AGAINST THE ODDS.
Education-to-job matches and less-educated workers' pathways into success

Inauguraldissertation
zur Erlangung des Doktorgrades
der Wirtschafts- und
Sozialwissenschaftlichen Fakultät
der Universität zu Köln

2020

presented by Jonas Wiedner
from Nürnberg

First Reviewer: Prof. Dr. Merlin Schaeffer
Second Reviewer: Prof. Dr. Marita Jacob

Dissertation defended on February 23rd, 2021

To my parents, Elke and Siegfried, and my brother, Tim.

Contents

List of Tables

List of Figures

Acknowledgements

The work that went into this dissertation took up three and a half years. That is a long time. And while a dissertation is something one is supposed to, and indeed often does, struggle with by oneself, three and a half years clearly are too long a time to be spent alone. And so my first thanks go to the people who accompanied me during this time: Mark, who was my first friend in Cologne, and who introduced me to Coltrane's innovations, Husserl's valid points, ERGMs, UFO's latest, the Pizza Mafiosi, and almost turned me around on hyper-positivism; Resa, who is fun, smart and fast and knows what SPO stands for; Hannah, who was always there when I needed coffee and a view from outside the bubble; Julia and Hakan, who made my life so much better by becoming my office mates and freely shared their *Nussecken* or picked me up at the ER, when the need arose. I thank all the other colleagues at the ISS for providing a productive environment. My two teaching assistants Lolita and Markus did tremendous work devising and programming materials for my stats-courses. That I was at all able to progress on my dissertation during semesters is in large parts due to them

During my times in Colchester I was privileged to enjoy the hospitality of Renee Reichl Luthra and the welcoming ISER staff and graduate students. Despite repeated Novembers, my two stays at the University of Copenhagen were the most stimulating times during the work towards this dissertation. Ea, Jesper, Stine, Nicola, Mads, Kristian, and the Quant Club deserve credit for that. These stays were made possible by IPAC grants from the University of Cologne and the German Research Foundation.

True to its motto *fiat veritas et pereat mundus* the transatlantic society of tendentious puzzlers has kept my horizons broad, never stopped feeding my odd interests, and has overall been a consistent and splendid source of

agitation, procrastination and intellectual stimulation. Special thanks are due to Aljoscha and Julian, who provided valuable feedback on parts of this dissertation. Almost as important were the *coureurs* of the *manivelle rouge*, who know that relaxation by overexertion is not an oxymoron and *riding one's brains out* not entirely figurative speech: *Debout, les damnés de la terre!*

This dissertation would not have been possible without the encouragement and the feedback of my two outstanding supervisors Marita Jacob and Merlin Schaeffer. Both were not only supervisors of my thesis but, at different times, my bosses, too. I have learnt a lot from both, in both capacities. Merlin was the responsive advisor PhD students don't think exists, even from Denmark. He taught me how to write papers, a skill I hope to continue to use.

Lastly, I want to thank Elke and Siggi, who have put up with their sons ridiculously long education phase without showing the slightest hint of impatience. They were always there and always supportive. I could not have better parents.

Sie aufschreiben, sie einfach aufschreiben, denke er immer, dieser Gedanke sei es, die Studie einfach aufschreiben, hinsetzen und die Studie aufschreiben.
Thomas Bernhard

Every true whaleman sleeps with his harpoon.
Herman Melville

Lieber geil angreifen.
Rainald Goetz

1 Introduction

> *At school there were two sorts of boys: those who wanted to stay on and those who wanted to get away. Simple as. He was the second kind. […]*
>
> *Philip Green got his wish and went out to work when he was 16. "Obviously," he said, "I was never going to be a scholar." He laid an emphasis on the "obviously" that is both pre-emptive and pragmatic. It tells you he finds nothing wrong with book-learning, but it was not for him, and if you imagine that makes him a dunce, you've got another think coming. While others chose to sit in classrooms be-ing told what to think and how to pass exams, he was out in the real world with the grown-ups, observing how many beans make five (Vincent 2004).*

- *Must be willing to work a part-time schedule from 7:00 AM-10:00 AM M-F*
- *1+ years of Barista experience in a fast-paced environment*
- *Maintain confidentiality and discretion within all aspects of this role*
- *Excellent interpersonal skills*
- *Team player; always willing to jump in when needed*
- *Excited to be part of a fast-growing startup*
- *Preferred college degree (cited in Lucas 2018)*

Philip Green is among the wealthiest businesspeople in the United Kingdom today. With an empire of retail brands, Green, who does not hold any formal qualification, is the controversial king of British high street retail. After leaving school at 16, he worked as garage attendant, and was later apprenticed in his mother's shoe retail business. Striking out on his own in his early 20s, he

thrived in the world of wholesale fashion. Before turning 30, Green had made his first million.

Millions are not what applicants to a job ad posted on LinkedIn in late 2018 can expect. The job on offer is to make coffee, part-time. A reasonable engagement for students, most people would think. What caused an outcry on social media platforms was the ad's last sentence: "College degree preferred". Might the maker of our next latte be a specialist on Husserl or polycrystalline ceramic matrix composite materials?

Philip Green is unusually successful by many standards. Not only did he achieve levels of economic success that the vast majority of people with his kinds of formal credentials can only dream about, on his way up he also surpassed virtually all of the more bookish types he sought to get away from in his teens. Even among the United Kingdom's arguably most gifted and privileged students, those who graduated first class from a Russell Group university, only about 60% make it into a broadly defined elite occupation (Friedman and Laurison 2019 p.39).[1] But also in his own occupational group, "Chief Executives and Senior Officials"[2] in companies that employ more than 250 workers, Green is an exception. According to estimates from the British Labour Force Survey (LFS) 80% of these top executives had some form of tertiary education in the spring quarter of 2018. Less than 3% report an apprenticeship as their highest qualification (Northern Ireland Statistics and Social Survey Division Office For National Statistics 2019, own calculations).

Life stories like that of Philip Green or the philosopher turned latte artists are outliers. They do not reflect the experience of the vast majority of people who get an education to get a decent job and then work to make a living. And

[1] Among the entire workforce just 17% work in such positions. Friedman and Laurison define elite occupations as the "higher professional and managerial occupations" of the official British NS-SEC classification to which they add competitive positions in the cultural sector (Friedman and Laurison 2019 p.11).
[2] According to the official SOC10-classification.

yet, such stories resonate widely in a world that is saturated with education and its symbols. They touch upon a common sentiment that education, after all, does not really teach what it takes to get ahead, and that what it teaches, is often far too removed from the real world to make a difference there.

Six decades of social science research have provided overwhelming evidence that this view is generally wrong. We know that education is the single best predictor of the location in society someone will end up in. We know that education is the factor that best explains why children of middle-class parents are so likely to remain middle class themselves, and why children from the working class are likely to remain there. This view is epitomized by the standard sociological model of occupational attainment introduced in Blau and Duncan's (1978 [1967]) seminal book. This model, here reproduced as Figure 1-1, documents that American men's occupational position is in the main a function of their education. If you know someone's education, the central claim is, you will be able to make a fairly accurate prediction about their position in the occupational structure, and in society more general.

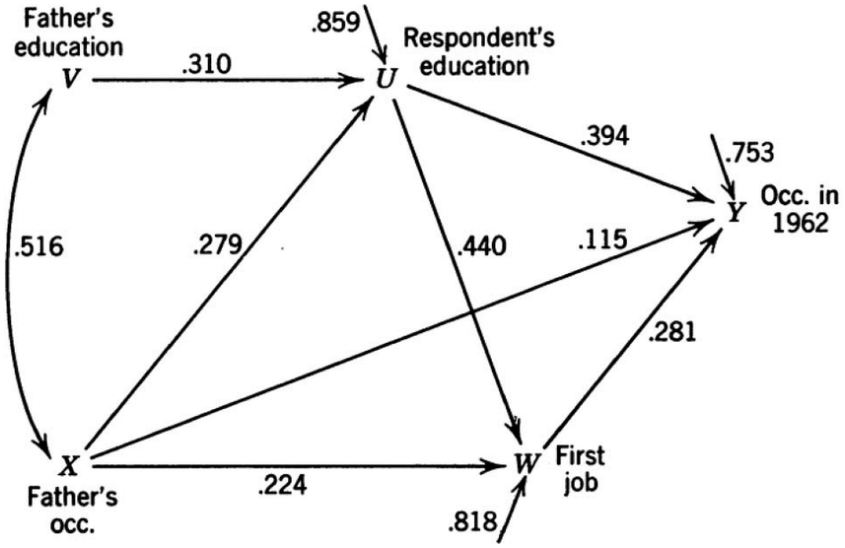


Figure 1-1 Basic model of the process of stratification from Blau and Duncan 1967, p.170, Figure 5.1

And still. Most of us know someone who fits in more with the colorful story of the "underqualified" Philip Green or the highly educated precarity experienced by an "overqualified" barista with years of university education.[3] These are people who found their way into very advantageous careers despite a seeming lack of formal education, or who remained stuck in less-prestigious positions even though they underwent training for far more difficult occupations. On the face of it, such "mismatched" cases contradict the bulk of theory in stratification research.[4] To be sure, social science statements are probabilistic, they deal in average effects, tendencies and populations, not in individual cases. In the technical language of regression analysis, careers of people like Philip Green, philosopher baristas or the colleague from the PhD program who winded up as assistant to someone with a BA in Industrial Engineering, are residuals. They make up the error term in the dominant sociological model of status attainment. We may know their education, but for the mismatched, this carries little information about their later position in society.

---

[3] Green is underqualified in the sense of having less *formal* education and training than required or typical for his job. This may or may not imply a lack of *actual* skill to perform the role well. A college-educated barista, vice versa, is overqualified in the sense of having undergone training that is typically not required in his position. For empirical studies on the degree of overlap between formal mismatch and (actual) *under-* and *overskilling*, see (Levels, van der Velden, and Allen 2014; McGuinness and Sloane 2011; Sánchez-Sánchez and McGuinness 2015).

[4] Workers can be mismatched in a number of ways: part-time workers who would like to work more, workers employed in one city, who would like to live somewhere else and so on (Kalleberg 2008). If there is a *qualification* mismatch and people's education does not fit their occupation or job, *vertical* mismatches can be distinguished from *horizontal* mismatches. In horizontal mismatches, workers' *field* of training does not line up with that of their job. Vertical mismatches refer to *under-* and *over*qualification, where the *level* of qualifications does not line up with requirements of the job. This dissertation is only about the latter phenomenon. Menze (2017) offers an insightful analysis of horizontal and vertical mismatch in the German skilled trades.

Motivation

This dissertation moves this error term of residuals to the center of its attention. Its goal is to transfer the subject of education-to-job mismatches from the realm of the merely anecdotal into a methodologically rigorous social-scientific examination. It is of course by no means the first study to investigate mismatches. However, few scholars study mismatches from a social stratification and social mobility perspective (but cf. Vaisey 2006; Capsada-Munsech 2019a; 2015). I aim to show that mismatches hold important insights for these fields.

Three reasons motivate this endeavor. First, the fact that we all can think of mismatched school mates, colleagues and friends for whom the simple model of status attainment seemingly does not apply, signals that a sizable portion of social reality is left poorly accounted for by the standard model. The first reason to focus on mismatches is therefore that it can help us develop a more nuanced understanding of status attainment, beyond the conditional expectation of occupation given education. On the one hand, this means that we will be able to account for hitherto unexplained variance in occupational attainment. More importantly, however, is that this focus on atypical cases prompts us to theorize mechanisms of occupational access that do not operate chiefly through education (see also Erikson and Jonsson 1998 for an early attempt). As we will see, this examination also reveals that the often used distinction between "achieved" and "ascribed" determinants of occupational access is sometimes less salient empirically than often assumed (Moerbeek and Flap 2008).

Second, a mismatch-perspective provides analytical leverage to inject new insights into other longstanding sociological problems. This may be termed an "instrumental" approach to studying mismatches because from this angle, mismatch is a useful perspective to advance substantive debates in other fields.

No matter if sociologists investigate returns to education, the intergenerational transmission of occupational status, or individuals' prospects of career mobility, they always rely on assumptions on how attained qualifications map onto likely occupational positions. But what is really a special case, the situation of a "correct" education-job match, is often the only way analysts think about this problem in many areas of applied research. If we systematically take into account that mismatch in fact does occur, and understand better in which situations it does, we will be in a better position to disentangle more precisely the mechanisms behind many of the processes that occupy stratification researchers, even beyond questions of occupational access.

The example I use to make this case is the debate on credential inflation and skill-biased technological change. I show that analyzing the balance of supply and demand of education in terms of mismatches offers a novel and more direct way to test the core claims in this debate. Interestingly, this innovative analysis is at odds with some of the received wisdom, suggesting that some of the bridging hypotheses relied on by previous studies do not hold.

Third, I argue that mismatch is a an important and surprisingly common social phenomenon in its own right. In particular when it comes to underqualification, it is also curiously understudied. This stance is more controversial than might appear. Among stratification researchers, there is debate on the ontological status of mismatch. Is it a *subjectively real* condition experienced by workers' themselves?[5] Is it an *heuristic* concept that *analysts* can employ to make sense of social dynamics, but that has no phenomenological validity to actors (in the sense of a relevance in first-person accounts as understood by Martin 2011, p.16)? Is it a mere statistical artifact? Or in the end just a clumsy way to rephrase some long-known truths? On the one hand, this controversy

[5] Results of a qualitative investigation into this question are reflected upon in Grimm (2013). While somewhat preliminary, the conclusions drawn suggest that individuals are well aware of inconsistencies in different status positions they occupy.

arises from a disagreement about how to measure mismatches and from the fact that different ways of measuring it tend to produce different estimates of prevalence and effects (Sloane 2003; Hartog 2000; Quintini 2011; Leuven and Oosterbeek 2011; Verhaest and Omey 2006b; 2006a; Capsada-Munsech 2019b). On the other hand, there are established approaches in the sociology of social stratification and mobility that aim to conceptualize phenomena similar to those which occupy this dissertation *without* making any explicit reference to mismatch at all.[6]

[6] One example is the idea of "direct effects of social origins" (DESO) (Bernardi and Ballarino 2016; Gugushvili, Bukodi, and Goldthorpe 2017; Erikson and Jonsson 1998), which is inspired by the classic OED-model of social reproduction (where social origin (O), education (E), and social destination (D) form a triangle and coefficients on the paths between them describe the dependencies between these concepts in a population). In the OED-model, a direct effect from origins to destinations (net of education) can be interpreted to imply a degree of mismatch: People with a certain background do better or worse than expected on the basis of their education. This is especially true, when destinations are measured in terms of occupational status scales, such as ISEI, which are largely a function of average education in an occupation (Ganzeboom, De Graaf, and Treiman 1992). In this case, the presence of DESO imply access to jobs for which people are over- or underqualified, relative to the average. The literature on "direct effects of social origins" is therefore closely related to the study of social origin effects on mismatches. I examine conceptual and empirical similarities in Chapter 2 and argue that a mismatch-perspective offers some novel *empirical* insights. Note also that a mismatch perspective, and an OED-perspective start from very different points. Mismatch-analysis starts from the actual situation of the individual, a mismatch between occupation and education, as experienced by individuals, and seeks to explain it. An OED-perspective, by contrast, starts from the theoretical construction of the OED-triangle, which, importantly, is defined at the level of a *population*. It then goes on the examine its logical implications. In contrast to mismatch, a DESO can never be directly experienced by individuals. While both approaches talk about similar substantive phenomena, they are therefore representative of different intellectual styles. Mismatches put actors at the center, OED-analyses, much in the tradition of social mobility research generally, population-level statistical relationships.
A related example of a non-mismatch approach with mismatch-implications are studies of occupational attainment at the micro-level, for instance by regressing ISEI-scores on indicators of education-quality for different origin groups (e.g. in Jacob, Klein, and Iannelli 2015; Tomaszewski et al. 2019). In this tradition, the explanandum is occupational status, and de-facto mismatches are only present as the residual of the education-regression. Mismatch-determinants, in turn, are identified as variables that predict occupational status *net* of education-quality. Like in a mismatch-approach, individuals' experience, in this case of their occupational status, is at the center. Note, however, that implicit in this approach is

The position that I seek to defend in the course of this dissertation is that mismatch is a real phenomenon that has quantifiable consequences for the individual. True, different ways to measure mismatch produce different results, because they capture different facets of the phenomenon. But this applies equally to even the most basic concepts in stratification research. Few scholars dispute the use of studying poverty just because there are different techniques to measure it. Everyday understandings of poverty or mismatch may not map exhaustively onto a single measurement. This does not mean, however, that the phenomena they are referring to are unfit for scientific study. It merely asks analysts to specify exactly which aspect of a phenomenon they talk and can legitimately draw conclusions about when they use a certain way of measuring it.

What about the ability of established frameworks to describe mismatch-phenomena without making use of mismatch-language? Is mismatch in the end a superfluous concept? As I have argued in Footnote 6, an explicit mismatch-perspective provides heuristic advantages for explaining mismatch-phenomena over indirect strategies that center on notions like "underachievement". What is more, the fact that their training and their occupation do not line up has important consequences for individuals, as my analyses in the following chapters show. If this is so, it deserves to be studied. Previous approaches might in theory be able to describe such consequences, but they

---

the assumption of a primacy of the individual as a carrier of status-determining variables. These studies ask, which characteristics make individuals over- or underachieve net of their education: Who will get farther compared to the average of their education group? A mismatch-approach, by contrast, tackles the problem from the occupation-side and asks, what characteristics of individuals can *substitute* for formal training in granting access to jobs: Who will get access to occupations for which more education is usually required? Essentially, it asks about employers' needs. A mismatch-approach therefore combines a focus on individual experience with explanations that focus on the interaction of social environments, i.e. jobs, tasks, and firms, and individuals.

rarely have done so. If the language of mismatch helps us to see phenomena other approaches have glossed over, it is warranted.

Mismatches, finally, are also very common. Measurement issues notwithstanding, the best estimates suggest that up to half of all workers are either under- or overqualified for the job they are in (for two summary reports see: Leuven and Oosterbeek 2011; Quintini 2011). Among that mismatched half of workers one fourth to one half, depending on the definition used, has less education than required by their job. Although this, too, constitutes a significant share of all workers, we know even less about this population of underqualified workers than we do about overqualified workers. Mismatches are common and they are consequential, yet poorly understood. This dissertation aims to shed light on this curious phenomenon.

Research questions

How and when does mismatch come about?

The research questions I seek to answer in the following chapters spring from this motivation. The first question is how, and under what circumstances mismatches come about, that is, how they can be explained. There are two sides to this question. One can ask about the micro-dynamics that lead some, but not others, into mismatch. One can also ask, however, under what macro-social conditions mismatch is more likely in the aggregate.

In answering the first kind of question, I dedicate special attention to underqualification. The reason for this focus is that underqualification has received even less attention than overqualification as an employment situation, so there is much less we know about it.[7] My research fills this gap. Compared

[7] A large literature in sociology and labor economics seeks to explain what kinds of workers are most likely to be overqualified. One result is that the overqualified are only sometimes

with overqualification, underqualification is also the more puzzling phenomenon. It is always possible, if not always desirable, to work jobs that require less demanding training than one may have received in the past. But how is it possible for individuals to work jobs that require *more* training than they have received? Drawing on human capital and labor queue theory, as well as on social mobility research, Chapter 2 attempts an answer at the micro-level of individual careers. It turns out that the improbable career of Philip Green is in some respects representative of successful underqualified workers generally.

Chapter 4 addresses the second kind of question on the macro-dynamics of mismatch. In contrast to Chapter 2, it adds the question under which circumstances *over*qualification is likely. Here, the concern is with technological change, globalization, educational expansion, and the change of the occupational structure. In what kind of labor market do we see what kind of mismatch, and how has its incidence changed over time in different countries? The answer to that question has important implications for scholarship on educational expansion, and on education and skill policy.

What are the consequences of mismatch?

The second research question I pursue, asks about the consequences of mismatches. In Chapter 2, I investigate the role of mismatch, in particular of underqualification, for processes of intergenerational mobility and reproduction. In principal, mismatch, under- as well as overqualification, could enhance or stymie intergenerational mobility – depending on who is more likely

over*skilled* – meaning that formal mismatch status can be partially explained by skill-heterogeneity within qualification levels (Levels, van der Velden, and Allen 2014; Capsada-Munsech 2019a; Green and McIntosh 2007; Rohrbach-Schmidt and Tiemann 2016). Other studies further suggest that it is mainly those of lower social backgrounds that are afflicted by overqualification (Capsada-Munsech 2015; 2019a; Erdsiek 2016). Due to language barriers and the limited transportability of human capital, immigrants are also at a higher risk of overqualification (Rafferty 2012; Chiswick and Miller 2008; 2009; 2010; H. Battu and P.J. Sloane 2002; Piracha, Tani, and Vadean 2012).

to be affected by it, the children of lower classes or upper classes. Underqualification could be a way for talented people of underprivileged origins to beat the odds, overcome the well documented disadvantages of lower-class students in the education system, and realize their potential on a less-discriminating labor market. It could also act, however, as a safety net for privileged children without success in the education system. Resources, (non-cognitive) skills and orientations associated with a privileged origin might turn out to be helpful for occupational attainment even after leaving the education system. A priori it is hence far from clear, how underqualification relates to upward social mobility and the reproduction of privilege.

Mismatches may also have more immediate effects on individuals. Chapter 3 is entirely dedicated to these consequences. I investigate whether mismatch changes workers' social and political attitudes and behaviors. Status inconsistency theory suggests that frequent qualification mismatches can have destabilizing effects on societies, as mismatched individuals perceive labor markets as unfair, radicalize politically, and withdraw from social organizations (Lenski 1954). What is an easy question to ask turns out to be a hard question to answer, at least when the main effects of occupation and education are taken into account. So hard in fact that a large literature and a generation of scholars have devoted much attention to it, arguably without much success. In order to tackle this seemingly simple question of longstanding interest, I introduce a novel identification strategy that helps to overcome the stalemate in the previous literature.

How is mismatch related to institutions of the labor market and the education system?

