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The Role of Parental Wealth in Children's Educational Pathways in Germany

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Abstract

In this article, I evaluate whether educational attainment in Germany is stratified by parental wealth and at which transitions stratification emerges. I propose a four-stage model to capture the emergence of stratification in the German education system, which is characterized by early between-school tracking: (i) transition to the tracked secondary school, (ii) attended track in the last year of mandatory schooling, (iii) highest school-leaving certificate, and (iv) transition to vocational or tertiary education. Results suggest that stratification by parental wealth emerges at all four stages, and, therefore, accumulates over the stages. Children living in wealthy households are 20 per cent more likely to attend the highest track in fifth grade and to obtain the highest school-leaving certificate and are 40 per cent more likely to enroll in tertiary education compared to children at the bottom of the wealth distribution. Furthermore, parental wealth seems to be particularly effective in preventing negative outcomes like leaving school without a certificate or not finding a fully qualifying vocational training. Among those who do not obtain the formal requirements to enroll in tertiary education, those with wealthy parents are more likely to start dual vocational training.

Introduction

Recent research shows that parental wealth is an important determinant of educational attainment (Hällsten and Pfeffer, 2017; Karagiannaki, 2017), net of other characteristics of socioeconomic status (SES). This has important consequences for the intergenerational reproduction of wealth: about a quarter of the association between parents' and children's wealth in the United States can be attributed to children's educational attainment (Pfeffer and Killewald, 2017). This issue may become even more relevant in the future as wealth gaps in educational attainment are increasing (Pfeffer, 2018), while

wealth inequalities are on the rise in most Western countries (Shorrocks, Davies and Lluberas, 2018).

Particularly for the United States, researchers found that children of wealthy parents are more likely to graduate from high school, to enroll in and graduate from college, and to complete more years of schooling (e.g. Conley, 2001; Lovenheim, 2011; Jez, 2014; Pfeffer, 2018; Diemer, Marchand and Mistry, 2020; for an overview Elliott III, Destin and Friedline, 2011). Similar results have been found for Germany (Pfeffer and Hällsten, 2012; Dräger and Müller, 2020), Norway (Wiborg, 2017), Sweden (Hällsten and Pfeffer, 2017;

Hällsten and Thaning, 2018), the UK (Karagiannaki, 2017), and developing countries, for instance Brazil and Mexico (Torche and Spilerman, 2009; Torche and Costa-Riberio, 2012). To advance studies in this field, I will evaluate at which points wealth stratification emerges in tracked education systems.

Most of these studies look at years of schooling or specific educational outcomes (e.g. enrolling in college), without considering the previous steps (e.g. graduating from high school). Although this allows us to evaluate the total inequality at this point, it does not allow us to assess at which educational transition the stratification occurred. Are children in wealthy households more likely to attend college because they are also more likely to graduate from high school, or because they are more likely to enroll in college conditional on high school graduation, or both?

Fewer studies examine where social stratification occurs by restricting the sample to those who fulfil the formal requirements to continue education (Conley, 2001; Haveman and Wilson, 2007; Nam and Huang, 2009), or by modelling a series of transitions (Pfeffer and Hällsten, 2012). Conley (2001) and Haveman and Wilson (2007) find social stratification by parental wealth in the United States for high school graduation, college attendance, and college graduation conditional on the previous steps. Nam and Huang (2009) get similar results, except for finding no effect of parental wealth on college graduation. Pfeffer and Hällsten (2012) find wealth stratification in the United States only regarding high school graduation and conditional college graduation, but not for conditional college attendance. For Sweden, they find a similar magnitude of wealth stratification for graduation from the academic secondary track, participating in tertiary education, and finishing extended tertiary education. For Germany, they had too few observations to identify where stratification occurred.

While this research provides further insights about where stratification by parental wealth occurs, it ignores that not all children fulfil the formal requirements to attend universities. Therefore, an important question remains: What happens to those children who do not achieve the required qualifications to continue to tertiary education? Although it is reasonable to assume that they are affected by parental wealth, existing research mostly focuses on pathways to tertiary education (Schindler, 2015; Biewen and Tapalaga, 2017). Wealth stratification in the educational and occupational trajectories of those who leave this path is yet to be studied.

These questions are particularly relevant in countries with early tracking like Germany, where almost half of the children do not obtain the required secondary school certificate to attend tertiary education. Yet the initial track placement does not determine the final secondary school qualification, as children may change tracks or continue secondary schooling after getting their first certificate. These alternative pathways have become more common in recent years. Furthermore, Germany provides an interesting case study for this research question thanks to its free tertiary education and attractive vocational education and training system.

Two studies on wealth stratification in educational attainment in Germany show that children of wealthy parents already have higher competencies in elementary school and are more likely to transition to the highest secondary school track (Dräger and Müller, 2020) and complete more years of schooling (Pfeffer and Hällsten, 2012). Yet, it remains unknown at which points in children's educational career the differences by wealth occur. In the current paper, I aim to fill this gap by tracing the educational pathways of children born in the mid-1990s for more than 10 years, and by evaluating the wealth stratification in Germany throughout tracked secondary schooling, as well as the transition to tertiary education or vocational training. By doing this, I contribute to two ongoing strands of research: first, examining the additional effect of parental wealth on the social stratification of educational attainment, and second, evaluating how alternative educational pathways affect social inequality in education. Knowing at which points stratification occurs is essential for effective interventions.

The Role of Parental Wealth in Tracked Education Systems

Parental wealth may affect educational attainment in two different ways: on the one hand, parental wealth may affect educational attainment indirectly by affecting children's competencies and performance in school (i.e. 'primary effects'). On the other hand, parents' wealth may affect educational decisions, net of differences in performance, by affecting the relative costs, aspirations, benefits, and perceived probability of success (i.e. 'secondary effects'). Both primary and secondary effects will affect educational trajectories, but I am interested in the total differences and do not want to decompose them here. Wealth provides further advantages for children's educational attainment through three functions, which add or substitute for the advantages provided by traditional measures of SES like parental educational, income, or occupational class (Hällsten and Pfeffer, 2017).

First, wealth allows families to buy resources and services (i.e. 'purchasing function') that help children to be more successful in their educational or occupational careers. Parents may use their wealth to invest in their child's competencies (e.g. private tutoring), cover tuition fees, or finance additional years of education. Moreover, children profit from the stable learning environment provided by the homeownership of parents.

Second, children can rely on their parents' wealth to fall back on should they fail in their educational career (i.e. 'insurance function'). Parents already anticipate that they could make further investment in children's education if this should become necessary in the future. For instance, parents know that their wealth may partially compensate for a lack of abilities by investing in private tutoring in case their child struggles in school. Therefore, wealthy families can choose more rewarding albeit riskier educational pathways, even when the prior school performance of the child was average or low. Furthermore, the insurance function of wealth may also have a positive effect on educational attainment by reducing parental stress, thereby increasing parenting quality and children's competencies (Conger and Conger, 2002).

Lastly, wealth fosters pro-educational norms and high educational aspirations (i.e. 'normative function'), as families aim to secure or increase their wealth advantage across generations (Conley, 2001). Children may dissave this wealth advantage during longer periods of unemployment or when working in low-paying jobs. Families try to minimize this risk by pushing their children to higher educational attainment. Thus, like families try to avoid status decline with respect to their occupational class (Breen and Goldthorpe, 1997), they also try to avoid status decline with respect to their wealth. Moreover, wealth allows families to act more future-oriented and the outlook of attending university may motivate children, while children in households with no wealth may be discouraged by the fact that financing tertiary education may be problematic (Zhan and Sherraden, 2011).

