Education + Training

What can children of immigrants gain from vocational education? Exploring long-term school-to-work trajectories using sequence analysis

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Abstract

Purpose – This study investigates the long-term school-to-work trajectories of children of immigrants (CI) in Norway, focusing on the potential benefits of vocational education and training (VET) compared to general education (GEN). The research aims to determine whether VET provides CI with advantageous career prospects, with a special focus on gender differences and poor-performing pupils.

Design/methodology/approach – Utilizing detailed annual register data from four Norwegian birth cohorts, this study employs social sequence analysis and linear probability models to examine the association between educational trajectories and variables such as gender, immigrant descent and school grades. The data covers a 15-year period, tracking individuals annually from ages 16 to 30.

Findings – Findings reveal that VET offers a secure pathway to employment for native male students but not for male CI. The gap in labour market inclusion for CI is linked to lower apprenticeship enrolment. Explanatory factors such as discrimination and immigrant drive towards higher education are discussed.

Originality/value – Empirically, we apply a method rarely used in the literature on CI's social mobility. Social sequence analysis is unique in that it enables us to understand not only specific outcomes at given time points – but also how the duration and timing of key transitions in young people's life courses impact long-term outcomes. We contribute to the literature on CI's incorporation by bridging the link between theories on the VET-system's inclusiveness with theories of CI's educational choices. Together, this enhances our understanding of the long-term consequences of CI's educational transitions within the Norwegian educational system.

Keywords School-to-work transitions, NEET, Children of immigrants, Educational returns, Vocational education and training, Early school leaving

Paper type Research article

Introduction

Children of immigrants' (CI) educational outcomes are often depicted as a litmus test of integration. Given CI's Norwegian upbringing and exposure to the same institutions as their native-background peers, truly efficacious integration policies should give them comparable chances to succeed in education and working life. For a long time, the overall picture of CI's structural integration has been described as a success story of social mobility. Both in Norway and in other countries in Western Europe and the US CI improve their education and earnings more than children of natives from similar social origins (Feliciano and Lanuza, 2017; Feliciano, 2020; Alba and Foner, 2015; Shah *et al*., 2010; Hermansen, 2013). Simultaneously, CI *also* appear to have higher rates of dropout and NEET (Not in Education, Employment or Training) than their native majority peers (Birkelund, 2020; Heath and Brinbaum, 2014; Engzell, 2019; Dollmann and Weiβmann, 2020; Jakobsen, 2023).

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In countries that offer viable vocational options, completing upper secondary education seems to provide stable transitions into the labour market, especially for poor-performing pupils and is therefore regularly described as "a vehicle for inclusion"(Schmid and Garrels, 2021; OECD, 2018). Consequently, scholars have suggested that low-performing CI would benefit more from choosing upper secondary vocational education (VET) rather than general upper secondary education (GEN) (Tjaden and Hunkler, 2017; Dollmann *et al*., 2023).

However, the question of whether choosing VET over GEN really is more favourable for CI with low grades remains to be empirically determined. In fact, scholars have largely overlooked CI's pathways through VET and beyond, resulting in limited empirical evidence of how CI fare within the VET system, including key transition points and within-system barriers. A few studies suggest that CI to a lesser degree, have access to apprenticeships (e.g. Hunkler, 2016), but little is known about the CI-specific predictors and consequences of not securing apprenticeships when enrolled in VET. Similarly, in the VET literature, the primary focus has been on the institutional level, with few studies exploring school-to-work trajectories for different groups, in particular CI (Blommaert *et al*., 2020).

In this article, our objective is to address this research gap by comparing the differences in longitudinal labour market trajectories of CI who enrol in VET and GEN, respectively. Using population-wide registry data and social sequence analysis, we seek to understand what characterises successful paths to labour market inclusion for CI who enter the VET system and to identify potential barriers to labour market inclusion.

We pose the following research questions: *What school-to-work trajectories are the most common among CI in VET?* and *What characterizes successful school-to-work transitions in VET for CI?*

By answering these research questions, this article makes several contributions to the literature. *Theoretically*, it enhances our understanding of both the inclusiveness of the VET system and also contributes to the ongoing debate on the role of educational choices and opportunities in labour market inclusion of CI. *Empirically*, we apply rich social sequence analyses to register data which provide us with detailed longitudinal information about educational, work and social welfare transitions for 15 consecutive years after entering upper secondary education – for four birth cohorts. Unlike traditional statistical methods, social sequence analysis can capture the complexity and variability of individual career paths and long-term outcomes. Sequence analysis allows us to identify and analyse different patterns and trajectories, providing a more nuanced understanding of how young people transition within and from school to work (Van Winkle and Fasang, 2017). This method is particularly useful for analysing non-linear paths, or paths specific to various sub-groups. While traditional methods might overlook these irregularities, sequence analysis can provide insights into the sequential and temporal order, timing and transition between states over time, without reducing complex life courses to single metrics.

We argue that Norway offers a particularly suitable case for investigating this topic, due to its high-quality dual VET system and access to population-wide registry data of exceptional value.

Previous research, theory and hypotheses

In formulating hypotheses for the empirical analyses of this study, we draw on three distinct but interrelated research literatures with implications for educational pathways into employment for CI. The first is research and theories about the inclusiveness of the VET system. The second is the literature on CI's educational aspirations and choices and the third is the literature on ethnic discrimination in the labour market.

Inclusiveness of the VET system

In Norway, education is free and accessible for all residents. The educational system is characterized by late tracking and national standardization. Primary school up until 10th grade is mandatory, and – irrelevant of completion, all pupils have the right to continue to the upper secondary level – which 98% of pupils do. The upper secondary level offers academic and vocational tracks. The academic track (GEN) qualifies pupils for higher education after three years of schooling. The vocational track requires two years of schooling and two years of apprenticeship. As an alternative to apprenticeships, VET pupils can, after completing two years of vocational school, also qualify for higher education through a supplementary academic year in school. Pupils have a right to upper secondary education (three years) but are not guaranteed an apprenticeship position following the two years of school-based VET. Completing an apprenticeship is mandatory to obtain a trade certificate.

The VET system is widely recognized for its pivotal role in securing stable and well-paid employment opportunities. In dual systems that combine theoretical school-based education with practical firm-based training, as the one in Norway, students often experience an easier transition between school and work (Blommaert *et al*., 2020).

Studies have found that male pupils with low grades have higher labour market returns if they complete VET, compared to GEN (Blommaert *et al*., 2020; Bertrand *et al*., 2021). Because of this, it has been assigned a key role in providing inclusion for students who struggle in school and upper secondary vocational education is regularly described as "a vehicle for inclusion" (Schmid and Garrels, 2021; OECD, 2018). Based on previous research and in line with theories of the inclusiveness of the VET system, we formulate the first hypothesis.