The third research question I ask is about contextual variation in causes, consequences, and patterns. Mismatch is a condition experienced by the

individual. It is, however, closely linked to the structure of the education system and the labor market. Both are institutions that vary widely even across highly developed market economies. A long-standing tradition in sociology is clear about the fact that this variation has significant effects on individual careers, and patterns of status attainment in general. I investigate to what extent such institutional differences are associated with different patterns of mismatch more specifically. As I explain in the following section, this is an overarching question that guides my research design throughout the dissertation.

Research design

An analysis to satisfactorily answer these research questions needs to fulfill different and even somewhat opposing demands. On the one hand, it requires data that are fine-grained enough to allow investigating the micro-mechanisms of how mismatch comes about in the course of individual careers. On the other hand, the data also need to be encompassing enough to permit zooming out to get the big picture of longer-term trends and international variation. To date there is no single, harmonized source of data available to social scientists that allows such varied analyses in the study of mismatches. In the following, I lay out my strategy to build a database from different but comparable sources which allows such inferences and describe the steps I undertake to provide an answer to my research questions.

A multilevel country-comparison approach

The analytic approach taken throughout the following chapters is to use high quality, nationally representative micro-data to examine the process of interest in a fashion that is as detailed as possible. This satisfies the first of the above demands. In order to learn about international variation in patterns and processes, I then replicate the analysis using a comparable data set from an

institutionally different country. Concretely, I rely on a comparison of the United Kingdom to Germany. This allows me to combine the detail and rigor of micro-data panel analysis with a cross-national perspective that is crucial to answer my third research question. Since my research questions are placed at different analytical levels – some asking about micro-level mechanisms, some about macro-level trends – my analytical approach can be described as a multilevel country-comparison. Figure 2 provides a schematic representation of this approach and its relation to the organization of the dissertation.

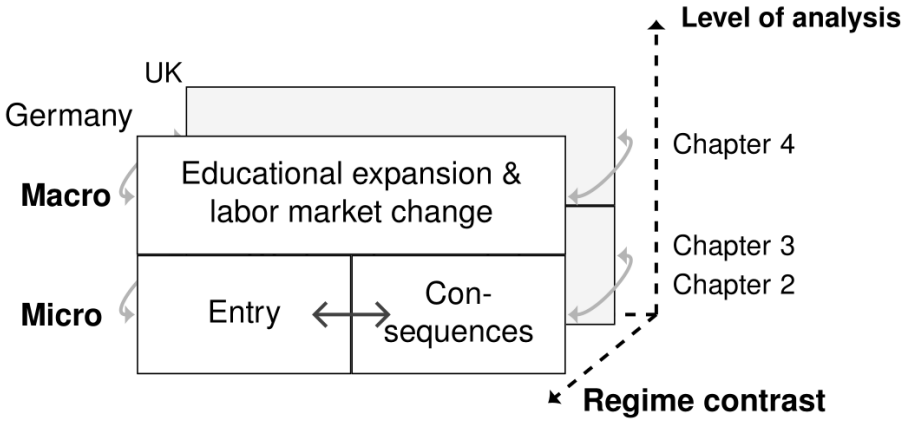


Figure 1-2 A multilevel approach to studying mismatches

In the first and second empirical chapter, I study the micro-dynamics behind individual-level mismatch: Who enters underqualification, what role does mismatch play in the intergenerational transmission of advantage, and what are the individual-level consequences of mismatch more broadly? As the double-headed arrow indicates, both questions are closely related. In the third empirical chapter, I shift my attention to the macro-level and examine how structural forces have changed the aggregate incidence of over- and underqualification in the United Kingdom and Germany since the 1980s.

Throughout all these analyses, I compare results for the United Kingdom and Germany. This means that the individual studies are not just large-N, quantitative population studies. On the country-level they are also case studies of how institutional regimes relate to mismatch patterns and trends. The replication of the analysis in a different context is a powerful guard against overly sweeping generalizations on mismatch phenomena based on a single country-case. At the very least, such a replication demonstrates the robustness of findings. Should the conclusions from the micro-level studies prove indeed similar in the two countries, this is furthermore evidence that the mechanisms at play are fairly general – and take place at a level that is unlikely to by strongly influenced by the workings of nationally specific institutions. If the comparison is set up more strategically – as I do it in chapter 4 – a country comparison can even shed light on how similar processes have operated differently in different countries. In the following section, I explain why the United Kingdom and Germany are especially insightful cases to compare.

Choice of countries

The selection of the two countries is guided by the idea of maximizing institutional difference, while keeping the availability of high-quality longitudinal data in mind. Contrasting Germany to the United Kingdom is somewhat of a classic in comparative stratification research (e.g. with a similar reasoning applied to life-course studies or firms' hiring decisions (Hillmert 2001; Windolf et al. 1988)). Although evolving from similar historical foundations (Thelen 2010), the two country cases occupy opposite positions in a number of typologies of labor market organization (Crouch 1994), skill formation systems (Finegold and Soskice 1988; Allmendinger 1989; Marsden and Ryan 1990), and entire politico-economical production regimes (Hall and Soskice 2001).

High vs. low skill standardization in education?

Moving to concrete differences between the British and the German *education* system, the most obvious one is in their *quantitative* expansion. A higher percentage of all students in the United Kingdom than in Germany undergoes some form of tertiary education (OECD 2019). In Germany, middling apprenticeship programs still attract a large share of youth (Powell and Solga 2011; Jacob and Solga 2015). In Britain high quality vocational education is rare, but a multitude of programs of lesser quality cater to young people who are neither in full-time work nor in tertiary programs (Wolf 2011; Wolf, Jenkins, and Vignoles 2006). Quantitative expansion is an important contextual factor for the study of mismatches, because more graduates of tertiary education mechanically translate into more workers at a relatively high risk of overqualification. More graduates, similarly, mean that less people are at the risk of underqualification. Expansion may also alter the balance of relative skill *supply* (by the education system) and *demand* (by employers) on the labor market (Collins 1979; Horowitz 2018; Araki 2020). If education expands beyond the need of industry for qualified workers, widespread overqualification might ensue. I focus on this hypothesis in Chapter 4.

There are, however, equally important *qualitative* differences between the British and the German education systems, relating to ability tracking, vocational specificity, and the prevalence of dual forms of vocational education and training (Bol and van Werfhorst 2011). The first point, the way in which the selection of students into different tracks and qualifications is organized, has far-ranging consequences both for the signaling value of the credentials produced by an education system and the distribution of actual skills possessed by graduates of different programs (Allmendinger 1989; Bol and van de Werfhorst 2011; Heisig and Solga 2015; Heisig 2018). Although ability tracking in secondary education plays a role in both contexts, it is more salient, more widespread, and more clearly related to previous performance in Germany.

Regarding the second point, the British education system is traditionally regarded as putting an emphasis on general skills that can be exploited in a large range of occupations (e.g. by Hall and Soskice 2001).[8] Germany forms a strong contrast, as its system aims to equip students with relatively highly specialized know-how in vocational training and even tertiary education (Bol et al. 2019; DiPrete et al. 2017; Busemeyer 2009).

Thirdly, in most countries, including the United Kingdom, both academic and vocational education and training overwhelmingly take place in the classroom (cf. Gospel 1994). In Germany, however, many students receive a large share of their vocational education in a dual-system, partly as an apprentice at the workplace, partly at school (Thelen and Busemeyer 2011; Solga et al. 2014; Jacob and Solga 2015). Recent research shows that these institutional differences translate into sizeable differences in the internal skill homogeneity of educational groups (Heisig 2018). In this regard, Germany occupies a middling position internationally. The United Kingdom, by contrast, is the country studied with the most skill heterogeneity within educational groups among those with at least intermediate education. In other words, the nominal level of a British qualification is relatively uninformative about the actual ability of their holder, while this is not true for Germany.

Ceteris paribus, occupational boundaries are therefore more salient in countries like Germany where tertiary and vocational education tend to be occupation-specific and where popular and functioning dual apprenticeship systems channel students into clearly defined occupational profiles early on. There should therefore be less vertical mismatch in German than in the United

[8] Many reforms since the 1980s have, however, have aimed to change that by incentivizing the uptake of highly specialized, vocational qualifications. The overwhelming failure of these reforms with respect to esteem and popularity of the resultant qualifications among both students and employers can be counted among one of the reasons why so many British students choose to go to university (Wolf, Jenkins, and Vignoles 2006; Wolf 2011; 2002; Gospel 1998; Fuller and Unwin 2009).

Kingdom. For the same reason, we would, however, expect that consequences of mismatch, when it occurs, are stronger in Germany with its tighter education-occupation link than in the United Kingdom (see also the results in Bol et al. 2019; DiPrete et al. 2017; Di Stasio, Bol, and Van de Werfhorst 2016).

Occupational vs. individualistic labor markets?

Not only education systems, the structure of labor markets, too, varies widely between the United Kingdom and Germany. These differences can partly be related to corresponding differences in education systems. Where labor market entrants are comparatively less, and less transparently, stratified regarding the level and the area of their skills, like in the United Kingdom, good matches between worker-skills and job-requirements will take longer to achieve, and be overall less frequent (DiPrete et al. 2017; Levels, van der Velden, and Di Stasio 2014; Shavit and Müller 1998). Sorting processes after, as opposed to prior to, labor market entry are comparatively more important. The results is increased occupational mobility and a reduced salience of occupations to both workers and employers (Longhi and Brynin 2010). In consequence, both under- and overqualification should be more prevalent, but less consequential, in such contexts.

According to a longstanding argument in the political economy literature, the structure of the labor market can be important in an even more fundamental way. Different occupation-groups require a different degree of specialization in their workers (Hall and Soskice 2001; Estevez-Abe, Iversen, and Soskice 2001; Streeck 2011). Many service-occupations, both at the lower (waiters, shop attendants) and at the upper (management, marketing) end of the labor market require generalists. Many production-related occupations, by contrast, require relatively high skill-specificity in workers at different skill-levels (technicians, engineers) (Streeck 1991). This makes unusual careers more likely in the service than in the manufacturing fields. Likewise, countries in which the

manufacturing sector plays a larger role should see less occupational mobility and hence less mismatches.

Labor market institutions and mismatch

A third dimension on which British and German labor market contexts differ is the presence and strength of institutions such as unions, collective bargaining, and work councils at the company level (Crouch 1994; Streeck 1991). Where organized labor is strong and well established, there should be less mismatch. From the standpoint of insider-workers and unions, mismatch is undesirable. Overqualification means that a worker's remuneration and work content is not adequate to his or her level of training. Underqualification should be even more unwelcome to the established parts of the workforce. Formal qualifications have always been not just a certification of technical skills, but also a means of social closure (Weber 1922 Chapter 1, §10; Collins 1971; Parkin 1974). Qualification requirements limit the labor supply available in a given occupation. This allows workers in that position to improve their bargaining position vis a vis management and to extract rents that would not be available in a strictly competitive labor market (Sørensen 2000).[9] Skilled workers currently in employment have therefore a strong interest in effectively enforced qualification requirements. If an employer was to hire less-skilled workers for a job, which is usually filled with qualified workers, this would undercut the latter's bargaining position.

Labor market insiders, like established skilled workers, are the core constituency of unions. Unions thus have powerful incentives to enforce qualification matching and to oppose management attempts to erode insider-rents by recruiting underqualified workers. This is why formal qualification

[9] Historically, limiting the supply of labor available to a company has been the dominant strategy by local trade unions to pressure for increased wages in the United Kingdom. In effect, union officials decided who could apply for a job (Thelen 2010, Chapter 3). Mandatory qualification requirements fulfill a very similar function.

requirements for certain occupations are often explicitly defined in the pay-scales of collective agreements. Where collective bargaining is well established and collective agreements cover significant shares of the workforce, formal entry requirements to positions are thus clearly defined. The existence of works councils and the presence of employee representatives in hiring committees, finally, means that unions have some leverage to enforce these rules. A final hypothesis regarding contextual determinants of mismatch patterns is therefore that mismatch and especially underqualification should be less common where labor organizations, collective bargaining, and union influence on hiring are stronger.

Arguments like these suggest that mismatch is a highly context-dependent phenomenon. My dissertation examines, in how far the incidence, the predictors, and the consequences of mismatch vary across countries with very different institutional set-ups in the labor market and the education system.

The logic of comparison

Inference about the causal effect of a single institution or even a single typological dimension of difference is not the goal of this dissertation. With just two data points and many potential variables, this is any way logically impossible. On a substantive level, it should be clear that countries' education and labor market regimes are not an arbitrary assortment of different institutions. Political science scholarship extensively shows how education systems and labor market institutions have co-evolved from their foundations in the middle-ages in close interdependence (Trampusch 2010; Busemeyer and Trampusch 2012). Links between different institutions are however not just historical (Thelen 2010), they are arguably functional as well (Hall and Soskice 2001). This means that different kinds of institutions, say, the way vocational training is organized, cannot be appreciated in isolation. The context of their

institutional environment is crucial to understand their effect on sociological processes – hence the common heuristic of institutional *regimes*.

Comparing outcomes between two very different regimes allows for two possible inferences: If no difference is found, this is strong evidence that the process under study is likely independent from institutional context. If a difference is found, it likely lies at the upper bound of possible variation that exists between contexts from the population of highly developed market economies. A comparison such as the one undertaken in the following studies is therefore always explorative in the sense that it outlines the extent of contextual variation in the processes studied.

Data sources

The empirical work in this dissertation is for the most part based on longitudinal individual-level panel survey data collected in the United Kingdom and Germany. For Germany, I mainly rely on data collected by the German Socio-Economic Panel Study (GSOEP, Wagner, Frick, and Schupp 2007), while for the United Kingdom, I use data from the UK Household Longitudinal Study (UKLHS, Buck and McFall 2011). These datasets are among the largest, longest-running and highest quality panel-survey datasets available to social scientists. They are very similar in sampling strategy, questionnaire design, and content. It is hence possible to derive comparable measures from these two datasets and perform longitudinal analyses of micro-dynamics largely in parallel. The concrete analytical steps taken for each study are described in detail in the respective chapters and their appendices.

For the historical analyses in Chapter 4, I resort to a trend-file of seven harmonized cross-sectional data sets from the UK, the Skills and Employment Surveys Series Dataset (UKSESS, Felstead et al. 2014), which offer additional self-assessment-based measures of under- and overqualification for the United Kingdom which are necessary to compare mismatch incidence over

time. In that chapter, I also include information from official labor market surveys, the (Quarterly) Labor Force Survey of the United Kingdom (Northern Ireland Statistics and Social Survey Division Office For National Statistics 2019), and the German Mikrozensus (DESTATIS and GESIS 2017). These datasets are even larger than the panel studies and hence allow me to precisely estimate labor market contexts' characteristics, which take center stage in that chapter.

Plan of the dissertation

In the remainder of this text I present three empirical studies on the causes, consequences, and wider implications of qualification-to-job mismatches. Each study is presented in a separate chapter and is intended to function as a self-contained essay that can be published in a refereed social science journal. A final concluding chapter summarizes the contributions of the three studies for the sociology of labor markets, social mobility, and educational expansion in light of the above research questions.

The empirical investigation starts out in Chapter 2, which is co-authored with Merlin Schaeffer.[10] In line with the schematism of Figure 2, we begin by asking how it is possible that a sizeable share of the labor force ends up in occupations for which more education is required than they have. We draw on human capital and queuing theory to propose different mechanisms. We identify those mechanisms with different personality traits that allow some individuals to access occupations in which most workers command over higher

[10] The broad topic of this chapter, undereducation, is due to Merlin Schaeffer. Conceptual work on this chapter was shared between Schaeffer and Jonas Wiedner, who decided on the kinds of analysis to be performed, drew attention to cognitive and non-cognitive skills and contributed the focus on intergenerational mobility. All empirical analyses and data preparation were carried out by Wiedner. Writing was shared between Schaeffer and Wiedner, with the first largely being responsible for the introduction, and the section on skills, and Wiedner for the rest. Revisions and further editing was equally shared.

qualifications than they do. Building on insights of social mobility research, we further argue that the resources conveyed through parents' social status are of great importance in explaining underqualification. Empirically, we rely on a longitudinal analysis of the careers of respondents from the UKHLS and SOEP. To gain analytical leverage, we distinguish between two ways of moving into underqualification: entry from outside the employing organization and promotion. Our results show that persons whose (non-)cognitive skills exceed their formal education are more likely to be underqualified in the cross-section and to enter underqualification employment or be promoted into it. Parental socio-economic status is a similarly important predictor of these outcomes. Using decomposition techniques, we can even trace a significant share of the effects of (non-)cognitive skills to it. To complete our intergenerational argument, we finally demonstrate that undereducation acts as an important pathway in the intergenerational reproduction of earnings inequality – more so, in fact, than the avoidance of overeducation. These results are remarkably similar across the United Kingdom and Germany, although some country differences suggest higher skill-induced career mobility in Britain and stronger origin effects in Germany.

In Chapter 3, I focus squarely on the consequences of mismatches for the individual. In doing so, I revisit the old debate on the concept of status inconsistency. Subject of this debate is the question, whether there are independent effects of a mismatch between different status-dimensions, such as education and occupation, on individual's social and political attitudes and behaviors. The challenge in testing this claim is that statistical models to quantify the independent effects of occupation, education, and mismatch are not identified. This problem has led to a large but contradictory literature where different methodological fixes are proposed and employed. I review these methods and show that they generally do not answer the purported research question. Inspired by recent work in the modelling of age-period and cohort effects, I

then introduce a novel identification strategy that relies on weaker, more general, and transparent assumptions. Empirical results of OLS and fixed-effects models employing this new technique show that mismatch has independent effects on well-being, identity, and social integration – but not on political variables. This suggests that mismatch is an important concept in studying the subjective experience of social stratification. As in Chapter 2, there is only very limited evidence of country differences.

In the final empirical chapter, I zoom out from the individual level and examine historical trends in mismatch-incidence. This step documents, firstly, that mismatch-patterns need to be understood in their historical and labor market context. Secondly, it shows how a mismatch-perspective can lend analytical leverage to problems that have not previously been studied through a mismatch-lens. On a substantive level, Chapter 4 investigates the relationship between labor market change, the expansion of education, and qualification-to-job mismatch. While educational expansion is recognized by sociologist as one of the major forces shaping social change, it remains debated whether it has outstripped the demand for qualified labor. The chapter therefore asks, to what degree the sharp expansion of education has been absorbed by the changing labor markets in the United Kingdom and Germany. I show that overqualification has increased and underqualification decreased in the United Kingdom since the 1980s, both over historical time and over cohorts. In West Germany, by contrast, mismatch-differences are minimal between cohorts, but the overall incidence of underqualification increased, whereas overqualification decreased. Further analyses of cohort-differences in mismatch provide clear evidence that overqualification increased with educational expansion in the United Kingdom but not in Germany. These findings document that the United Kingdom experiences credential inflation, whereas West Germany is affected by a mild skill-shortage, mainly among middling positions that require vocational training. The chapter thus shows that differences in

patterns of educational expansion and labor market change, which are rooted in the contrasting institutional logics discussed above, have a crucial effect on aggregate levels of mismatch.

The concluding chapter revisits the three research questions raised above and examines the empirical results of the three studies for answers. I put special emphasis on how the combined findings shed light on my third research question regarding the relationship between institutions and mismatch patterns. The final chapter also takes stock of the contributions the dissertation can make to various current debates in sociology and policy. I then sum up the lessons of my research for future studies.

Literature

Allmendinger, Jutta. 1989. “Educational Systems and Labor Market Outcomes.” *European Sociological Review* 5 (3): 231–250.

Araki, Satoshi. 2020. “Educational Expansion, Skills Diffusion, and the Economic Value of Credentials and Skills.” *American Sociological Review* 85 (1): 128–75. https://doi.org/10.1177/0003122419897873.

Bernardi, Fabrizio, and Gabriele Ballarino. 2016. “Education as the Great Equalizer: A Theoretical Framework.” In *Education, Occupation and Social Origin: A Comparative Analysis of the Transmission of Socio-Economic Inequalities*.

Blau, Peter Michael, and Otis Dudley Duncan. 1978. *The American Occupational Structure*. Free Press.

Bol, Thijs, Christina Ciocca Eller, Herman G. van de Werfhorst, and Thomas A. DiPrete. 2019. “School-to-Work Linkages, Educational Mismatches, and Labor Market Outcomes.” *American Sociological Review* 84 (2): 275–307. https://doi.org/10.1177/0003122419836081.

Bol, Thijs, and Herman G. van de Werfhorst. 2011. “Signals and Closure by Degrees: The Education Effect across 15 European Countries.” *Research in Social Stratification and Mobility* 29 (1): 119–32. https://doi.org/10.1016/j.rssm.2010.12.002.

Bol, Thijs, and Herman van Werfhorst. 2011. “Measuring Educational Institutional Diversity: External Differentiation, Vocational Orientation and Standardization.” mimeo. http://amcis.uva.nl/binaries/content/assets/subsites/amsterdam-centre-for-inequality-studies/amcis_wp_2011_1_bol_werfhorst.pdf.

Buck, Nick, and Stephanie McFall. 2011. “Understanding Society: Design Overview.” *Longitudinal and Life Course Studies* 3 (1): 5–17.

Busemeyer, Marius R. 2009. “Asset Specificity, Institutional Complementarities and the Variety of Skill Regimes in Coordinated Market Economies.” *Socio-Economic Review* 7 (3): 375–406. https://doi.org/10.1093/ser/mwp009.

Busemeyer, Marius R., and Christine Trampusch. 2012. *The Political Economy of Collective Skill Formation*. OUP Oxford.

Capsada-Munsech, Queralt. 2015. "The Role of Social Origin and Field of Study on Graduates' Overeducation: The Case of Italy." *Higher Education* 69 (5): 779–807. https://doi.org/10.1007/s10734-014-9805-2.

———. 2019a. "Overeducation, Skills and Social Background: The Influence of Parental Education on Overeducation in Spain." *Compare: A Journal of Comparative and International Education* 50 (2): 216–36. https://doi.org/10.1080/03057925.2019.1579085.