These arguments originally were derived from the US context. Yet, they also apply to other national contexts, although wealth differences are probably less pronounced in contexts with lower costs of education and more generous welfare states (Pfeffer and Hällsten, 2012). Moreover, most research has only considered wealth stratification of educational attainment at specific ages and did not consider at which transitions these differences arise, although the mechanisms suggest that stratification results from the combination of several

stratified transitions. The question of where stratification arises is particularly important in countries with (between-school) tracking, as further alternatives depend on prior educational pathways.

To assess where wealth stratification in educational trajectories occurs and to evaluate whether advantages accumulate, we must look at it from two perspectives. First, we can evaluate whether some groups are more likely to make a specific transition or to get a specific educational degree independently (*unconditional*) of prior educational trajectories. For instance, unconditional stratification of whether children have obtained the school-leaving certificate (B) from the academic track (b) is usually presented as the ratio of the unconditional probability for different groups: $\frac{\Pr(B=b)\,|\,SES=high)}{\Pr(B=b\,|\,SES=low)}$.

The unconditional stratification of having obtained the academic school-leaving certificate allows us to assess total stratification as a combination of stratified transitions into the tracked system, stratified changes between tracks, and stratified dropout and graduation rates. Moreover, if the unconditional stratification is larger for obtaining the academic school-leaving certificate than for transitioning to the academic track, we can conclude that socially selective transitions took place in between. However, we cannot tell which transitions are socially selective.

Second, we can examine the outcome at one of the stages conditional on the prior educational trajectories, for instance, the initial track in secondary school ($A = a$) : $\frac{\Pr(B=b|SES=high, A=a)}{\Pr(B=b|SES=low, A=a)}$.

Thus, we look at social stratification but only among a subset of children on a specific track or with a specific school-leaving certificate. This allows us to single out specific socially selective educational decisions. Looking at the school leaving certificate—separately by the initial track—allows us to assess stratified graduation rates net of stratification at the transition to the tracked system.

The functions of wealth imply conditional stratification at several educational transitions. Therefore, inequalities accumulate, and unconditional wealth stratification should be larger at later points in children's educational trajectories.

Yet, some mechanisms should be more important for certain educational transitions than for others. The purchasing function of wealth should be particularly important for educational decisions when there are large differences in the financial costs between the alternatives. The insurance function should be most important

at transitions to educational pathways with a low probability of success and large negative consequences of failure. Lastly, the normative function should affect all transitions but should be more pronounced for earlier ones. Children become more independent with increasing age and are more likely to make educational choices on their own. Moreover, we could assume that wealthy, future-oriented parents with high educational aspirations will push their children on educational paths that will allow them a smoother transition to tertiary education later.

At which transition exactly inequalities emerge depends on the characteristics of the educational system. In the following, I will look at the German education system. Germany is an interesting case for this analysis because of its early tracking and the vocational education and training system.

The German Education System

A simplified model of the German education system is shown in Figure 1. Children are required to stay in school for at least 9 years in Germany. Additionally, they are required to be enrolled in some type of schooling or training until they are 18 years old or have a fully qualifying occupational certificate. After 4 years of schooling, children are tracked based on their abilities and a teacher's recommendation into a tripartite system of secondary schooling (albeit in most federal states parents are not obliged to follow the recommendation). The lowest track (*Hauptschule*) ends after ninth grade, and it prepares students for manual jobs. The middle track (*Realschule*) prepares students for skilled non-manual jobs and ends after tenth grade. The highest track (*Gymnasium*) ends after twelfth or thirteenth grade and prepares students for tertiary education. Additionally, there are schools that do not track students or offer multiple tracks.

Depending on the track that students attend they get a *Hauptschulabschluss* (lowest school-leaving certificate; 'HSA' in Figure 1), a *Realschulabschluss* (middle school-leaving certificate; 'RSA' in Figure 1), or an *Abitur* (general qualification for tertiary education) after passing their final exams. In schools with multiple tracks or without tracking, students get a *Hauptschulabschluss* and can advance to the higher certificates if their performance grants it. After passing the ninth grade, students can attend different subject-specific vocational-oriented schools ('Vocational School' in Figure 1), which however belong to the secondary schools of general education. In addition to the certificates already mentioned, students can obtain

certificates here, which give them subject-specific or restricted qualification for tertiary education (*Fachhochschulreife*; 'FHR' in Figure 1).

The school-leaving certificate determines which alternatives the students have for their vocational and tertiary education. A broad summary of the available alternatives is given in Table 1. Within the VET system, there are three types of training: first, there is the dual system of employer-based vocational training combined with education in school (dual VET). Dual VET usually takes 3 years and offer vocational credentials in a broad range of jobs from lower-skilled service jobs to high-skilled jobs like bank clerk. Doing a dual VET can be an attractive option even for children with *Abitur* because it offers a salary from the first month and the outlook of a good and stable job afterward. While there are no formal eligibility criteria for most dual VET positions, they are highly competitive (Protsch and Solga, 2016). Qualifications for other occupations can only be obtained in school-based VET (e.g. nurses, kindergarten teachers). Unlike dual VET, school-based VET often requires at least a *Realschulabschluss* and is unpaid. Children under 18 who have left secondary school but are unable to find a dual or school-based VET must attend prevocational training to meet the requirements of compulsory schooling. Prevocational training should serve as preparation for a fully qualifying VET; however, a large share of attendees does not enter a fully qualifying VET afterward.

In tertiary education, a distinction is made between (academic) universities and universities of applied science. Academic universities focus more on theoretical aspects and usually require an *Abitur* or subject-specific qualification, while universities of applied science are more vocationally oriented and require a *Fachhochschulreife*. Some programmes like medicine and law are only offered at academic universities. Additionally, dual studies have become more common recently. Like dual VET, dual studies combine practical employer-based training with theoretical training at a university and are paid.

