions), it is somewhat surprising that the difference in attending tertiary education at age twenty-two is only 6 percentage points (32% of the cohort in urban areas and 26% in rural areas). The most pronounced differences at this age are found in terms of employment. 57% of those living in rural areas actively participate in the labour market at this stage of their careers, whereas this is true for only 40% of their counterparts in urban areas.

Taking a longitudinal perspective, our analyses reveal that the most common sequences vary considerably by place of residence. In urban areas, the most common trajectories lead from elementary school directly into an academic track in lower and upper secondary education, followed by tertiary education until the age of twenty-three. For those who are resident in rural areas, the most common trajectories commence in elementary school, continue through compulsory education and vocational education (in the form of an apprenticeship or higher vocational school), and culminate in employment. By federal state, we find that trajectories typical of urban contexts are most common in Vienna, while pathways characteristic of rural regions are widespread in Salzburg, Tyrol, and Vorarlberg.²

² Analyses by federal states are not shown, as the urban-rural distinction captures the main patterns of interest.

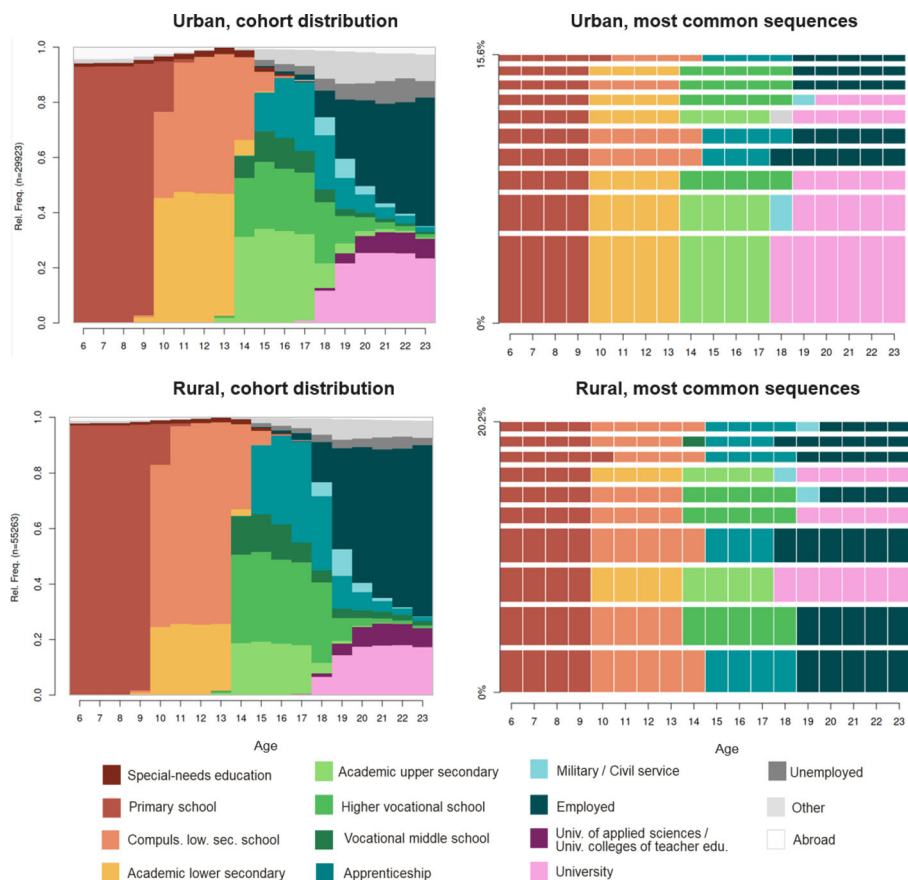


Fig. 5 State distribution and most common sequences by urbanity of place of residence

6 Discussion and conclusion

Tracing an entire student cohort from childhood to early adulthood, this study shows how early emerging inequalities translate into divergent pathways in a stratified education system. Our findings underscore the central role of parental education in shaping students' pathways through education and into the labour market. Considerable variation also emerges across demographic characteristics. Differences by migration background and place of residence follow similar patterns, with native-born and urban-resident students more frequently following academic pathways, whereas students with a migration background or living in rural areas are more likely to follow pathways that lead directly into employment. Overall, these patterns align with the expectations outlined in the theoretical background, with social origin (operationalised by parents' education) emerging as the most prominent gradient.