———. 2019b. "Measuring Overeducation: Incidence, Correlation and Overlaps Across Indicators and Countries." *Social Indicators Research* 145 (1): 279–301. https://doi.org/10.1007/s11205-019-02112-0.

Chiswick, Barry R., and Paul W. Miller. 2008. "Why Is the Payoff to Schooling Smaller for Immigrants?" *Labour Economics* 15 (6): 1317–40. https://doi.org/10.1016/j.labeco.2008.01.001.

———. 2009. "Earnings and Occupational Attainment among Immigrants1." *Industrial Relations: A Journal of Economy and Society* 48 (3): 454–465.

———. 2010. "The Effects of Educational-Occupational Mismatch on Immigrant Earnings in Australia, with International Comparisons." *International Migration Review* 44 (4): 869–98. https://doi.org/10.1111/j.1747-7379.2010.00829.x.

Collins, Randall. 1971. "Functional and Conflict Theories of Educational Stratification." *American Sociological Review* 36 (6): 1002–19. https://doi.org/10.2307/2093761.

———. 1979. *The Credential Society : An Historical Sociology of Education and Stratification*. New York : Academic Press. https://trove.nla.gov.au/version/10058848.

Crouch, Colin. 1994. *Industrial Relations And European State Traditions*. Reprint. Oxford England; New York: Oxford University Press, U.S.A.

DESTATIS, and GESIS. 2017. "Wichtige Informationen zur Nutzung des Mikrozensus Scientific Use Files 2013." https://www.gesis.org/missy/files/documents/MZ/readme/readme_suf2013.pdf.

Di Stasio, Valentina, Thijs Bol, and Herman G. Van de Werfhorst. 2016. "What Makes Education Positional? Institutions, Overeducation and the Competition for Jobs." *Research in Social Stratification and Mobility* 43 (March): 53–63. https://doi.org/10.1016/j.rssm.2015.09.005.

DiPrete, Thomas A., Thijs Bol, Christina Ciocca Eller, and Herman G. van de Werfhorst. 2017. "School-to-Work Linkages in the United States, Germany, and France." *American Journal of Sociology* 122 (6): 1869–1938. https://doi.org/10.1086/691327.

Erdsiek, Daniel. 2016. "Overqualification of Graduates: Assessing the Role of Family Background." *Journal for Labour Market Research* 49 (3): 253–68. https://doi.org/10.1007/s12651-016-0208-y.

Erikson, Robert, and Jan O. Jonsson. 1998. "Social Origin as an Interest-Bearing Asset: Family Background and Labour-Market: Rewards among Employees in Sweden." *Acta Sociologica* 41 (1): 19–36.

Estevez-Abe, Margarita, Torben Iversen, and David Soskice. 2001. "Social Protection and the Formation of Skills: A Reinterpretation of the Welfare State." In *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*, edited by Peter A. Hall and David Soskice. Oxford, UK: Oxford University Press. https://www.oxfordscholarship.com/view/10.1093/0199247757.001.0001/acprof-9780199247752-chapter-4.

Felstead, Gallie, Green, and Inanc. 2014. "Skills and Employment Surveys Series Dataset, 1986, 1992, 1997, 2001, 2006 and 2012." Colchester, Essex: UK Data Archive. https://doi.org/10.5255/UKDA-SN-7467-2.

Finegold, David, and David Soskice. 1988. "The Failure of Training in Britain: Analysis and Prescription." *Oxford Review of Economic Policy* 4 (3): 21–53. https://doi.org/10.1093/oxrep/4.3.21.

Friedman, Sam, and Daniel Laurison. 2019. *The Class Ceiling: Why It Pays to Be Privileged*. Bristol, UK ; Chicago, IL: Policy Press.

Fuller, Alison, and Lorna Unwin. 2009. "Change and Continuity in Apprenticeship: The Resilience of a Model of Learning." *Journal of Education and Work* 22 (5): 405–16. https://doi.org/10.1080/13639080903454043.

Ganzeboom, Harry B. G., Paul M. De Graaf, and Donald J. Treiman. 1992. "A Standard International Socio-Economic Index of Occupational Status."

Social Science Research 21 (1): 1–56. https://doi.org/10.1016/0049-089X(92)90017-B.

Gospel, Howard. 1994. "The Survival of Apprenticeship Training: A British, American, Australian Comparison." *British Journal of Industrial Relations* 32 (4): 505–22. https://doi.org/10.1111/j.1467-8543.1994.tb01048.x.

———. 1998. "The Revival of Apprenticeship Training in Britain?" *British Journal of Industrial Relations* 36 (3): 435–57. https://doi.org/10.1111/1467-8543.00101.

Green, Francis, and Steven McIntosh. 2007. "Is There a Genuine Under-Utilization of Skills amongst the over-Qualified?" *Applied Economics* 39 (4): 427–39. https://doi.org/10.1080/00036840500427700.

Grimm, Natalie. 2013. "Statusinkonsistenz revisited! Prekarisierungsprozesse und soziale Positionierung." *WSI-Mitteilungen* 66 (2): 89–97. https://doi.org/10.5771/0342-300X-2013-2-89.

Gugushvili, Alexi, Erzsébet Bukodi, and John H. Goldthorpe. 2017. "The Direct Effect of Social Origins on Social Mobility Chances: 'Glass Floors' and 'Glass Ceilings' in Britain." *European Sociological Review* 33 (2): 305–16.

H. Battu, and P.J. Sloane. 2002. "To What Extent Are Ethnic Minorities in Britain Over-educated?" *International Journal of Manpower* 23 (3): 192–208. https://doi.org/10.1108/01437720210432194.

Hall, Peter A., and David Soskice. 2001. "Introduction to Varieties of Capitalism." In *Varieties of Capitalism. The Institutional Foundations of Comparative Advantage*, 1–68. Oxford, New York: Oxford University Press.

Hartog, Joop. 2000. "Over-Education and Earnings: Where Are We, Where Should We Go?" *Economics of Education Review* 19 (2): 131–147.

Heisig, Jan Paul. 2018. "Measuring the Signaling Value of Educational Degrees: Secondary Education Systems and the Internal Homogeneity of Educational Groups." *Large-Scale Assessments in Education* 6 (1): 9. https://doi.org/10.1186/s40536-018-0062-1.

Heisig, Jan Paul, and Heike Solga. 2015. "Secondary Education Systems and the General Skills of Less- and Intermediate-Educated Adults A Comparison of 18 Countries." *Sociology of Education* 88 (3): 202–25. https://doi.org/10.1177/0038040715588603.

Hillmert, Steffen. 2001. *Ausbildungssysteme und Arbeitsmarkt*. Wiesbaden: VS Verlag für Sozialwissenschaften. http://link.springer.com/10.1007/978-3-663-07908-8.

Horowitz, Jonathan. 2018. "Relative Education and the Advantage of a College Degree." *American Sociological Review* 83 (4): 771–801. https://doi.org/10.1177/0003122418785371.

Jacob, Marita, Markus Klein, and Cristina Iannelli. 2015. "The Impact of Social Origin on Graduates' Early Occupational Destinations—An Anglo-German Comparison." *European Sociological Review* 31 (4): 460–76. https://doi.org/10.1093/esr/jcv006.

Jacob, Marita, and Heike Solga. 2015. "Germany's Vocational Education and Training System in Transformation: Changes in the Participation of Low- and High-Achieving Youth Over Time." *European Sociological Review* 31 (2): 161–71. https://doi.org/10.1093/esr/jcv016.

Kalleberg, Arne L. 2008. "The Mismatched Worker: When People Don't Fit Their Jobs." *The Academy of Management Perspectives* 22 (1): 24–40.

Lenski, Gerhard E. 1954. "Status Crystallization: A Non-Vertical Dimension of Social Status." *American Sociological Review* 19 (4): 405–13. https://doi.org/10.2307/2087459.

Leuven, Edwin, and Hessel Oosterbeek. 2011. "Overeducation and Mismatch in the Labor Market." In *Handbook of the Economics of Education*, edited by Eric A. Hanushek, Stephen Machin, and Ludger Woessmann, 4:283–326. Elsevier.

Levels, M., R. van der Velden, and J. Allen. 2014. "Educational Mismatches and Skills: New Empirical Tests of Old Hypotheses." *Oxford Economic Papers* 66 (4): 959–82. https://doi.org/10.1093/oep/gpu024.

Levels, M., R. van der Velden, and V. Di Stasio. 2014. "From School to Fitting Work: How Education-to-Job Matching of European School Leavers Is Related to Educational System Characteristics." *Acta Sociologica* 57 (4): 341–61. https://doi.org/10.1177/0001699314552807.

Longhi, Simonetta, and Malcolm Brynin. 2010. "Occupational Change in Britain and Germany." *Labour Economics* 17 (4): 655–66. https://doi.org/10.1016/j.labeco.2010.02.001.

Lucas, Suzanne. 2018. “Why Your Barista Probably Has a College Degree.” Inc.Com. April 10, 2018. https://www.inc.com/suzanne-lucas/why-that-barista-has-a-college-degree-grade-inflation.html.

Marsden, David, and Paul Ryan. 1990. “Institutional Aspects of Youth Employment and Training Policy in Britain.” *British Journal of Industrial Relations* 28 (3): 351–69. https://doi.org/10.1111/j.1467-8543.1990.tb01000.x.

Martin, John Levi. 2011. *The Explanation of Social Action*. Oxford ; New York: Oxford University Press.

McGuinness, Seamus, and Peter J. Sloane. 2011. “Labour Market Mismatch among UK Graduates: An Analysis Using REFLEX Data.” *Economics of Education Review* 30 (1): 130–45. https://doi.org/10.1016/j.econedurev.2010.07.006.

Menze, Laura. 2017. “Horizontale und vertikale Adäquanz im Anschluss an die betriebliche Ausbildung in Deutschland.” *KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie* 69 (1): 79–107. https://doi.org/10.1007/s11577-016-0397-y.

Moerbeek, Hester, and Henk Flap. 2008. “Social Resources and Their Effect on Occupational Attainment through the Life Course.” In *Social Capital: An International Research Program*, edited by Nan Lin and Bonnie Erickson. Oxford: Oxford University Press. https://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780199234387.001.0001/acprof-9780199234387-chapter-7.

Northern Ireland Statistics, and Social Survey Division Office For National Statistics. 2019. “QLFSQuarterly Labour Force Survey, 1992-Quarterly Labour Force Survey, April - June, 2018.” https://doi.org/10.5255/UKDA-SN-8381-3.

OECD. 2019. *Education at a Glance 2019: OECD Indicators*. Education at a Glance. OECD. https://doi.org/10.1787/f8d7880d-en.

Parkin, Frank. 1974. “Strategies of Social Closure in Class Formation.” In *The Social Analysis of Class Structure*, 1–18. London: Tavistock.

Piracha, Matloob, Massimiliano Tani, and Florin Vadean. 2012. “Immigrant Over-and under-Education: The Role of Home Country Labour Market Experience.” *IZA Journal of Migration* 1 (1): 1.

Powell, Justin J. W., and Heike Solga. 2011. "Why Are Higher Education Participation Rates in Germany so Low? Institutional Barriers to Higher Education Expansion." *Journal of Education and Work* 24 (1–2): 49–68. https://doi.org/10.1080/13639080.2010.534445.

Quintini, Glenda. 2011. "Over-Qualified or Under-Skilled." OECD Social, Employment and Migration Working Papers. Paris: Organisation for Economic Co-operation and Development. http://www.oecd-ilibrary.org/content/workingpaper/5kg58j9d7b6d-en.

Rafferty, Anthony. 2012. "Ethnic Penalties in Graduate Level Over-Education, Unemployment and Wages: Evidence from Britain." *Work, Employment & Society* 26 (6): 987–1006.

Rohrbach-Schmidt, Daniela, and Michael Tiemann. 2016. "Educational (Mis) Match and Skill Utilization in Germany: Assessing the Role of Worker and Job Characteristics." *Journal for Labour Market Research*, 1–21.

Sánchez-Sánchez, Nuria, and Seamus McGuinness. 2015. "Decomposing the Impacts of Overeducation and Overskilling on Earnings and Job Satisfaction: An Analysis Using REFLEX Data." *Education Economics* 23 (4): 419–32. https://doi.org/10.1080/09645292.2013.846297.

Shavit, Yossi, and Walter Müller, eds. 1998. *From School to Work: A Comparative Study of Educational Qualifications and Occupational Destinations*. 1 edition. Oxford : New York: Clarendon Press.

Sloane, Peter J. 2003. "Much Ado about Nothing? What Does the Overeducation Literature Really Tell Us." In *Overeducation in Europe*, edited by Felix Büchel, Andries De Grip, and Antje Mertens, 11–45. Cheltenham, UK: Edward Elgar. https://books.google.com/books?hl=en&lr=&id=n_RBL3etgUcC&oi=fnd&pg=PA11&dq=%22effects+are+returns+specific+to+educational+credentials+in+contrast+to+accumulated+years+of%22+%22on+the+level+of+earnings+in+both+the+short-run+and+the+long-run%3F+If+there+is%22+&ots=z9IcpxpzrW&sig=HqPuEpycKoComHpOoMmGOptl-2c.

Solga, Heike, Paula Protsch, Christian Ebner, Christian Brzinsky-Fay, and others. 2014. "The German Vocational Education and Training System: Its Institutional Configuration, Strengths, and Challenges." Social

Science Research Center Berlin (WZB). https://ideas.repec.org/p/zbw/wzbslm/spi2014502.html.

Sørensen, Aage B. 2000. "Toward a Sounder Basis for Class Analysis." *American Journal of Sociology* 105 (6): 1523–58. https://doi.org/10.1086/210463.

Streeck, Wolfgang. 1991. "On the Institutional Conditions of Diversified Quality Production." In *Beyond Keynesianism*, edited by Egon Matzner and Wolfgang Streeck, 21–61. Cheltenham: Edward Elgar.

———. 2011. "Skills and Politics: General and Specific." In *The Political Economy of Collective Skill Formation*, edited by Marius R. Busemeyer and Christine Trampusch, 316–52. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199599431.003.0012.

Thelen, Kathleen. 2010. *How Institutions Evolve: The Political Economy of Skills in Germany, Britain, the United States, and Japan*. Cambridge ; New York: Cambridge University Press.

Thelen, Kathleen, and Marius R. Busemeyer. 2011. "Institutional Change in German Vocational Training: From Collectivism toward Segmentalism." In *The Political Economy of Collective Skill Formation*, edited by Marius R. Busemeyer and Christine Trampusch, 68–100. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199599431.003.0003.

Tomaszewski, Wojtek, Francisco Perales, Ning Xiang, and Matthias Kubler. 2019. "Beyond Graduation: Socio-Economic Background and Post-University Outcomes of Australian Graduates." *Research in Higher Education*, October. https://doi.org/10.1007/s11162-019-09578-4.

Trampusch, Christine. 2010. "Co-Evolution of Skills and Welfare in Coordinated Market Economies? A Comparative Historical Analysis of Denmark, the Netherlands and Switzerland." *European Journal of Industrial Relations* 16 (3): 197–220. https://doi.org/10.1177/0959680110375129.

Vaisey, Stephen. 2006. "Education and Its Discontents: Overqualification in America, 1972–2002." *Social Forces* 85 (2): 835–864.

Verhaest, Dieter, and Eddy Omey. 2006a. "The Impact of Overeducation and Its Measurement." *Social Indicators Research* 77 (3): 419–48. https://doi.org/10.1007/s11205-005-4276-6.

———. 2006b. “Measuring the Incidence of Over- and Undereducation.” *Quality & Quantity* 40 (5): 783–803. https://doi.org/10.1007/s11135-005-3955-3.

Vincent, Sally. 2004. “Sally Vincent Meets Retail Entrepreneur Philip Green.” *The Guardian*, October 23, 2004, sec. Business. https://www.theguardian.com/business/2004/oct/23/highstreetretailers.marksspencer.

Wagner, Gert G., Joachim R. Frick, and Jürgen Schupp. 2007. “The German Socio-Economic Panel Study (SOEP)-Evolution, Scope and Enhancements.” http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1028709.

Weber, Max. 1922. *Wirtschaft Und Gesellschaft*. Tübingen: Mohr.

Windolf, Paul, Stephen Wood, H. W. Hohn, and T. Manwaring. 1988. *Recruitment and Selection in the Labour Market: A Comparative Study of Britain and West Germany*. Aldershot, Hants England ; Brookfield, Vt: Avebury.

Wolf, Alison. 2002. *Does Education Matter? Myths About Education and Economic Growth*. Penguin Books Limited.

———. 2011. “Review of Vocational Education: The Wolf Report.”

Wolf, Alison, Andrew Jenkins, and Anna Vignoles. 2006. “Certifying the Workforce: Economic Imperative or Failed Social Policy?” *Journal of Education Policy* 21 (5): 535–65. https://doi.org/10.1080/02680930600866124.

2 Career Trajectories into Undereducation.

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

Co-authored with Prof. Dr. Merlin Schaeffer, Department of Sociology, University of Copenhagen.

This chapter has been published in Research in Social Stratification and Mobility, Volume 68, August 2020,
doi: https://doi.org/10.1016/j.rssm.2020.100526

* Parts of this paper were presented at the RC28 Spring Meeting 2018, the DGS-Kongress 2018, the ECSR meeting 2018 and in seminars at University of Cologne, University of Essex, University of Copenhagen, and Rockwool Fonden. We thank participants for their helpful feedback. We are particularly indebted to Marita Jacob, Johannes Giesecke and Sarah Carol for helpful comments and suggestions.

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.

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-á-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.

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.[11]

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

[11] 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.

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.

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.[12]

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 research 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

[12] 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.

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.

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.

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:

$$\text{Undereducation}_{ijk} = \mathbb{1}(\text{Edu}_{ijk} < (\overline{\text{Edu}_{jk}} - \text{SD}(\text{Edu}_{jk}))),$$

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-á-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).

Predictor Variables

The key predictors of our analyses are respondents' cognitive and non-cognitive skills, and parental SES. Table 1 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[13]

[13] 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

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.[14] 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.

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

beyond my control' with a six-point scale ranging from `strongly disagree' to `strongly agree".

[14] For the UKHLS, we obtain ISEI-values through a translation routine pro-vided by the CAMSIS project (Lambert & Prandy, 2008).

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.[15] 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.

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-

[15] 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 (UKHSL) and two-digit NACE (SOEP).

)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 1. All our longitudinal analyses make use of the consecutively measured undereducation indicator (indicated by O in Table 2-1). We z-standardize all continuous predictors and report LPM coefficients in terms of percentage points (pp.).

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

Table 2-2-1 Timing of measurements

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 unemployed, 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.

Results

According to our realized matches indicator and population definition, considerable shares of 14.04% (±0.60 percentage points (pp.)) and 12.35% (± 0.90pp.) 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?

Probability of undereducation

Figure 2-1 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 2-1 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.

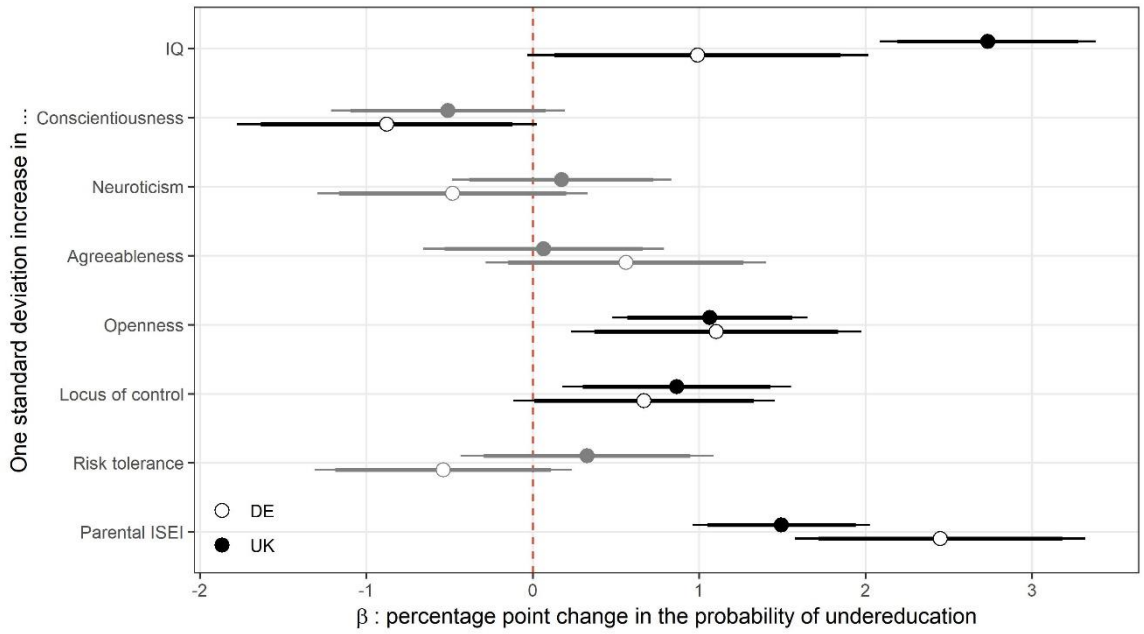


Figure 2-1 Linear probability models predicting undereducation

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 schooling², 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 2-1, 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 3 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.

Career trajectories into undereducation

What are typical career trajectories into undereducation? Table 2-2 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.

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

Table 2-1-2 Outflow and inflow rates into undereducation (in %)

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 2-2 presents results of two model specifications. Model 1 mirrors the design of the model presented in Figure 2-1, 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.

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 2-2 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.