H1. Compared to GEN, VET can provide CI with more stable employment trajectories, especially among young men with low grades

Educational aspirations and choices

Empirical studies have found that CI tend to avoid VET, even when they are low performing (Beicht and Walden, 2019; Dollmann *et al*., 2023; Birkelund, 2020). Among those who enter VET in Norway, a higher share of CI choose supplementary education compared to their native majority peers – qualifying for admission to higher education (Reisel, 2014). This may indicate that CI in VET have ambitions to move beyond the occupation in which they are being trained. These patterns align with theories of "immigrant optimism" (Kao and Tienda, 1998), which describe the phenomenon of immigrant families moving with the belief that hard work and education will lead to upward mobility – leading their children to aim high regardless of social or economic barriers. CI's strong orientation towards higher education has, for decades, been attributed to their high educational aspirations and preferences (Heath and Brinbaum, 2014; Dollmann *et al*., 2023). This leads us to the second hypothesis.

H2. CI in VET are more likely than their native-majority peers to pursue pathways leading to higher education.

Discrimination

Some scholars warn that CI's preference for GEN combined with their overall high educational aspirations might represent a "trap": CI's potential inability to fulfil their aspirations may lead to lower completion rates (Dollmann *et al*., 2023). Another explanation for higher dropout rates among CI is related to the important role of accessing apprenticeships for completion rates (Markussen and Seland, 2012; Bratholmen and Ekren, 2020). An ethnic gap in the transition to firm-based apprenticeships has previously been documented in the German context (Roth and Weiβmann, 2022). In Norway, a study from 2006 found considerable differences in apprenticeship access between students with and without

immigrant backgrounds (Helland and Støren, 2006). While grade differences explained some of this gap, an unexplained ethnic difference remained.

Employers are responsible for offering training positions and tend to favour apprentices who demonstrate high ability levels and certain personality traits (Protsch and Dieckhoff, 2011). Although application materials provide observable indicators – such as grades, attendance records and certificates – these are often imperfect measures of an applicant's potential to succeed in training. As a result, employers may turn to alternative signals they associate with desirable but unobservable traits, such as gender or ethnicity, which can lead to discriminatory practices (Arrow, 1971). Ethnic discrimination continues to be a widespread issue in labour markets, both in Norway and internationally (Di Stasio and Larsen, 2020; Quillian and Midtbøen, 2021). Several indicators suggest that such discrimination may also be present in the apprenticeship hiring process in Norway. Firms have full autonomy in selecting apprentices, and the fact that a significant share of VET students are unable to secure apprenticeship placements points to a highly selective apprenticeship market (Bratholmen and Ekren, 2020; Helland and Støren, 2006). Aligning with theories of discrimination, we formulate the third hypothesis.

H3. CI are less likely to secure apprenticeships, and therefore more likely to have more disparate trajectories, such as those leading to dropout, compared to their native majority peers

Given the political emphasis on VET as a vehicle for inclusion, it is important to determine the inclusiveness of the VET system for individuals and groups that do not follow the typical path. The aim of the current study is therefore to use sequence analysis to identify and categorise the different paths, including key transitions and potential sliding door moments, through the VET system, and to evaluate the long-term outcomes of these distinctive paths. Results have implications for educational policy and the design of the VET system as a tool in securing labour market inclusion of CI. Our detailed longitudinal analyses can inform policymakers in designing effective programs that address the specific needs of different groups.

Data

The dataset includes total birth cohorts 1986–1989, a total of 201,269 individuals (193,930 natives, 7,329 children of immigrants) who completed primary education and started either VET or GEN during the year they turned 16. We follow the cohorts between ages 16 and 30, during 15 consecutive years in the observation period 2002–2019 (see overview of data structure in Figure 1). CI are individuals born in Norway or who immigrated to Norway before the age of seven with two immigrant parents from non-Nordic countries. Immigrants who came to Norway after the age of six were excluded (3,661 individuals). Persons who were not residing in Norway every year between the ages of 16 and 30 were excluded (i.e. due to death or migration). Among the majority, 52% (100,126) start VET at age 16, and 48% (93,804) start GEN. Among CI only 40% (2,914) start VET and 60% (4,415) start GEN. For the analysis, we draw a random sample of 25,000 individuals from the total cohorts, due to the data-intensive

		Calendar year																
	Age	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Birth year	1986	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
	1987		16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
	1988			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
	1989				16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	1994									16	17	18	19	20	21	22	23	24	25

Figure 1. Data structure showing included cohorts and their age during the observation period. Cohort 1994 is used for sensitivity analyses. Source: Figure created by authors

nature of sequence analysis. Birth cohort 1994 is included in supplementary analyses to test the robustness of the main results.

The dataset employed in this study was merged from several national administrative registries and includes information about gender, year of birth, country background, social background (parent's education at age 16), educational information from primary school to higher education, including grades and income.

Methods

Social sequence analysis (SA) is a method that allows for analysing individual trajectories holistically, rather than considering single events in isolation. Since the pioneering work of, social sequence analysis has become increasingly popular among scholars of education to work transitions, career trajectories and family-life patterns (Ritschard and Studer, 2018; Blanchard, 2011; Lorentzen and Dahl, 2021; Vogt *et al*., 2020; Wel *et al*., 2021). The added value of sequence analysis over, for example, event history analysis, is the holistic perspective on life course processes, facilitating the analysis of individual long-term histories. This also entails that single events are not analysed isolated, but "in their continuity" (Aisenbrey and Fasang, 2010, 421). Social sequence analysis is well-suited to describe trajectories and long-term returns to upper secondary education as it accounts for the course of life and the impact of early choices on later events.

We perform the empirical analysis according to the following steps: 1) defining the alphabet (Table 1) and constructing individual sequences; 2) partitioning of the sequences into clusters and 3) predicting cluster membership by means of linear probability models (LPM).

A sequence is a chronological list of states, defined by a constructed system of mutually exclusive and exhaustive categories, called the alphabet (Table 1). We construct a 15-year sequence for every individual in our dataset between their ages 16 and 30. Every annual state is the dominant activity during that year, which is defined by the priority rule of the alphabet. Thus, the alphabet guides the construction of individual sequences. Subsequently, we partition the sequences into clusters by comparing the distance between sequences. The pairwise distance between sequences is computed according to a dissimilarity measure of choice – guided by the research question. The dissimilarity measure can emphasise either timing, order or duration of states, or a combination of these factors. Consequently, a typology of sequences

Table 1. Alphabet of states, operationalisation and priority

Status	Operationalisation	Priority
Higher education and postsecondary	NUDB. NUS-code first digit 5 to 8	Above everything below
Apprenticeship	NUDB. NUS-code: 212	Equal to suppl. academic year, above everything below
Supplementary academic year	NUDB NUS-code: 401110	Equal to app., above everything below
Vocational education	NUDB	Equal to gen, above everything below
General education	NUDB	Equal to vet, above everything below
Normal income	Annual income of >3.5 PBA (≈35,000 EUR in 2023)	Above everything below
Low income	Annual income of >0.5 PBA & <3.5 PBA	Above everything below
NEET	Annual income below 0.5 PBA and not registered in education or apprenticeship	Rest category

Source(s): Table created by authors

is created by applying a clustering algorithm that takes the dissimilarities between sequences as input (Abbott and Tsay, 2000).