Wealth Stratification in the German Education System

Social stratification can occur at several points in this highly differentiated education system. This complexity cannot be captured by the sequential model of educational transitions (Mare, 1980). Instead, I use an approach similar to Breen and Jonsson's (2000), whose multinomial transition model
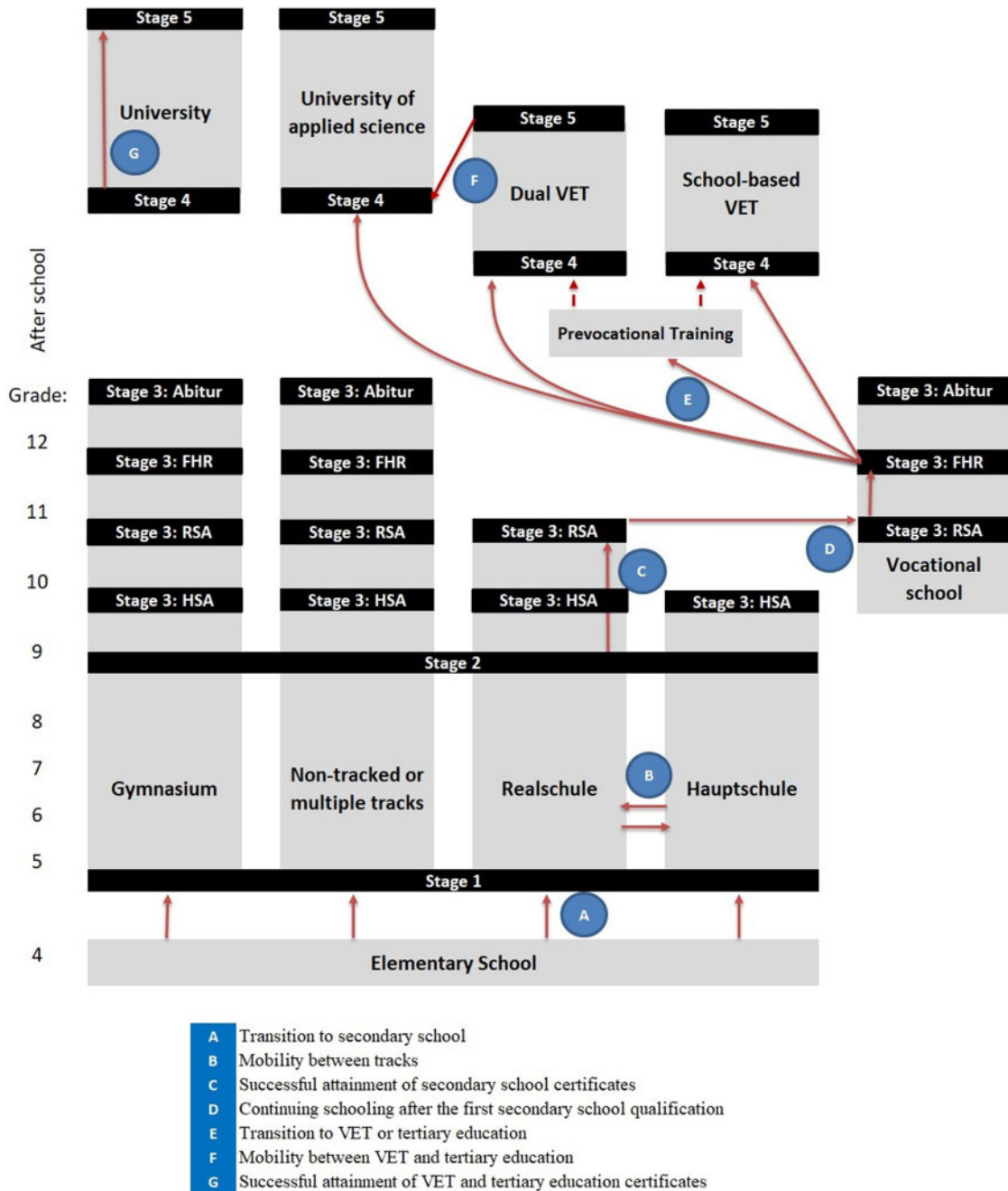
Figure 1. Simplified model of the German education system and potential points for stratification . *Note:* FHR=Fachhochschulreife; HSA=Hauptschulabschluss; RSA=Realschulabschluss.

considers the education system's multiple opportunities and alternative pathways.

Based on the work of Hillmert and Jacob (2010), I distinguish seven points within the German education

system where social stratification may happen. Empirical evidence for social stratification exists for all these stages, although the stages are often combined:

Table 1. Summary of vocational and tertiary education

Training	Required certificate	Duration (years)	Tuition fees	Wage	Share of all new vocational training or tertiary education attendees in 2017 (per cent)
Dual VET					
Firm-based vocational training combined with education in schools	None (but competitive)	2–3.5	None	Depending on sector; on average 900 EUR per month	34
School-based VET					
Theoretical vocational training in school	*Hauptschulabschluss* (more alternatives with *Realschulabschluss*)	2–3.5	None for public schools (60 per cent are enrolled in public schools)	None (but exceptions for e.g. nurses)	14
Prevocational training					
Preparation for fully qualifying VET and general education	None (but more alternatives with higher certificates)	1–2	None	None	19
University					
Tertiary education with focus on theoretical aspects	*Abitur* or subject-specific qualification	3–5	Small administration fee	None	19
University of applied science					
Tertiary education with focus on practical aspects	*Fachhochschulreife* or *Abitur*	3–5	Small administration fee	None	13
Dual study					
Firm-based vocational training combined with tertiary education	*Fachhochschulreife* or *Abitur* (and competitive)	3–5	Company usually pays the administration fee	Depending on sector and size of company; comparable to dual VET	2

Note: Numbers are taken from Autorengruppe Bildungsberichterstattung (2018) and Bundesinstitut für Berufsbildung (2019).

A. transition to secondary school after grade four: children with high-SES parents are much more likely to transfer to *Gymnasium* (Neugebauer, 2010);

B. mobility between tracks: children with high-SES parents are more likely to transfer to a higher track and less likely to transfer to a lower track (Jacob and Tieben, 2009; Blossfeld, 2018);

C. successful attainment of secondary school certificates: children with high-SES parents are more likely to graduate from *Gymnasium* and are less likely to leave *Gymnasium* before graduating (Schneider, 2008; Schindler, 2015);

D. continuing schooling after the first secondary school qualification: children with high-SES parents are more likely to upgrade their initial school-leaving certificate (Buchholz and Schier, 2015; Biewen and Tapalaga, 2017);

E. transition to VET or tertiary education: children with high-SES parents are more likely to enroll in tertiary education (Reimer and Pollak, 2010) and are less likely to not start any fully qualifying training (Protsch and Solga, 2016);

F. mobility between VET and tertiary education: children with high-SES parents are more likely to enroll in tertiary education after finishing VET (Jacob, Steininger and Weiß, 2013); and

G. successful attainment of VET and tertiary education certificates: children with high-SES parents are less likely to drop out of (academic) universities (Müller and Schneider, 2013).

In Figure 1, examples of these transitions are represented by the arrows and the dots. For all transitions in the stages (A) to (D) all transitions are possible, depending on the performance of the child.

I propose to break down the educational careers into five stages to assess where stratification occurs: (i) the track attended after elementary school (capturing A; in fifth grade); (ii) the track in the last grade of mandatory schooling (capturing B; in ninth grade); (iii) the highest secondary school qualification when leaving mandatory schooling (capturing C and D); (iv) the first vocational or tertiary education track after leaving the mandatory schooling system (capturing E); and (v) the highest vocational or tertiary educational level obtained (capturing F and G).[1] These five stages are presented as black blocks in Figure 1.

In the German education system, the purchasing function of wealth should be most relevant after the ninth grade when children are not required to go to school anymore because the alternative of earning money in a dual VET creates direct and salient opportunity costs for continuing general schooling (Schneider, 2008). These potential earnings may make leaving school at this stage more attractive for children in households with little wealth. After leaving school, parental wealth may allow children to start programmes that are not paid, like enrolling in universities or doing a school-based VET. Furthermore, the purchasing function of wealth could increase the probability of delaying the transition to further training because of the reduced need for an own income and a higher utility of leisure time (Müller, Pforr and Hochman, 2020).

The insurance function should be most relevant for the transition to the highest track in the fifth grade and enrolling in tertiary education for which the probability of failure is comparatively high. While we can assume that this risk affinity also increases the probability of changing to a more ambitious track afterward, this may be pre-empted by risk-affine behaviour at the transition to secondary school (Lucas, 2001). For the transition after leaving school, the attractive dual VET system in Germany plays an important role: Particularly children in households with little wealth may choose the risk-averse option of a VET and only start tertiary education afterward (Hillmert and Jacob, 2003).