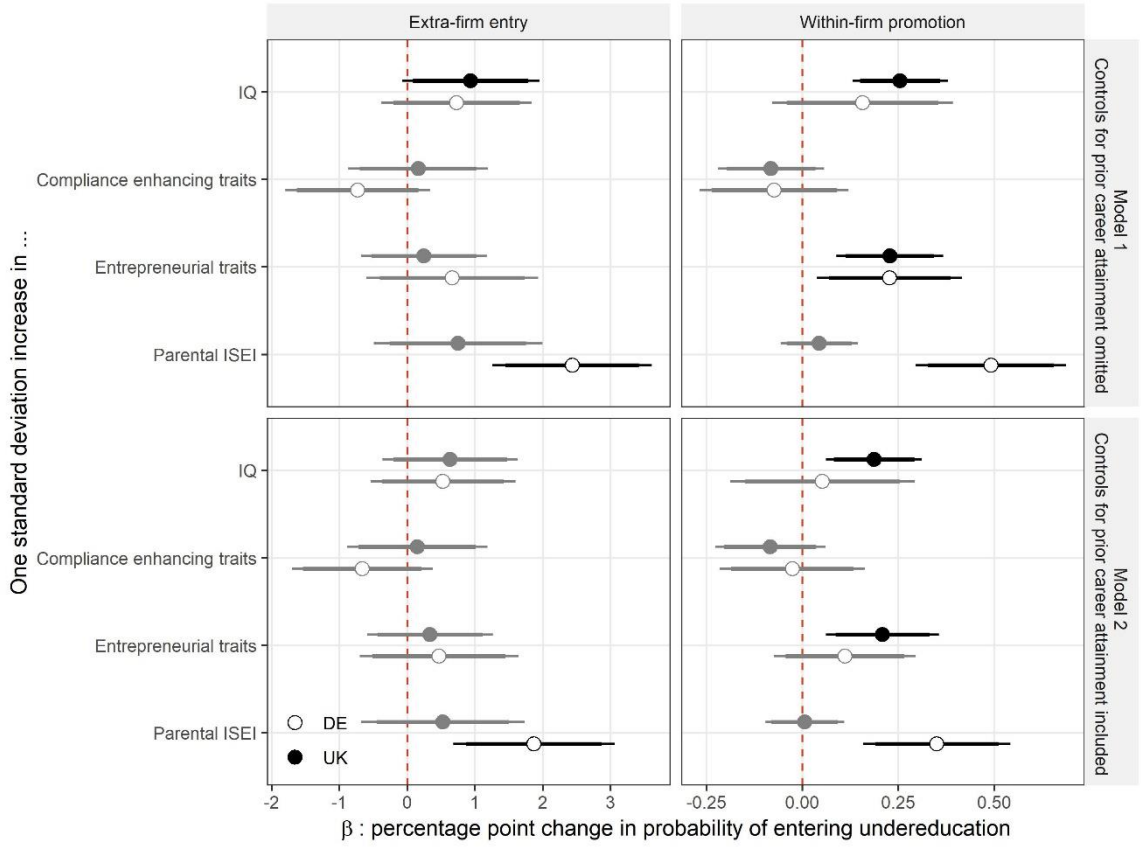


Table 2-2 Linear probability models predicting entry into undereducation

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). $n_{obs,\ UK,\ promotions} = 27{,}594, n_{persons,\ UK,\ promotions} = 10{,}256, n_{obs,\ UK,\ extra\text{-}firm\ entry} = 3{,}696, n_{persons,\ UK,\ extra\text{-}firm\ entry} = 3{,}191;\ n_{obs,\ DE,\ promotion} = 53{,}304, n_{persons,\ DE,\ promotion} = 13{,}904, n_{obs,\ DE,\ extra\text{-}firm\ entry} = 7{,}161, n_{persons,\ DE,\ extra\text{-}firm\ entry} = 4{,}926.$ *Full regression results are displayed in Table B.2 in the Online Supplement.*

Figure 2-2 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.

Mechanisms of parental SES effects on undereducation

Figure 2-1 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 2-1) 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.

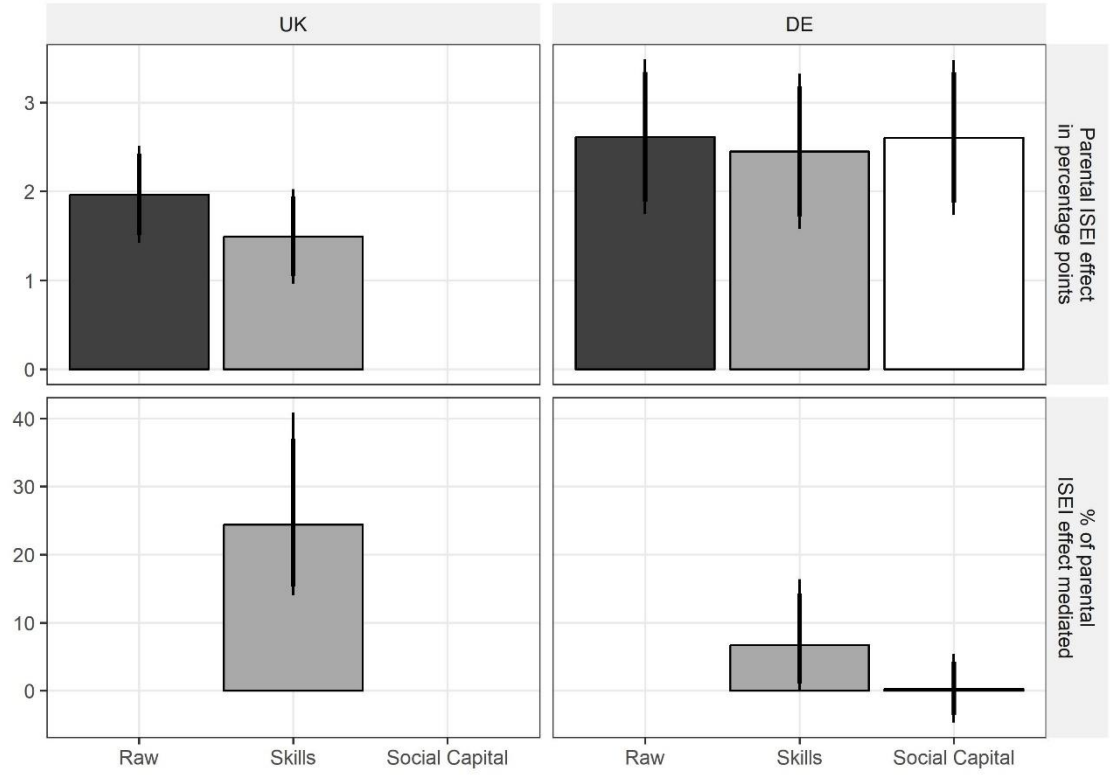


Figure 2-2 Decomposition of social background effects on undereducation

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 2-3 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 6 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 jobsearch 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.

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.

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

Table 2-1-3 Mediators of the direct effects of social origin on logged-labor-income

Note: OLS estimates with t-values based on robust standard errors in parentheses. Results are controlled for age, age squared, years of education,[16] mental and physical health scores, migration origin, gender, region, and survey year.

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

Column 1 of Table 2-2 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.[17] 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 avoidance 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

[17] 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 belief 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).

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.[18] 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.

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

[18] 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 belief 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).

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.

Literature

Allen, J., & van der Velden, R. (2001). Educational mismatches versus skill mismatches: effects on wages, job satisfaction, and on-the-job search. *Oxford Economic Papers*, *53*(3), 434–452.

Allmendinger, J. (1989). Educational systems and labor market outcomes. *European Sociological Review*, *5*(3), 231–250.

Andersen, H. H., Mühlbacher, A., & Nübling, M. (2007). Die SOEP-Version des SF 12 als Instrument gesundheitsökonomischer Analysen. *SOEP Papers*, *6*, 53.

Ballarino, G., & Bernardi, F. (2016). The intergenerational transmission of inequality and education in fourteen countries. In *Education, occupation, and social origin. A comparative analysis of the transmission of socio-economic inequalities* (pp. 255–282). Edward Elgar.

Becker, A., Deckers, T., Dohmen, T., Falk, A., & Kosse, F. (2012). The Relationship Between Economic Preferences and Psychological Personality Measures. *Annual Review of Economics*, *4*(1), 453–478.

Becker, G. S. (1964). Human capital: a theoretical and empirical analysis, with special reference to education. Columbia University Press.

Bernardi, F. (2014). Compensatory Advantage as a Mechanism of Educational Inequality: A Regression Discontinuity Based on Month of Birth. *Sociology of Education*, *87*(2), 74–88.

Bernardi, F., & Ballarino, G. (2016). Education as the great equalizer: a theoretical framework. In Education, Occupation and Social Origin: A Comparative Analysis of the Transmission of Socio-Economic Inequalities.

Borghans, L., Duckworth, A. L., Heckman, J. J., & Weel, B. ter. (2008). The Economics and Psychology of Personality Traits. *Journal of Human Resources*, *43*(4), 972–1059.

Bourdieu, P. (1984). *Distinction*. Harvard University Press.

Bourne, M., Bukodi, E., Betthaeuser, B., & Goldthorpe, J. H. (2018). 'Persistence of the social': The role of cognitive ability in mediating the effects of social origins on educational attainment in Britain. *Research in Social*

Stratification and Mobility. http://www.sciencedirect.com/science/article/pii/S0276562417301415

Bowles, S., Gintis, H., & Osborne, M. (2001). The Determinants of Earnings: A Behavioral Approach. *Journal of Economic Literature*, *39*(4), 1137–1176.

Brand, J. E., & Xie, Y. (2010). Who Benefits Most from College?: Evidence for Negative Selection in Heterogeneous Economic Returns to Higher Education. *American Sociological Review*, *75*(2), 273–302. https://doi.org/10.1177/0003122410363567

Breen, R., & Goldthorpe, J. H. (1997). Explaining Educational Differentials Towards a Formal Rational Action Theory. *Rationality and Society*, *9*(3), 275–305.

Breen, R., Karlson, K. B., & Holm, A. (2018). Interpreting and Understanding Logits, Probits, and Other NonLinear Probability Models. *Annual Review of Sociology*, *44*, 39–54.

Buchel, F., Grip, A., & Mertens, A. (2004). *Overeducation in Europe: Current Issues in Theory and Policy*. Edward Elgar Publishing Ltd.

Buck, N., & McFall, S. (2011). Understanding Society: design overview. *Longitudinal and Life Course Studies*, *3*(1), 5–17.

Capsada-Munsech, Q. (2015). The role of social origin and field of study on graduates' overeducation: the case of Italy. *Higher Education*, *69*(5), 779–807. https://doi.org/10.1007/s10734-014-9805-2

Collins, R. (1979). The credential society: An historical sociology of education and stratification. Academic Press.

Conger, R. D., & Donnellan, M. B. (2007). An Interactionist Perspective on the Socioeconomic Context of Human Development. *Annual Review of Psychology*, *58*(1), 175–199.

Dehne, M., & Schupp, J. (2007). Persönlichkeitsmerkmale im Sozio-oekonomischen Panel (SOEP) - Konzept, Umsetzung und empirische Eigenschaften. http://www.diw.de/documents/publikationen/73/diw_01.c.76533.de/rn26.pdf

Erikson, R., & Jonsson, J. O. (1998). Social Origin as an Interest-Bearing Asset: Family Background and Labour-Market: Rewards among Employees in Sweden. *Acta Sociologica*, *41*(1), 19–36.

Farkas, G. (2003). Cognitive Skills and Noncognitive Traits and Behaviors in Stratification Processes. *Annual Review of Sociology*, *29*, 541–562.

Flap, H., & Völker, B. (2008). Social, Cultural, and Economic Capital and Job Attainment: The Position Generator as a Measure of Cultural and Economic Resources. In N. Lin & B. Erickson (Eds.), *Social Capital: An International Research Program*. Oxford University Press. https://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780199234387.001.0001/acprof-9780199234387-chapter-4

Freeman, R. (1976). *The Overeducated American*. Academic Press.

Frick, J. R., & Grabka, M. (2014). Missing Income Data in the German SOEP: Incidence, Imputation and its Impact on the Income Distribution. *SOEP Survey Papers*, *225*, 36.

Goebel, J., Grabka, M. M., Liebig, S., Kroh, M., Richter, D., Schröder, C., & Schupp, J. (2018). The German Socio-Economic Panel (SOEP). *Jahrbücher Für Nationalökonomie Und Statistik*.

Granovetter, M. S. (1973). The Strength of Weak Ties. *American Journal of Sociology*, *78*(6), 1360–1380.

Grätz, M., & Pollak, R. (2016). Legacies of the past: social origin, educational attainment and labour market outcomes in Germany. In Education, occupation, and social origin: a comparative analysis of the transmission of socio-economic inequalities (pp. 34–48). Edward Elgar Publishing.

Green, F., & McIntosh, S. (2007). Is there a genuine under-utilization of skills amongst the over-qualified? Applied Economics, 39(4), 427–439.

Gugushvili, A., Bukodi, E., & Goldthorpe, J. H. (2017). The Direct Effect of Social Origins on Social Mobility Chances: 'Glass Floors' and 'Glass Ceilings' in Britain. European Sociological Review, 33(2), 305–316.

Hall, P. A., & Soskice, D. (2001). Introduction to Varieties of Capitalism. In Varieties of Capitalism. The Institutional Foundations of Comparative Advantage (pp. 1–68). Oxford University Press.

Handel, M. J. (2003). Skills Mismatch in the Labor Market. Annual Review of Sociology, 29(1), 135–165.

Heckman, J. J., & Kautz, T. (2012). Hard evidence on soft skills. Labour Economics, 19(4), 451–464.

Heckman, J. J., Stixrud, J., & Urzua, S. (2006). The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior. Journal of Labor Economics, 24(3), 411–482.

Heineck, G. (2011). Does it Pay to Be Nice? Personality and Earnings in the United Kingdom. ILR Review, 64(5), 1020–1038.

Heisig, J. P. (2018). Measuring the signaling value of educational degrees: secondary education systems and the internal homogeneity of educational groups. Large-Scale Assessments in Education, 6(1), 9.

Holtmann, A. C., Menze, L., & Solga, H. (2017). Persistent Disadvantages or New Opportunities? The Role of Agency and Structural Constraints for Low-Achieving Adolescents' School-to-Work Transitions. Journal of Youth and Adolescence, 46(10), 2091–2113.

Hout, M. (1988). More Universalism, Less Structural Mobility: The American Occupational Structure in the 1980s. American Journal of Sociology. https://doi.org/10.1086/228904

Jackson, M. (2007). How far merit selection? Social stratification and the labour market1. The British Journal of Sociology, 58(3), 367–390.

Jæger, M. M., & Karlson, K. (2018). Cultural Capital and Educational Inequality: A Counterfactual Analysis. Sociological Science, 5, 775–795. https://doi.org/10.15195/v5.a33

Kalleberg, A. L. (2007). The Mismatched Worker. W. W. Norton & Company.

Karlson, K. B. (2019). College as equalizer? Testing the selectivity hypothesis. Social Science Research, 80, 216–229. https://doi.org/10.1016/j.ssresearch.2018.12.001

Knies, G. (2018). Understanding Society. Waves 1-8. User Guide. Institute for Social and Economic Research University of Essex. https://www.understandingsociety.ac.uk/sites/default/files/downloads/documentation/mainstage/user-guides/mainstage-user-guide.pdf

Korpi, T., & Tåhlin, M. (2009). Educational mismatch, wages, and wage growth: Overeducation in Sweden, 1974–2000. Labour Economics, 16(2), 183–193.

Lambert, P., & Prandy, K. (2008). CAMSIS project: Files for distribution covering occupational unit codes and translations. http://www.camsis.stir.ac.uk/occunits/distribution.html#UK

Leitch, S. (2006). Prosperity for all in the global economy. World class skills. Stationery Office.

Leuven, E., & Oosterbeek, H. (2011). Overeducation and Mismatch in the Labor Market. In E. A. Hanushek, S. Machin, & L. Woessmann (Eds.), Handbook of the Economics of Education (Vol. 4, pp. 283–326). Elsevier.

Levels, M., Velden, R. van der, & Allen, J. (2014). Educational mismatches and skills: new empirical tests of old hypotheses. *Oxford Economic Papers*, *66*(4), 959–982.

Lin, D., Lutter, R., & Ruhm, C. J. (2018). Cognitive performance and labour market outcomes. *Labour Economics*, *51*, 121–135.

Lin, N., Vaughn, J. C., & Ensel, W. M. (1981). Social Resources and Occupational Status Attainment. *Social Forces*, *59*(4), 1163–1181. JSTOR. https://doi.org/10.2307/2577987

McFall, S. (2013). Understanding Society: Cognitive Ability Measures. *Understanding Society User Manual*, 20.

McGuinness, S. (2006). Overeducation in the Labour Market. *Journal of Economic Surveys*, *20*(3), 387–418.

Moerbeek, H., & Flap, H. (2008). Social Resources and Their Effect on Occupational Attainment through the Life Course. In N. Lin & B. Erickson (Eds.), *Social Capital: An International Research Program*. Oxford University Press. https://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780199234387.001.0001/acprof-9780199234387-chapter-7

Pecoraro, M. (2016). The incidence and wage effects of overeducation using the vertical and horizontal mismatch in skills: Evidence from Switzerland. *International Journal of Manpower*, *37*(3), 536–555.

Protsch, P., & Solga, H. (2015). How Employers Use Signals of Cognitive and Noncognitive Skills at Labour Market Entry. Insights from Field Experiments. *European Sociological Review*, *31*(5), 521–532.

Rohrbach-Schmidt, D., & Tiemann, M. (2016). Educational (Mis) match and skill utilization in Germany: Assessing the role of worker and job characteristics. *Journal for Labour Market Research*, *49*(2), 99–119.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied*, *80*(1), 1–28. https://doi.org/10.1037/h0092976

Sattinger, M. (1995). Search and the Efficient Assignment of Workers to Jobs. *International Economic Review*, *36*(2), 283–302.

Schupp, J., Herrmann, S., Jaensch, P., & Lang, F. R. (2008). *Erfassung kognitiver Leistungspotentiale Erwachsener im Sozio-oekonomischen Panel (SOEP)* (No. 32; Data Documentation). DIW. https://www.diw.de/documents/publikationen/73/diw_01.c.85173.de/diw_datadoc_2008-032.pdf

Shanahan, M. J., Bauldry, S., Roberts, B. W., Macmillan, R., & Russo, R. (2014). Personality and the Reproduction of Social Class. *Social Forces*, *93*(1), 209–240.

Shapiro, C., & Stiglitz, J. E. (1984). Equilibrium Unemployment as a Worker Discipline Device. *The American Economic Review*, *74*(3), 433–444.

Sloane, P. J., Battu, H., & Seaman, P. T. (1999). Overeducation, undereducation and the British labour market. *Applied Economics*, *31*(11), 1437–1453.

Thurow, L. C. (1975). Generating inequality: mechanisms of distribution in the U.S. economy. Basic Books.

Torche, F. (2011). Is a College Degree Still the Great Equalizer? Intergenerational Mobility across Levels of Schooling in the United States. *American Journal of Sociology*, *117*(3), 763–807. https://doi.org/10.1086/661904

Vaisey, S. (2006). Education and its discontents: Overqualification in America, 1972–2002. *Social Forces*, *85*(2), 835–864.

Van Buuren, S. (2012). *Flexible imputation of missing data*. CRC press.

Vandecasteele, L. (2016). Social orgin, education and socio-economic inequalitites: trends in the United Kingdom. In F. Bernardi & G. Ballarino (Eds.), *Education, occupation, and social origin. A comparative analysis of the transmission of socio-economic inequalities* (pp. 215–236). Edward Elgar.

Verhaest, D., & Omey, E. (2006). Measuring the Incidence of Over- and Undereducation. *Quality and Quantity*, *40*(5), 783–803.

Wiedner, J. (2020). Political and social consequences of qualifica-tion mismatches. *Unpublished Manuscript*.

3 Political and Social Consequences of Qualification Mismatches.

A bounding approach to status inconsistency

Abstract

A significant number of employees work in jobs that do not match their level of formal education. Status inconsistency theory (SIT) argues that mismatches result in stress, political alienation, and social withdrawal. As the number of mismatched workers rises in many countries, status inconsistency may pose a threat to social cohesion and political moderation there. However, the existing evidence on the social and political consequences of mismatch is neither conclusive nor convincing. Previous SIT scholarship does not fully appreciate two identification problems: Selection bias and the perfect collinearity among the effects of occupation, education, and mismatch. These issues lead to contradictory conclusions, as different methodological fixes are proposed and employed. I review these methods for their theoretical content and show that they generally do not answer the purported research question. To address these problems, I build on recent advances in the modelling of age, period and cohort effects. My approach is based on relatively weak, transparent assumptions that are grounded in sociological theory to partially identify mismatch effects and estimate bounds on effect sizes. The empirical analysis draws on comparable large-scale survey data from the United Kingdom (UKLHS) and Germany (GSOEP). Cross-sectional and panel fixed-effects models show strong mismatch effects on work-related identities, satisfaction, and wages. Contra the SIT hypothesis, I find no evidence that mismatch effects spill over into the political domain. My results suggest that the effects of mismatches do not arise from cognitive dissonance, as theorized by SIT, but from an expectation formation mechanism. Despite large institutional differences, the results are very similar across countries.

Introduction

Many employees work in occupations for which they have not been trained (Rohrbach-Schmidt and Tiemann 2016; Sloane, Battu, and Seaman 1999; Vaisey 2006). This paper investigates consequences of such qualification-job mismatches for political and social attitudes of workers who are vertically mismatched (i.e. workers who are under- or overqualified for the occupations they work in).

Social scientists have asked for more than half a century, whether such status-inconsistent employment situations lead to stress, poor health, dissatisfaction, social withdrawal, opposition to achievement ideology, political alienation, and in the last consequence to societal instability and unrest (Blocker and Riedesel 1978; Burris 1983; Goffman 1957; Hope 1975; Lenski 1954). Empirical research has generally produced highly mixed results, but more recent studies find an association between mismatches, in particular overqualification, and measures of these outcomes (Vaisey 2006; Zhang 2008; Zhu and Chen 2016). Given increasing rates of overqualification in countries like the United Kingdom and the United States, these results are clearly worrying (Felstead et al. 2007; Horowitz 2018; Vaisey 2006).