Due to the data-intensive cluster analysis, we perform the complete empirical analysis on a random sample of 25,000 sequences, while descriptive statistics are presented on the total population of approximately 200,000 individuals. Drawing a random sample from a full population dataset may incur biases and estimates are likely to be associated with a higher degree of uncertainty than estimates based on the full population. Therefore, we perform robustness checks by drawing several random samples of 25,000 sequences, which yield similar results in terms of clusters and predicted membership.

Alphabet

We define eight states (Table 1) in the following order of priority: 1) Higher education, 2) apprenticeship, 2) supplementary year, 3) school-based vocational upper secondary education, 3) general upper secondary education, 4) normal income, 5) low income and 6) not in education, employment or training (NEET, rest category). Apprenticeship and supplementary year have equal priority as these are mutually exclusive on an individual level. The same applies to VET and GEN. We chose eight states since these categories capture what we believe are the most important transitions in young people's school-to-work trajectories. Increasing the number of states will increase the computational intensity of the partitioning process and make it challenging to arrive at stable clusters. Reducing the number of clusters will yield less nuanced and less informative trajectories.

In constructing the states listed in Table 1, we use the National Education Database (NUDB) and its detailed classification of education, as well as information on annual income. Income cutoffs are measured in price-based amounts (PBA), which is a fixed annual amount used to calculate applicability and level of welfare benefits, pensions, and student allowances in Norway. In 2024, 1 PBA was equivalent to 10,500 EUR, and 3.5 PBA approximately 36,750 EUR. In accordance with former studies of employment trajectories, we use 3.5 PBA as a threshold for normal income (Bäckman and Nilsson, 2011; Elstad and Heggebø, 2019; Gauffin *et al*., 2021; Widding-Havneraas, 2016). The amount approximates the annual income of a full-time worker in the lowest-paid professions. The threshold for economic activity is set to 0.5 PBA, which is a commonly used threshold to categorize NEET (Ballo *et al*., 2022; Bäckman and Nilsson, 2016).

Dissimilarity algorithm and partitioning

We partition sequences into a typology of typical trajectories by calculating the distance between sequences in terms of the number of operations needed to transform one sequence into another (Aisenbrey and Fasang, 2010). In our analyses, we are more focused on *order* of states than the exact timing and therefore choose dissimilarity algorithms accordingly. The sample is partitioned using a dissimilarity algorithm called longest common subsequence (LCS), which defines similarity in terms of recurring patterns of states in the same order within the individual sequences (see Studer and Ritschard, 2016; Gabadinho *et al*., 2011). We choose an algorithm based on both theoretical knowledge and empirical evidence as recommended by Studer and Ritschard (2016). This means that several different algorithms were tested and evaluated in terms of quality metrics and by visually interpreting the various cluster solutions. The main objective of the clustering procedure is to create groups of sequences that are as similar as possible within each cluster, and as dissimilar to sequences of other groups, as possible (Studer, 2013), which was best achieved using LCS and a five-cluster solution.

We use the TramineR package in R (Gabadinho *et al*., 2011) to perform the SA, and use a combination of Ward hierarchical clustering and Partitioning Around the Medoids (PAM) to group similar sequences (Studer, 2013). Further details on the method and sensitivity analyses are available in the supplementary material.

Results

Descriptive statistics

In Table 2 we summarize descriptive statistics of the study population by immigrant descent and gender. Descriptive distributions reveal that the share of CI choosing VET is lower for both boys (42%) and girls (37%) compared to their native majority peers (56% for boys and 47% for girls). The share of students registered with apprenticeships is also substantially lower among CI than among children born to Norwegian parents (19 vs 40% for boys and 10 vs 17% for girls). Mean grade point average from primary school is somewhat lower for CI than for the native majority (see also complete grade point average (GPA) distributions by immigrant descent in the Supplementary material figure A1). Parental education of CI is, on average, expectedly lower than for the native majority. The distribution by study program shows that although a lower share of CI chooses VET, the gender distribution across VET programs is roughly the same as for the native majority.

To provide an overview of the different school-to-work trajectories in the study population, we present three descriptive figures of the sequenced data. Figure 2 displays all sequences in the sample ordered according to status at age 16. The figure shows that among GEN students (grey), a significant proportion go straight into higher education (orange) after graduation, while a smaller proportion take what we interpret as a gap year (yellow/purple) before they start higher education. After a shorter or longer period in higher education, most students

Table 2. Descriptive statistics of study population by immigrant descent and gender

	Majority (197,940, 96%)				CI (7,329, 4%)			
	Boys (100,025, 52%)		Girls (93,915, 48%)		Boys (37,690, 51%)		Girls (3,569, 49%)	
	N	%	N	%	N	%	N	%
VET	56,370	56%	43,756	47%	1,586	42%	1,328	37%
GEN	43,655	44%	50,159	53%	2,174	58%	2,241	63%
		100%		100%		100%		100%
Apprenticeship (min. 1 year)	39,962	40%	15,865	17%	714	19%	359	10%
Supplementary year (min. 1 year)	10,646	11%	18,272	19%	605	16%	653	18%
GPA Primary school (mean)	41		46		39		43	
Region of residence: Oslo	6,058	6%	5,673	6%	1,655	42%	1,552	42%
Parental education								
Unknown/no edu	9,994	10%	9,587	10%	1,456	39%	1,368	38%
Upper secondary	48,992	49%	46,564	50%	1,183	31%	1,152	32%
BA	30,559	31%	28,200	30%	810	22%	781	22%
MA	10,480	10%	9,564	10%	311	8%	268	8%
		100%		100%		100%		100%
Study program								
General academic (GEN)	34,229	34%	39,042	42%	1,958	52%	2,128	60%
Sports (GEN)	6,058	6%	4,453	5%	154	4%	34	1%
Music, dance, drama (GEN)	1,672	2%	4,434	5%	22	1%	45	1%
Construction	14,013	14%	444	0%	292	8%	2	0%
Design and handicrafts	1,929	2%	14,004	15%	77	2%	273	8%
Electro	14,542	15%	1,485	2%	409	11%	13	0%
Health and upbringing	1,144	1%	14,839	16%	83	2%	723	20%
Media and comms	1,696	2%	2,230	2%	40	1%	34	1%
Agriculture	1,974	2%	2,602	3%	6	0%	3	0%
Restaurant and food	3,929	4%	5,486	6%	116	3%	64	2%
Service and transport	2,555	3%	3,735	4%	200	5%	237	7%
Technical and industrial prod	16,284	16%	1,161	1%	403	11%	13	0%
		100%		101%		100%		99%

Source(s): Table created by authors

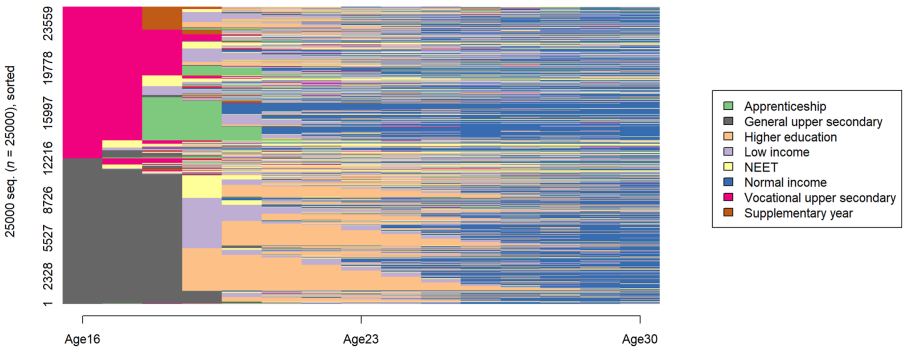

Figure 2. Overview of all sequences in sample ordered according to status at age 16. Source: Figure created by authors

experience the transition to employment with a normal income (blue) in their early to late 20s. Among students who start VET (pink), about one in four students transition to apprenticeship (green) after two years of vocational schooling. A minority take a supplementary year (brown) before starting higher education or embarking on unstable paths of low income or NEET. Although providing a general idea of typical trajectories, it is difficult to interpret from Figure 2 how trajectories of VET students who neither take a supplementary year nor transition to apprenticeships look like in the long run.

