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## Career trajectories into undereducation. Which skills and resources substitute formal education in the intergenerational transmission of advantage?

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# Career Trajectories into Undereducation.

## Which Skills and Resources Substitute Formal Education in the Intergenerational Transmission of Advantage?

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### *Abstract*

A significant share of employees in Europe has less formal training than is required by their job; they are undereducated. We use harmonized panel data from the United Kingdom and Germany to investigate the skills and resources allowing the undereducated to develop careers in occupations supposedly beyond their reach. Our theoretical approach complements individual-centered labor market theory with an intergenerational mobility perspective which regards undereducation as a form of family status maintenance. Our empirical results show that persons whose (non-)cognitive skills exceed their formal education are more likely to be undereducated in the cross-section, and to enter undereducated employment or be promoted into it throughout the life course. Yet beyond individual merit, parental socio-economic status is a similarly-important predictor of these outcomes; our analyses even trace a significant share of the importance of (non-)cognitive skills to it. To complete our intergenerational argument, we finally demonstrate that undereducation acts as a pathway to the intergenerational reproduction of earnings inequality – more so, in fact, than the avoidance of overeducation. These results are remarkably similar across the UK and Germany, although some country differences suggest higher skill-induced career mobility in Britain and stronger origin effects in Germany. We discuss promising avenues for further comparative research in the conclusion.



# 1 Introduction

A large literature in sociology and related fields studies the causes and consequences of overeducation, that is, people attaining a certain level of education but finding no appropriate employment thereafter (for reviews see Kalleberg, 2007; McGuinness, 2006). On the flipside, some 5% to 25% of employees in Western labor markets are undereducated, meaning that they have less formal schooling than is required by their current job (Rohrbach-Schmidt & Tiemann, 2016; Sloane et al., 1999; Verhaest & Omey, 2006). While there is an ongoing debate among social scientists on how to conceptualize their situation, for employees themselves over- and undereducation are real phenomena. Self-assessment studies show that a sizeable proportion of workers self-identify as mismatched (Verhaest & Omey, 2006). In line with this, qualification-mismatched employment has measurable consequences in terms of life and job satisfaction or even civic engagement as status inconsistency theory predicts (Vaisey, 2006; for a review and most recent results see Wiedner, 2020).

Undereducation is a phenomenon among the less educated, because the chances to find employment in an occupation where requirements are higher than one's own qualifications diminish with increasing education. Unfortunately, we know very little about the undereducated, since social science scholarship is preoccupied with overeducation. This lack of attention is unfortunate against the fact that many less educated workers who reach middle income and status positions actually work as undereducated employees.

The curious phenomenon of undereducation poses two questions. One might wonder why the undereducated did not gain a better formal education to begin with, that is, why they apparently dropped out of school too early. But we rather focus on the equally important labor market side of undereducation and ask: Which skills and resources allow the undereducated to successfully develop careers for which the majority of their colleagues need significantly more formal education?

In setting out to answer this question, this article combines two approaches. Our starting point are classic labor market theories. Seeking to redress some of their blind spots with regards to undereducation, we propose that it must be certain worker qualities, such as general cognitive ability and specific non-cognitive skills, which go beyond the skill set indicated by persons' formal education, that allow them to compensate for their lack of formal education. We complement this individual-centered approach by secondly proposing an argument based on intergenerational reproduction. This type of explanation regards undereducation as a form of status maintenance among persons who failed to attain a level of education that reflects their parents' socio-economic status. Importantly, this perspective also implies that undereducation mediates the intergenerational transmission of earnings. Ours is thus the first study to relate undereducation to questions of intergenerational social reproduction.

Using panel data, we investigate various implications of these two approaches across the careers of employees: the overall likelihood of undereducation, extra-firm entry into undereducation, within-firm promotion into undereducation, and finally the role of undereducation vis-à-vis (avoidance of) overeducation in the intergenerational transmission of earnings inequality. Moreover, by analyzing harmonized data from two institutionally highly dissimilar countries, the UK (2009-2015, UKLHS) and Germany (2004-2016; SOEP), we hope to demonstrate that our arguments generalize across different labor markets and their linked education systems.

We indeed find largely similar results across the UK and Germany. In support of the idea that individual characteristics can partially substitute for schooling, it is persons whose cognitive skills exceed their formal education, or who are characterized by what we refer to as an 'entrepreneurial' personality, who are more likely to work as undereducated employees and to be promoted into undereducation, especially in the UK. At the same time, parental occupation is, especially in Germany, a systematic predictor of these

outcomes, too. Subsequent results of mediation analyses, which bring together the individual-centered with our intergenerational perspective, suggest that this is partially due to class-specific transmission of beneficial cognitive and non-cognitive traits. Counter standard expectations, we find no evidence that social capital utilization in terms of job search strategies accounts for the importance of family background. We finally show that undereducation is an important channel for the intergenerational transmission of earnings inequality, and actually matters more than the (avoidance of) overeducation.

## 2 Theoretical Background

In every economy some people work in jobs that do not fit their formal level of qualification. Scholarly work on such job-education mismatches was sparked off in the 1970s by concerns that the educational expansion of the 1960s may have led to wide-spread overeducation and declining returns to education (Collins, 1979; Freeman, 1976). A vast literature has since investigated the origins and consequences of overeducation (for reviews see Kalleberg, 2007; McGuinness, 2006). Since the 1980s other macro level developments (postindustrialism and nowadays digitalization) lead to the opposite concern about a skills shortage in the economy (Handel, 2003; Leitch, 2006). Yet, a comparable interest in the undereducated never arose. The reason is probably that undereducation is not regarded as a disadvantage or social problem for the individual employee. Having overcome career barriers that restrict most of their similarly-educated peers, the undereducated tend to earn more than the latter (McGuinness, 2006), and do not even feel overburdened by their job tasks (Pecoraro, 2016; Rohrbach-Schmidt & Tiemann, 2016). But what allows them to achieve this?

We maintain that certain skills and resources allow for career trajectories into undereducation. Below, we introduce two types of arguments in favor of this general claim. Our review of classic labor market theories suggests that undereducation may be the

outcome of individual characteristics that are not accurately reflected in formal degrees, especially general cognitive ability and non-cognitive skills. We complement this individual-centered approach by secondly proposing an intergenerational mobility perspective according to which undereducation should be understood as a form of family-status maintenance enabled by beneficial parental resources, so that undereducation acts as pathway for the intergenerational transmission of advantage.<sup>1</sup>

### *2.1 Undereducation as the Outcome of Individual Skills*

Two labor market theories dominate the field of job-education mismatch research (McGuinness, 2006). Human capital theory assumes a competitive labor market in which employers try to hire the most productive workers at the lowest cost (G. S. Becker, 1964). Queuing theory assumes jobs (not applicants) to be more or less productive and that employers sort applicants according to how well they appear to be trainable to perform a given job well (Thurow, 1975). By default, research in either tradition tends to equate applicants' productivity or trainability with their formal education because it is a reliable and easily observable indicator. Undereducation therefore poses a problem to strict interpretations of these theories. In response, economists have devised assignment and search models, which consider that search is costly to workers and firms. From the perspective of employers, hiring undereducated workers may thus be preferable to continued search (Sattinger, 1995). These models accommodate the existence of mismatches in the aggregate, but they do not explain *who* will be undereducated. To do that, conventional perspectives need to recognize that the undereducated must have skills which are not well captured by their formal education; skills that (if indirectly) render them more productive, that signal higher trainability than their formal education alone would indicate, or that shape their job search behavior.