However, existing empirical work suffers from two major shortcomings that severely limit our understanding of the effects of mismatches. First, virtually all studies that investigate the effects of mismatches use cross-sectional data and infer effects from observed correlations. This approach makes conclusions vulnerable to selection bias. The second problem is rooted in the difficulty to empirically separate the effects of someone's education, occupation, and of mismatches proper, since they are linearly dependent: a mismatch is the difference between education and occupation (Blalock 1966). To identify effects, previous work had to rely on strong assumptions about the nature of mismatch-effects. These assumptions, however, were not explicitly justified

but hidden in the mechanics of the respective statistical model used. The result of these *ad-hoc* fixes has been a sharp disagreement in main conclusions between different studies.

This study reviews earlier efforts to model mismatch effects and makes their sometimes questionable theoretical positions explicit. In a second step, I propose a novel methodology to addresses the problems of previous research. Firstly, I provide the only analysis of the effect of mismatches on social and political attitudes exploiting longitudinal data. Secondly, I tackle the fundamental identification problem in mismatch research by building on recent advances in the modelling of age, period and cohort effects, which suffers from a similar identification problem (Fosse and Winship 2019b). My approach makes explicit use of relatively weak, and more importantly, transparent assumptions about the data generating process to partially identify mismatch effects. Throughout, I focus on social and political outcomes, which, once at the center of debate, have received relatively little attention in recent research.

I employ data from two comparable longitudinal population surveys with large sample sizes, the United Kingdom Longitudinal Household Study (UKLHS; Buck and McFall 2011) and the German Socio-Economic Panel Study (GSOEP; Deutsches Institut Für Wirtschaftsforschung 2017). The UK and Germany are interesting cases to study, because of the large differences that exist in their organization of labor markets, education systems and political cleavages. Comparing results across these two very different countries can serve as a first test into the generalizability of my main findings. If there is any contextual variation in the relationship between mismatches and political attitudes, I would expect it to be present in this comparison. Vice versa, if the results prove to be similar in these countries, they should generalize to other (Western) countries, too.

Overall, the results of my analyses document that qualification-job mismatches are highly consequential for the economic and subjective well-being

of individuals, even net of the main effects of education and occupation. However, the analyses also provide evidence that the consequences of mismatches for the political domain have been overstated in previous research.

Theory and previous research

In this section, I first discuss the original hypotheses put forward by status inconsistency theory (SIT) and their empirical record, before I explain the fundamental identification problem using a numerical example. In a next step, I then examine previous approaches to handle the problem for their theoretical content. Finally, I propose a bounding approach to estimating mismatch effects, which avoids some of the pitfalls of older work.

Status inconsistency theory

Why should a qualification mismatch result in stress, dissatisfaction, social withdrawal, and political alienation? Qualification mismatches were first investigated as a source of political dissatisfaction in the context of sociological status inconsistency theory (Lenski 1954). SIT originated in the post-war United States and had important conceptual affinities to role theory, Parsonian functionalism, and the social psychology of the time (see Stryker and Macke 1978 for a review).

The micro-mechanism suggested by SIT starts from the premise that actors seek to achieve cognitive consonance in their self-image, and that this is hampered by incongruous positions on different dimensions of social status. According to SIT, four channels through which status inconsistency[19] creates psychological stress and eventually results in political unrest can be

[19] I will use the terms inconsistency and mismatch interchangeably. I speak of inconsistencies, when I refer to the SIT-literature, and of mismatches, when other scholarship is concerned.

distinguished: First, status inconsistency creates cognitive dissonance through uncertainty about one's identity, which leads to stress (Festinger 1962; Geschwender 1967; Jackson 1962). Second, status inconsistency makes it hard for others to determine the appropriate role of actors in social interactions, and hence make it less likely that actors experiences interactions as rewarding (Lenski 1956). Third, status inconsistency in terms of education and occupation can take the form of overqualification, which implies that past expectations about the future, as instilled by education and training, have not been realized. Such "underrewarded inconsistency" leads to frustration (Geschwender 1968). The fourth and final causal relationship hypothesized by SIT is that status inconsistent individuals will eventually externalize these sources of stress and seek to change the social environment that they blame for their dissatisfaction (Goffman 1957). Originally, analysts hypothesized that this would result in left-wing activism and voting, but other contributions also argue that frustration can be expressed by endorsing far-right politics (Portes 1972; Stryker and Macke 1978).

It is worth noting that each of the four causal channels in original SIT has implications that are to a large degree testable in separation. The first channel implies that *any* mismatch should lead to dissatisfaction and stress, regardless whether it is one of over- or underqualification. It is the absolute difference between actual and common education that matters, regardless of its sign. The second channel implies that mismatch should affect not only cognitive states, such as satisfaction, but have effects on social behavior, e.g. membership in voluntary organizations, as well. The third channel implies that effects of overqualification should be stronger than those of underqualification, since it is especially when realized states fall short of anticipated ones that disappointment can be expected. The combination with the first channel thus suggests a pattern where both types of mismatch affect satisfaction negatively, but more strongly for overeducation. The fourth channel, finally, is in operation, when

the effects of mismatches exceed the personal level and affect political and social attitudes and behaviors.

What empirical evidence on these dynamics has mismatch scholarship produced? The SIT literature has resulted in a large number of inconsistent findings, with some reporting strong evidence for (Geschwender 1968; Goffman 1957; Jackson 1962; Jackson and Burke 1965; Lenski 1954, 1956; Vaisey 2006; Zhang 2008), and others reporting strong evidence against mismatches as sources of personal and political discontent (Blocker and Riedesel 1978; Jackson and Curtis 1972; Olsen and Tully 1972; Portes 1972).

In the following I will explain, why this lack of agreement is rooted in conceptual and methodological difficulties in defining and modelling mismatches (Blalock 1966; Duncan 2005; Hope 1975; Lenski 1964; and Sobel 1981). As I will elaborate, these complications also put the evidential value of the existing empirical literature into question.

The fundamental identification problem of mismatch theory

Conceptual and methodological difficulties in inconsistency research are due to a fundamental identification problem. This issue is often regarded as a merely methodological one, but my intention is to show that it cannot be separated from theory. To clarify this claim, I distinguish between three levels: the actual data generating process (DGP) in reality, the theoretical "structural model" of that process, and the empirical ("reduced form") model which is statistically estimable.

The basic problem is already apparent in Lenski's seminal statement of the basic hypothesis of status inconsistency research: "individuals characterized by a low degree of status [consistency] differ significantly in their political attitudes and behavior from individuals characterized by a high degree of status [consistency], *when status differences in the vertical dimensions are controlled*." (Lenski 1954:405f., my italics). The key point in this statement is that

a third variable – the degree of consistency, which is itself a function exclusively of education and occupation – is proposed to influence experiences, attitudes, and behavior, net of education and occupation.

Applied to an example, Lenski's hypothesis suggests that a lower-level hotel-manager with a college degree in business administration experiences more stress than one, who underwent the vocational training typical for his position, conditional on their respective actual levels of education, and that this is because the former perceives a stressful difference between his high-status education and his relatively lower status occupation, whereas the two fall together for the latter.

In order to illuminate the fundamental identification problem, I now introduce a simple formal framework to represent Lenski's conjecture. I concentrate on two dimensions of status, education and occupation, and on linear relationships. This is because the identification problem is limited to the linear components of the relationships. Any non-linear deviations from them are identified without problems, a fact I discuss below (see also Fosse and Winship 2019b).

A linear version of Lenski's hypothesis can be represented as proposing a non-zero β_{MM} in the model

$$Y = \beta_E X_E + \beta_O X_O + \beta_{MM}(X_E - X_O), \qquad \textit{(Eq. 3-1)}$$

where Y is the outcome of interest, and X_E and X_O are education and occupation, two different metric z-standardized dimensions of social status, for instance job prestige and years of education. Since they are standardized, they indicate an individual's relative position on that dimension in the population. $(X_E - X_O)$ represents the linear mismatch term. It is positive for over- and negative for underqualified workers. Eq.1 is best thought of as a structural model of the true DGP: Y is produced from combinations of X_E and X_O according to the parameters β_E, β_O, and β_{MM}.

Returning to my example, the term $(X_E - X_O)$ is zero for the hotel manager with the required vocational education, because the relative status of his education and his occupation are identical. However, $(X_E - X_O)$ is positive for the college graduate, because the relative status of his occupation is lower than that of his education. If β_{MM} is nonzero, as hypothesized by Lenski, this third term will affect Y above and beyond X_E and X_O for the mismatched graduate.

The framework of Eq.1 is important, because it shows that the structural model proposed by Lenski is empirically unidentified. Three distinct parameters $(\beta_E, \beta_O, \beta_{MM})$ govern the relationship between just two independent variables (X_E and X_O) and the outcome (Blalock 1966). This means that given identical combinations of education and occupation (X_E and X_O), an infinite number of combinations of the structural parameters β_E, β_O, and β_{MM} could theoretically result in the same Y. For the hotel-managers, this means that the same observed values of stress (e.g. $Y_{\text{matched}} = 10$; $Y_{\text{mismatched}} = 11.25$) could result from identical independent variables (e.g. with the relative statuses as $X_{E,\text{college}} = 15$; $X_{E,\text{voctrain}} = 10$ and $X_{O,\text{ hotel man.}} = 10$) through radically different data generating processes (e.g. with $\beta_E = 0.25$, $\beta_O = 0.75$, and $\beta_{MM} = 0$ or with $\beta_E = -0.25$, $\beta_O = 1.25$, and $\beta_{MM} = 0.5$).[20]

For a researcher who observes X_E, X_O and Y and wants to understand the true DGP as represented by the structural model in Eq. 3-1, it is therefore *never* possible to decide without further assumptions, whether the relative stress levels of the college-educated manager compared to the vocationally trained one

[20] This is shown by the following simple calculations, which plug in the respective values into Eq. 1., once for the first set of structural parameters (2a and 2c) and once for the second set (2b and 2d):

$$\begin{aligned} Y_{\text{matched}} = 10 &= .75 * 10 + .25 * 10 + 0(10 - 10) \\ &= 1.25 * 10 - 0.25 * 10 + 0.5(10 - 10) \\ Y_{\text{mismatched}} = 11.25 &= .75 * 10 + .25 * 15 + 0(15 - 10) \\ &= 1.25 * 10 - 0.25 * 15 + 0.5(15 - 10) \end{aligned}$$

are affected by his mismatch, or exclusively due to processes resulting in higher levels of stress among the higher educated.

At its core, this fact is due to the nature of the DGP, but its implications appear as methodological problems to researchers. The fundamental problem of mismatch research is that because different structural parameters can produce the same data, the data and empirical models alone cannot reveal the true DGP. Data alone can therefore never provide an answer as to whether mismatches indeed have effects on social and political outcomes. Thus, in order to identify mismatch effects, assumptions about the DGP, that is restrictions on the structural model of one kind or another, are indispensable. As I will show below, such theoretical assumptions are present even in the approaches which try to hide them. However, good scientific practice asks to justify constraints on substantive grounds and to make them transparent. The identification problem that mismatch research has faced cannot therefore be solved by *methods*, it must be solved by leveraging *prior knowledge* with careful and transparent *theoretical examination*

Theories about the structure of mismatch effects

Throughout the last 60 years, different fields with different research questions have approached mismatch-effects. The different strategies to study mismatch effects were often framed as purely methodological proposals. But really they are theoretical statements about the process that generates the data. Theoretical models like Eq.1 do not have in themselves a unique solution in terms of β_E, β_O, and β_{MM}. Previous strategies achieved a unique solution only by implicitly assuming various structures that differ from that in Eq. 3-1. The fact that different proposals lead to different estimates of β_E, β_O, and β_{MM} resulted in the confusion that has plagued the literatures on mismatches since the early 1960s. Even worse, as I have shown above, these estimates cannot be distinguished on empirical grounds, because they are compatible with the same

data. What is needed, therefore, is a review of the theoretical commitments different research strategies imply and an informed discussion in which situations they are appropriate. In the following, I offer such a discussion.

Sociologists and their cross-tables

An important class of early strategies to test for mismatch effects were the so-called square additive models. Originally, they were formulated in a cross-table context, but here I translate them into a linear equation framework, with which modern researchers are more familiar. These empirical models compare the variance explained by a baseline model of additive main effects of education and occupation (β_E and β_O in above model),

$$Y = \beta_E X_E + \beta_O X_O + \epsilon, \qquad \text{(Eq. 3-2)}$$

with the variance explained by models that allow for separate inconsistency parameters (e.g. dummies for over- and underqualified workers) (Duncan 2005:90ff.). After fitting a baseline model like Eq. 3-2, researchers regarded significant effects of such dummy-variables as evidence of inconsistency effects.

But recalling the example for the case of two hotel managers, data which was in fact generated by linear mismatch effects can easily be described using a constrained baseline model like Eq. 3-2 (compare footnote 3). However, this comes at the price of estimates of the remaining βs that do not correspond to the true DGP. The estimates of the main effects in the baseline model will absorb the linear component of mismatch effects. This is problematic, because what is left for the additional mismatch-parameters to pick up in additive models are merely the non-linear components of mismatch-effects. All linear components are contained in the baseline estimates.

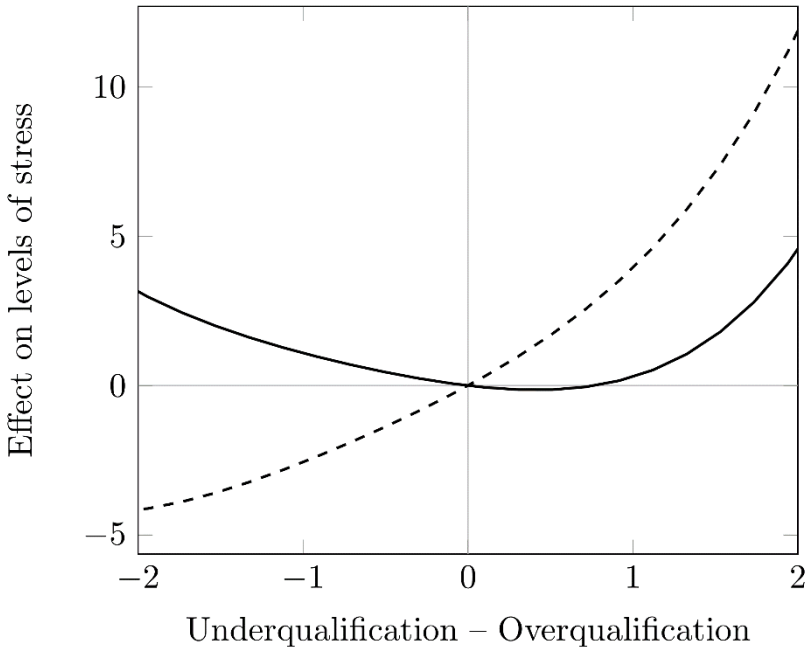


Figure 3-1: Illustration of the bias introduced by square additive models

Omitting the linear component may give a very distorted picture of the true effects of mismatches. This is illustrated by the fictitious example in Figure 3-1. Assume the values of stress on the y-axis are in reality produced from the values of mismatch on the x-axis according to the DGP represented by the dashed line. We see decreased stress among the under- and increased stress among the overeducated. The mismatch effects an additive model will return, on the other hand, are given by the solid line. These estimates, or any approximation of them, only contain the non-linear components of the true mismatch effects. Based on these values, we would wrongly conclude that

underqualification has a stress-increasing effect, whereas the true stress-enhancing effect of overqualification would be underappreciated.[21]

Square additive models are an example of a strategy to identify point estimates of mismatch effects that rely on a theoretical commitment to one of the structural linear components in Eq.1 being zero in reality. If this assumption is true, one of the three terms of Eq. 3-1 vanishes, and the two remaining structural parameters match two independent variables and can be uniquely and unbiasedly estimated from the data. If it is not true, however, the structural model that is being parametrized is different from the process that produced the data, resulting in the problems I have illustrated.

If the goal is to learn about the true DGP, strong assumptions like those embedded in additive models should be carefully defended. In general, there is arguably no good reason to believe that there is no linear mismatch parameter in the structural model. After all, the existence of these effects is what the empirical examination is supposed to reveal. As has been noted before, this makes the results of the square additive model literature questionable (Blalock 1966; Hendrickx et al. 1993; Hope 1975; Sobel 1981).

As a reaction to these problems, the so-called diamond model, which allows linear mismatch effects in the structural model, was proposed (Hope 1975). However, to achieve this, Hope had to reformulate the structure implied by Eq.1 in a way that amounts to a full-blown restatement of SIT. In Hope's model, *any* multidimensionality of social status that is consequential for an outcome appears as an inconsistency effect.

---

[21] In this example, the true relationship between mismatch and stress, net of education and occupation, is given by $Y = 0.09(X_E - X_O)^4 + 0.25(X_E - X_O)^3 + 0.6(X_E - X_O)^2 + 3(X_E - X_O)$, whereas the square additive model would return at best $Y = 0.09(X_E - X_O)^4 + 0.25(X_E - X_O)^3 + 0.6(X_E - X_O)^2 - 0.65(X_E - X_O)$. This is because the linear approximation of the true relationship is $Y = 3.65(X_E - X_O)$ and will be absorbed by the vertical dimensions.

Hope regards social status as a latent, vertical, unidimensional construct. In practice, this general status index is constructed as some weighted average of, for instance, education and occupation. According to Hope, inconsistency refers to any non-zero value on a dimension of social status apart from this general vertical index. Such non-vertical dimensions could be, for example, the variances in education or occupation that do not fully align with general status. In other words: As soon as the constituent empirical referents of the general status dimension (say a diploma or a job role) do not correlate perfectly, agents are thought to feel strain from inconsistent statuses. But such a view leaves open, how the latent status dimension proposed by Hope is supposed to become socially effective or even be perceived by actors. So while parameters of the structural model implied by the diamond model may be estimated from data without problems, it comes at the cost of positing an unobservable, intangible concept and an unspecified causal mechanism.

Technically, the separation into vertical and non-vertical components can be achieved by the cross-table techniques (the diamond-model) described in Hope (1975) or by principal component analyses and similar methods. However, it is important to note that such procedures do not offer any new identifying information. They merely rotate the existing status matrix and relabel the dimensions. In Hope's example of a diamond model, the columns of the rotated matrix, (i.e. the first variable in a linear model) represent the vertical status, defined simply as the mean of the two main dimensions, and the rows (i.e. the second variable) indicate linear inconsistency values, defined as the difference between the constituent dimensions, e.g. education and occupation.

For the case of hotel managers, this would mean that the matched manager receives a vertical status score of 10 $((10 + 10)/2)$ and an inconsistency values of 0 $((10 - 10)/2)$, the mismatched manager a vertical status of 12.5 $((10 + 15)/2)$, and an inconsistency of 2.5 $((15 - 10)/2)$. In this example, Hope's

model would return an inconsistency parameter of -0.5.[22] Note that in this model, the higher level of stress in the mismatched manager will be regarded as evidence of inconsistency effects, *regardless* of whether it is due to a separate mismatch-parameter in the sense of Eq. 3-1 or simply due to an independent effect of education, net of occupation (compare footnote 3). More generally, Hope's model will return inconsistency effects, whenever the main dimensions of Eq. 1 differ in the strength of their association to the outcome. This criterion for inconsistency effects is clearly weaker and substantively different from that implied by Lenski's original formulation.

Economists and the refined Mincer equation

A second perspective on mismatch-effects emerged in the 1980s among economists, who saw them as a way to test different theories of labor market allocation. The so-called ORU decomposition (Over-, Required, and Undereducation) splits up the attained education (E) term in a wage equation into three components: required education, the amount of education that is required in a worker's job (R, to which I here refer to as O for "occupation" in order to maintain consistency with the SIT literature); overqualification (OQ), the years of education of a worker beyond of what is required, and underqualification (UQ), the years of education a worker is short of requirements, such that $E = O + OQ - UQ$, where $OQ = E - O$, if $E - O > 0$ and 0 otherwise, and $UQ = O - E$, if $O - E > 0$ and 0 otherwise, resulting in the wage equation

$$Y = \beta_0 + \beta_{OQ} OQ + \beta_O O + \beta_{UQ} UQ + \epsilon \qquad \text{(Eq. 3-3)}$$

(Duncan and Hoffman 1981).

In an important advance over the classic Mincer equation, the OQ and UQ parameters in this specification allow analysts to investigate whether

[22] The respective equations are $11.25 = 1 * 12.5 - .5 * 2.5$, for the mismatched worker, and $10 = 1 * 10 - .5 * 0$, for the matched worker.

mismatched workers differ from matched workers with respect to Y in an occupation with the same education requirements.

From the perspective of the general framework of Eq. 3-1, Eq. 3-3 amounts to omitting $\beta_E X_E$, the term that captures the main effect of education. The ORU decomposition is hence another example of an identification strategy that proposes one linear term of Eq. 1 to be zero in the structural model. In addition, Eq. 3 splits up the term $\beta_{MM}(X_E - X_O)$ into $\beta_{OQ}OQ$ and $\beta_{UQ}UQ$, that is, it allows for a nonlinearity in mismatch effects. Since only two linear effects, β_O and the shared linear component in β_{OQ} and β_{UQ} have to be estimated, the model is uniquely identified.

The structural model implied by this strategy is one, where past education does not play a role *beyond* occupational positions and potential mismatch. Applied to the hotel manager example, all differences in stress between the matched and the mismatched manager are regarded as stemming from their differing mismatch status – but not from their differing education. In this view, an enduring, independent role of socialization through education for later life outcomes is excluded.

How convincing is such a perspective on labor market careers? Arguably, this very much depends on the outcome of interest. We have to distinguish between outcomes that result exclusively from the current employment situation and outcomes that reflect a more complex layering of experiences over the life-course. For instance, decades of research have documented that many political and social attitudes and behaviors are relatively stable and partially formed early in life, among other things by educational experiences (for reviews, see Sears and Brown 2013). For these outcomes, a structural model as proposed by ORU models seems to poorly reflect reality. However, for outcomes, which economists have investigated with it, a structural model in the form of an ORU model is much more plausible. It is difficult to conceive of a causal influence on an employee's wages that is not fully mediated through

properties of her current employment situation. So, while ORU models are plausible in typical applications in economics, they should not unthinkingly be applied in sociological research.