If parents want to ensure that their child has a smooth transition to tertiary education, they must set the foundation for this already at the transition into the tracked system. However, a different argument applies when parents own a business and plan to hand this over to their child: While it requires tertiary education to take over some businesses, e.g. a doctor's practice, other businesses may require a dual VET, e.g. for handicraft.

Overall, in the first three stages, I expect that children of wealthy parents are more likely to transition to higher tracks and graduate from these, net of other characteristics of the parents and conditional on the prior stage. For the transition to vocational and tertiary education, the different functions of wealth predict different outcomes, but overall, wealthy children should be more likely to start a fully qualifying training and less likely to enter directly into the labour market.

Methods

Data

I use data from the German National Educational Panel Study (NEPS), starting cohort ninth grade (SC 4), for the empirical analysis (Blossfeld, Roßbach, and von Maurice, 2011). The target population was all students who attended ninth grade at regular schools in fall 2010.

Students were sampled using stratified cluster sampling using different types of schools. Within these strata, schools and classes within these schools are randomly selected, and all students within these classes were invited for participation. The most recent panel wave took place between October 2016 and August 2017. Thus, students who got *Abitur* after 12 years of schooling (in summer 2014) are observed for at least 2 years after graduating, students who leave school earlier even longer.

NEPS sampled 16,425 children. I exclude 1,361 children who attend schools for special needs, 6,512 children whose parents did not participate in the survey, 2,457 children who did not take part in any of the two most recent waves, and 53 children who are yet to leave secondary school. This leaves 6,042 students for the analysis.

To account for potentially selective non-response and panel attrition, I weight all cases by the inverse of the probability that they are included in the analysis sample. I estimate these probabilities with a Random Forest algorithm (Lee, Lessler and Stuart, 2009) using sampling characteristics, parental characteristics, meta-data about prior interviews, and children's prior educational trajectories. These weights are multiplied with the design weights offered by NEPS. Standard errors are adjusted to the stratified sampling design.

Variables

Tracks in Fifth and Ninth Grade (Stages 1 and 2)
I use the retrospective information on students' track in fall 2006, when they were are 11 years old, to measure the attended track in fifth grade. I distinguish between (i) *Hauptschule*, (ii) *Realschule*, (iii) *Gymnasium*, and (iv) non-tracked. When students attend a specific track at a school that offers more than one track they are coded by this track; otherwise, they are coded as non-tracked. I make the same differentiation for tracks in the ninth grade but use the currently attended track in the first wave of the survey.

School-Leaving Certificate (Stage 3)
I operationalize the highest school-leaving certificate as the certificate that students have when leaving secondary schooling for the first time. I distinguish between (i) no certificate, (ii) *Hauptschulabschluss*, (iii) *Realschulabschluss*, (iv) *Fachhochschulreife*, and (v) *Abitur*.

Activity after School (Stage 4)
I define activity after school as the first fully qualifying training attended for at least 6 months after leaving secondary school. Among the fully qualifying kinds of training, I distinguish between (i) school-based VET, (ii) dual VET, (iii) attending university of applied science, (iv) attending university, or (v) dual studies. If secondary school graduates did not start a fully qualifying training, I further distinguish between those who (vi) enroll in prevocational training or re-entered the secondary schooling system, (vii) enter the labour market directly, and (viii) do none of the above ('other'). This includes unemployment, civilian or military service, parental leave, and gaps in the data. For the respective conditional analyses, I collapse transitions to the conditionally most frequent transitions, because not all transitions are possible, and others are too rare to analyse separately.[2]

Wealth
All household assets and debts were measured—self-reported by parents—when children were in the ninth grade.[3] I use net worth (assets minus debts) to get results that are comparable with most existing research. Net worth is transformed using an inverse-hyperbolic sine transformation (Friedline, Masa, and Chowa, 2015) to deal with the highly skewed distribution of net worth and negative values.[4] I include quadratic and cubic terms to detect non-linear associations. In a sensitivity analysis, I evaluate the results when using only assets or when allowing heterogeneous effects of assets depending on the level of debts instead of net worth (see Supplementary Materials G).

Control Variables
To distinguish differences by parents' wealth from other dimensions of parents' SES, which may confound the association between wealth and educational attainment, I control for parents' highest educational level (ISCED), highest occupational class (EGP), and logarithmized household income (for the correlations between these variables see Supplementary Materials B). Moreover, I control for household size, average age of parents, parents' migration background, marital status, and whether the family lives in eastern or western Germany. Like parental wealth, all variables were measured when children were in the ninth grade. I control for household size instead of adjusting net worth to the household size because there is no widely accepted scale for how to equivalize net worth yet.

I generate 50 imputed data sets using categorization and regression trees to deal with missing values in predictor variables (for more information on missings and the multiple imputation, see Supplementary Materials A).

Methods

First, I look at differences by parental wealth unconditional on earlier educational trajectories. Therefore, I apply multinomial logistic regression for each of the four stages and present the results as predicted probabilities for different values of parental net worth (Tables 3, 5, 7, and 9). Predicted probabilities are generated for all individuals conditional on their observed values on control variables, and are then averaged.

In a second step, I use conditional analysis to disentangle which specific transitions are stratified by parental wealth. I estimate a separate multinomial logistic regression for each outcome in the first three stages (Tables 4, 6, and 8). For the conditional analysis, it is important to consider selection into the different tracks and certificates: The attended track in the fifth grade will depend on SES and factors that are partially unobserved like abilities and motivation. While most high-SES children will attend *Gymnasium*, even with low abilities, low-SES children will only attend *Gymnasium* if they have high abilities. Therefore, among children in *Gymnasium*, we will observe a different correlation between SES and abilities than among all children. Thus, in an extreme case, we may underestimate the effect of SES in the conditional analysis, because we compare low-SES children with high abilities to high-SES children with average abilities (Mare, 1980; Cameron and Heckman, 1998). In other words, conditioning on the collider 'track in fifth grade' changes the correlation between SES and abilities and introduces endogenous selection bias. I use latent class analysis on observed earlier measures of aspirations, academic self-conception, skills, and marks to approximate these unobserved factors and add the latent classes as control variables to reduce this bias (for more details, see Supplementary Materials D).

Results

Descriptive Statistics

Table 2 shows the distribution of variables in the weighted sample. The average net worth of families is 250 k EUR. Yet, the distribution of net worth is highly unequal (Gini = 0.75), and the median net worth is only 100 k EUR. The level of inequality is similar to overall inequality in Germany (Shorrocks, Davies, and Lluberas, 2018). On the one hand, around 10 per cent of parents have more debts than assets and another 8 per cent have zero net worth. On the other hand, the 10 per cent of the wealthiest households (ranging from

Table 2. Descriptive statistics

	Mean/percentile/proportion	Standard deviation
Household net worth		
Mean	250,872	1,548,016
10. percentile	0	—
25. percentile	10,000	—
50. percentile	100,000	—
75. percentile	250,000	—
90. percentile	470,000	—
Household income		
Mean	3,527	2,366.193
10. percentile	1,700	—
25. percentile	2,400	—
50. percentile	3,100	—
75. percentile	4,000	—
90. percentile	5,000	—
Parents' average birthyear		
Mean	1965	5.022
Parents' marital status		
Married	0.800	—
Not married	0.200	—
Parents' migration background		
Yes	0.197	—
No	0.803	—
Region		
East	0.111	—
West	0.889	—
Parents' highest ISCED		
0, 1, 2	0.063	—
3	0.369	—
4	0.076	—
5B	0.210	—
5A/6	0.282	—
Parents' highest EGP		
I	0.274	—
II	0.300	—
IIIa, IV	0.185	—
IIIb, V, VI, VII	0.241	—
Household size		
2	0.065	—
3	0.220	—
4	0.442	—
5	0.189	—
6 or more	0.083	—

Note: NEPS, SC 4. $N = 6,042$. Weighted and averaged over all imputed datasets.