To further theorize these skills, it is useful to summarize the little we know about the undereducated, most of which is unsystematized bycatch from research on overeducation. Their wage-advantages over similarly educated peers are driven by their more complex job tasks (Rohrbach-Schmidt & Tiemann, 2016). Nevertheless, they do not report to lack important skills more frequently than their correctly-matched colleagues (Allen & van der Velden, 2001; Green & McIntosh, 2007). They might have gained these skills because in comparison to correctly-matched or overeducated employees they tend to receive more formal on the job training (Buchel et al., 2004; Verhaest & Omey, 2006; but cf. Korpi & Tåhlin, 2009), and report to be better at informal learning during work (Buchel et al., 2004).

An obvious first candidate of what could qualify the undereducated is therefore *general cognitive ability*, as often measured by IQ tests. Cognitive ability is highly predictive of labor market outcomes (Heckman et al., 2006; D. Lin et al., 2018) because it directly increases productivity, but also allows workers to understand complex job tasks, increase their skills with work experience, and benefit from further education. From an employers' perspective, formal certification may simply be not as important if workers are able to demonstrate cognitive ability. In line with these arguments, numeracy skills indeed partly explain the wage-advantages of the undereducated over their similarly educated peers, and many of those, who are mismatched with regards to their education, appear to be matched regarding their actual skill-levels (Levels et al., 2014; Rohrbach-Schmidt & Tiemann, 2016). From a career trajectory perspective, it seems most plausible that cognitive ability matters only for within-firm promotions into undereducation, that is, when employers were able to observe actual performance. But smarter workers might also have smart job-search strategies allowing them to directly enter undereducation when joining a new firm.

According to another tradition, employers are not only concerned with finding able workers, but also with getting them to work diligently (Shapiro & Stiglitz, 1984). From this

perspective, monitoring and aligning workers' incentives to their employer are central features of the employment relationship. Because monitoring is costly, *compliance enhancing characteristics* might be rewarded (Bowles et al., 2001). A corresponding empirical literature aims to show that non-cognitive skills, such as conscientiousness, agreeableness, or emotional stability, are similarly important on the labor market as is cognitive ability (Borghans et al., 2008; Farkas, 2003; Heckman & Kautz, 2012). In line with these claims, field-experimental correspondence tests reveal employer preferences for such non-cognitive skills over cognitive ability, particularly with respect to less educated applicants (Protsch & Solga, 2015). This pattern finds further support by content analyses of job advertisements (Jackson, 2007). It could thus be that the undereducated compensate for their lack of formal education by being particularly reliable, compliant, and conscientious. Similar characteristics are often regarded as features of the petty bourgeoisie and their conformist mobility strategies (Bourdieu, 1984). These skills could be observable to employers during the application process. But they should matter particularly for job performance and hence for promotions into undereducation.

As a final alternative, we could ask which non-cognitive skills persons must possess in order to aspire to, dare, and actively search an unusual career beyond their level of formal education. Following Bowles et al. (2001), we might call such personality facets *entrepreneurial traits*. Taken from this angle, it is notable that some studies report positive wage effects of openness (Heineck, 2011), which might indicate workers' willingness to expose themselves to uncertain and challenging work situations. Two related traits are risk tolerance (for a review see: A. Becker et al., 2012) and an internal locus of control, which describes the belief in the ability to determine one's own future (Rotter, 1966). Insofar as these traits shape job-search behavior, they will play a role in entering new employment situations. But according to Collins (1979, Chapter 2), they can also drive the active pursuit of job success within organizations and affect undereducation through promotions.



## *2.2 Undereducation as Status Maintenance*

The idea that people seek to reproduce parents' socio-economic status (SES), is fundamental to research in intergenerational social mobility (Breen & Goldthorpe, 1997). The predominant strategy by which people try to achieve this is educational attainment. Nevertheless, two strands of literature in the field of social mobility document that parental SES continues to matter over and beyond one's formal level of education. The first line of work demonstrates so-called 'direct effects of social origin' (DESO). That is, adult children of higher-class families achieve significantly higher occupational positions and incomes than children from a lower-class background, even when their education is formally of the same level (Bernardi & Ballarino, 2016; Erikson & Jonsson, 1998). Beneficial resources constitute 'glass floors' (Gugushvili et al., 2017) or 'compensatory advantages' (Bernardi, 2014; Bernardi & Ballarino, 2016) that ensure intergenerational reproduction of advantage. The second line of work emphasizes that the importance of parental SES is reduced at higher levels of education, so that a university education seems to equalize opportunities across people of varying parental SES backgrounds (Karlson, 2019; Torche, 2011; Brand & Xie, 2010; Hout, 1988; but also see the discussion in Ballarino & Bernardi, 2016).

In this section, we propose to think of these two strands of literature in terms of job-education mismatches, and to thus consider undereducation as a form of status maintenance among persons who failed to attain an education that reflects their parents' socio-economic status. With respect to the first line of work, we suggest that DESOs are, to a considerable extent, driven by less-educated persons with high SES parents benefitting from opportunities to work as undereducated employees. With respect to the second line, we note that our argument could explain why the intergenerational transmission of advantage is often reduced at higher levels of education: Undereducation among less-

educated persons with high SES parents is a more important pathway of intergenerational reproduction than the avoidance of overeducation among better-educated persons with high SES parents. Our argument therefore contrasts with existing research that instead sees DESOs primarily as the result of high-educated persons with low SES parents facing the risk of overeducation (Capsada-Munsech, 2015).

Which family-related resources can higher-class children draw on to compensate for a lack of formal education? We focus on two kinds of resources proposed by DESO scholarship: Social capital, and the outcomes of class-specific socialization (Bernardi & Ballarino, 2016; Erikson & Jonsson, 1998). In the following we explain how social capital may help entry into undereducation from outside an organization, while socialized class-specific traits and behavior potentially accounts for intra-organizational promotion into undereducation, too.<sup>2</sup>

From the outset of *social capital* research, job access has always been considered as one of its main benefits (Granovetter, 1973; N. Lin et al., 1981). According to this perspective, people from privileged backgrounds find it easier to gain access to jobs, because they know about vacancies via their networks, and because they are more likely to be acquainted with those who take the relevant hiring decisions (Flap & Völker, 2008). Social capital stemming from one's social origin might thus explain potential SES-origin advantages of externally entering undereducation, but it is doubtful that it increases or compensates for the job-performance that is necessary to be promoted into undereducation.