Recent trends

The most recent studies of mismatch effects have abandoned the traditional cross-table models of mismatch effects and instead relied on more flexible regression techniques. Public health researchers, for instance, have rediscovered the original claims of SIT and produced a series of studies that link qualification mismatch to higher levels of stress, poorer self-rated health, and increased mortality (Dudal and Bracke 2019; Dunlavy, Garcy, and Rostila 2016; Smith et al. 2012; Zhu and Chen 2016). Some of these studies claim that mismatches have potentially important health-consequences, which may be associated with decreased social and political activity. Studies in this literature are of course equally affected by the identification problems I have pointed out. Closer examination reveals that the empirical models in this literature assume different structural models, most often ones, which exclude the main effect of occupation. They thereby assume that people's current occupation is unrelated to their health status – an unlikely situation. It is hence not clear, how much evidence of the health consequences of qualification-mismatches, net of occupation, there actually is.

In sociology, two papers have renewed the discipline's longstanding interest in inconsistency effects. In the first, Vaisey (2006) claims that workers in the United States, who are overqualified are more politically liberal and less achievement oriented than workers in a similar job, who are not inconsistent. His work relies on the ORU decomposition. This approach is descriptively valid and informative. But as I have argued above, from a DGP perspective it is questionable, whether the structural model implicit in ORU approaches (i.e. one that assumes that effects of education are fully mediated by occupation)

is a valid representation of the process of attitude formation. In the second, Zhang (2008) explicitly proposes a test of SIT for the case of inconsistencies in income and education. However, his empirical models are only identified, because he constrains the effect of inconsistency to have the same sign, regardless of the direction of a mismatch. While a symmetric mismatch-term (strictly equal effects of under- and overqualification, $\beta_{OQ} = \beta_{UQ}$) is a feature of Lenski's original statement of SIT (he assumed a squared relationship between outcomes and mismatch, which implies symmetry), I think that its existence should be concluded *a posteriori* from the data, rather than required *a priori* for a method to work. Note that similar to the square additive model, the assumption of symmetric effects of inconsistency claims that the linear component of the mismatch effect is zero in the DGP. Hence, all the caveats I discussed above apply. It is unclear in how far the results in Zhang (2008) depend on these problematic assumptions.

A bounding approach to mismatch-effects

My literature review has shown that past attempts to test for mismatch effects were implicitly wed to very specific theoretical models of the mismatch process. In the following I introduce a new approach to investigate mismatch effects that allows us to use prior knowledge and theoretical analysis to flexibly and transparently specify a theoretical model that better reflects the true DGP.

To do this, I follow recent work of Fosse and Winship in the context of modelling age, period, and cohort (APC) effects (Fosse and Winship 2019a, 2019b). The bounding-approach developed by Fosse and Winship (2019b) is based on the idea that prior knowledge can be used to formulate explicit constraints on the parameters of a structural model that is empirically non-identified. If some values of structural parameters can be discarded *a-priori* on theoretical grounds, this limits the range of values other parameters in the model can take.

The starting point of a bounding analysis is that even though single parameters of a general structural APC- or a mismatch-model are not uniquely identifiable from the data, combinations of them are (O'Brien 2014). In the case of mismatches, we can identify the empirical parameters θ_1 and θ_2, with

$$\theta_1 = \beta_E + \beta_O \text{ and} \quad \textit{(Eq. 3-4)}$$

$$\theta_2 = \beta_O - \beta_{MM}, \quad \textit{(Eq. 3-5)}$$

where the βs are the structural coefficients from Eq. 3-1 (Fosse and Winship 2019b). The fact that θ_1 and θ_2 are uniquely identified creates dependencies in the parameter space that analysts can exploit to arrive at partial identification of a structural parameter of interest. By making an informed assumption about the sign and potentially the magnitude of β_E and β_O, it is possible to create finite bounds around empirical estimates of β_{MM}. By rearranging Eq. 3-5 and substituting β_O in Eq. 3-4 we get two restrictions which β_{MM} has to satisfy:

$$\beta_{MM} = \beta_O - \theta_2 \text{ and} \quad \textit{(Eq. 3-6)}$$

$$\beta_{MM} = \theta_1 - \theta_2 - \beta_E. \quad \textit{(Eq. 3-7)}$$

If it can now be assumed that $\beta_O$is larger than some minimal value, $\beta_O > \beta_O^{min}$, and similarly that $\beta_E > \beta_E^{min}$, we know that

$$\beta_O^{min} - \theta_1 < \beta_{MM} < \theta_1 - \theta_2 - \beta_E^{min}, \quad \textit{(Eq. 3-8)}$$

which represent the bounds within which the true linear mismatch effect lies. In other words: if prior knowledge and theoretical examination suggest that the true main effects of education and occupation are larger than some values, this results in finite bounds for the structural mismatch effect. The same holds if both education and occupation effects are negative and can be assumed to be *below* some value. Instead of relying on implicit and *ad-hoc* constraints to arrive at point identification, the Fosse and Winship approach allows using weaker, theoretically justifiable, and, most importantly, transparent constraints to identify a range of values for the parameters of interest,

which are consistent with the theoretical assumptions (represented by β_O^{min} and β_E^{min}) and the data (represented by θ_1 and θ_2 in Eq. 3-8).

What do we know about the relative importance of education and occupation?

Since they define the structural model, the identifying assumptions in Eq. 3-8, β_O^{min} and β_E^{min}, have to be carefully specified. Large literatures in sociology and political sciences have shown that social and political attitudes and behaviors vary strongly and partially independently with education and occupation (e.g. Niemi and Sobieszek 1977; Verba, Nie, and Kim 1978). Extant research is also clear about the fact that education and occupational status covary with our outcomes of interest in the same directions. Therefore Eq. 3-8, which requires that both main effects have the same sign, is applicable: the theoretical constraints I impose on the structural model in Eq. 3-1 will result in finite bounds for the estimates of the linear mismatch parameter β_{MM} in Eq. 3-1 for all of our variables of interest.

But recalling my discussion of the applicability of ORU models in different domains, we can go one step further. On the basis of substantive reasoning, it is possible to distinguish between two types of dependent variables, those with a socialization component, where experiences made during the education-phase are likely to have a lasting impact, and those that are produced directly by actors' experiences and behavior in the workplace. As I have argued, it is theoretically hard to conceive of a scenario in which education directly (that is, net of occupation and mismatch) affects wages and, arguably, job satisfaction. For this second type of outcome, there is more specific prior knowledge than for the first type, where we usually just know that both education and occupation have some non-trivial effect of the same direction. As a result, I am able to present plausibly point-identified estimators of mismatch effects on outcomes of the second type.

But what about the first type of variables? Here, the width of the bounds, that is the amount of information conveyed, partially depends on the amount of prior information available. However, it is difficult to extract from existing research precise lower bounds for main effects of education and occupation. In the main text, I employ the following relatively conservative constraints:

$$\frac{\beta_E}{3} < \beta_O^{min} < 3\beta_E \text{ , which implies that } \frac{\beta_O}{3} < \beta_E^{min} < 3\beta_O \qquad \textit{(Eq. 3-9)}$$

In other words: I assume that the effect of occupation is at most three times as strong as that of education and vice versa. This leaves plenty of room for empirical differences to play out: If β_O were 1, β_E could range between 0.3 and 3. While plausible, this choice of relative weights is admittedly arbitrary. I therefore present results obtained using other, even less restrictive values in Supplement D.

To sum up, in contrast to earlier efforts, which assumed an arbitrarily stunted versions of Eq. 3-1, I propose to work with a structural model that preserves all the features of the general model in Eq. 3-1. Instead of indiscriminately claiming that one entire term is zero, as most previous approaches implicitly did, I merely claim that both occupation and education have *some* association with our outcomes – except in cases, where substantive reflection suggests otherwise.

Data and methods

I base my empirical estimates of mismatch effects on two harmonized data sources from two countries: the UK Longitudinal Household Study 2009-2016 (UKLHS; Buck and McFall 2011) and the German Socio-Economic Panel Study 1984-2016 (SOEP; Deutsches Institut Für Wirtschaftsforschung 2017). UKLHS and SOEP are comparable sources of data in that both are longitudinal surveys

of private households with high-quality fieldwork. Both studies rely on similar sampling strategies, questionnaire design, and often even use the same items.

I restrict the analytical sample to non-self-employed working men and women between the ages of 20 and 60, who are not currently enrolled in full-time education or training. For the cross-sectional analysis, I restrict the SOEP sample to the years after 2004, because important control variables were collected only after that date. Throughout, I employ the post-stratification weights provided with the data to account for unequal sampling and attrition probabilities.

Measuring education, occupation and mismatch

I rely on a generalized version of the ORU decomposition to model the effects of vertical qualification mismatch that allows including a separate term for the main effect of education. My central independent variables are therefore measures of actual education (E), required education in someone's occupation (O) and of mismatch. In line with the ORU tradition, I rely on virtual years of education and the so-called realized matches approach to identify the required education in an occupation (see McGuinness 2006 for an overview of measurement approaches, and Section A in the Online Supplement for details on the coding of years of education). Concretely, I distinguish occupations using the 3-digit ISCO88 classification and estimate the mean years of education in each occupation in the post-stratified UKLHS and SOEP samples as a measure of required education. Overqualification (OQ) and underqualification (UQ) are defined as explained above. Note that while O is regarded in the ORU tradition as a measure of qualification requirements, it can just as well be interpreted as a measure of occupational status as in the SIT-tradition. Indeed, the empirical correlation between the occupation mean years of education and the ISEI, an accepted measure of occupational status, is $r = 0.87$ in Germany and $r = 0.81$ in the UK in the respective 2014 waves of my sample.

Control variables

In the cross-sectional analysis I control for a rich set of personal characteristics, including age, age-squared, measures of cognitive ability, BIG-5 personality, risk aversion, locus of control, parental occupation, parental education, immigration background, gender, as well as for region and survey year. Details on the measurement of these variables can be found in Online Supplement A. I also ran separate analyses by gender, but results were largely identical. Gender specific results can be found in Supplement C. In the longitudinal models, I only adjust for age, the tenure in the current position, and survey year.

Not all controls were measured in all years or for all respondents. If information is missing, I carry forward the latest observation of a respondent. If a control variable has never been measured, I rely on 10 imputations from a chained equations model (Van Buuren 2012). The multiple imputation models take into account all variables that feature in the analysis models and additional variables that may help to reduce prediction uncertainty.

Outcomes

In order to comprehensively capture the relevance of mismatch, I consider nine different facets of social, political and occupational behaviour, involvement, identities and satisfaction, as well as trust and income. While the items I rely on are designed to capture identical concepts in the two surveys, it is important to note that sometimes the wording is not strictly identical in SOEP and UKHLS. The Online Supplement A documents the questions and response categories used in the two countries.

Table 3-1 shows how many data points, from how many respondents the two datasets provide on these variables. These figures equal the sample sizes my models can draw on. Since many variables were collected in different

waves, my analytical samples differ for different dependent variables, and in Germany for different specifications.

Trust, *satisfaction with democracy*, *job* and *life satisfaction*, and the respective *importance of politics*/*one's profession* were measured using standard Likert scales in both questionnaires. In order to increase comparability between these measures, I z-standardize them, so that one unit corresponds to one sample specific standard deviation.

Left vote, *far-right vote*, and *member of an organization* are binary variables that indicate whether a respondent expresses left-wing/far-right voting intentions or reports being the member of at least one organization. I refer readers to Supplement A for details on my coding of parties.

My last dependent variable is *hourly gross labour income*. I derive this variable from the imputed gross labour incomes in the datasets, which I divide by the reported contracted monthly working hours. I report results for the unstandardized natural logarithm of this variable.

		Trust	Satisfaction democracy	Job satisfaction	Life satisfaction	Importance politics	Importance profession	Logged hourly wages	Vote left party	Vote far-right party	Member organization
UKHLS	N_{Obs}	14 789	22 112	84 428	77 446	20 528	21 599	84 661	59 687	59 687	11 838
	N_{Resp}	14 789	14 964	25 955	24 334	14 631	15 227	25 990	20 749	20 749	11 838
	Mean number of waves/person	1	1.47	3.25	3.18	1.40	1.41	3.25	2.87	2.87	1
	Longest gap	-	2	0	0	2	2	0	0	0	-
SOEP	$N_{Obs,pooled}$	25 771	17 353	124 858	124 858	40 624	40 682	122 666	45 928	45 928	21 368
	$N_{Resp,pooled}$	17 383	13 331	28 377	28 377	22 597	22 619	27 769	14 157	14 157	14 332
	$N_{Obs,FE}$	14 977	22 112	202 729	205 849	45 387	45 387	201 381	83 225	83 225	34 436
	$N_{Resp,FE}$	11 825	14 964	36 625	37 491	23 358	23 358	36 730	20 707	20 707	18 040
	Mean number of waves/person	1.26	1.47	5.53	5.49	1.94	1.94	5.48	4.01	4.01	1.90
	Longest gap	4	4	0	0	4	4	0	0	0	4

Table 3-1: Sizes and characteristics of analytical samples

Modelling strategies

I proceed in two steps. In the first, I estimate a generalized version of the cross-sectional ORU decomposition on pooled samples. In the second, I estimate a specification of this model that includes person-specific fixed-effects and hence rules out confounding by unobserved time-constant variables.

The model I estimate in the first step is given by the equation

$$Y = \beta_0 + \beta_O O + \beta_E E + \beta_{OQ} OQ + \beta_{UQ} UQ + \sum \beta_{X_j} X_j + \epsilon, \qquad \textit{(Eq. 3-10)}$$

where O, E, OQ, UQ refer to the parameters discussed above and X_j is the jth control variable. This specification corresponds to a general structural model, which contains a perfect linear dependency between O, E, and the shared linear component of OQ/UQ. Eq. 10 is partially identified through the constraints in Eq. 3-9. I refer to this as the E-ORU specification, since it contains all four terms of E, OQ, O and UQ simultaneously. Note that I report results with O, E, OQ, and UQ in a years-of-education-metric, while the constraints in Eq. 3-9 refer to standardized coefficients.

In the E-ORU specification, the bounded OQ and UQ parameters reflect the change in the outcome associated with one additional year of under- or overeducation, net of actual education, required education, and other covariates. The E-ORU model is estimated using constrained least squares. I base inference on standard errors that are clustered at the person-level.

The pooled-data E-ORU specification addresses the linear dependency of O, E and MM. However, it is still susceptible to selection bias. I address this problem using a person-fixed-effects (FE) approach. This design eliminates all time-constant confounders that might bias the relationship between mismatches and outcomes.

In this step, I make use of all the survey years available to us, in which the respective dependent variable was measured, i.e. I use all waves of the GSOEP

since 1984. Table 3-1 lists the number of gap years between measurements for the dependent variables, and the mean number of observations per respondent that I draw on to estimate the FE models. I only make use of data from respondents, whose education has remained constant throughout the observation period and use only mismatch-changes that I can relate to job-changes as indicated by changes in the 3-digit ISCO occupational title, ignoring periods of unemployment and inactivity.

If the E-ORU specification is applied in a FE context, the E-term is absorbed by the demeaning-procedure, yielding the ORU-FE specification. Again, assuming only linear effects, both β_O and β_{MM}, the shared linear component of β_{OQ} and β_{UQ} have to be estimated from the same changes of occupation. There is hence again an identification problem. As in the cross-sectional case, the combination of both parameters is identified as $\theta_2 = \beta_O - \beta_{MM}$. In order to learn something about, β_{MM} we must make assumptions about β_O. Unfortunately, β_{MM} and β_O may take the same direction, so that constraining the sign of β_O is usually not informative about the range of values β_{MM} can take. Instead, we must specify a maximal effect size for β_O in order to infer β_{MM}.

Since it is impossible to know such a maximal effect size *a priori*, I gauge the potential for causal mismatch effects by again resorting to bounded estimates. The endpoints of the bounds are comprised of the two extreme cases: that the linear effect of changing occupation is entirely due to the linear mismatch-component, and that there is no linear effect of mismatch. To the respective estimates of β_{MM} I add the non-linear components of mismatches. Concretely, I allow different coefficients for moving deeper into overqualification, *relative to actors' multi-year average*, and *vice versa* for moving deeper into underqualification, relative to actors' multi-year average. This procedure leaves us with conservative bounds on the effects of under- and

overqualification. In many cases, it allows demonstrating or ruling out mismatch-effects, even when the relative size of the linear component is unclear.

Results

Is there any evidence that mismatched workers are affected by the dynamics hypothesized by SIT scholars? In the following, I report results from two sets of models: the pooled E-ORU specification and the ORU-FE model.

Cross-sectional results

Figure 3-2 shows the ranges of estimates of under- and overqualification effects that are compatible with my assumptions about the DGP and the data in the E-ORU specification. I refer readers to Supplement B for a comparison of these results to those obtained from a conventional ORU decomposition. Black bars indicate that all estimates are statistically significant at the 0.1 level.

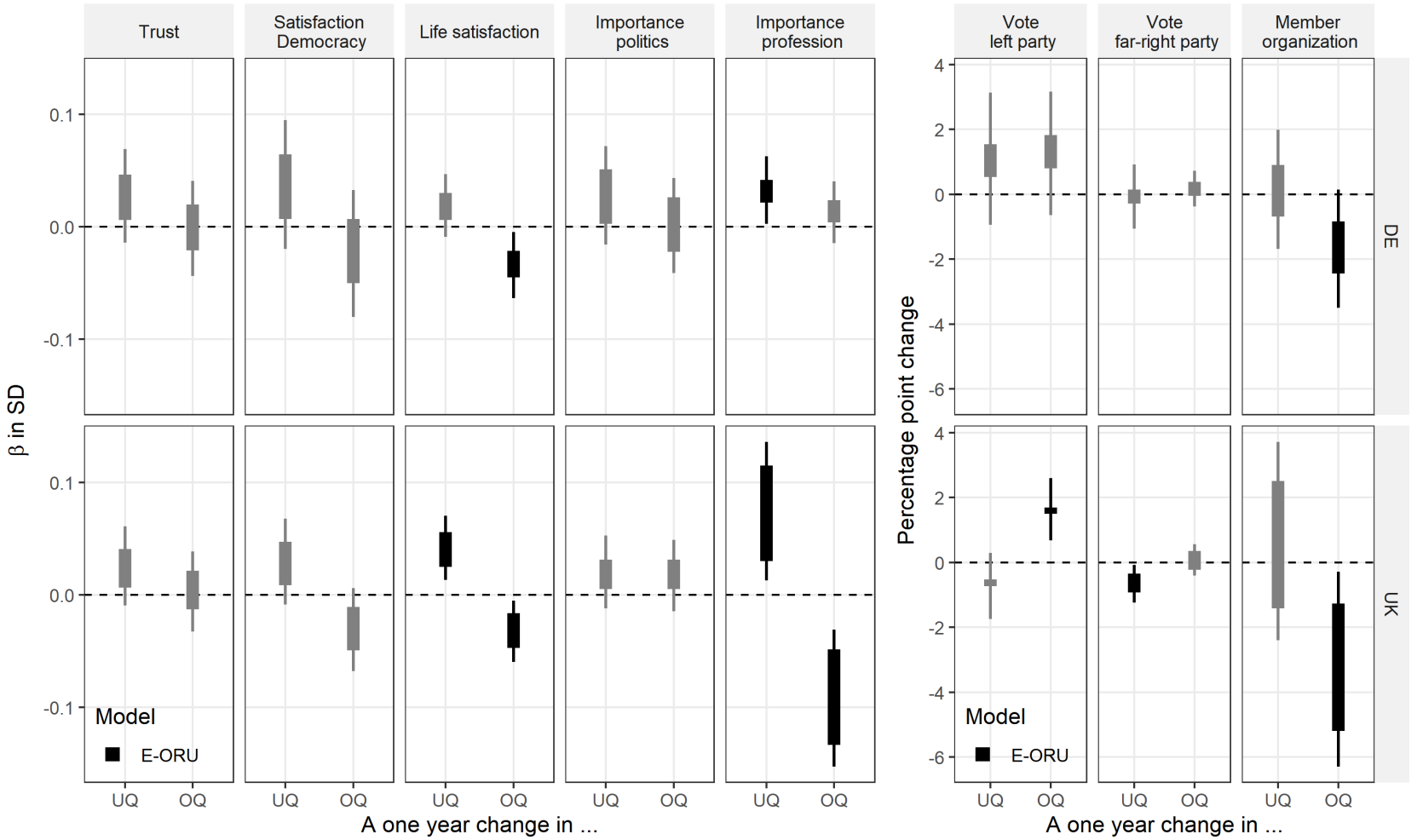


Figure 3-2: Social and political attitudes, and wages among mismatched workers

Note: Constrained least squares models estimated on pooled data. 95% confidence intervals based on cluster-robust standard errors and ten imputations. UQ: Underqualification, OQ: overqualification. Results controlled for personal characteristics.

I find that overqualification is associated with lowered life satisfaction, a lower likelihood of organizational membership, and, in the, UK with a clearly decreased salience of workers' professional identity and an increased probability to express voting intentions for a left-wing party. Underqualification, on the other hand, goes along with a heightened professional identity, and in the UK also with increased life satisfaction, and a lower likelihood to support the extreme right. The strength of these associations is often small, but arguably of substantive importance. A median effect size of about 0.03 SD implies that somebody who is overqualified by three years, which roughly corresponds to the difference between the main educational categories, reports, for example, about a tenth of a standard deviation lower life satisfaction than someone with a similar occupation and job, who is not mismatched.

For all other variables, I cannot safely conclude effects of mismatch. Either the identification bounds or the confidence intervals overlap with zero, which means that DGPs that are compatible with my assumptions about the relative weights of β_O and β_E could have produced the data with a linear mismatch term of zero. I need to highlight, however, that, especially in my application, a *failure to refute* the null-hypothesis of no mismatch-effect does not imply *support* for the null hypothesis. My tests are very conservative, because prior knowledge about the true main effect of education and occupation is weak. In fact, for virtually all dependent variables, DGPs that imply non-zero mismatch effects are compatible with the data. To rule out mismatch effects in these cases, or to show their existence, stronger assumptions, or more data, are necessary.