470 k EUR to 9 m EUR) own 59 per cent of the total net worth.

Educational Trajectories

Figure 2 shows the distribution of tracks in the fifth and ninth grade, highest certificate, and activities after school, as well as the transitions between them. About
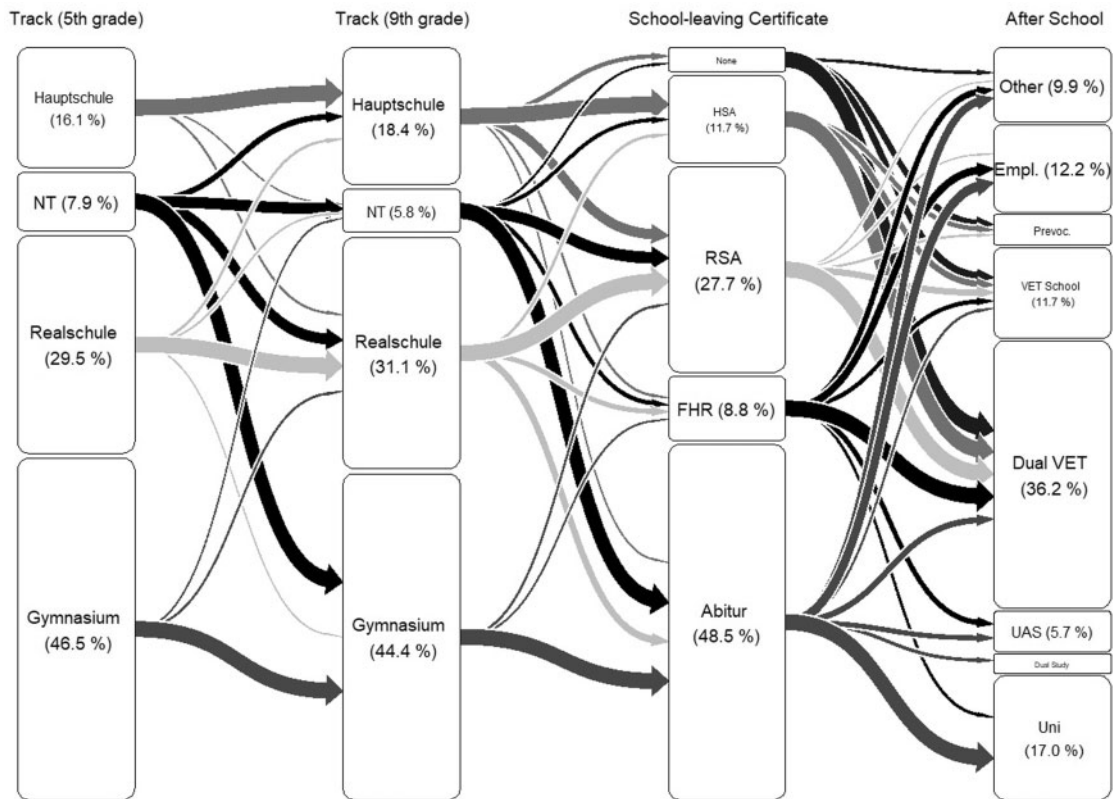
Figure 2. Transition plot of the most frequent trajectories (proportion of categories in parenthesis)

Note: FHR=Fachhochschulreife; HSA=Hauptschulabschluss; NT=non-tracked, none (proportion = 3.3 per cent); Prevoc.=prevocational training (proportion = 4.4 per cent); RSA=Realschulabschluss; UAS=university of applied science, dual study (proportion = 2.8 per cent). Only transitions with relative frequencies higher than 2.5 per cent in each departing state are shown. The different tones of grey and black indicate where the arrows stem from.

16 per cent of students attended *Hauptschule* in the fifth grade, 29 per cent *Realschule*, and 46 per cent *Gymnasium*. The vast majority are still on the same track in the ninth grade. The attended track in the ninth grade is also a very good predictor for the school-leaving certificate, particularly among those students who attend *Gymnasium*. About 85 per cent of those at *Gymnasium* obtain *Abitur*. Of those who attended *Hauptschule* and *Realschule*, about half got the corresponding certificates. However, a substantial share also got higher certificates than that. Leaving school without a certificate is much more common among those attending *Hauptschule*.

The picture gets more complicated after children leave school. Of those with *Hauptschulabschluss* or *Realschulabschluss*, about two-thirds start a dual VET, and about one-fifth start a school-based VET. Even among those with no certificate, the majority start a fully qualifying VET. Starting a dual VET is also the most

common alternative for those with *Fachhochschulreife*. Less than one-fifth of children with *Fachhochschulreife* start tertiary education. Only among those with *Abitur* is enrolling in universities the most common choice. However, we also see that a large share of those with *Fachhochschulreife* or *Abitur* did not start any further training. A reason for this is that about 20 per cent of those children are observed for less than 1.5 years after leaving school. Overall, the sample includes slightly more children in high tracks and more graduates from higher tracks than in the population of this cohort.

Stratification by Parental Wealth

Track in Fifth Grade (Stage 1)
Table 3 shows the predicted probabilities of attending the different tracks for children living in households

with zero net worth (10th percentile of the net worth distribution; 'low-wealth children') and children living in households with 470 k EUR net worth (90th percentile; 'high-wealth children'), as well as the ratio of these predicted probabilities. Additionally, I present the ratios of the predicted probabilities in Figure 3 to show more intuitively where stratification emerges in the educational trajectories. The colours of the boxes imply unconditional stratification and the colours of the arrows show conditional (on the box of departure) stratification.

We already see stratification by parental wealth in the fifth grade. About 50 per cent of high-wealth children attend *Gymnasium*, compared to only 42 per cent of low-wealth children (the difference is statistically significant at $P = 0.001$). Therefore, there are 1.19 times as many high-wealth children attending *Gymnasium* as there are low-wealth children (see lower left box in Figure 3). High-wealth children are eight percentage points less likely to attend *Hauptschule* (Ratio = 0.60; $P < 0.001$).

Transition from Fifth to Ninth Grade (Stage 1 to Stage 2)

Table 4 shows the predicted probabilities of the attended track in grade nine by parental wealth, conditional on the track in the fifth grade. While most children stay in their track, the few occurring transitions are stratified by parental wealth. In general, high-wealth children are more likely to transfer to higher tracks and less likely to transfer to lower tracks. However, due to the smaller number of observations, these differences are only statistically significant for those children who were in *Realschule* or *Gymnasium* in the fifth grade. For instance, among those in *Realschule*, only 5.1 per cent of high-wealth children transfer to *Hauptschule*, while 12.6 per cent of low-wealth children do ($P = 0.004$). Thus, the ratio of high-wealth to low-wealth children

for this transition is 0.41 (see dark-red arrow from *Realschule* in fifth grade to *Hauptschule* in ninth grade in Figure 3). High-wealth children are eight percentage points more likely to stay in *Realschule* ($P = 0.023$) and are five percentage points more likely to stay in *Gymnasium* ($P = 0.073$).