By contrast, traits and preferences due to origin-specific socialization can account for that just as well. Sociology has long argued that class-specific socialization patterns are chief drivers of the intergenerational reproduction of social status (Bourdieu, 1984; Jæger & Karlson, 2018). While this tradition focuses on various differences in socio-cultural practices, which are hard to capture comprehensively in a study like ours, recent re-

search suggests that general cognitive abilities and non-cognitive skills are also influenced by class-specific socialization styles (Conger & Donnellan, 2007; Farkas, 2003), and as such mediate the effect of parental status on children's educational and occupational attainment (Bourne et al., 2018; Gugushvili et al., 2017; Shanahan et al., 2014). We thus hypothesize that one reason why children of high SES parents may be more likely to enter undereducation is that they command over more of the skills and traits that give access to it: If cognitive ability and non-cognitive skills are class-specific and related to undereducation, they should account for class differences in undereducation.

### 3 Data and Methods

We base our analyses on harmonized data from the UK Longitudinal Household Study 2009-2016 (UKHLS; Buck & McFall, 2011) and the German Socio-Economic Panel Study 2004-2016 (SOEP; Goebel et al., 2018). This allows us to test the generalizability of our results across institutional contexts. Both panel surveys are comparable with respect to their sampling strategies, their fieldwork, and even the wording of most of the instruments we rely on.

Overall, we restrict the analytic sample to men and women between 20 and 60 years of age, who are currently not enrolled in full-time education or training. We exclude self-employed respondents, because our discussion of labor market theories does not apply to them. Finally, we restrict the UK sample to respondents who have joined the study prior to wave three, and the SOEP sample to respondents who participated at least in round 2006 or 2012; our key predictors were collected in or before these survey years. To account for unequal sampling and attrition probabilities, we employ provided post-stratification weights.

### 3.1 Dependent variables

Our first dependent variable is a binary indicator of undereducation status which identifies respondents who have substantially less formal education than what is typical in their current occupation. This variable is available for every UKHLS and SOEP survey wave. The crucial factor in measuring undereducation is the operationalization of the typically-required formal education in a given occupation. We use the so-called realized matches procedure, which relies on the observed distribution of years of schooling in each occupation (for a review see: McGuinness, 2006). We distinguish occupations via the ISCO88 classification on a three-digit level and estimate occupation-specific mean years of schooling and standard deviations from that mean based on the poststratification-weighted overall UKHLS and SOEP samples (see Section A in the Online Supplement for details and Section J for sensitivity analyses). Following standard practice, we define respondents as undereducated if their personal years of schooling are less than one occupation-specific standard deviation of their current occupation's mean years of schooling:

$$\text{Undereducation}_{ijk} = \mathbb{I}(\text{Edu}_{ijk} < (\overline{\text{Edu}}_{jk} - \text{SD}(\text{Edu}_{jk}))),$$

where  $i$  indexes employees and  $j$  indexes occupations. Because of significant regional differences,  $k$  indicates East Germany or London.

Although binary indicators are intuitive, they come at the loss of fine-grained information. Section E of the Online Supplement therefore reports results for the metric depth of undereducation and details the steps in our construction of these variables. Where the results diverge meaningfully from the binary specification, we report them in the main article. Some of our analyses use these metric depths of under- and overeducation as explanatory variables (see Section 4.4).

For Germany, we are able to test the robustness of our findings against another indicator of undereducation that is based on respondents' self-assessment of their job's qualification requirements. We are thus able to address concerns regarding the quality

of measurement in the job-education mismatch literature (Leuven & Oosterbeek, 2011). Results using this alternative measure largely confirm our main findings (see Section D of the Online Supplement).

Our second dependent variable is log-transformed monthly gross labor income. Analyzing labor income allows us to demonstrate the importance of under- vis-à-vis overeducation for the intergenerational transmission of advantage. In both datasets, we rely on labor income variables that were imputed by the data provider (Knies, 2018, p. 88ff; Frick & Grabka, 2014).

### 3.2 Predictor Variables

The key predictors of our analyses are respondents' cognitive and non-cognitive skills, and parental SES. Table I shows the survey years during which time-varying variables were collected. Direct measures of *general cognitive ability* are a rarity in population surveys. The UKHLS and SOEP contain such measures, although the tests are somewhat different and hence not directly comparable. UKHLS respondents solved logical puzzles, subtraction exercises, and tests of their everyday numeracy skills (McFall, 2013). SOEP respondents had to match a range of symbols to numbers according to a predefined key (Schupp et al., 2008). Unfortunately, only a random 25% sub-sample of the SOEP was assessed each time. Because the other 75% are missing completely at random (MCAR) we imputed their cognitive ability scores (see below).

Our measures of *non-cognitive skills* are directly comparable across the UKHLS and SOEP. To assess the Big-5 personality dimensions, both surveys rely on identical short versions of the FFM personality inventory (Dehne & Schupp, 2007). For each survey year, we performed a varimax rotated principal-component analysis of the 15 items, which are measured on 7-point scales. As predictors in our analysis we use factor scores based on a five-component solution reflecting the Big-5 personality dimensions. The two

other concepts we investigate, risk aversion and locus of control, were measured using standard single item scales in both surveys.<sup>3</sup>

To facilitate ease of interpretation in our longitudinal models, we use confirmatory factor analysis to reduce the various measures of non-cognitive skills to two scales that reflect our theoretical approach: The *compliance enhancing traits scale* comprises of all items that inform the subscales of conscientiousness and agreeableness; the *entrepreneurial traits scale* consists of openness, locus of control, and risk tolerance items (for details on scaling and model fit see Section K in the Online Supplement).

We measure *parental SES* by using respondents' recollection of their parents' occupation when they were 14/15 years old. In particular, we use the average of parents' international socio-economic index (ISEI) to measure socio-economic origin.<sup>4</sup> Section F in the Online Supplement discusses results for parental years of education as an alternative indicator. To illuminate potential sources of parental SES effects we additionally use a SOEP item on whether the current job was found 'through friends or relatives' to test the *social capital* mechanism.

### 3.3 Control variables

The baseline controls across all models include age (also squared), gender, immigration status and generation, scores from the MCS-12/PCS-12 mental and physical health component scales (Andersen et al., 2007), survey year fixed effects, and dummies for East Germany or London. Most importantly, all results are controlled for respondents' years of education, because undereducation is more prevalent among the less educated. Controlling for own schooling prevents us from merely estimating determinants of low education. Our models of undereducation also include a squared term for education to improve model fit. Our longitudinal models of extra-firm entry into undereducation additionally control for employment status in the previous survey wave, or in the promotion models for overtime worked, part-time employment, and tenure.