Gender remains an important dimension in educational transitions, as boys and girls tend to navigate the system differently. According to our analysis, boys spend more years in primary education than girls. This can partly be attributed to a higher

likelihood of preschool grade retention (Steiner 2025). Girls more frequently pursue the academic track and subsequently enter tertiary education. Conversely, male students are more likely to enter the labour market rather than move into tertiary education after upper secondary school. These patterns reflect gendered differences in educational pathways shaped not only by performance-related factors but also by gendered expectations and educational choices (Thompson 2003). Previous research further shows that boys and girls also differ in the fields of study they choose, such as the well-documented underrepresentation of women in STEM-related (Science, Technology, Engineering, Mathematics) areas and their overrepresentation in social and service fields (Lessky et al. 2022). These field-specific differences were beyond the scope of this study but should be considered in future research, as they have important implications for later occupational opportunities and earnings (e.g. Ransmayr and Weichselbaumer 2024).

Disparities by gender, migration background or place of residence are comparatively small when set against the much stronger stratification by social background. For migration background this result seems initially surprising but refers to the fact that migrants represent a very heterogeneous group spanning from expats, having noticeable more favorable educational outcomes, to heavily disadvantaged groups characterised by low income and low educational background (Reiter and Steiner 2026).

Consistent with theoretical approaches that emphasize primary and secondary effects of social origin (Boudon 1974), students' educational trajectories in Austria are strongly structured by parental education. Individuals whose parents have a higher level of education are more likely to attend the general academic track at lower secondary level, continue through academic-track upper secondary education and subsequently enter university, a pattern consistently documented in previous research (Bacher 2025; Astleithner et al. 2023). These pathways reflect both differences in performance-related resources and differences in educational decision-making and expectations across social groups (Breen and Goldthorpe 1997). In contrast, individuals whose parents have a lower level of education are more likely to enter vocational education pathways, illustrating how early institutional sorting interacts with social background to channel students into divergent trajectories. Taken together, these findings highlight that social background remains the strongest predictor of students' educational trajectories in Austria.

Overall, our findings demonstrate that although all students formally enter the same education system at the primary level, social differences emerge early and lead to increasingly divergent educational pathways. These results highlight the transition to lower secondary education as a key leverage point for reducing educational inequality. Institutional procedures guiding track placement and counselling at this stage should therefore be examined for potential biases and unequal access to information and support. Providing targeted guidance and outreach to families with lower educational backgrounds may help counteract cumulative disadvantages at this transition. More broadly, policies that strengthen support structures during the early secondary phase and maintain opportunities for later mobility between tracks could be important steps toward reducing the persistent reproduction of social inequality in education. Recent evidence further suggests that the socioeconomic

composition of schools remains associated with students' educational outcomes even after accounting for individual background characteristics (Reiter and Steiner 2026), underscoring the importance of institutional contexts and school segregation for cumulative educational disadvantage.

Using linked administrative data and SA, our study offers a novel perspective on the persistence and reproduction of educational inequality in Austria by mapping educational trajectories of an entire cohort and examining variation across key social groups over an 18-year period. At the same time, several limitations remain. First, our analysis is descriptive and does not model causal relationships or the joint influence of overlapping social dimensions. Second, by focusing on sequences of school forms grouped into broader school types, we also abstract from within-track variation such as subject choices or fields of study that may also contribute to the reproduction of inequality.

Despite these limitations, the descriptive approach provides clear value: using state distribution and sequence frequency plots, we capture both overall cohort patterns and the most common trajectories, thereby providing a clear visual summary of complex longitudinal data. Although dimensions such as parental education, migration background, and regional differences are inherently intertwined, our bivariate analysis allows for detailed subgroup comparisons highlighting how specific social characteristics are associated with distinct trajectories. Future research could combine trajectory-based methods with more fine-grained curricular or programme-level data to deepen our understanding of how educational careers unfold over time, while employing multivariate analyses to account for overlapping dimensions of disadvantage. It should also examine how specific institutional arrangements and school practices in lower secondary education may mitigate or reinforce inequalities.