In Figure 3 we display a state distribution plot, which in essence is a bar graph showing the distribution of states at each specific age among the population. From this plot, we see that at ages 16 and 17, the population is divided in half between school-based VET and GEN. At age 18, the largest proportion is still in GEN, a smaller proportion in school-based VET and an even smaller proportion has transitioned to apprenticeship. The rest are either in their supplementary year or categorised with low income or as NEET. At age 19, the share of apprentices has increased to about 20%. Around 18% have started higher education and a large proportion, almost 50% are categorised as NEET or with low-income. The share of NEET and low-income decreases somewhat until age 24–25 and remains stable during the rest of the observation period. The share of the population in higher education is largest between ages 20–24 and decreases after that. The proportion of individuals with normal income increases steadily from about 5% at age 20 to 60% at age 30.

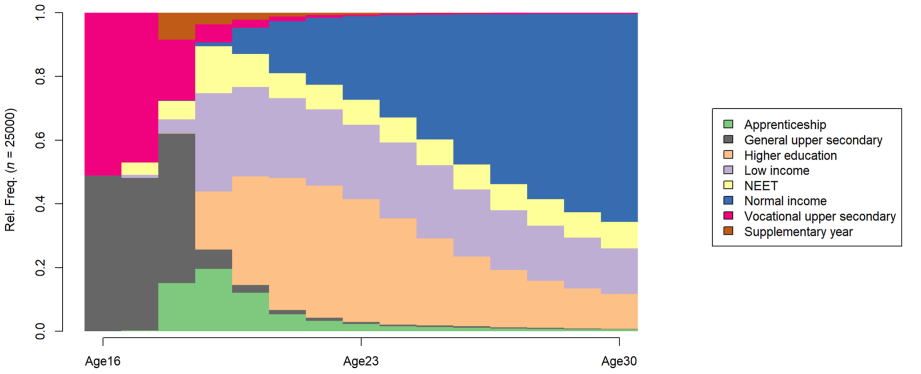

Figure 3. State distribution plot of sample. Source: Figure created by authors

Figure 4 displays the 20 most frequent sequences in the sample. The plot reveals that the most common sequences can be categorised into two main types: the VET-apprenticeship-trajectory cluster and the GEN-higher ed-trajectory. The first type is characterised by two years of VET school (pink), two or three years of apprenticeship (green), followed by continuous normal income until the end of the observation period at age 30. The second type is characterised by three years of GEN followed by several years of higher education, one year of low income and then stable, normal income from the early to mid-twenties. Notice that the VET sequences do not have the purple year of low income, indicating a swift transition to employment – a characteristic of VET related to the expression "vehicle for inclusion".

Partitioning and prediction

In Figure 5, we display the result of the LCS-algorithmic partitioning. Sequences within the five clusters are displayed using silhouette sorting, meaning that the top sequence of each cluster is the most distinct from other clusters, while the bottom sequence has the smallest distance to one or several other clusters. We named the clusters by interpreting the looks of these silhouette-sorted plots. Cluster 1 includes 31% of the sample and collects most trajectories characterised by GEN, short higher education and relatively long periods of normal income. Cluster 2 titled "Unstable, low-income" contains 18% of all trajectories and is characterised by initial school-based VET followed by frequent transitions between states throughout the observation period and a lack of continuity in both education and work.

Cluster 3, titled "long higher education", contains trajectories predominantly characterised by three years of GEN, long higher education and transitions to normal income towards age 30. Cluster 4 is the apprenticeship trajectory cluster where a majority of individuals display two years of VET schooling and most transition to two or three years of apprenticeship training. One-fifth of the sequences in the sample belong to cluster 4. Finally, cluster 5 constitutes 8% of the sample and is characterised by early school leavers from school-based VET. A large majority of trajectories in cluster 2 include NEET or low-income in combination with NEET from leaving school at age 18 or 19 and until the end of the observed period.

Overall, the five-cluster solution partitioned by the LCS algorithm shows how starting GEN versus VET at age 16 leads to substantially different school-to-work trajectories. While GEN students experience either short or long higher-education trajectories following a gap year at age 19, VET students either fall into the seemingly advantageous apprenticeship trajectory or experience negative trajectories of incomplete education, and unstable, low or no income.

To understand how children of immigrants who choose VET distribute across the five types of trajectories, we predict probabilities of cluster membership using linear probability models

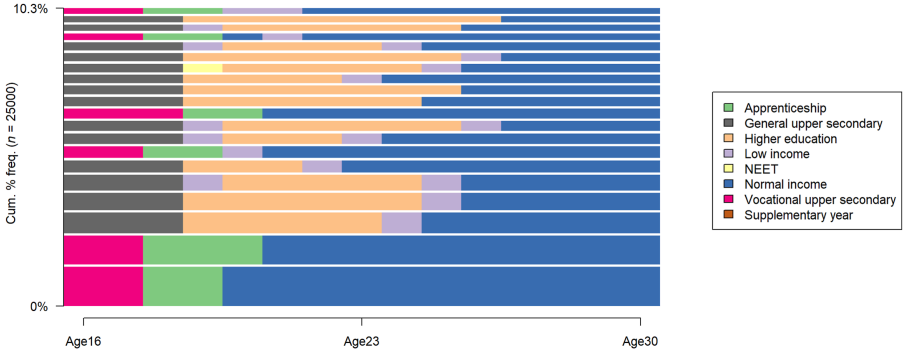

Figure 4. Overview of the 20 most frequent sequences in the sample. Source: Figure created by authors