For our longitudinal analyses we additionally estimate a second specification, which aims to compare transitions into undereducation among persons with similar prior career trajectories. This strategy results in a very conservative test of our claims, because all cumulative career effects of our predictors are effectively purged. What remains is simply whether workers can successfully signal or exploit their skills and resources at any specific point of transition. We control for prior-career trajectories via fixed effects for respondents last reported occupational position and industry.<sup>5</sup> We exclude respondents for whom these variables are undefined because they never worked. In consequence, our longitudinal analyses focus on workers' career trajectories after their initial school-to-work transition has taken place. It thus complements existing research on the importance of non-cognitive skills and social background for school-to-work transitions of low-achieving adolescents (Holtmann et al., 2017). Finally, our longitudinal models of within-firm promotions into undereducation additionally condition on company size and pre-promotion wages.

### *3.4 Modelling strategy*

We use linear probability models (LPM) with (cluster-)robust standard errors to regress undereducation on our predictor variables. LPMs allow us to compare coefficients across models and samples (Breen et al., 2018). Section C of the Online Supplement provides results, which are similar in conclusion, based on generalized linear models. We also use linear models with (cluster-)robust standard errors to regress logged labor income on parental SES along with metric measures of under- and overeducation.

Across all analyses, the predictor variables are measured as recently to the outcome as possible, but always prior to it, so as to prohibit reverse causality. For cross-sectional analyses of the UKLHS we regress our two dependent variables measured in Wave 4 on our predictors measured in Waves 1, 2, and 3. For cross-sectional analyses of the SOEP we regress our two outcomes measured in 2007 or 2013 on predictors measured

in 2004 to 2006 or 2009 to 2012 respectively. Among SOEP respondents who participated in 2007 and 2013, we choose the more recent observation. These analyses draw on all measures indicated by X in Table I. All our longitudinal analyses make use of the consecutively measured undereducation indicator (indicated by O in Table I). We standardize all continuous predictors and report LPM coefficients in terms of percentage points (pp.).

*Table I: Timing of measurements*

UKHLS survey wave			W1	W2	W3	W4	W5	W6	W7			
Survey year			'09/'10	'10/'11	'11/'12	'12/'13	'13/'14	'14/'15	'15/'16			
IQ					X							
Big5					X							
Locus of control				X								
Risk aversion			X									
Undereducation						X	O	O	O			
SOEP survey year	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16
IQ		X						X				
Big5	X			X					X			
Locus of control	X				X			X			X	
Risk aversion		X		X	X	X	X	X	X	X	X	
Undereducation			X	O	O	O	O	O	X	O	O	O

If information on an independent variable is missing, we rely on 100 imputations by chained equations (Van Buuren, 2012). The imputation models use information from all variables included in the actual analysis, and from informative background variables. The imputation equations entail past, present and future values of the dependent variable, and their interactions to ensure an adequate temporal structure.

In a first step, we predict the general cross-sectional probability of undereducation on the person level. In a second step, we predict extra-firm entry and within-firm promotion into undereducation. The analysis of extra-firm entry into undereducation focuses on respondents, who will enter a new company the following year and who are currently un-



employed, nonworking, or who are employed but not undereducated. We then investigate which of these entries into a new company are also entries into undereducation. Our analysis of within-firm promotion into undereducation looks at those who were employed with the same employer for at least two consecutive years. In the spirit of discrete-time duration models, we estimate employees' probability to transition into undereducation, given that they have not been undereducated the year before. To capture only meaningful promotions into undereducation, we demand that respondents actually change their 3-digit occupation. Respondents stop being at risk of experiencing a transition if they change company, or after being promoted into undereducation. We account for the possibility that promotions into undereducation might depend on time spent in a position (i.e., duration-dependence), by adding a linear term for tenure with an employer (transformations of that variable did not improve model fit). For both types of analyses, we add dummies for the current number of employment spells eligible for extra-firm entries or within-firm promotions. In a third step, we revisit our initial cross-sectional model and investigate in how far parental SES effects are mediated by social capital and class-of-origin-specific (non-)cognitive traits. In a fourth and final step, we again use the cross-sectional model and investigate in how far under- and overeducation as well as (non-)cognitive traits mediate DESOs (i.e. the effects of parental SES adjusted for educational attainment) on labor income.

## 4 Results

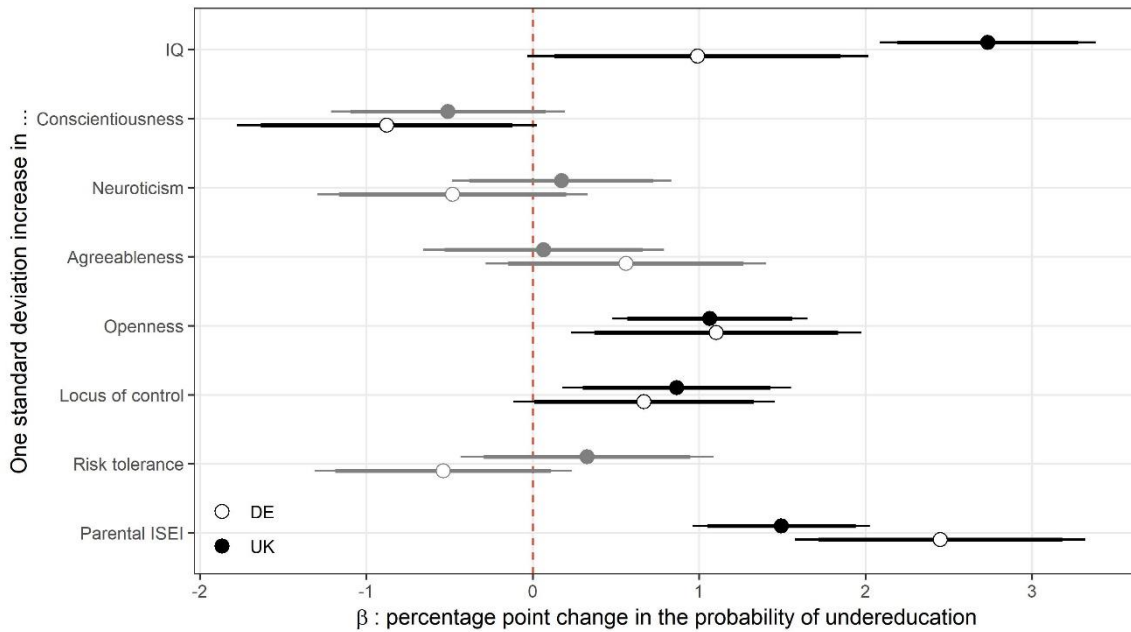
According to our realized matches indicator and population definition, considerable shares of 14.04% ( $\pm 0.60$  percentage points (pp.)) and 12.35% ( $\pm 0.90$ pp.) of all employees were undereducated in 2014 in the UK and Germany respectively. Which skills and resources allow these individuals to develop careers in occupations in which their colleagues tend to be significantly better educated? And in what way do these two figures reflect on the intergenerational transmission of advantage?