Track in Ninth Grade (Stage 2)

The differences in transition by parental wealth result in slightly larger unconditional stratification in the ninth grade (Table 5). High-wealth children are 10 percentage points more likely to attend *Gymnasium* ($P < 0.001$). Thus, the ratio of high-wealth to low-wealth children in *Gymnasium* increased slightly from 1.19 in the fifth grade to 1.26 in the ninth grade. Low-wealth children are 10 percentage points more likely to attend *Hauptschule* ($P < 0.001$) and three percentage points more likely to be non-tracked ($P = 0.023$).
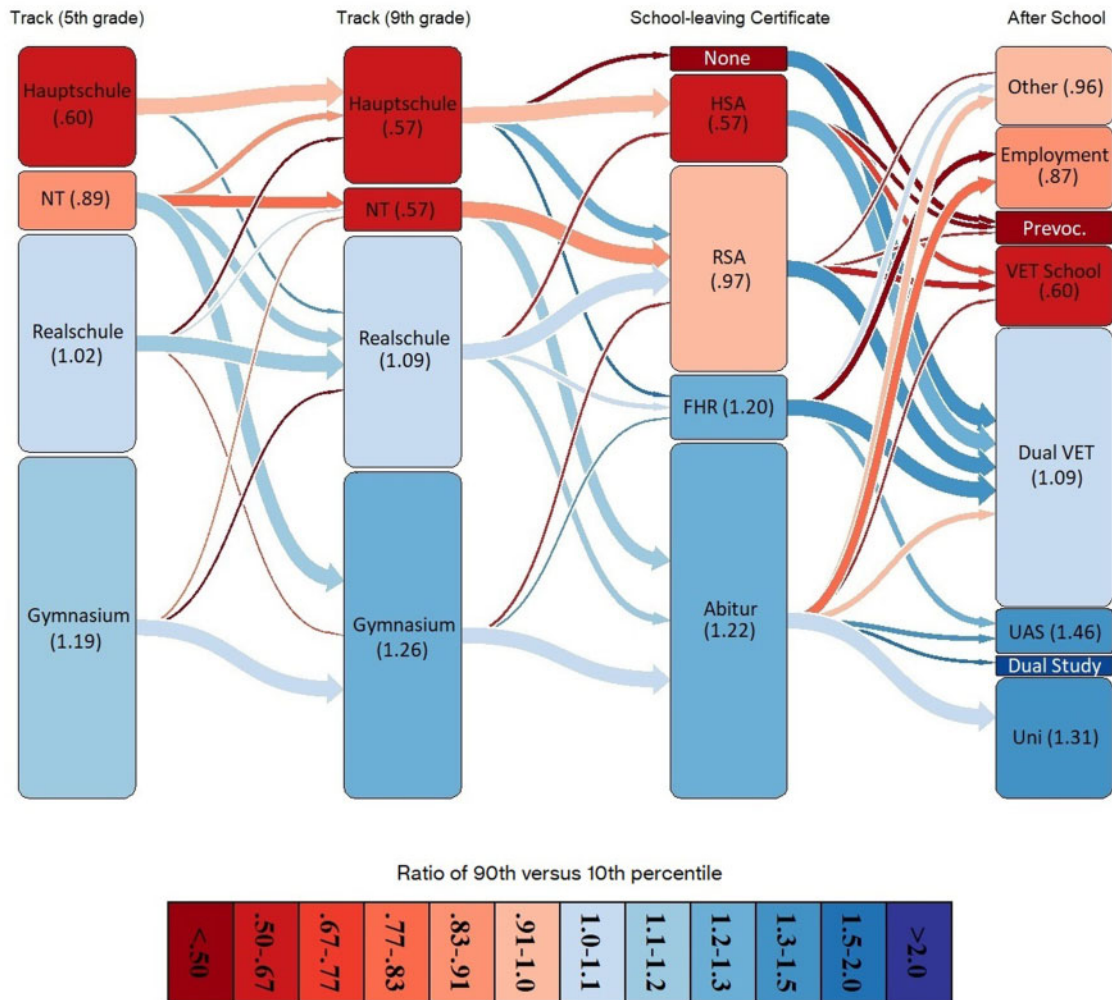
Transition from Ninth Grade to School-Leaving Certificate (Stage 2 to Stage 3)

For the transition from tracks in ninth grade to school-leaving certificate, a similar pattern emerges to the transition from tracks in the fifth grade to tracks in the ninth grade: there are rather few transitions, but these are stratified by parental wealth. High-wealth children are slightly more likely to get a higher certificate and are less likely to get a lower certificate, relative to their track in ninth grade (Table 6). This tendency is particularly pronounced among children who were in *Hauptschule*. Of those children, only 6.1 per cent of the high-wealth children do not get any certificate compared to 15.4 per cent of low-wealth children ($P = 0.011$). High-wealth children are about five percentage points more likely to still get *Fachhochschulreife* or *Abitur* ($P = 0.086$).

Table 3. Predicted probabilities of secondary school track in fifth grade by net worth, unconditional

	10th percentile 0 EUR		90th percentile 470 k EUR		P-value of difference	Ratio 90th/10th percentile
	Pred. prob.	SE	Pred. prob.	SE		
Hauptschule	19.589	1.175	11.791	1.080	0.000	0.602
Non-tracked	8.453	0.880	7.542	1.099	0.526	0.892
Realschule	29.791	1.460	30.360	1.817	0.817	1.019
Gymnasium	42.167	1.518	50.307	1.697	0.001	1.193

Note: NEPS SC4. $N = 6,042$. Predicted values based on multinomial regression. The underlying regression estimates are available in the Supplementary Materials Table E1.

Figure 3. Wealth stratification throughout the educational career (ratios of predicted probabilities of the 90th versus 10th percentile of net worth in parenthesis). *Note:* FHR=Fachhochschulreife; HSA=Hauptschulabschluss; NT=non-tracked, none (ratio = 0.25); Prevoc.=prevocational training (ratio = 0.42); RSA=Realschulabschluss; UAS=university of applied science, dual study (ratio = 2.03).

School-Leaving Certificate (Stage 3)

The strong social stratification at the transition from ninth grade to school-leaving certificate among children attending lower tracks results in increased unconditional stratification regarding those who leave school without any certificate (Table 7). Low-wealth children are four times more likely to leave school without any qualifications ($P < 0.001$). Yet, the ratio of high-wealth to low-wealth children getting *Abitur* (ratio = 1.22) remains

similar to the ratio of high-wealth to low-wealth children attending *Gymnasium* in the ninth grade. High-wealth children are about nine percentage points more likely to obtain *Abitur* ($P < 0.001$).

Transition from School-Leaving Certificate to Activity after School (Stage 3 to Stage 4)

While the school-leaving certificate restricts the set of available alternatives after graduating from secondary

Table 4. Predicted probabilities of secondary school track in ninth grade by net worth; conditional on track in fifth grade

Conditional on:	Outcome:	10th percentile 0 EUR		90th percentile 470k EUR		P-value of difference	Ratio 90th/10th percentile
Track in fifth grade	Track in ninth grade	Pred. prob.	SE	Pred. prob.	SE		
Hauptschule	Hauptschule	90.700	2.429	87.597	2.931	0.441	0.966
	NT, RS, or Gym	9.300	2.429	12.403	2.931	0.441	1.334
Non-tracked	Hauptschule	13.062	2.405	11.519	3.499	0.754	0.882
	Non-tracked	29.320	4.433	21.878	4.852	0.262	0.746
	Realschule	22.651	4.080	25.448	5.620	0.670	1.124
	Gymnasium	34.967	4.660	41.155	5.281	0.392	1.177
Realschule	Hauptschule	12.590	1.739	5.141	1.322	0.004	0.408
	Non-tracked	4.622	1.295	4.636	1.915	0.996	1.003
	Realschule	80.371	2.168	88.376	2.430	0.023	1.100
	Gymnasium	2.416	0.742	1.847	0.735	0.579	0.765
Gymnasium	HS or RS	10.043	1.480	7.777	1.396	0.329	0.774
	Non-tracked	5.146	1.800	2.236	0.720	0.128	0.435
	Gymnasium	84.812	2.105	89.987	1.502	0.073	1.061

Note: NEPS SC4. $N = 6,042$. Predicted values based on multinomial regression. Gym, gymnasium; HS, Hauptschule; NT, non-tracked; RS, Realschule. The underlying regression estimates are available in the Supplementary Materials Tables E2.1–E2.4.