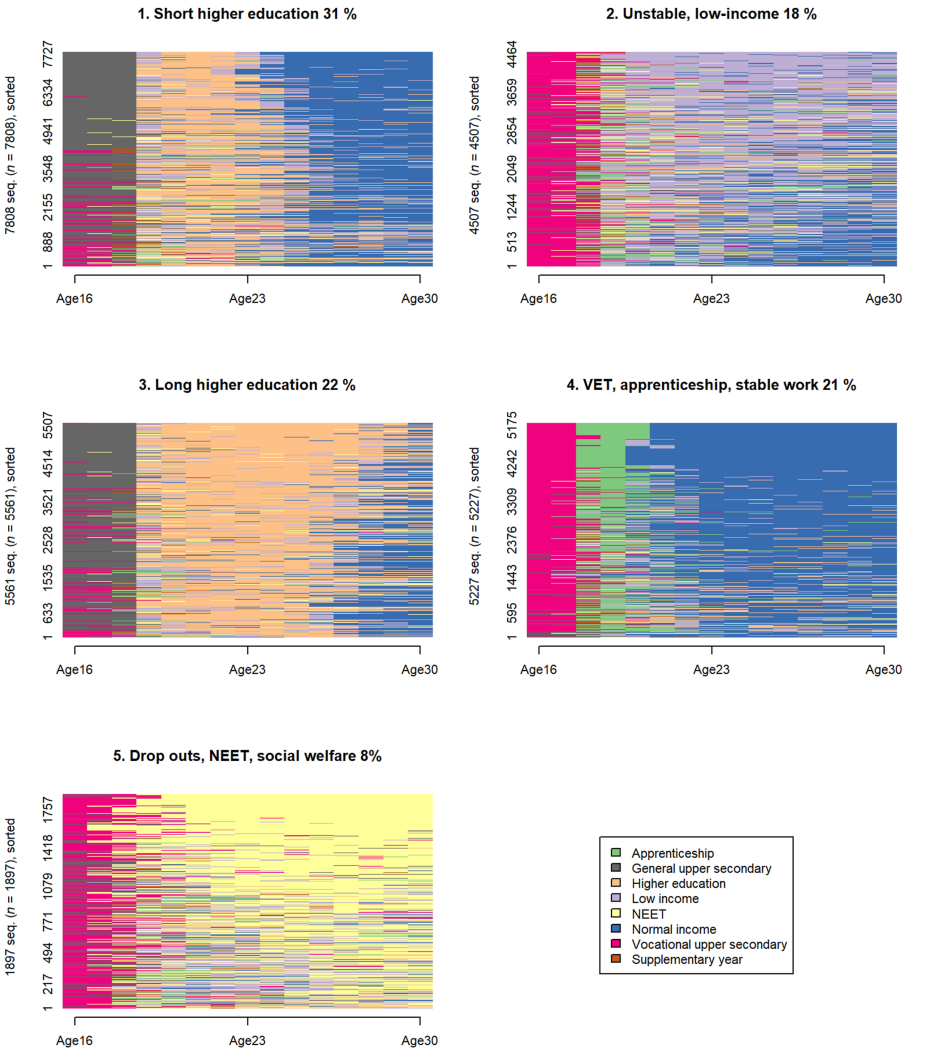

Figure 5. Five cluster solution using LCS algorithm. Source: Figure created by authors

(LPM), with interactions between immigrant descent, gender, grades and whether they started GEN or VET at age 16, with controls for year of birth, social background and region of residence. We construct three outcome variables and estimate three separate models: (1) Apprenticeship trajectory cluster (cluster 4); (2) NEET, unstable low income (cluster 2 and 5) and (3) higher education (clusters 1 and 3). Results of interactions are displayed as margins plots in Figures 6–8. In these figures, the markers represent point estimates of predicted probabilities with confidence intervals (whiskers) at the 95% level. The four different groups of interest (native female, CI female, native male and CI male) are displayed along the *y*-axis, while the *x*-axis shows the predicted membership probabilities. In figures 6–8, all point estimates can be compared to each other. Point estimates where confidence intervals overlap horizontally are not significantly different from each other, while point estimates where confidence intervals do *not* overlap are different with statistical significance at the 95% level.

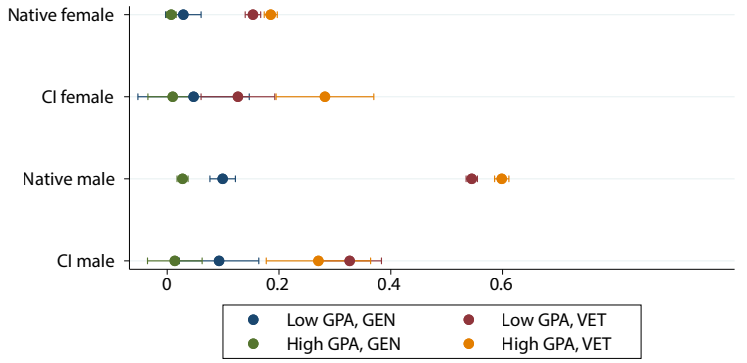

Figure 6. Predicted probabilities of membership in apprenticeship-trajectory cluster (cluster 4). Source: Figure created by authors

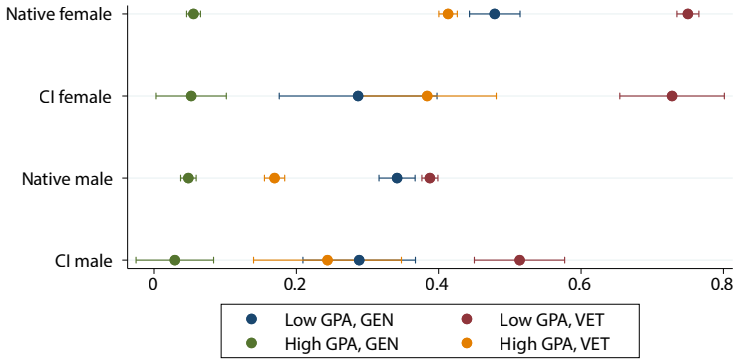

Figure 7. Predicted probabilities of membership in NEET or unstable, low-income cluster (cluster 2 and 3). Source: Figure created by authors

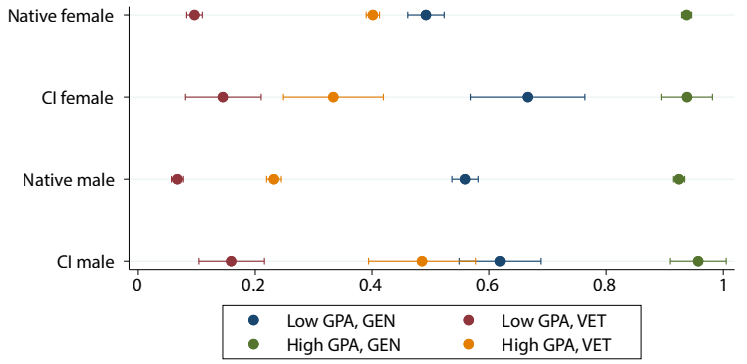

Figure 8. Predicted probabilities of membership in higher-education clusters (clusters 1 and 5). Source: Figure created by authors

Figure 6, which displays predicted probabilities of membership in the apprenticeship-cluster, shows that women in VET (red and yellow markers) have significantly lower chances

of having positive apprenticeship-to-work trajectories than native men in VET, with no statistically significant differences between native women and female CI. For men, ethnic differences are large. While male VET students with immigrant parents have a probability ranging from about 19 to 39% of following an apprentice trajectory, native male VET students' chances are around 60%.