#### 4.1 Probability of undereducation

Figure I is a coefficient plot of our cross-sectional results. It visualizes the percentage point change in the probability of undereducation (x-axis) associated with a standard deviation increase in any of the respective predictor variables, adjusted for the discussed covariates.

At the top of Figure I we see that general *cognitive ability* that goes beyond the ability indicated by one's formal qualification is a systematic predictor of undereducation. Additional analyses presented in Section H of the Online Supplement show that this result (and the following ones) cannot be explained by final school grades. The importance of cognitive ability therefore really goes beyond formally certified skills. This finding is particularly strong in the UK, where a standard deviation increase in cognitive ability statistically increases the probability of undereducation among employees by 2.79pp.. In Germany, by contrast, the result is only marginally significant and indicates a 0.99pp. increase. One could interpret this as a first tentative sign of country differences. But our additional results in the Online Supplement based on the metric depth of undereducation (Section E), generalized-linear models (Section C), and a more lenient definition of undereducation (Section E) all suggest that cognitive ability is a significant predictor of undereducation in Germany. We therefore regard these results as weaker, although nevertheless supportive evidence for ability effects in Germany, too. At first glance the magnitude of both effect sizes may seem very small. But because undereducation is rather rare, these coefficients correspond to considerable increases of 19.87% and 8.01% relative to the overall prevalence of undereducation.

Figure I: Linear probability models predicting undereducation



Note: LPM estimates with 95 and 90% confidence intervals based on robust standard errors. Estimates that do not reach a marginal level of significance are displayed in grey. Results are controlled for region, years of schooling, years of schooling<sup>2</sup>, gender, migration status, year, and health.  $n_{UK} = 10,964$ ,  $n_{DE} = 12,348$ . Full regression results are displayed in Table B.1 in the Online Supplement.

The idea that *compliance enhancing traits* can effectively compensate for a lack of schooling finds no support. The Big-5 contain three dimensions that might reasonably be interpreted as aligning workers' behavior with managements' needs: Conscientiousness, emotional stability (i.e. low neuroticism), and agreeableness. But according to Figure I, none of the three corresponding personality traits shows a significantly positive relationship with undereducation in either of the two countries. The undereducated are not rewarded for (petty-bourgeois) diligence.

What then about the somewhat opposing perspective that emphasizes the agency of *entrepreneurial types* in seeking undereducation careers? Overall, our cross-sectional data are consistent with this argument. Openness to experience and an internal locus of control are very similarly associated with a higher probability of undereducation in both countries (locus of control is only marginally significant in Germany in the LPM-

specification, but just as IQ a consistently significant predictor in the alternative specifications reported in Sections E and C in the Online Supplement). The estimated effect sizes for these variables all lie between a 0.67pp. (5.42%) and a 1.10pp. (8.90%) increase in the probability of undereducation per standard deviation. Only the third entrepreneurial trait, risk tolerance, does not predict undereducation.

Turning to our second argument, according to which undereducation is an expression of status maintenance, we indeed see that being from a high-SES family substantially increases one's probability of undereducation. Figure I shows results for parental ISEI, but similar conclusions hold if we use parental education (see Section F in the Online Supplement). Children of high-status parents are often able to offset unsuccessful education careers. Interestingly, the results for parental background reverse-mirror those for cognitive ability with respect to our two countries. That is, whereas cognitive ability seems to be somewhat more predictive of undereducation in the UK, parental SES is a stronger predictor in Germany.

#### *4.2 Career trajectories into undereducation*

What are typical career trajectories into undereducation? Table II reports the annual probability of a transition into undereducation (given employment the following year; 'outflow') and the last employment states of the newly undereducated ('inflow') for people with a history of employment. The annual probabilities to advance into undereducation are only about 2.82% in the UK and 3.24% in Germany, respectively. Low transition probabilities are especially evident among workers who stay with their firm, whereas the annual probabilities are at 13.62% (UK) and 12.08% (Germany) much higher if workers begin a new employment spell. Nevertheless, the inflow rates document that about 37% of newly undereducated workers in the UK and 44% in Germany were employed with the same employer before their transition into undereducation; despite relatively low transition rates, a large share of the undereducated were promoted into it.

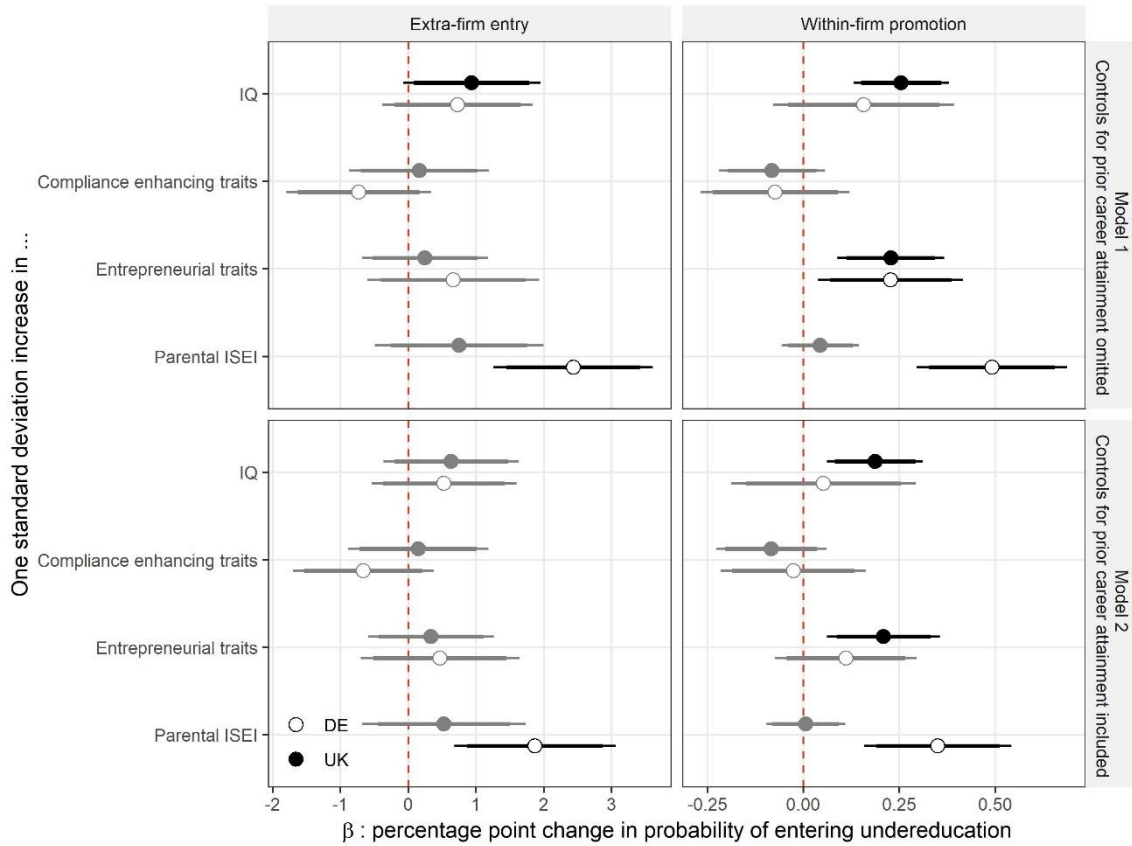
*Table II: Outflow and inflow rates into undereducation (in %)*