Such stronger assumptions are available for two of our dependent variables: job satisfaction and wages. I have argued that they represent instances, where a direct effect of education can safely be assumed away. The first panel of Figure 3-3 demonstrates that overqualification is associated with lower job

satisfaction, whereas underqualification goes together with higher satisfaction in the UK. This is true for a model using the assumption of zero education effects, represented by the circle marker, as well as for an E-ORU model, where I instead use the assumption of non-zero/equal-sign effects of both main-dimension. In this case, the returned mismatch effects are even more drastic, but possibly overstated, because they require that education per se increases job satisfaction.[23]

[23] One might even argue that the main effect of education should be *negative*, representing the idea that more schooling makes workers more demanding. I pursued this idea but did not find the evidence in its favor compelling. In a model, where the main effect of education is equal to the main effect of typical education, none of the main dimensions' effects is significantly different from zero. What is more, this model would indicate that overeducation makes people more satisfied, something that seems hard to believe.

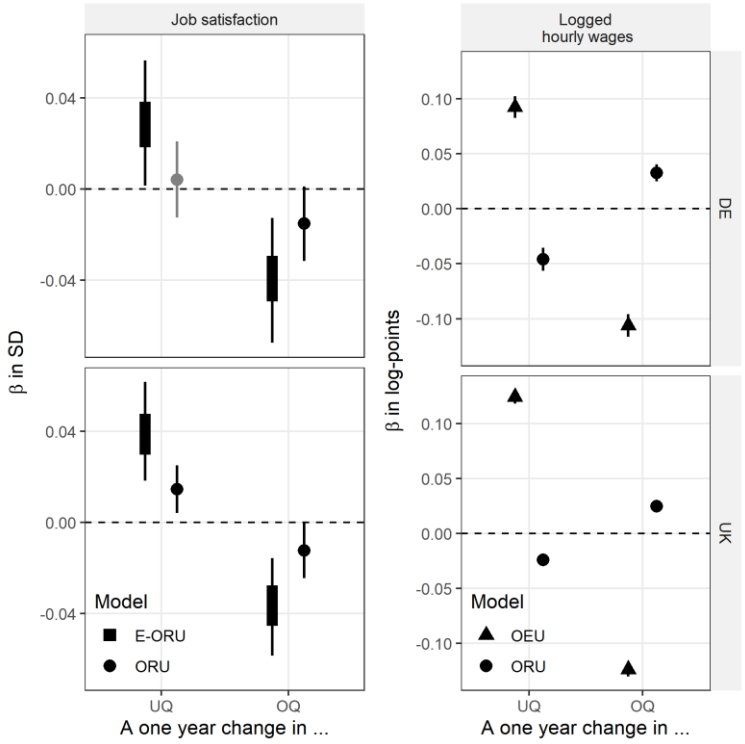


Figure 3-3. Social and political behaviors among mismatched workers

Note: Constrained linear probability models estimated on pooled data. 95% confidence intervals based on cluster-robust standard errors and ten imputations. UQ: Underqualification, OQ: overqualification. Results controlled for personal characteristics.

What could drive the association between mismatch, satisfaction and the other relationships I have documented? Wages are an obvious candidate. But when I turn to the second panel of Figure 3-3 and thus to the results for hourly wages, the first thing to note is that in both countries overqualified workers earn about 0.03 log-points, i.e. about 3%, *more* per hour than matched workers in the same occupation, and that underqualified workers earn less, net of all the personal characteristics I control for. This pattern is represented by the circle markers. As I have noted above, when the main effect of education is assumed to be zero in the E-ORU model, it collapses to the conventional ORU

decomposition. And indeed, my results on job satisfaction and wages echo findings from that literature (Korpi and Tåhlin 2009; Vaisey 2006).

However, I can also compare mismatched to matched workers with similar *education*. This approach highlights the opportunity costs to mismatching and takes into account that while overqualification might result in higher wages within one occupation, wages might have been even higher had overqualified workers found matched employment. Technically, this amounts to replacing required education (R) with actual education (E) in an ORU regression. The triangle markers provide the estimates of this OEU specification. In line with the rest of my results, I find that underqualification is associated with significant net-gains, and overqualification with large net-losses.

The first conclusion to draw from the empirical analysis is that the proposition of mismatch-effects without any linear component is not borne out by the data. This casts doubt on results obtained from the square additive model, from Zhang's model, and on Lenski's original formulation. For virtually all dependent variables, I find that over- and underqualification are associated with an outcome in opposing directions, even though my empirical model does in no way require such a pattern.

This is also an important finding for status inconsistency research on a theoretical level. While mismatches are clearly consequential for many outcomes, it does not appear to be the first and second psychological mechanisms proposed by status inconsistency theory, i.e. role conflict and cognitive dissonance, that result in dissatisfaction and withdrawal. It is not inconsistency per se that causes discontent. Rather, the negative consequences of mismatches expected by SIT are only present among the overqualified. This pattern is compatible with the third channel discussed above. It predicts opposing consequences for under- and overqualification as a result of an expectation formation mechanism: Discontent arises because prior expectations of occupational advancement, as instilled by education and training, have not been met.

The underqualified, vice versa, report, if anything, *higher* levels of satisfaction. Presumably, this is because they exceed their own expectations, and hence experience the socio-economic environment as particularly fair.

My results are less clear about the fourth mechanism in SIT, which claims that mismatch-experiences in the occupational domain spill over into the domain of political attitudes and behaviors. While all indicators that pertain directly to the world of work are clearly connected to mismatches in the E-ORU model, such patterns are weaker for political variables, which hardly reach statistical significance. What seems rather robust, however, is that the overqualified are less likely to be members of organizations.

One potential point of skepticism regarding these findings arises from the fact that in the E-ORU model mismatch effects are partially identified by explicit assumptions about the relative importance of education and occupation. How sensitive are my conclusions to these assumptions? I provide results for weaker assumptions in Online Supplement D. Here I note that the core of my results, i.e. those for job and life satisfaction, the importance of one's profession, wages, left-vote and organizational membership, are substantively unaffected by the choice of identifying assumptions.

Fixed-effects results

My discussion so far has assumed that mismatches *cause* views and behaviours. But this need not be so. People who end up in overqualification may have been different even before they became overqualified. I test the robustness of my results in the face of such concerns using fixed-effects models that control for all time-constant heterogeneity between individuals. This is only possible, however, for variables, where repeated measurements are available.

In my models, I allow for heterogeneous mismatch effects depending on whether a worker's current value of the linear mismatch term $(X_E - X_O)$ is

above (relative overqualification) or below (relative underqualification) the person-specific average across the period in the sample.

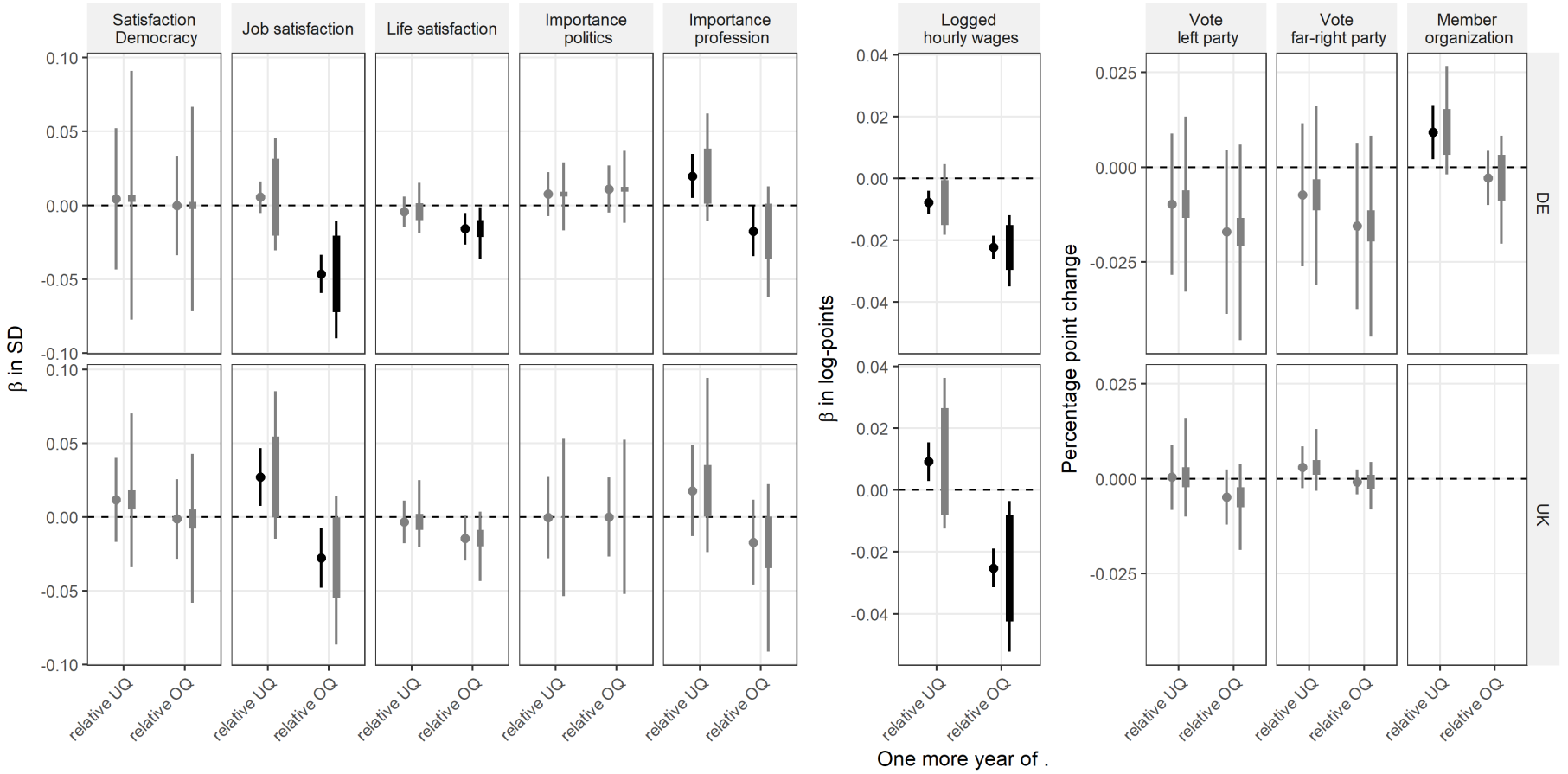


Figure 3-4: Changes in social and political attitudes, and wages after changes of occupation

Note: Constrained least squares fixed effects models. UQ: Underqualification, OQ: overqualification. 95% confidence intervals based on cluster-robust standard errors and ten imputations. Controls for age, tenure, and survey year.

Figure 3-4 gives the bounded estimates of mismatch-effects (bars) and the point estimates that result from assuming equal linear effects of mismatch and of occupation (circles). As explained above, the bounded estimates represent results for assuming that between all and none of the linear portion of effects are due to the mismatch component.

The results of these very conservative tests confirm the findings from the cross-sectional analysis. I find that outcomes close to the employment relationship are affected by changing mismatch-states. Relative overqualification decreases wages and satisfaction (the satisfaction variables are, however, not statistically significant in the UK). If we are willing to believe that half of the observed change in the personal importance attached to one's profession is due to the changing *mismatch* (as opposed to occupational) status (circle marker), we also find an effect on this outcome in Germany.

The effects of increasing relative undereducation appear to be weaker, but are present in the case of organizational membership, wages, and the importance of a professional identity in Germany – if we are willing to assume that some of the effects of job-changes are due to mismatches. Interestingly, I find that German workers, who move into relative underqualification, likely earn a bit less then implied by the occupation-change alone, whereas British workers likely earn a bit more. While my weak assumptions do not allow a definitive conclusion, this pattern seems to suggest that relative underqualification is less penalized in the UK than in Germany. Once we move towards attitudes and behaviours relating to politics, there is hardly any evidence for an effect of mismatch-changes, or, for that matter, of occupation changes, at all. Again, this echoes the results of the cross-sectional analysis. Across all outcomes, I find more statistically significant effects in the German data. This could be interpreted as a country difference. However, my longitudinal German data is much richer, because of the larger number of observations and years I can draw on. Therefore, the dissimilarities apparent in Figure 3-4 are in

all likelihood the result of lower statistical power in the British sample, rather than a reflection of genuine differences between the countries. All things considered, the results of the longitudinal models thus support the conclusions from the cross-sectional analysis.

Conclusion

Do qualification-to-job mismatches have consequences for the social and political attitudes of affected workers? This article started out with a critique of previous efforts to answer this question. I argued that the theoretical commitments of conventional strategies do not permit an answer except under very specific circumstances. Referring to the most recent age-period-cohort literature, I instead introduced a framework that uses explicit restrictions on the theoretical model based on substantive reflection to bring us closer to a solution in a wider range of scenarios.

I find that under weak and plausible assumptions, mismatched differ from matched workers beyond what is implied by their differing occupations and qualifications alone in well-being, identity, and social integration. Mismatch or inconsistency is therefore an important concept in studying the subjective experience of social stratification. Conservative fixed-effects estimators that tackle the issue of selection bias confirm the gist of my cross-sectional findings.

While I was able to show that mismatch or status inconsistency does have important consequences for the individual, my analyses nevertheless refute some of the core hypotheses of status inconsistency theory. First, I find that the most important psychological mechanism assumed by status inconsistency theory, cognitive dissonance, is unlikely to account for the observed patterns. The predicted pattern of dissatisfaction, distance from professional roles, social withdrawal, and political opposition, is evident only for the

overqualified. The underqualified, however, despite their mismatch, are more satisfied, identify more with their professional role and are not more critical of the democratic system. In this sense, undereducation does not seem to be a problematic condition. All this suggests that it is not role incongruences as such, but the specific experience of underachievement that is at the root of the strains described by status inconsistency theory.

Second, while scholarly debate has strongly focused on the wider political and societal consequences of pervasive mismatch, neither the cross-sectional nor the longitudinal analyses provide convincing evidence for such a relationship. This suggests that any link between mismatch and political dissatisfaction is at most weak and likely not causal. Hence, while I was able to demonstrate that overqualification poses problems for the wellbeing of individuals even in a conservative within-person comparison, rising rates of mismatch are unlikely to cause widespread political alienation.

The results of my analyses are very similar between the UK and Germany. Methodologically, this builds confidence into my core results, as it demonstrates that conclusions can be replicated using a different survey study and slightly different questionnaire wording. Substantively, the evident similarity suggests that the processes I investigated take place on a rather basal psychological level and are less affected by the respective institutional context.

In the end, the substantive contributions of this study may appear somewhat paradoxical. On the one hand, the analyses have shown that classic inconsistency theory as pioneered by Lenski is hardly suited to explain the experience of mismatched workers. On the other hand, however, the main result of this study – that a mismatched employment situation affects the wellbeing of individuals beyond occupation and education – provides an occasion for sociology to reinvigorate research into the multi-dimensionality of social status. The experience of falling short of institutionalized expectations, but also

of exceeding them, seems to provide workers with an independent source of strain, or satisfaction, respectively.

Beyond the question of mismatches, I would like this study to be seen as an application of a broader conceptual point. As the conflation of mismatch and education effects in the ORU model demonstrates, the fact that a quantity is readily measurable does in no way mean that it corresponds to the process that actually generated the data. Vice versa, the fact that a parameter is not empirically identified does not mean that it is theoretically, or indeed in reality, meaningless. In this sense, sociological research can profit from distinguishing much more sharply between theoretical ("structural") models of the data generating process and the empirical ("reduced form") models that can in fact be statistically estimated.

Literature

Blalock, Hubert M. 1966. 'The Identification Problem and Theory Building: The Case of Status Inconsistency'. *American Sociological Review* 31(1):52.

Blocker, T. Jean and Paul L. Riedesel. 1978. 'The Nonconsequences of Objective and Subjective Status Inconsistency: Requiem for a Moribund Concept'. *The Sociological Quarterly* 19(2):332–39.

Buck, Nick and Stephanie McFall. 2011. 'Understanding Society: Design Overview'. *Longitudinal and Life Course Studies* 3(1):5–17.

Burris, Val. 1983. 'The Social and Political Consequences of Overeducation'. *American Sociological Review* 48(4):454.

Deutsches Institut Für Wirtschaftsforschung. 2017. 'Sozio-Oekonomisches Panel (SOEP), Daten Der Jahre 1984-2016'.

Dudal, Pieter and Piet Bracke. 2019. 'On the Moderation of the Relation between Overeducation and Depressive Symptoms through Labor Market and Macro-Economic Factors'. *Health & Place* 56:135–46.

Duncan, Greg J. and Saul D. Hoffman. 1981. 'The Incidence and Wage Effects of Overeducation'. *Economics of Education Review* 1(1):75–86.

Duncan, Otis Dudley. 2005. 'Methodological Issues in the Analysis of Social Mobility'. Pp. 51–97 in *Social Structure and Mobility in Economic Development*, edited by S. Lipset. New York: Routledge.

Dunlavy, A. C., A. M. Garcy, and M. Rostila. 2016. 'Educational Mismatch and Health Status among Foreign-Born Workers in Sweden'. *Social Science & Medicine* 154:36–44.

Felstead, Alan, Duncan Gallie, Francis Green, Yingxiong Zhou, and Centre on Skills, Knowledge and Organisational Performance, eds. 2007. *Skills at Work, 1986 to 2006*. Oxford: ESRC Centre on Skills, Knowledge and Organisational Performance.

Festinger, Leon. 1962. *A Theory of Cognitive Dissonance*. Stanford University Press.

Fosse, Ethan and Christopher Winship. 2019a. 'Analyzing Age-Period-Cohort Data: A Review and Critique'. *Annual Review of Sociology* 45(1):467–92.

Fosse, Ethan and Christopher Winship. 2019b. 'Bounding Analyses of Age-Period-Cohort Effects'. *Demography*.

Geschwender, James A. 1967. 'Continuities in Theories of Status Consistency and Cognitive Dissonance'. *Social Forces* 46(2):160–71.

Geschwender, James A. 1968. 'Status Inconsistency, Social Isolation, and Individual Unrest'. *Social Forces* 46(4):477–83.

Goffman, Irwin W. 1957. 'Status Consistency and Preference for Change In Power Distribution'. *American Sociological Review* 22(3):275.

Hendrickx, John, Nan Dirk De Graaf, Jan Lammers, and Wout Ultee. 1993. 'Models for Status Inconsistency and Mobility: A Comparison of the Approaches by Hope and Sobel with the Mainstream Square Additive Model'. *Quality and Quantity* 27(4):335–52.

Hope, Keith. 1975. 'Models of Status Inconsistency and Social Mobility Effects'. *American Sociological Review* 40(3):322–43.

Horowitz, Jonathan. 2018. 'Relative Education and the Advantage of a College Degree'. *American Sociological Review* 83(4):771–801.

Jackson, Elton F. 1962. 'Status Consistency and Symptoms of Stress'. *American Sociological Review* 27(4):469.

Jackson, Elton F. and Peter J. Burke. 1965. 'Status and Symptoms of Stress: Additive and Interaction Effects'. *American Sociological Review* 30(4):556–64.

Jackson, Elton F. and Richard F. Curtis. 1972. 'Effects of Vertical Mobility and Status Inconsistency: A Body of Negative Evidence'. *American Sociological Review* 37(6):701.

Korpi, Tomas and Michael Tåhlin. 2009. 'Educational Mismatch, Wages, and Wage Growth: Overeducation in Sweden, 1974–2000'. *Labour Economics* 16(2):183–93.

Lenski, Gerhard. 1964. 'Comment'. *Public Opinion Quarterly* 28(2):326–30.

Lenski, Gerhard E. 1954. 'Status Crystallization: A Non-Vertical Dimension of Social Status'. *American Sociological Review* 19(4):405–13.

Lenski, Gerhard E. 1956. 'Social Participation and Status Crystallization'. *American Sociological Review* 21(4):458–64.

Levels, M., R. van der Velden, and J. Allen. 2014. 'Educational Mismatches and Skills: New Empirical Tests of Old Hypotheses'. *Oxford Economic Papers* 66(4):959–82.

McGuinness, Seamus. 2006. 'Overeducation in the Labour Market'. *Journal of Economic Surveys* 20(3):387–418.

Niemi, R. G. and B. I. Sobieszek. 1977. 'Political Socialization'. *Annual Review of Sociology* 3:209–33.

O'Brien, Robert M. 2014. 'Estimable Functions in Age-Period-Cohort Models: A Unified Approach'. *Quality & Quantity* 48(1):457–74.

Olsen, Marvin E. and Judy Corder Tully. 1972. 'Socioeconomic-Ethnic Status Inconsistency and Preference for Political Change'. *American Sociological Review* 37(5):560.

Portes, Alejandro. 1972. 'Status Inconsistency and Lower-Class Leftist Radicalism'. *The Sociological Quarterly* 13(3):361–82.

Rohrbach-Schmidt, Daniela and Michael Tiemann. 2016. 'Educational (Mis) Match and Skill Utilization in Germany: Assessing the Role of Worker and Job Characteristics'. *Journal for Labour Market Research* 1–21.

Sears, David O. and Christia Brown. 2013. 'Childhood and Adult Political Development'. Pp. 59–95 in *The Oxford Handbook of Political Psychology*, edited by L. Huddy, D. O. Sears, and J. S. Levy. Oxford, New York: Oxford University Press.

Sloane, P. J., H. Battu, and P. T. Seaman. 1999. 'Overeducation, Undereducation and the British Labour Market'. *Applied Economics* 31(11):1437–53.

Smith, Brendan T., Peter M. Smith, Jacob Etches, and Cameron A. Mustard. 2012. 'Overqualification and Risk of All-Cause and Cardiovascular Mortality: Evidence From the Canadian Census Mortality Follow-up Study (1991–2001)'. *Canadian Journal of Public Health* 103(4):e297–302.

Sobel, Michael E. 1981. 'Diagonal Mobility Models: A Substantively Motivated Class of Designs for the Analysis of Mobility Effects'. *American Sociological Review* 46(6):893.

Stryker, Sheldon and Anne Statham Macke. 1978. 'Status Inconsistency and Role Conflict'. *Annual Review of Sociology* 4(1):57–90.