According to Model 1, grades play only a small predictive role for native majority, and no role for CI in VET. Looking at predicted probabilities of Model 2 (Figure 6) predicting membership in either NEET cluster or unstable, low-income cluster, we see that differences between CI and native students are small for both men and women, with one exception. Male CI in VET with low grades have a significantly higher chance (approximately 55%) of NEET and unstable trajectories, than their native male VET students with low grades (approximately 39%). Findings also show that women on average have a higher risk of NEET trajectories and unstable labour market attachments than men – irrelevant of immigrant background.

Finally, we predict probabilities of higher education trajectories (Figure 7) and find few differences between CI and the native majority (since markers of the same colour mostly align vertically), with some exceptions. Male CI in VET with high grades are significantly more likely (approximately 48%) to follow a higher education trajectory than native male VET students with high grades (approximately 22%). Male CI in VET with low grades are also significantly more likely to have higher education trajectories than their native counterparts. The same applies to female CI with low grades in GEN.

To test the robustness of results, we performed a sensitivity analysis using the 1994-cohort (see Figures A3-A6 with a more detailed interpretation in the supplementary material), showing substantially identical results and thus confirming the robustness of the main results.

Regression models can be summarised into three main findings. First, we find that women, irrelevant of immigrant background have lower chances of apprenticeship-to-work trajectories following VET, compared to native men. In fact, we find no ethnic disadvantage in terms of school-to-work trajectories for *women* at all in either VET or GEN. Instead, we find that CI have significantly *lower* probabilities of NEET or unstable trajectories when comparing women in GEN with low grades from primary school. Second, for *men*, ethnic penalties are large among VET students with low grades in terms of both positive apprenticeship trajectories and negative NEET and unstable trajectories. The third finding is the increased probability of higher education trajectories among male CI VET students with both low and high grades compared to their native male peers.

Concluding discussion

Literature on returns to VET emphasises the benefits of the dual system, namely, quick school-to-work transitions with good wages. Consequently, it has been suggested that a higher share of immigrants' children could benefit longitudinally from going into VET, rather than aiming high and falling through the higher education system. However, there has been a lack of empirical research on the pathways and transitions of CI in VET.

The objective of this article has been to address this knowledge gap by comparing the differences in longitudinal labour market trajectories of CI who enrol in VET to those who enrol in GEN, and to identify potential barriers to labour market inclusion within the VET system. We have done this empirically by using detailed annual register data of four birth cohorts from Norway during a 15-year period in their young adulthood. The article makes an important empirical contribution by showing in great detail how educational choices and transitions in early adulthood shape longitudinal labour market trajectories.

Our findings show highly gendered patterns in school-to-work trajectories, with ethnic penalties applying only to men in VET. The positive transitions from VET to stable employment emphasised in previous research are valid for *native men* only, irrelevant of their grades from primary school. Both native women and CI are, according to our analyses, less likely to experience transitions to apprenticeships with consequent labour market attachment.

Thus, native women and CI in VET – and especially those with low grades – are more likely to experience longitudinal income instability or marginalisation. This means that our first hypothesis about VET providing CI with more stable employment trajectories than GEN is not supported.

Current findings also indicate that both native women and CI in VET with high grades are more likely to enrol in higher education than the native male majority in VET, suggesting that instead of enrolling in apprenticeships, native women and CI continue with an academic supplementary year following school-based VET. Thus, our second hypothesis - *CI in VET are more likely than their native-majority peers to pursue pathways leading to higher education* – is supported. These findings correspond to international research, which consistently shows that ethnic minorities are more inclined to pursue tertiary education rather than vocational training (Birkelund, 2020; Dollmann, 2021; Tjaden and Hunkler, 2017). This is also true in Norway, where previous research has shown that CI students more frequently enrol in VET to qualify for higher education entry through the academic supplementary year instead of opting for apprenticeship training (Reisel, 2014).

Our findings also show that while the default for majority male students in VET seems to be apprenticeships and subsequent labour market attachments, native women, and CI in VET to a much higher degree either strive for higher education (if high grades) or become early school leavers (if low grades).

A suggested mechanism explaining dropout among CI is the challenge of acquiring an apprenticeship position, due to potential discrimination among employers. Our findings show that male CI are less likely to have trajectories leading to apprenticeship positions and stable employment. Consequently, our third hypothesis that CI are less likely to secure apprenticeships and therefore more likely to have disparate trajectories, such as those leading to dropout, is also supported. This finding underscores the need for further research to uncover the underlying mechanisms that hinder access to apprenticeships for CI.

Current results confirm our expectations related to VET providing CI with a two-track course of either a route to higher education or a higher risk of drop out. However, if higher education is the ultimate aspiration, our findings show that entering GEN is a much better option than choosing VET, even when grades are low. CI pupils who enter GEN have significantly lower risks of dropout and NEET trajectories, than CI pupils who enter VET. Our detailed depiction of educational trajectories reveals that seeking and securing apprenticeships is key to successful labour market transitions for pupils in VET. Consequently, the lack of apprenticeships among CI appears to be the main barrier inhibiting advantageous trajectories following VET enrolment.

A limitation to our analysis of the cohorts 1986–1989 is that both the educational system and the labour market have evolved since these cohorts went to upper secondary school 15–20 years ago. The downside to examinations of long-term outcomes will always be that the explanatory factors of interest may be historically outdated. To test the robustness of our results, we repeated the cluster analysis and prediction of cluster membership on the 1994 cohort using 10-year sequences instead of 15. Results of the sensitivity analyses are displayed in Figures A3-A6 and show that the main results hold with regard to upper secondary track, gender, immigrant descent and grades (some confidence intervals are larger due to fewer observations).

This article makes two important contributions to theoretical debates about 1) CI educational choices and 2) the inclusiveness of the VET system. First, choosing VET over GEN has no net positive effect for low-achieving CI due to its high risk of marginalisation. Instead, for CI who aspire for higher education, aiming directly for GEN is likely to produce equal or better longitudinal outcomes compared to detouring VET with supplementary academic courses to enter higher education. The current findings support recent research on the returns to GEN for children of immigrants (Dollmann *et al*., 2023), which – using high-quality Swedish register data – found that aspirations towards higher education among immigrants and their descendants are likely to yield net positive outcomes.

Second, native women and CI's comparatively poorer prospects from VET are evidently connected to the inaccessibility of apprenticeships – especially among male CI. Despite firms' complete discretion when selecting apprentices, completing an apprenticeship is a mandatory requirement before graduating with a VET diploma. Therefore, our findings depict VET as an educational institution that systematically excludes students based on both gender and immigrant background. The gender gap in returns to VET may be partly explained by gendered educational choices in terms of VET programs and redirection towards higher education, as well as the gendered labour market in general. Although we find no ethnic gap in apprenticeship transitions among women, this gap is substantial among men, supporting previous German research (Roth and Weiβmann, 2022).

We find no evidence of grades closing the gap between male descendants and their native majority peers in terms of membership in the typical apprenticeship trajectory cluster, supporting previous findings from Norway (Helland and Støren, 2006), which showed that male CI and native majority peers with similar grades had unequal apprenticeship opportunities. The current findings, however, suggest that accessing apprenticeships for immigrant descendants in VET is decisive for stable labour market inclusion, and that those who fail in transitioning to firm-based training are at risk of early school leaving and long-term labour market exclusion.