Last employment status	Outflow		Inflow	
	UK	Germany	UK	Germany
External entries ...	13.62	12.08	63.01	55.94
... of which from ...				
... outside the labor force	14.26	9.93	16.76	10.83
... unemployment	17.28	16.22	18.78	14.21
... employment (with different employer)	11.62	11.60	27.47	30.90
Employment (with same employer)	1.20	1.68	36.99	44.06
Overall	2.82	3.24	100.00	100.00
N	67905	99429	1928	4175

*Note:* Weighted results for waves 2-7 of the UKLHS and the years 2005-2016 of the SOEP.

Do the earlier identified skills and resources predict extra-firm entries and within-firm promotions into undereducation? Figure II presents results of two model specifications. Model 1 mirrors the design of the model presented in Figure I, but now predicts extra-firm entries and within-firm promotions into undereducation. Starting with extra-firm entries, the results only reflect our earlier findings with respect to the importance of parental background in Germany. That is, the children of upper-class parents are more likely to enter a new firm as undereducated employees in Germany. But apart from that, we are unable to systematically predict extra-firm entries into undereducation.

Figure II: Linear probability models predicting entry into undereducation



Note: LPM estimates with 95 and 90% confidence intervals based on cluster-robust standard errors. Estimates that do not reach a marginal level of significance are displayed in grey. Results are controlled for region, age, age2, years of schooling, years of schooling2, gender, migration status, year, health, and repeated spells. Tenure, part-time, and share overtime worked are also controlled in promotion models. Controls for past attainment include industry, occupational position of the last job, and company size and wages earned (promotion only).  $n_{\text{obs, UK, promotions}} = 27,594$ ,  $n_{\text{persons, UK, promotions}} = 10,256$ ,  $n_{\text{obs, UK, extra-firm entry}} = 3,696$ ,  $n_{\text{persons, UK, extra-firm entry}} = 3,191$ ;  $n_{\text{obs, DE, promotion}} = 53,304$ ,  $n_{\text{persons, DE, promotion}} = 13,904$ ,  $n_{\text{obs, DE, extra-firm entry}} = 7,161$ ,  $n_{\text{persons, DE, extra-firm entry}} = 4,926$ . Full regression results are displayed in Table B.2 in the Online Supplement.

Turning to within-firm promotions, and thus to career-trajectories of persons who have left an impression on their supervisors, we see most of the earlier reported patterns. That is, non-cognitive skills that we identified as ‘entrepreneurial’ traits predict within-firm promotions into undereducation. Compliance enhancing traits, by contrast, remain unrelated to promotions into undereducation. Finally, we again obtain interesting results regarding country differences in the relative importance of (non-)meritocratic characteristics. In the

UK persons with high cognitive ability have a higher probability to be promoted into undereducation. In Germany, by contrast, employees with higher SES parents can more often convince their supervisors to promote them. The results of Figure II therefore tentatively suggest that the UK labor market might offer more meritocratic post-education careers than the German, where individual upward mobility instead remains determined by social backgrounds.

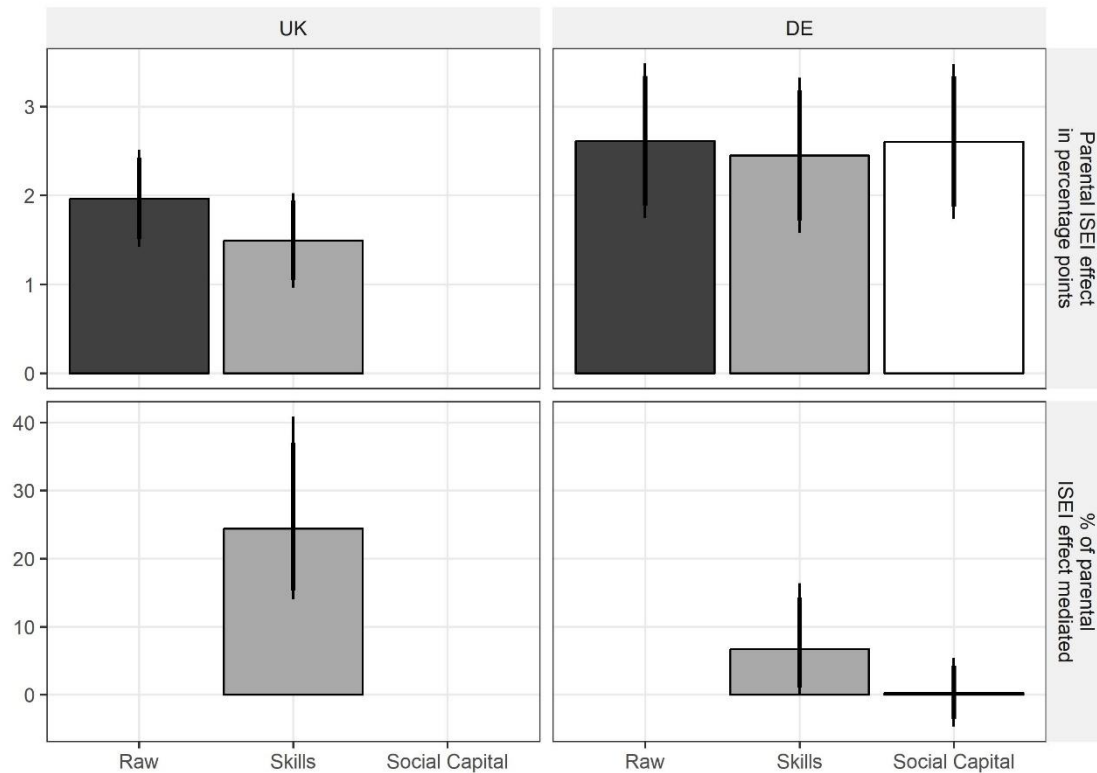
Figure II further contains results of another set of models, which condition on past career attainment, that is, estimates which are purged of possible confounders, but also of cumulative career effects. We do not suggest this to be a better, but rather a different test. What effectively remains in these conservative models, is whether skills and resources can be successfully signaled or exploited at any potential point of transition. The results confirm that even compared to persons on similar career trajectories, workers in the UK can exploit high cognitive abilities and entrepreneurial traits to increase their probability of being promoted into undereducation in the coming year. Vice versa, German workers seem to be able to exploit whatever resources higher parental SES offers, when it comes to entering undereducation externally and through promotion, even when we limit the comparison to workers who have had identical career paths up until that point. This finding further highlights the pattern of the continuing importance of social background in Germany versus the relevance of individual traits in the UK.