Table 5. Predicted probabilities of secondary school track in ninth grade by net worth, unconditional

	10th percentile 0 EUR		90th percentile 470 k EUR		P-value of difference	Ratio 90th/10th percentile
	Pred. prob.	SE	Pred. prob.	SE		
Hauptschule	22.826	1.295	12.919	1.198	0.000	0.566
Non-tracked	7.487	1.350	4.232	0.799	0.023	0.565
Realschule	30.509	1.827	33.316	2.084	0.283	1.092
Gymnasium	39.178	1.607	49.532	1.865	0.000	1.264

Note: NEPS SC4. $N = 6,042$. Predicted values based on multinomial regression. The underlying regression estimates are available in the Supplementary Materials Table E3.

school, we also see strong stratification by parental wealth, conditional on these certificates (Table 8). For those children who are not eligible for tertiary education (no certificate, *Hauptschulabschluss*, or *Realschulabschluss*) we can observe two important patterns: First, high-wealth children are more likely to start a fully qualifying VET (dual or school-based). Among those with no school-leaving certificate, low-wealth children are 22 percentage points more likely than high-wealth children ($P = 0.001$) to do only pre-vocational training or other activities; low-wealth children with *Hauptschulabschluss* are 10 percentage points more likely to do so ($P = 0.017$).

Second, high-wealth children are much more likely to start a dual VET. For instance, among those with *Realschulabschluss*, high-wealth children are 19 percentage points more likely to start a dual VET compared to low-wealth children ($P < 0.001$). Low-wealth children

are more likely to start school-based VET. Only among those children with Abitur, high-wealth children are slightly less likely to start a dual VET.

High-wealth children with *Fachhochschulreife* or *Abitur* are more likely to enroll in tertiary education. Among those with *Abitur*, high-wealth children are about 1.5 times more likely to enroll in universities of applied science ($P = 0.063$) and 1.7 times more likely to start dual studies ($P = 0.044$). However, conditional on having *Abitur*, high-wealth children are only 2.3 percentage points or 1.07 times more likely to enroll in academic universities ($P = 0.436$).

Activity after School (Stage 4)

The higher probability of high-wealth children enrolling in tertiary education, conditional on having a qualification for tertiary education, further increases the unconditional stratification in stage 4 (Table 9). High-wealth

Table 6. Predicted probabilities of school-leaving certificate by net worth; conditional on track in ninth grade

Conditional on: Track in ninth grade	Outcome: School-leaving certificate	10th percentile 0 EUR		90th percentile 470 k EUR		*P*-value of difference	Ratio 90th/10th percentile
		Pred. prob.	SE	Pred. prob.	SE		
Hauptschule	None	15.419	2.315	6.126	2.177	0.011	0.397
	HSA	49.012	2.703	46.259	4.616	0.619	0.944
	RSA	28.497	2.251	35.257	4.170	0.165	1.237
	FHR or Abitur	7.071	1.207	12.358	2.619	0.086	1.748
Non-tracked	FHR or lower	58.600	4.169	51.519	4.444	0.318	0.879
	Abitur	41.400	4.169	48.481	4.444	0.318	1.171
Realschule	None or HSA	8.857	2.118	4.642	1.197	0.133	0.524
	RSA	54.577	2.720	55.641	2.544	0.776	1.019
	FHR	14.395	2.078	14.935	1.965	0.877	1.037
	Abitur	22.170	1.821	24.782	2.283	0.424	1.118
Gymnasium	RSA or lower	10.482	1.353	6.871	1.036	0.057	0.655
	FHR	5.027	0.858	7.073	0.921	0.190	1.407
	Abitur	84.491	1.459	86.056	1.303	0.491	1.019

Note: NEPS SC4. N = 6,042. Predicted values based on multinomial regression. FHR, Fachhochschulreife; HSA, Hauptschulabschluss; RSA, Realschulabschluss. The underlying regression estimates are available in the Supplementary Materials Tables E4.1–E4.4.

Table 7. Predicted probabilities of school-leaving certificate by net worth, unconditional

	10th percentile 0 EUR		90th percentile 470 k EUR		*P*-value of difference	Ratio 90th/10th percentile
	Pred. Prob.	SE	Pred. Prob.	SE		
None	5.280	0.756	1.330	0.378	0.000	0.252
Hauptschulabschluss	14.357	1.068	8.134	0.877	0.000	0.567
Realschulabschluss	28.473	1.240	27.552	1.520	0.674	0.968
Fachhochschulreife	8.193	0.863	9.862	0.986	0.297	1.204
Abitur	43.696	1.266	53.121	1.533	0.000	1.216

Note: NEPS SC4. N = 6,042. Predicted values based on multinomial regression. The underlying regression estimates are available in the Supplementary Materials Table E5.

children are about 2 percentage points more likely to enroll in universities of applied science or to start dual studies and 4.4 percentage points more likely to enroll in academic universities ($P = 0.005$). Combining the predicted probabilities of attending university, universities of applied science, and dual studies, we get a ratio of high-wealth to low-wealth children of 1.40, compared to a ratio of 1.22 for obtaining *Abitur*.

A different picture emerges for starting a dual VET. Most of the children starting a dual VET have *Hauptschulabschluss* or *Realschulabschluss*. These certificates are more common among low-wealth children. However, due to the higher probability of high-wealth children starting a dual VET, conditional on having these certificates, we see that, unconditionally,

high-wealth children are slightly more likely to start a dual VET (Ratio = 1.09; $P = 0.145$). Here, the conditional stratification counterbalances earlier stratification regarding the obtained school leaving certificate. Moreover, we see that high-wealth children are less likely to do school-based VET (ratio = 0.60; $P < 0.001$) or only prevocational training (ratio = 0.42; $P < 0.001$).

Importantly, all these stratifications by parental wealth emerge net of other differences by parental SES. For most transitions, differences by parental education or income are larger than differences by wealth. However, for the transition after leaving school, we see that wealth results in other patterns of stratification (see Supplementary Materials F).