Implications for policy and future research

Results of the current study inform policy that the advantages of the dual VET-system do not apply to all groups equally. In designing targeted efforts, educational policymakers must be sensitive to the fact that apprenticeships are crucial for completions rates, but with low acquisition rates among CI. Some have argued that an effective policy action for increased completion rates in VET would be to provide students with guaranteed access to an apprenticeship position (NOU, 2024: 82,024). A guarantee could, however, pose challenges, for several reasons. First, the VET system is entirely dependent on training firms offering apprenticeships. Removing firms' complete discretion in selecting apprentices could affect the firms' willingness to make apprenticeships available. Second, the fact that apprentices are recruited on the same basis as ordinary employees contributes to the perception of apprentices as full-fledged members of a company's staff. The authenticity of the learning situation is considered one of the most important factors for maintaining the high quality of vocational education. Changing the existing recruitment rules and procedures bears the risk of affecting the position of apprentices' position within firms and may ultimately reduce their chances of ordinary employment following graduation (Olsen *et al*., 2014).

Another policy action with potential to impact students' career opportunities is guidance counselling in upper secondary education. Findings of the current study highlight the need for guidance to acknowledge that labour market returns to VET are significantly lower for low-achieving male descendants compared to low-achieving native male students, possibly due to the high risk of not securing apprenticeships. While previous research has argued that students with immigrant backgrounds would be better off choosing vocational instead of general upper secondary education, for example, via guidance counsellors nudging (e.g. Tjaden and Hunkler, 2017), our findings do not support this claim, at least not under the current system. Given our finding that entering GEN – even with low grades – is a much better long-term option for students with immigrant parents, it would be ethically problematic to actively discourage students with immigrant backgrounds from following their educational aspirations.

Instead, guidance counsellors should focus on providing comprehensive information about both educational paths, including detailed insights about the apprenticeship system's potential challenges. As immigrant families often lack crucial information about vocational education systems (Hegna and Smette, 2017), counsellors have a potentially important role in understanding the specific demands and potential obstacles of children of immigrants who consider selecting a vocational path. For CI students who do choose VET, counsellors could

play an important role in offering targeted support for securing apprenticeship positions, for example, by building networks with potential employers.

To disentangle potential mechanisms that can explain the ethnic gap in accessing apprenticeships, more research is needed. For instance, causal design research is needed to determine whether discrimination exists in the apprentice hiring market, in which sectors and for whom. Further, there is a need for studies examining how potential apprentices of immigrant descent navigate the apprenticeship market, which barriers they anticipate and how they make use of their social networks (Roth, 2014) in their endeavour to secure a position. Understanding why and how the observed gap in apprenticeship acquisition occurs is essential for the development of effective policy actions that can prevent long-term exclusion of a growing population of immigrants' children. Further research into the mechanisms behind the observed ethnic gap in apprenticeship acquisition is essential for the development of effective policy action.

Data availability statement

This study used administrative Norwegian register data provided by Statistics Norway. For reasons of individual data protection, data are not publicly available. However, researchers affiliated with Norwegian research institutions can instantly access Norwegian microdata through the online platform www.microdata.no.

Acknowledgments

We presented this study at the Transitions in Youth Workshop (Edinburgh, 2023), the Norwegian Sociological Association's Winter Seminar (2024) and seminars at NIFU – Nordic Institute for Studies in Innovation, Research and Education. We thank participants for their helpful input and are especially grateful to Thea Bertnes Strømme for valuable comments on earlier drafts.

Supplementary material

Methodological addendum

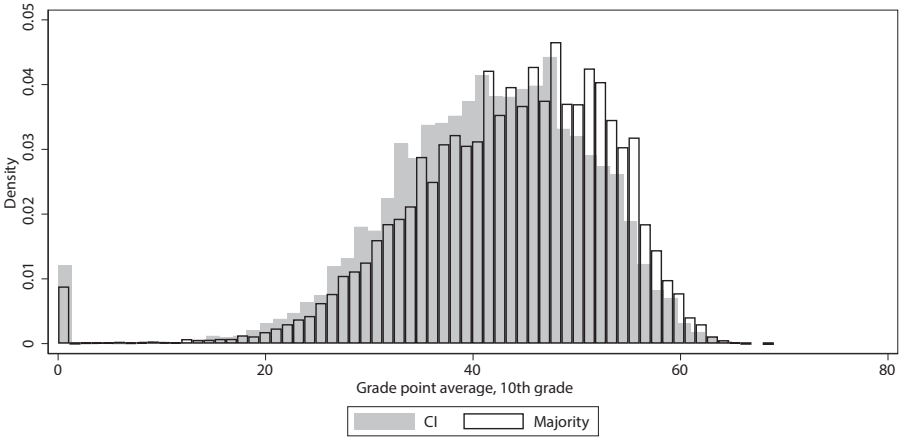

Figure A1. Distribution of grade point average from 10th grade in primary school for CI and native majority pupils. Source: Figure created by authors

Figure A2 displays the values of the four most interesting quality measures for N number of clusters. The Average Silhouette Width (ASW) (Kaufman and Rousseeuw, 2009) is the most important measure: "It is based on the coherence of the assignment of an observation to a given group, comparing the average weighted distance of an observation from the other members of its group and its average weighted distance from the closest group" (Studer, 2013, p. 14). The indicators "point biceral correlation" (PBC) and "Hubert's Gamma" (HG) "measure the capacity of a partition of the data to reproduce the distance matrix" (Studer, 2013, p. 33). A partition should aim to maximise ASW, PBC and HG. Finally, the "Hubert's C" (HC) measure "compares the partition obtained with the best partition that could have been obtained with this number of groups and this distance matrix. In contrast to the other indexes, a small value indicates a good partition of the data" (Studer, 2013, p. 33). According to Figure A2, the five-cluster solution constitutes a good compromise between the indicator values.

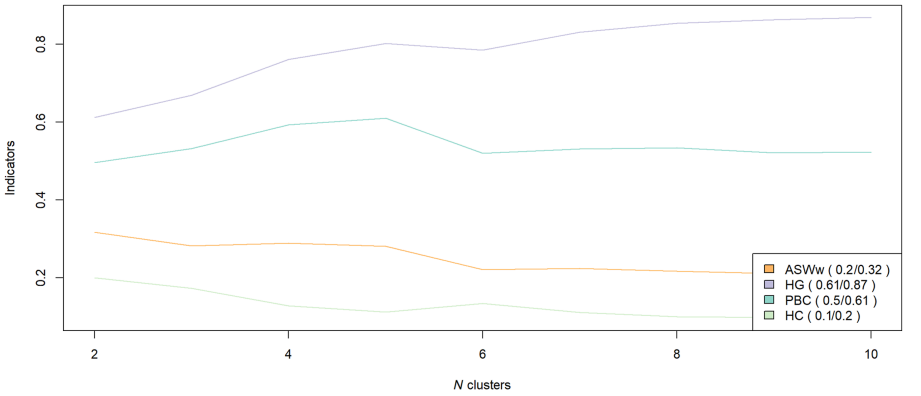

Figure A2. Overview of partition quality indicators ASWw, HG, PBC and HC for N clusters. Source: Figure created by authors

Sensitivity analysis

To test the robustness of our results, we repeated the cluster analysis and prediction of cluster membership on the 1994 cohort using 10-year sequences instead of 15. Results of the sensitivity analyses are displayed in Figures A3–A6 and show almost identical results. The cluster analysis displays the same five typical trajectories identified in the main analysis. The predicted probabilities show almost no differences between native and CI females in terms of grades, VET/GEN enrolment and trajectory membership. For males, CI are less likely to be in the typical apprenticeship cluster compared to native male. CI male in VET are more likely to belong to the NEET/unstable clusters compared to native majority males, but confidence intervals are large due to few observations. Regarding higher education, there are no ethnic gaps for either male or female. All of these findings concur with the main analysis.