7 Appendix

7.1 Appendix A. Summary of status assignment rules & state definitions

We assign mutually exclusive status categories for each individual and school year based on school and higher education enrolment records as well as labour market data and information from migration statistics. When multiple activities across different domains of activity occur within the same school year, a hierarchical decision rule is applied: Up to the age of 15, school enrolment is prioritised over all other activities. From age 16 onwards, priority is given to higher education, followed by school enrolment, labour market activity, and, with lowest priority, 'Abroad' or 'Other'.

School enrolment The yearly status reflects the individual's school enrolment at the beginning of the respective school year recorded in the school statistics. If multiple school records appear at the beginning of the same year, priority is given to (1) completed enrolments, (2) terminated enrolments, and (3) the enrolment with the earliest start date. The assigned school type corresponds to the school form

(*Schulform*) an individual attended during the school year and is grouped into broader categories using the IPUB2 school-type classification.

Higher education When multiple concurrent enrolments occur, the following hierarchy is applied: (1) the highest degree level (doctoral > master > bachelor/diploma), (2) completed programmes, (3) longest active enrolment, and (4) earliest start date. Higher education institutions are grouped into standard sector categories.

Labour market activity Labour market statuses are derived from register-based employment histories (*Registerbasierte Erwerbsverläufe*). Daily records are aggregated to the school-year level (1 September–31 August). The longest cumulative activity determines the status for that year. Marginal employment is excluded and coded as ‘Other’.

Years without activity School years with no identifiable education or employment activity are coded as ‘Other’. Years in which an individual does not reside in Austria, based on migration and employment records, are coded as ‘Abroad’.

Table A.1 Overview of yearly status categories for sequence analysis

Status category	Description/included educational institutions
Primary school	<i>Volksschule</i>
Special-needs education	Instruction according to special educational needs curriculum
Compulsory school	Compulsory track of lower secondary school: <i>Hauptschule/Neue Mittelschule</i> & one-year pre-vocational programmes (<i>Polytechnische Schule</i>)
Academic lower secondary	<i>Allgemeinbildende Höhere Schule (AHS)</i> (grades 5–8)
Academic upper secondary	<i>Allgemeinbildende Höhere Schule (AHS)</i> (grades 9–12)
Higher vocational school	<i>Berufsbildende Höhere Schule (BHS)</i>
Vocational middle school	<i>Berufsbildende Mittlere Schule (BMS)</i>
Apprenticeship	Dual VET (part-time vocational school and apprenticeship, <i>Lehre</i>)
University	Public or private university
University of applied sciences/	<i>Fachhochschule (FH)</i>
University colleges of teacher education	<i>Pädagogische Hochschule (PH)</i>
Military/Civil service	Participation in military or alternative civilian service (compulsory for male Austrian citizens, 6–9 months)
Employed	Full- or part-time employment or self-employment; marginal employment is excluded
Unemployed	Registered as unemployed/job seeking or in AMS-training
Other	Any other non-education and non-employment status (e.g., marginal employment, pension, parental leave)
Abroad	Identified as not residing in Austria according to the migration statistics or register-based labour market data

7.2 Appendix B. State distribution tables

Table B.1 State distribution of the full cohort (Due to rounding differences, the sum does not always equal 100%)

		Age 13 (%)	Age 16 (%)	Age 22 (%)
<i>Full cohort</i> (<i>n</i> =85,535)	Primary School	0	0	0
	Special Needs Education	2	1	0
	Compulsory School	65	0	0
	Academic-lower Secondary School	31	0	0
	Academic-higher Secondary School	1	24	0
	Higher vocational Schools	1	28	1
	Vocational middle Schools	0	12	2
	Apprenticeship	0	28	3
	University	0	0	20
	Univ. of applied sciences/Univ. colleges of teacher education	0	0	8
	Military/Civil service	0	0	0
	Employed	0	1	51
	Unemployed	0	2	6
	Other	0	4	7
	Abroad	0	1	2