Table 8. Predicted probabilities of activity after graduating from secondary school by net worth; conditional on school-leaving certificate

Conditional on:	Outcome:	10th percentile 0 EUR		90th percentile 470 k EUR		*P*-value of difference	Ratio 90th/10th percentile
School-leaving certificate	Activity after school	Pred. prob.	SE	Pred. prob.	SE		
None	Fully qualifying	73.079	4.471	95.469	4.441	0.001	1.306
	Prevocational or other	26.921	4.471	4.531	4.441	0.001	0.168
Hauptschulabschluss	VET school	22.397	2.772	15.514	4.089	0.226	0.693
	Dual VET	59.029	3.076	76.103	4.764	0.008	1.289
	Prevocational or other	18.574	2.539	8.383	2.692	0.017	0.451
Realschulabschluss	VET school	29.741	2.431	16.908	2.124	0.001	0.569
	Dual VET	55.396	2.578	74.833	2.375	0.000	1.351
	Prevocational	8.857	1.523	4.632	1.136	0.060	0.523
	Other	6.006	1.147	3.627	1.018	0.190	0.604
Fachhochschulreife	VET	42.148	4.018	56.098	4.194	0.035	1.331
	Tertiary	16.155	3.291	19.379	3.220	0.552	1.200
	Employment	27.930	4.854	10.242	2.587	0.006	0.367
	Other	13.766	3.158	14.281	3.539	0.925	1.037
Abitur	VET school	4.319	0.833	2.744	0.477	0.139	0.635
	Dual VET	12.307	1.338	11.383	1.103	0.633	0.925
	University	32.376	2.018	34.642	1.615	0.436	1.070
	UAS	7.247	1.162	10.730	1.095	0.063	1.481
	Dual study	3.924	0.750	6.584	0.831	0.044	1.678
	Employment	22.380	1.966	18.030	1.275	0.100	0.806
	Other	17.446	1.629	15.888	1.553	0.546	0.911

Note: NEPS SC4. *N* = 6,042. Predicted values based on multinomial regression. UAS=University of applied science. The underlying regression estimates are available in the Supplementary Materials Tables E6.1–E6.5.

Table 9. Predicted probabilities of activity after graduating from secondary school by net worth, unconditional

	10th percentile 0 EUR		90th percentile 470 k EUR		*P*-value of difference	Ratio 90th/10th percentile
	Pred. prob.	SE	Pred. prob.	SE		
Other	10.077	0.866	9.620	0.950	0.755	0.955
Employment	13.164	1.042	11.425	0.841	0.263	0.868
Prevocational	6.076	0.671	2.563	0.483	0.000	0.422
VET school	14.796	1.038	8.825	0.781	0.000	0.596
Dual VET	35.107	1.290	38.421	1.513	0.145	1.094
UAS	4.631	0.614	6.754	0.682	0.048	1.458
Dual study	1.810	0.357	3.667	0.488	0.008	2.026
University	14.339	0.978	18.724	0.993	0.005	1.306

Note: NEPS SC4. *N* = 6,042. Predicted values based on multinomial regression. UAS=University of applied science. The underlying regression estimates are available in the Supplementary Materials Table E7.

Discussion

My findings suggest that the wealth stratification of educational attainment in tracked education systems results from the accumulation of unequal transition rates throughout children's entire educational trajectories. However, in line with prior research using other measures of SES (e.g. Neugebauer and Schindler, 2012), crucial differences already occur at the transition to the tracked secondary schools in Germany. An explanation for this could be that parents already anticipate the future benefits of their wealth at the transition to secondary school, rather than reacting differently to the

developments during secondary school. Transferring to *Gymnasium* in the fifth grade and staying there until obtaining *Abitur* may still be considered the easiest path to tertiary education. Ultimately, about half of wealth stratification in university enrolment can be attributed to achieving the required certificate, and half to the decision to enroll conditional on having the required qualification.

Yet, the results imply that parental wealth is even more helpful in preventing negative outcomes like leaving school without a certificate or not finding a fully qualifying vocational training. This could indicate that families are especially likely to use their wealth to compensate for the disadvantages of children performing poorly at school (Wiborg, 2017; Bernardi and Triventi, 2020). Wealth seems to enable families to push their children over the low threshold of dropping out of school and thereby maintain all options for a smooth transition to vocational training.

Overall, high-wealth children are less likely to end up without a qualification for tertiary education. However, among those children ineligible for tertiary education, high-wealth children are more likely to start a dual VET. Together, these two tendencies result in dual VET attendance—unconditional on prior educational trajectories—being hardly stratified by parental wealth. Findings like these can only be obtained when doing both conditional and unconditional analysis. What we see here might be an extension of Lucas' (2001) effectively maintained inequality hypothesis: If high-wealth children fail to obtain a quantitative advantage in educational attainment (more years of education), they still manage to enter qualitatively better vocational training programmes.

Wealth stratification regarding attendance of tertiary education is of a magnitude similar to the one found in the US context. For example, Pfeffer (2018) finds that children in the top quintile of the wealth distribution are 8.4 percentage points more likely to attend college compared to children in the lowest quintile. This is surprising since tertiary education is far less costly in Germany. The 10 percentage points difference by parental wealth regarding attainment of *Abitur* is even larger than the difference for high school graduation in the United States. On the one hand, this may be attributable to the early tracking system in Germany. Children in families with little wealth who showed average performance in primary school will likely not transfer to Gymnasium after the fourth grade. However, even if children show better academic performance later, they will have a much more difficult pathway to acquire the required

certificate for tertiary education in comparison to education systems without early tracking. On the other hand, the dual VET system provides a secure alternative to tertiary education for the transition to the labour market, whereas in the United States, alternatives to tertiary education are also rather insecure paths into the labour market.

Some limitations must be considered when interpreting the results. First, some students who attain one of the higher school-leaving certificates participate in the survey for the last time only a few months after leaving school, leading to an underestimation of the prevalence of starting a fully qualifying VET or tertiary education. However, the results barely change when controlling for the time that students have been observed after leaving school. Moreover, in this study, it was not possible to evaluate wealth stratification regarding the successful attainment of VET and tertiary education. Lastly, parental wealth was only measured once in NEPS. Therefore, the wealth measure is potentially imprecise and does not capture changes over time, which probably leads to an underestimation of stratification by wealth (Mazumder, 2005).

To give recommendations on how to reduce inequality in educational attainment, we need not only to know where stratification occurs but also which mechanisms drive it. The results here give some hints: The insurance function of wealth may imply that children in less wealthy families make risk-averse decisions and do not attend higher tracks despite good academic performance. However, I do not find that they catch up on the higher certificates later. Furthermore, I do not find support for the demotivating effect of very high wealth as proposed by Müller, Pforr and Hochman (2020).[5]

These results highlight that social stratification in education emerges throughout the entire school career and beyond, and that we, therefore, must examine complete educational trajectories to better understand stratification processes. Looking only at specific transitions or educational certificates might obscure that different processes took place earlier (for unconditional analysis) or ignore these earlier processes (for conditional analysis).

Notes

1 F and G are only discussed for the sake of completeness but cannot be studied empirically with the data at hand.

2 A more detailed description of the outcomes for the conditional analysis of activities after school and

sequence-index plots are available in the [Supplementary Materials](#) C.

3   First, parents were first asked whether they possess different kinds of assets: saving books or checking accounts; building loan agreements; life insurances and private pension insurances; fixed-interest securities; other securities such as stocks, funds, bonds; business assets; owner-occupied real estate property; and other real estate property. In the next step, they were asked to report the total values of these assets and their total liabilities.

4   Measuring wealth only once may lead to an underestimation of wealth effects (see also discussion). However, calculations with data of the German Socio-Economic Panel suggest that the net worth of families with 13- to 17-year-old-children remained rather stable between 2012 and 2017 (correlation of inverse hyperbolic sine-transformed net worth = 0.82; $N = 1,562$).

5   Separating net worth into assets and debts gives further hints on the underlying mechanisms (see [Supplementary Materials](#) G).

Supplementary Data

[Supplementary data](#) are available at *ESR* online.

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