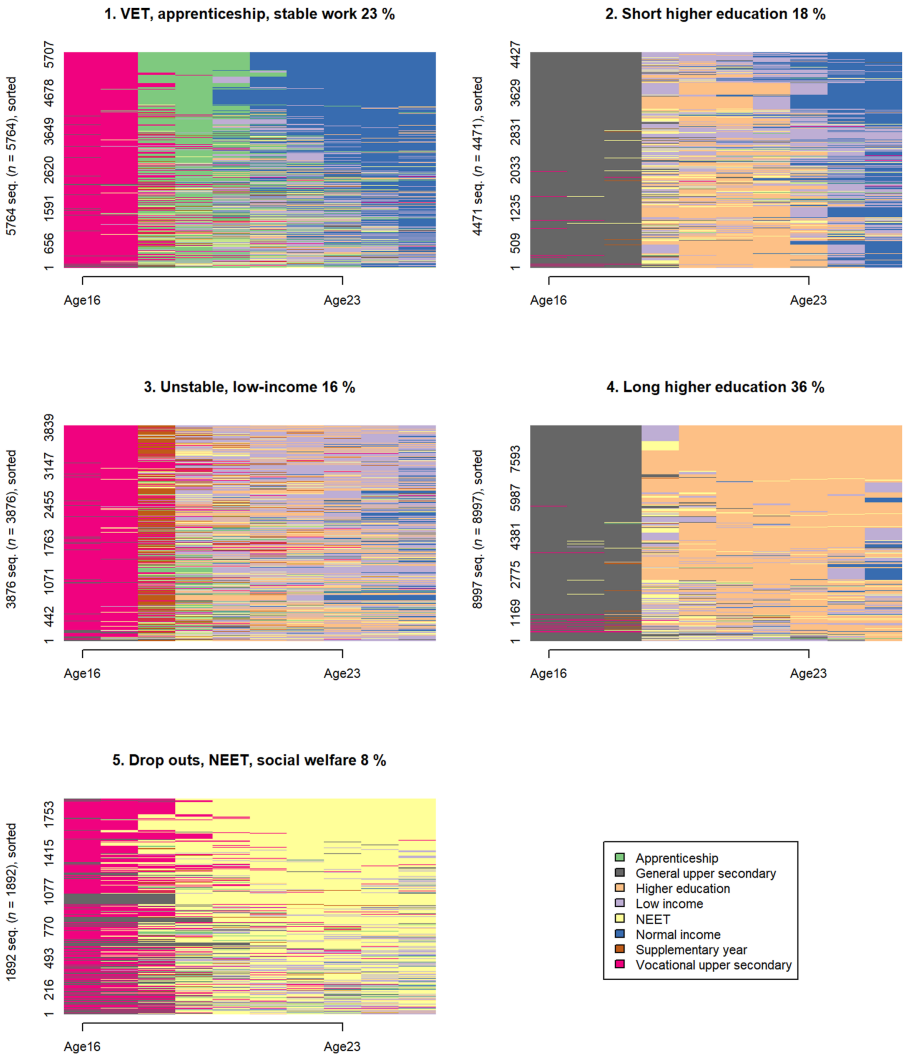

Figure A3. For birth cohort 1994, 5-cluster solution using LCS-algorithm. Source: Figure created by authors

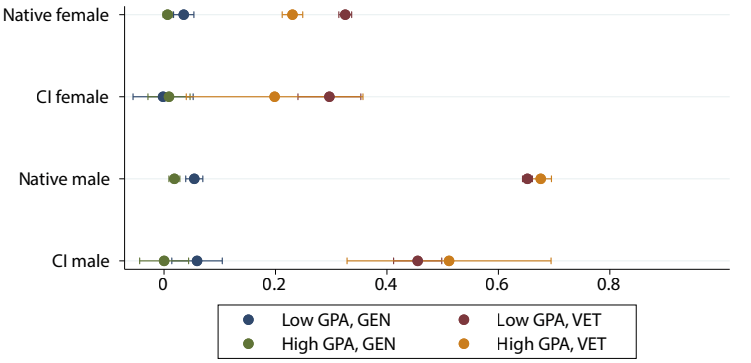

Figure A4. Predicted membership in apprenticeship-trajectory cluster for birth cohort 1994. Source: Figure created by authors

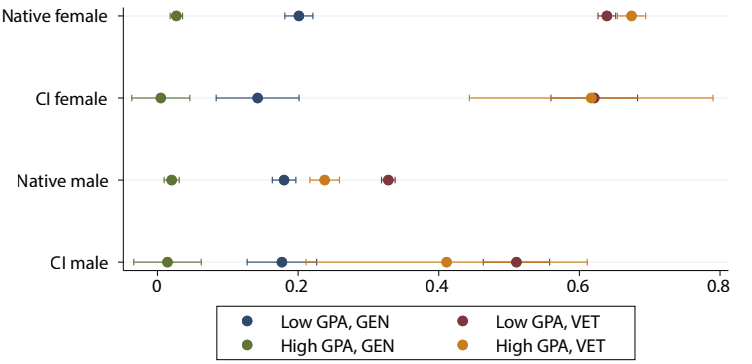

Figure A5. Predicted membership in NEET or unstable low-income cluster for birth cohort 1994. Source: Figure created by authors

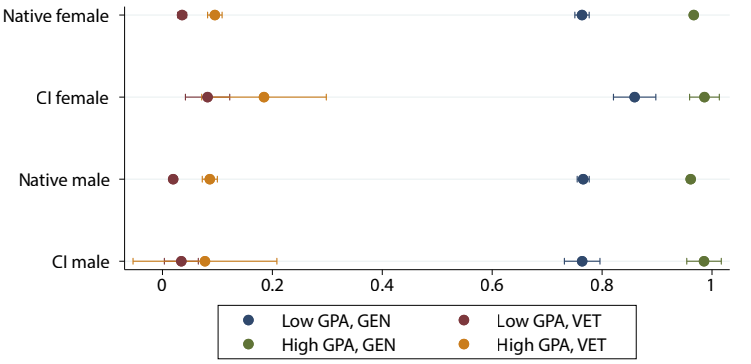

Figure A6. Predicted membership in higher education cluster for birth cohort 1994. Source: Figure created by authors

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