Table B.2 State distribution by gender (Due to rounding differences, the sum does not always equal 100%)

		Age 13 (%)	Age 16 (%)	Age 22 (%)
<i>Girls</i> (<i>n</i> =41,710)	Primary School	0	0	0
	Special Needs Education	1	1	0
	Compulsory School	63	0	0
	Academic-lower Secondary School	33	0	0
	Academic-higher Secondary School	1	28	0
	Higher vocational Schools	1	30	1
	Vocational middle Schools	0	14	2
	Apprenticeship	0	20	2
	University	0	0	23
	Univ. of applied sciences/Univ. colleges of teacher education	0	0	9
	Military/Civil service	0	0	0
	Employed	0	1	47
	Unemployed	0	2	5
	Other	0	3	8
	Abroad	0	1	2

Table B.2 (Continued)

		Age 13 (%)	Age 16 (%)	Age 22 (%)
<i>Boys</i> (<i>n</i> =43,825)	Primary School	0	0	0
	Special Needs Education	3	1	0
	Compulsory School	67	1	0
	Academic-lower Secondary School	30	0	0
	Academic-higher Secondary School	1	20	0
	Higher vocational Schools	0	25	1
	Vocational middle Schools	0	11	2
	Apprenticeship	0	36	3
	University	0	0	18
	Univ. of applied sciences/Univ. colleges of teacher education	0	0	6
	Military/Civil service	0	0	1
	Employed	0	0	55
	Unemployed	0	2	6
	Other	0	4	6
	Abroad	0	1	2

Table B.3 State distribution by migration background (Due to rounding differences, the sum does not always equal 100%)

		Age 13 (%)	Age 16 (%)	Age 22 (%)
<i>Natives</i> (<i>n</i> =68,791)	Primary School	0	0	0
	Special Needs Education	2	1	0
	Compulsory School	64	0	0
	Academic-lower Secondary School	32	0	0
	Academic-higher Secondary School	1	24	0
	Higher vocational Schools	1	29	1
	Vocational middle Schools	0	11	2
	Apprenticeship	0	30	3
	University	0	0	22
	Univ. of applied sciences/Univ. colleges of teacher education	0	0	8
	Military/Civil service	0	0	0
	Employed	0	1	53
	Unemployed	0	2	5
	Other	0	3	6
	Abroad	0	0	0

Table B.3 (Continued)

		Age 13 (%)	Age 16 (%)	Age 22 (%)
<i>Second Genera- tion (n=10,087)</i>	Primary School	0	0	0
	Special Needs Education	3	1	0
	Compulsory School	67	1	0
	Academic-lower Secondary School	28	0	0
	Academic-higher Secondary School	1	22	1
	Higher vocational Schools	0	25	2
	Vocational middle Schools	0	17	1
	Apprenticeship	0	24	3
	University	0	0	17
	Univ. of applied sciences/Univ. colleges of teacher education	0	0	6
	Military/Civil service	0	0	1
	Employed	0	1	50
	Unemployed	0	3	11
	Other	0	6	9
	Abroad	0	0	0
<i>First Genera- tion (n=5805)</i>	Primary School	0	0	0
	Special Needs Education	4	1	0
	Compulsory School	71	3	0
	Academic-lower Secondary School	23	0	0
	Academic-higher Secondary School	2	22	1
	Higher vocational Schools	0	17	2
	Vocational middle Schools	0	15	1
	Apprenticeship	0	21	3
	University	0	0	13
	Univ. of applied sciences/Univ. colleges of teacher education	0	0	4
	Military/Civil service	0	0	1
	Employed	0	2	41
	Unemployed	0	5	11
	Other	0	8	11
	Abroad	0	6	13

Table B.4 State distribution by parental education (Due to rounding differences, the sum does not always equal 100%)