#### *4.3 Mechanisms of parental SES effects on undereducation*

Figure I documents large social background effects on undereducation likelihoods. Social origin also matters to explain career trajectories into undereducation, at least in Germany. How can we explain such 'glass-floors' or 'compensatory advantages' in post-school occupational attainment? To answer this question, we now revisit our initial models (Figure I) and test whether two explanations that are prominent in the social mobility literature apply to the case of undereducation. We do so by calculating the share of the

parental SES effect accounted for by measures of social capital and of origin-specific traits, respectively.

Figure III: Decomposition of social background effects on undereducation



Note: LPM estimates with 90 and 95% confidence intervals based on robust standard errors, or non-parametric 90 and 95% confidence intervals based on 5,000 bootstrap replications. See Section I in the Online Supplement for underlying regression models.

Figure III displays our findings. In the upper panel, it reports the raw social origin coefficient estimated in a model featuring only basic control variables and the size of the reduced social origin coefficient estimated in a model that additionally features the mediator of interest. In the bottom panel, it displays the relative share of the social origin coefficient that can be accounted for by the respective mediator. According to our estimates, between 24.4% (UK) and 6.3% (Germany) of background effects result from class-differences in (non-)cognitive skills that go beyond the skill-set indicated by formal education. Even using relatively crude measures of origin-class-specific attributes, these



results demonstrate a significant role of social-origin-related traits in accounting for background effects in undereducation careers, especially in the UK. Importantly, this also means that a significant share of the above-mentioned importance of (non-)cognitive skills in fact reflects parental SES.

Nevertheless, these figures leave plenty room for mediation via social capital, which, however, we can only test for Germany. Are people from higher status backgrounds more likely to be undereducated, because through their social networks they can draw on personal references, better information about vacancies, or outright patronage? Figure III does not show any evidence that this might be the case. The percentage change in the social origin undereducation association if we control for how workers found their current job, which includes “through friends or family”, is negligible and far from being statistically significant, which is in line with previous research on DESOs (Gugushvili et al., 2017).

We further test for heterogeneous effects by parental SES (see Section I in the Online Supplement). This additional test answers to a frequently-raised argument, according to which class-specific network quality, rather than the mere quantity of network use, matters for labor market success. That is, drawing on social capital leads to advantages only in resource-rich networks (Moerbeek & Flap, 2008). But according to our analyses the degree to which job-search methods (including social capital utilization) matter for undereducation does not depend on one’s SES background. In line with Shanahan et al. (2014), however, there is evidence that (non-)cognitive traits are more important among workers of less privileged backgrounds.

#### *4.4 Undereducation and the intergenerational transmission of advantage*

So far, the results are in line with our intergenerational perspective: Persons from advantaged backgrounds are more likely to be undereducated, enter undereducation, or be promoted into undereducation. Moreover, even the (non-)cognitive skills that similarly

predict these outcomes can partly be traced back to parental SES. But this evidence remains suggestive with respect to our claim that DESOs are driven by undereducation, which we also suggested as a potential explanation for why DESOs have been shown to be stronger among the less as compared to the better educated. Focusing on labor income, we now test this claim explicitly.

*Table III: Mediators of the direct effects of social origin on logged-labor-income*

	(1)	Complete sample (2)	(3)	Non-graduates (4)	(5)	Graduates (6)	(7)
<b>UK</b>							
Parents' average ISEI	0.0575*** (8.20)	0.0282*** (4.23)	0.0501*** (7.33)	0.0400*** (5.79)	0.0566*** (7.62)	0.0330*** (4.58)	0.0573** (3.04)
SD undereducated		0.371*** (22.48)		0.316*** (19.77)		0.374*** (21.23)	
SD overeducated		-0.409** (-25.68)	-0.351*** (-21.84)				
N	10584	10584	10584	10584	8980	8980	1604
<b>Germany</b>							
Parents' average ISEI	0.0493*** (5.91)	0.0252** (3.11)	0.0429*** (5.12)	0.0321*** (3.94)	0.0529*** (5.48)	0.0316*** (3.37)	0.0324* (2.10)
SD undereducated		0.225*** (14.59)		0.222*** (14.59)		0.245*** (15.42)	
SD overeducated		-0.210*** (-12.79)	-0.206*** (-12.46)				
N	12594	12594	12594	12594	10494	10494	2100

*Note:* OLS estimates with *t*-values based on robust standard errors in parentheses. Results are controlled for age, age squared, years of education,<sup>6</sup> mental and physical health scores, migration origin, gender, region, and survey year.

Column 1 of Table III reports estimates of the direct effects of social origin on labor income for both the UK and Germany. A standard deviation increase in parental SES goes along with a statistically significant increase in earnings of about 5.8 and 4.9%, respectively, despite holding education constant. There is thus evidence of significant earnings DESOs in both countries.<sup>7</sup> Adding under- and overeducation, Column 2 shows that about half of these DESO estimates can be traced to educational mismatches. Yet the distinct advantage of our focus on undereducation becomes apparent only in Columns 3 and 4, which each contain only one of the two mismatch types. The two columns reveal that DESOs operate more through undereducation than they do via (the avoid-

ance of) overeducation: In both countries more than 30% of the DESOs can be accounted for by undereducation, while overeducation only accounts for 13%. In line with our claim, parental advantage is passed on more strongly through promoting undereducation of lower attaining children than through shielding highly educated children from overeducation. Our perspective thereby reveals that 'glass-floors' and 'compensatory advantages' are more important than 'boosting effects' in explaining the intergenerational transmission of inequality net of education.

Is there also evidence for the second part of our claim, according to which the importance of undereducation provides an explanation for stronger DESOs among non-graduates? We begin our test by calculating DESOs for employees with and without a university diploma (Column 7 and 5 respectively). This exercise reveals that the pattern of larger DESOs among lower educated employees is present only in Germany but not in the UK. It is thus important to note that the implied second part of our claim fully applies to the German case only. To which extent can undereducation explain the difference between the DESO among graduates as compared to non-graduates? The crucial test lies in the comparison between the DESO estimates of Column 6 and 7 for Germany. It appears that controlling for undereducation among non-graduates in Column 6 yields an estimate of the remaining parental influence that is all but identical to the corresponding estimate for graduates in Column 7.<sup>8</sup> In other words, were it not for non-graduates' opportunities to work in jobs beyond their qualification level and the fact that those from upper class backgrounds exploit these opportunities over-frequently, earnings DESO would not differ between employees with and without higher education credentials In Germany. We can thus confirm that, to the degree they are present, higher DESOs among the non-tertiary educated operate through undereducation. In the UK, an absence of undereducation would even result in earnings DESOs among non-graduates that are lower than those among graduates.