		Age 13 (%)	Age 16 (%)	Age 22 (%)
<i>Max. compul- sory (n=7360)</i>	Primary School	0	0	0
	Special Needs Education	6	1	0
	Compulsory School	82	2	0
	Academic-lower Secondary School	11	0	0
	Academic-higher Secondary School	0	10	1
	Higher vocational Schools	0	14	2
	Vocational middle Schools	0	16	1
	Apprenticeship	0	36	3
	University	0	0	8
	Univ. of applied sciences/Univ. colleges of teacher education	0	0	3
	Military/Civil service	0	0	1
	Employed	0	2	56
	Unemployed	0	7	15
	Other	0	10	11
	Abroad	0	1	0
<i>VET qualifi- cation (BMS/ appren- ticeship; n=44,362)</i>	Primary School	0	0	0
	Special Needs Education	2	1	0
	Compulsory School	79	0	0
	Academic-lower Secondary School	17	0	0
	Academic-higher Secondary School	0	12	0
	Higher vocational Schools	1	26	1
	Vocational middle Schools	0	15	2
	Apprenticeship	0	40	3
	University	0	0	11
	Univ. of applied sciences/Univ. colleges of teacher education	0	0	6
	Military/Civil service	0	0	0
	Employed	0	1	64
	Unemployed	0	2	6
	Other	0	3	6
	Abroad	0	0	1

Table B.4 (Continued)

		Age 13 (%)	Age 16 (%)	Age 22 (%)
<i>High school diploma (AHS, BHS, Kollege; n=14,927)</i>	Primary School	0	0	0
	Special Needs Education	1	0	0
	Compulsory School	53	0	0
	Academic-lower Secondary School	44	0	0
	Academic-higher Secondary School	1	30	0
	Higher vocational Schools	1	39	1
	Vocational middle Schools	0	10	1
	Apprenticeship	0	16	3
	University	0	0	27
	Univ. of applied sciences/Univ. colleges of teacher education	0	0	11
	Military/Civil service	0	0	0
	Employed	0	1	45
	Unemployed	0	1	4
	Other	0	2	6
	Abroad	0	0	0
<i>Tertiary (n=17,189)</i>	Primary School	0	0	0
	Special Needs Education	1	0	0
	Compulsory School	31	0	0
	Academic-lower Secondary School	65	0	0
	Academic-higher Secondary School	3	55	1
	Higher vocational Schools	1	28	1
	Vocational middle Schools	0	6	1
	Apprenticeship	0	7	2
	University	0	0	47
	Univ. of applied sciences/Univ. colleges of teacher education	0	0	12
	Military/Civil service	0	0	0
	Employed	0	0	25
	Unemployed	0	0	2
	Other	0	2	9
	Abroad	0	0	0

Table B.5 State distribution by place of residence (Due to rounding differences, the sum does not always equal 100%)

		Age 13 (%)	Age 16 (%)	Age 22 (%)
<i>Urban</i> (<i>n</i> =29,923)	Primary School	0	0	0
	Special Needs Education	2	1	0
	Compulsory School	51	1	0
	Academic-lower Secondary School	44	0	0
	Academic-higher Secondary School	2	33	1
	Higher vocational Schools	1	23	2
	Vocational middle Schools	0	11	1
	Apprenticeship	0	22	3
	University	0	0	25
	Univ. of applied sciences/Univ. colleges of teacher education	0	0	7
	Military/Civil service	0	0	1
	Employed	0	1	40
	Unemployed	0	3	9
	Other	0	5	9
	Abroad	0	1	2
<i>Rural</i> (<i>n</i> =55,263)	Primary School	0	0	0
	Special Needs Education	2	0	0
	Compulsory School	73	0	0
	Academic-lower Secondary School	24	0	0
	Academic-higher Secondary School	1	19	0
	Higher vocational Schools	1	30	1
	Vocational middle Schools	0	13	2
	Apprenticeship	0	32	2
	University	0	0	18
	Univ. of applied sciences/Univ. colleges of teacher education	0	0	8
	Military/Civil service	0	0	0
	Employed	0	1	57
	Unemployed	0	2	4
	Other	0	3	6
	Abroad	0	0	1

Data availability statement All data used and analysed in this contribution can be accessed via the AMDC (Austrian Micro Data Center) by Statistic Austria. For further details please refer to: <https://www.statistik.at/services/tools/datenzugang/center-wissenschaft/austrian-micro-data-center-amdc>

Declarations

Conflict of interest M. Steiner, N. Haag and M. Köpping declare that they have no competing interests.

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