## 5 Conclusion

According to our results, roughly 13% of all workers are undereducated in the UK and Germany. This article is the first to explicitly investigate the undereducated by asking what skills and resources set them apart and allow them to develop careers in occupations in which most of their colleagues are significantly better qualified, and, in consequence, to enjoy the associated wage benefits over their similarly educated peers. Beyond an approach focusing on workers' skills exclusively, we suggested that undereducation should also be regarded as an important form of intergenerational status maintenance. This perspective implies that direct effects of social origin (DESOs) in part come about, because children of high SES parents find ways to offset low educational attainment and access employment for which they are formally undereducated.

We identified three types of skills, which, if not accurately reflected in formal degrees, may explain undereducation: While employers might value skills that increase productivity and trainability, or skills that increase the compliance with employer interests, a final set of entrepreneurial skills may shape workers' opportunity-seeking behavior. Our analyses reject the second perspective, but largely confirm the first and the third. General cognitive ability goes along with a considerably increased probability of being undereducated. In the UK, it also predicts career transitions into undereducation. The idea of undereducation as a reward for compliance and diligence, by contrast, finds no support. Moreover, we found that entrepreneurial traits are positively associated with undereducation. But in contrast to the idea that such traits operate through affecting search behavior on the labor market, our results suggest that they drive the pursuit of within-firm success: Entrepreneurial workers are more likely to be promoted into undereducation.

Beyond individual-centered approaches, our analyses also document that social origin is a main determinant of undereducation. To our best knowledge, ours is thereby the first study to explicitly relate undereducation to questions of intergenerational social reproduction. Parental SES is among the strongest predictors of undereducation, but

only in Germany does it also predict longitudinal career trajectories into undereducation. Our subsequent analyses of the drivers of these background effects found no evidence in favor of social capital mechanisms. Consistent with explanations that center on durable qualities of individuals themselves, our analyses demonstrate that (non-)cognitive traits mediate social origin effects, especially in the UK. In other words, our analyses show that a significant share of the importance of (non-)cognitive skills can be traced to parental SES.

To underline the relevance of our intergenerational argument, we finally demonstrated that so-called direct effects of social origins in terms of earnings are driven by undereducation. We find that between 30% and 35% of earnings DESOs come about because less-educated children of high SES parents are able to enter careers that lie beyond their formal qualification level. The corresponding estimate for overeducation, and the idea that high SES parents can support their better-educated children to find appropriate employment, is just 13%. This suggests that the intergenerational transmission of advantage mainly takes the form of 'glass floors' (Gugushvili et al., 2017) or 'compensatory advantages' (Bernardi, 2014; Bernardi & Ballarino, 2016). We further show that the finding that privileged origins generate labor market advantages primarily among the less educated (cf., Karlson, 2019; Torche, 2011; Hout, 1988) can, where it is present, be accounted for by undereducation: Were it not for undereducation, parental influence would be equally strong among employees with and without a university education in Germany.

We compared the UK to Germany and found overall very similar results across the two heterogeneous contexts. This underlines the generalizability of the core set of our findings. Nevertheless, we also found an important difference: Individual skills and in particular cognitive ability play a stronger and more systematic role in the UK, while parental SES is a stronger and more decisive factor in Germany. This general pattern is quite robust across models and specifications. The fact that parental SES in Germany

mirrors the role of individual skills in the UK indicates an interesting difference between the two countries, which merits further attention. Based on our work, it appears that British labor markets are more permeable in allowing workers with higher cognitive skills than implied by their schooling to embark on undereducation careers. To a degree then, British (internal) labor markets correct a mislabeling of students by the education system, allowing them to realize some of their potential. We find less evidence for such processes in Germany. Yet, rather than attributing this result to the UK's permeable labor market, one could also see it as the result of a more effective German education system, which mislabels fewer skilled pupils than the British one (Heisig, 2018). Against this follow-up puzzle, future research should engage deeper with what characteristics of institutions, occupations and industries allowing talented versus privileged workers to enter careers beyond their formal education.

## Notes

1. Both arguments raise the question why the educational system did not allow the future undereducated to attain a higher level of education to begin with, and why the labor market is permeable enough to eventually compensate for the apparent mislabeling of pupils. While this question is an interesting one, it is also beyond the scope of this article. But by analyzing panel data from two countries with highly dissimilar education systems and associated labor markets, the UK and Germany, we hope to demonstrate that our findings hold under general institutional configurations: Germany's stratified and vocationally-oriented education system is tightly interlinked with a comparatively regulated labor market, characterized by deep-rooted occupational profiles. The UK's more comprehensive, general-education system, on the other hand, has fuzzy links to a liberal labor market (Allmendinger, 1989; Hall & Soskice, 2001). As a result, formal qualifications are of lower signaling value in the UK (Heisig, 2018), and the labor market is more permeable.

2. Instead of our focus on resources stemming from one's parental SES background, one could also argue that the mere motive of status maintenance might drive parental SES effects on undereducation. Note however, that this implies a theory about the ambition to decrease the *relative* difference between one's own and one's parents' socio-economic status. Section G in the Online Supplement discusses why any such relative measure of social origin is difficult to operationalize in our set-up, and presents results from two different approaches to approximate it.

3. Risk aversion: 'Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?' with an eleven-point scale ranging from 'avoid taking risks' to 'fully prepared'. Locus of control: 'I feel that what happens in life is often determined by factors beyond my control' with a six-point scale ranging from 'strongly disagree' to 'strongly agree'.

4. For the UKHLS, we obtain ISEI-values through a translation routine provided by the CAMSIS project (Lambert & Prandy, 2008).

5. Occupational position is measured by NS-SEC classification (UKHLS) and the comparable classification of the German Federal Statistical Office (SOEP). Industry is measured by the two-digit Standard Industrial Classification (UKHLS) and two-digit NACE (SOEP).

6. Our results are numerically almost identical when we instead use a finer grained, categorical scheme like CASMIN.

7. This is at odds with Grätz & Pollak's (2016) analysis of the same data for Germany, and Vandecasteele's (2016) analysis of the 2008 BHPS sample. Using a wide variety of specifications, we were able to come close to their reported null-finding only when taking analytic decisions that we believe are inferior to the ones we adopt in this paper (e.g. casewise deletion instead of multiple imputation, or using the highest instead of the average ISEI of parents).

8. Non-graduates can still be overeducated. However, accounting for overeducation in our models only reduces the DESO estimate for this group to 0.046 (t-value: 6.35) in the UK and to 0.047 (t-value: 4.83) in Germany. It does hence not explain the difference in DESO-strength between people with and without tertiary education.



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