Vaisey, Stephen. 2006. 'Education and Its Discontents: Overqualification in America, 1972–2002'. *Social Forces* 85(2):835–864.

Van Buuren, Stef. 2012. *Flexible Imputation of Missing Data*. CRC press.

Verba, Sidney, Norman H. Nie, and Jae-on Kim. 1978. *Participation and Political Equality*. New York: Cambridge University Press.

Zhang, Xiaotian. 2008. 'Status Inconsistency Revisited: An Improved Statistical Model'. *European Sociological Review* 24(2):155–68.

Zhu, Rong and Linfeng Chen. 2016. 'Overeducation, Overskilling and Mental Well-Being'. *The B.E. Journal of Economic Analysis & Policy* 16(4).

4 Skill-Shortages or Credential-Inflation?

A cohort-analysis of qualification-mismatches in Great Britain and Germany

Abstract

Over the past century, completion of educational programs at all levels has increased dramatically. This dramatic expansion of education has been recognized by sociologist as one of the major forces shaping social change. However, it remains debated whether educational expansion has outstripped the demand for qualified labour, resulting in credential-inflation, or, whether, despite increases in education, modern economies face a skill-shortage. Focussing on the United Kingdom and West Germany, two highly developed, but institutionally dissimilar countries, this paper therefore asks to what degree the sharp expansion of education has been absorbed by labour markets. I point out shortcomings of traditional wage-centred analyses and develop an alternative approach that focuses on period and cohort trends in self-reported mismatches between individuals' education and their jobs, that is, on over- and underqualification. Based on repeated surveys (UK: Skills and Employment Survey, 1986-2017; Germany: Socioeconomic Panel Study, 1984-2016) and on official labour force surveys, I show that overqualification has increased and underqualification decreased in the United Kingdom since the 1980s, both over historical time and over cohorts. In Germany, by contrast, mismatch-differences are minimal between cohorts, but the overall incidence of underqualification increased whereas overqualification decreased. Further analyses of cohort-differences in mismatch provide clear evidence that overqualification increased with educational expansion in the United Kingdom but not in Germany. I document that credential inflation at the tertiary level trickled down the qualification hierarchy in the United Kingdom, suggesting a labour queue mechanism and a positional value of education. My findings document that the United Kingdom experiences credential inflation, whereas West-Germany is affected by a mild skill-shortage, mainly among middling positions that require vocational training. I relate these findings to well-documented differences in patterns of educational expansion between the United Kingdom and Germany that are rooted in contrasting institutional logics.

Introduction

Over the past century, completion of educational programs at all levels has increased dramatically. In 1953 just 19% of 17 year old Britons attended full time schooling or training, but in the 2010s close to 90% did (House of Commons, 2012). By 2018 half of 25 to 34 year olds had undergone tertiary programmes (OECD, 2019). In West Germany, 79% of 7th graders attended *Volksschulen* in 1952 and were thus bound to graduate by the age of 15. As a result, just 8% of a cohort enrolled in tertiary education in 1960. In 2010, by contrast, almost 40% did (Geißler, 2014: 335 ff.). This dramatic expansion of education has been recognized by sociologist as one of the major forces shaping social change (Baker, 2014; Collins, 1979). However, there is disagreement as to whether educational expansion has outstripped the demand for qualified labour, or, whether, despite increases in education, modern economies increasingly face a shortage of highly educated labour (Collins, 1979; Goldin and Katz, 2010; Wolf, 2002). I refer to these diagnoses as the credential-inflation and the skill-shortage hypothesis, respectively.

Focussing on the United Kingdom and Germany, two highly developed but institutionally dissimilar countries, this paper therefore asks the following two questions: First, to what degree has the sharp expansion of education been absorbed by labour markets? Do we witness an inflation of credentials or is there a skill-shortage? Second, to which extent does this differ between the United Kingdom and Germany with their different institutions and patterns of expansion?

Traditionally, answers to similar questions are based on analyses of changes in the relative wages of qualification groups (Tinbergen, 1956; Goldin and Katz, 2010). Such analyses suffer from the fact that wages are the product of market as well as of institutional forces. Wage-based analyses have therefore been criticized on the grounds that wage inequality between qualification groups is

confounded by factors such as changing minimum wage legislation, collective bargaining, or firms' degree of monopsony power. According to this line of critique, wage trends alone are not an adequate measure of the supply and demand of skills (Cappelli, 2015; Kristal and Cohen, 2017). I thus argue that the question whether we face a skill-shortage or an education glut is still open.

I develop an alternative approach that focuses on period and cohort trends in self-reported mismatches between individuals' education and their jobs, that is on over- and underqualification. I regard prevalent overqualification as indication that educational expansion has outstripped the upgrading of the occupational structure. Vice versa, I argue that widespread underqualification indicates that there are more jobs requiring high qualifications than there are adequately educated workers to fill them. My approach adds to an emerging literature that uses alternative measures to assess the labour market absorption of educational expansion more directly (Horowitz, 2018).

Mismatches do not only offer a fresh analytical angle, they are also sociologically important in their own right (Vaisey, 2006; Kalleberg, 2008). Overqualification, for instance, is often regarded as an indication of inefficient investments in human capital (McGuinness, 2006; Berg and Gorelick, 2003), and has been linked to lower wages, and lower job- and life-satisfaction (Korpi and Tåhlin, 2009; Allen and van der Velden, 2001; Battu et al., 1999; Wiedner, 2020), possibly also causing political discontent (Burris, 1983; Lenski, 1954; but cf. Wiedner, 2020). Underqualification, on the other hand, opens up pathways to the reproduction of social status outside the education system (Wiedner and Schaeffer, 2019). Since mismatches concern the link between individuals' education and their occupation, they bear directly on models of intergenerational social mobility (Bernardi and Ballarino, 2016; Capsada-Munsech, 2015, 2019b). Historical trends in mismatch incidence are therefore indicative of the general development of systems of status attainment and should thus be of great interest to sociologists (Vaisey, 2006).

The first contribution of my paper is therefor to provide comparable estimates of mismatch-trends for the period 1986-2017 and for cohorts born between the 1920s and 1980s for the United Kingdom and Germany, and to offer a cohort-based perspective on the relationship between increasing educational levels and qualification. A cohort perspective naturally accommodates the process of educational upgrading, which essentially takes place between generations. However, existing research has so far mainly sought to identify the relationship between educational expansion and overqualification from cross-sectional variation between countries and regions (Di Pietro, 2002; Verhaest and Van der Velden, 2013; but cf. Horowitz, 2018).

The second contribution is to include underqualification into the analysis, and to systematically consider expansion at different qualification levels. Previous work has largely been confined to the study of overqualification, often limited to graduates and tertiary expansion. Underqualification, however, is arguably of similar importance from the individual's point of view, and according to my data quite frequent. It should thus be taken into consideration in order to get a full picture of the relationship between macrosocial forces and individual's occupational attainment. Similarly, I show that educational expansion has had strong effects on qualification mismatch patterns below the graduate level.

The third contribution of this paper is to show that the relationship between educational expansion and qualification mismatch is highly contingent on contextual factors. Educational expansion went hand in hand with increasing over- and falling underqualification in the United Kingdom, but not in Germany.

I arrive at these conclusions by studying time-series of mismatch-incidence based on repeated surveys from the United Kingdom (Skills and Employment Survey, UKSES, 1986-2017) and Germany (Socioeconomic Panel Study, SOEP, 1984-2016). These countries represent different varieties of

capitalism with vastly different education systems, industry structures, and labour market rules (Wren, 2013; Müller and Gangl, 2003; Hall and Soskice, 2001). I complement these microdata with contextual information from labour force surveys and estimate statistical models, which link patterns of educational expansion to under-/overqualification rates. My models exploit differences in education within historical time and regions between cohorts to estimate the relationship between a cohorts' incidence of mismatch and its qualification structure.

Skill biased labour market change, educational expansion, and the role of institutional context

The two most prominent theories of the changing value of formal qualifications provide contradictory assessments of the labour market absorption of educational expansion. The skill-biased technological change hypothesis (SBTC) highlights growing demand for education due to technological development. SBTC largely treats educational expansion, the supply of skill, as exogenous. But at some point, SBTC argues, demand for skill has outstripped supply. Labour markets thus increasingly experience a shortage of skilled workers. The sociological credential-inflation literature, on the other hand, focuses on the supply side and proposes mechanisms causing educational expansion. Typically, these are thought of as largely separate from technical development. But if forces other than technology-induced demand are behind increased qualification-uptake, inflation theorists argue, there should be an inflation of credentials. In the following section, I review these theories and

their evidence.[24] I then examine the education systems and labour markets of the two cases under study and provide an argument, why the global forces proposed by the two theories need to be understood in the context of national institutions.

Skill-biased technological change

The dominant view in on the changing balance between educational expansion and skill-demand in economics is that of an increasing skill-shortage (at least at stable prices, i.e. wages).[25] To be sure, SBTC theory's main concern is with increasing wage-inequality, but the mechanism it assumes is that of a skill-shortage. This analysis is rooted in the idea that technological innovations complement the productivity of workers with higher levels of education, but often substitute for less-educated workers (Acemoglu and Autor, 2012; Goldin and Katz, 2010; Tinbergen, 1956). Technological progress thus increases the relative demand for skilled vs. unskilled workers. Education's value on the labour market therefore depends on a "race between education and technology": If the rate of technological innovation outpaces the expansion of education, the economy's skill demand will outstrip supply, increasing skilled relative to unskilled wages (Goldin and Katz, 2010). A large literature in labour economics argues that this mechanism explains much of the increases in

[24] A third neo-institutionalist position sees the question of whether there is "too much" education as ill-posed and argues that increased educational uptake has changed the very nature of contemporary societies in ways that go beyond simple demand-supply-relations (Baker, 2014).I do not have the space to explicitly consider this criticism in this paper, but I note that the fact that there *are* significant numbers of people who say that a lower qualification than theirs to perform their current role shows that, at least to some workers, overqualification is a real phenomenon.

[25] Of course, the concept of "skill-shortage" is ill-defined from a strictly economic perspective, because in a flexible economy market forces will ensure relative wage-levels that reflect the scarcity of different kinds of labor, which will in turn lead firms to reorganize production efficiently (Arrow and Capron, 1959). The term "skill-shortage" thus implies that consequences of the relative scarcity of a qualification-group have consequences that are deemed *normatively* unacceptable, such as excessive wage-inequality.

wage-inequality that have occurred in rich societies, but particularly in the United States since the 1970s (Acemoglu and Autor, 2011; Katz and Murphy, 1992; Machin and Reenen, 1998). From an SBTC perspective, increasing wage inequality thus reflects a shortage of skilled labour. A related strand of research in sociology documents that occupational structures in Europe have indeed upgraded dramatically, suggesting that relative skill-demand has in fact increased (Fernández-Macías and Hurley, 2017; Oesch, 2013; Oesch and Piccitto, 2019)

Credential inflation and relative education

SBTC-research is based on the human capital theory of education, which holds that education and qualifications are valued by employers and students because they create and certify relevant skills, which then translate into high productivity and earnings. By contrast, many sociological approaches highlight that education's function goes beyond technical know-how. Prominent theories around the notion of credential inflation argue that schooling is important to policy makers, parents, students and employers, because it instils obedient work-attitudes, legitimizes social stratification, equips students with cultural currency that gives access to closed occupational positions, is a means of self-realization, or a symbol of family prestige. From the perspective of these theories, educational expansion is thus either an ideological deception which creates the mere appearance of upward-mobility (Bourdieu and Passeron, 1970; Bowles and Gintis, 1977), the result of struggles for cultural hegemony and occupational closure (Collins, 1979), or an expression of a growing desire for personal development (Baker, 2014). In any case, these ideological, political, or cultural reasons for expansion bear preciously little connection to technological requirements. Expansion for these non-technical reasons is therefore likely to exceed employers' demand for more highly qualified workers.

Other social scientists point to micro-level processes, which lead rational actors to acquire education beyond labour market demand. The central argument in such analyses is that education has a relative rather than an absolute value. According to the labour queue model, education is a signal of future productivity or trainability and employers rank applicants according to their level of qualification (Thurow, 1975). The value of a given person's qualification therefore depends on the levels of education of others in the queue. This mechanism is therefore described as the relative or positional education hypothesis (Horowitz, 2018). If education is positional, educational expansion translates into a heightened incentive to obtain yet more education, in order to preserve one's relative position (Bol, 2015). Since education essentially becomes a race for the highest degree, overqualification, relative to actual skill-requirement, will be very prevalent, as firms' hiring standards escalate. The implications of the arguments sketched in this section for mismatch trends are clear: If forces other than technology-induced demand are behind increased qualification-uptake, there should be an excess-expansion of education. Holders of higher degrees will find it increasingly hard to find fitting work and rates of overeducation will rise across cohorts and historical time.

Evidence on credential inflations and skill-shortages

Even though they are mutually contradictive, there are compelling arguments for the idea that modern societies face a skill-shortage as well as for the idea that expansion has dramatically outstripped demand. Existing empirical studies likewise produce inconsistent results. Wage-based analyses often conclude that there is a skill-shortage, but studies using other approaches overwhelmingly find support for the credential-inflation thesis. This section summarizes the lessons and limitation of these studies.

Work by economists on the United States documents dramatically increasing wage inequality between but also within qualification groups that is linked

to the stagnation of college completion rates since the 1970s (Goldin and Katz, 2010; Katz and Murphy, 1992). Variants of the skill-shortage thesis of SBTC are hence widely accepted among US economists (Acemoglu and Autor, 2011; but cf. Card and DiNardo, 2002). In Germany, increases in wage inequality have been much more moderate, which might reflect the substantial expansion of the education system since the 1950s. Nevertheless, studies conclude that SBTC, and hence skill-shortages, had a part in increasing wage inequality in Germany (Dustmann et al., 2009). In Britain, educational expansion was even more pronounced. At the same time, however, between education-group inequality, and wage inequality overall, rose dramatically, suggesting that institutional changes may have played a dominant role there (Gosling and Lemieux, 2004). In sum, economics analyses provide some evidence for the skill-shortage thesis, although the British pattern does not fully square with the dominant perspective.

However, studies that infer changes in the ratio of skill-demand to its supply from wage data face increasing criticism (Cappelli, 2015; Kalleberg, 2011). In order to provide evidence in favour of SBTC, they must assume that observable wage changes are due to shifting demand or supply, and not to other factors. But much research demonstrates that factors such as changing minimum wages, de-unionisation and other forms of rent-destruction and -creation have contributed significantly to increased wage-inequality (for examples, see Kristal and Cohen, 2017; Weeden and Grusky, 2014; Fitzenberger et al., 2013; Gosling and Lemieux, 2004). At least in simple wage-analyses these forces act as omitted variables and bias estimates of excess-demand for skill.

If we take this criticism seriously, the conclusion that wage inequality rose because of a shortage of skilled labour is premature. Vice versa, this also puts important evidence in favour of the skill-shortage thesis into question. Above, I have introduced rates of qualification mismatch as an alternative measure of the degree of absorption of educational expansion by labour markets. Under

SBTC rates of overeducation should decrease, as employers seek to exploit the capacities of highly qualified workers. At the same time, rates of undereducation should increase, as firms hire workers for positions above their formal level of education to avoid interruptions of their business. Credential inflation approaches would expect the inverse pattern: rising overqualification, and sinking underqualification, as education becomes the sole mean to allocate desirable jobs. What do the findings of previous research tell us about these relationships?

In contrast to wage inequality analyses, mismatch analyses tend to find evidence against the skill-shortage and in favor of the credential-inflation hypothesis. The analysis of mismatch rates started in earnest with Di Pietro (2002), who analysed the aggregated country-level incidence of overeducation. He reports a positive relationship of overqualification rates with educational expansion. Croce and Ghignoni (2012) apply a similar cross-country comparative design, but fail to find a robust relationship between qualification supply and graduate overeducation in a sample of European countries. Similarly focusing on graduates and a country-comparison, Verhaest and van der Velden (2013) find that their indicator of graduate oversupply, essentially the difference between a country's relative graduation rate and its relative research and development spending, is strongly predictive of overqualification rates. Between-country analyses thus suggest that educational expansion goes hand in hand with higher rates of overqualification.

While suggestive, between-country analyses suffer from limitations. Firstly, there might be omitted variables at the country level that simultaneously affect expansion and growing overqualification. Secondly, another problem arises from aggregating information at the country level. In aggregate data, compositional differences cannot be adjusted for. But a higher proportion of degree holders in the population does not just mean higher competition for a given number of graduate jobs, it also means that there are simply

more workers at risk of overqualification in the first place. Aggregate regressions thus overstate the relationship between expansion and overqualification.

Two studies apply more nuanced strategies. These, too, support the idea that educational expansion has outstripped demand. Davia et al. (2017) use repeated measures from different countries to estimate the effects of changes in the supply of graduates on graduate mismatch rates in a two-way fixed-effect design, which purges the estimates of country- and period-confounders. They find that increases in their measure of "excess educated labor supply" go hand in hand with increases in the share of overqualified people. Horowitz (2018) brings the analysis to the cohort level and reports that the skill-utilization-bonus conferred by a college degree in the US is diminished in birth-cohorts with higher graduation rates. Because this is not true for wage-bonuses, Horowitz concludes that wage-based studies suggesting unmet demand for high-skilled workers likely suffer from omitted variable bias.

Mismatch scholarship puts the dominant skill-shortage thesis into question. However, given the limited number of studies employing alternative measures, more careful research is needed before any conclusion can be reached. In this contribution, I add to this literature and extend it in three important ways, by considering expansion and possible displacement dynamics below the tertiary level, by covering undereducation, and by acknowledging that the relationship between educational expansion and mismatches depends on the economic and institutional context. These extensions are crucial to systematically evaluate the question of education-absorption with mismatch-indicators and outline its social consequences.

Credential inflation and skill-shortages in different contexts

In order to highlight the importance of contextual moderators in shaping the relationship between educational expansion and mismatch trends, I compare cohort-level relationships in the United Kingdom and in Germany. These

countries exemplify different institutional environments and socio-economic models. In the following I argue that the United Kingdom has experienced, first, stronger mismatch dynamics and, second, credential-inflation. Germany, by contrast, should show better qualification-to-job matching and, if anything, a shortage of qualified labour.

In general, mismatches will be more prevalent, when workers with different kinds of qualifications are easier to substitute for one another. Much research has documented that in the United Kingdom's general skills regime the signalling value of qualifications is low, and the correspondence of education to jobs is weak, whereas Germany's occupation specific labour markets and training pathways are in many ways the polar opposite (Heisig, 2018; Bol and Weeden, 2015; Hall and Soskice, 2001; Müller and Gangl, 2003). In the German context, a higher level of qualification can even penalize applicants if the field of training does not match the vacancy (Di Stasio, 2017). As a strategy for occupational attainment, overqualification in Germany is less likely to pay off (Di Stasio et al., 2016).

But institutions' influence on mismatches is even more fundamental. Institutional regimes shape what kinds of jobs and what kinds of workers there are in the first place. In Germany, a tracked school-system and limited access to university act as a brake on credential inflation (Mayer et al., 2007; Powell and Solga, 2011). Occupationally distinct pathways between secondary education, training and employment create little incentive to invest in surplus qualifications as a strategy to stay ahead of the labour queue (Di Stasio, 2017). In Britain, by contrast, expanding education at all levels has long been a policy priority among both Labour and Conservative governments. There are now many routes into higher education and an outright competition for students among providers of education (Busemeyer, 2014). The generalist nature of the British education system also means that there is a high individual incentive to aim for higher qualifications (Di Stasio et al., 2016).

The result is that according to the British Labour Force Survey (see below) about 19% of those born in 1953 went on to acquire tertiary education, while 37% did not attain any qualifications at all, but among those born in 1986, fully 44% graduated from a tertiary institution, whereas just under 7% reported no qualifications at all by their 30th birthday.[26] In Germany, the share of tertiary graduates (including from universities of applied sciences) expanded more mildly from 15% in the 1953 cohort to 24% in the 1984 cohort and the share of people without any vocational qualification fell from around 16% to 14%, according to the official micro census (see below). While expansion has therefore been substantial in both countries, these figures reveal that it has been more pronounced in the United Kingdom.

On the demand side of the labour market occupational upgrading, the shift of employment from less-skilled to more skill-intensive occupations, has been the dominant trend across the last 40 years in both countries. Nevertheless, when it comes to more nuanced differences, prominent theoretical arguments suggest that the United Kingdom and Germany responded to the challenge of technological and economic change in path-dependent ways (Hall and Soskice, 2001; Iversen and Wren, 1998; Wren, 2013). According to such arguments, growth in liberal market economies like the United Kingdom is driven by high- *and* low-skill services, while growth in political economies dominated by Christian democracy, like Germany, is driven by high-value added manufacturing that continues to require technically trained middle-skill workers (Esping-Andersen, 1999: 111 ff.). That is, institutional foundations determine the shifts in what kind of jobs are created as economies modernize. However, empirical assessments of these claims remain debated. While they agree that a general upgrading has taken place, scholars disagree about the precise form and extent shifts in the occupational structure took in the two countries

[26] For the sake of comparability, I focus on birth cohorts for which the labour force data that I use in the main analysis are available for 30-year olds.

(Fernández-Macías and Hurley, 2017; Oesch and Piccitto, 2019; Oesch and Rodriguez Menes, 2011). Hence, I treat the degree to which *occupational* has matched *educational* upgrading as an empirical question. I turn to this question after introducing the data and analytical strategy.

Data and Methods

Data sources

I rely on two kinds of data sources. For information on individuals, I use representative repeated surveys with a focus on matters of employment and qualifications, the United Kingdom Skills and Employment Survey Series (UKSESS; with seven surveys in the period 1986-2017; Felstead et al., 2014), and the German Socio-Economic Panel Study (GSOEP; with yearly rounds between 1984-2016; Wagner et al., 2007), respectively. Both studies collect comparable data in face-to-face interviews using well-documented sampling plans. A rarity in population surveys, both studies also asked respondents about the qualifications required for their jobs, the crucial measure to estimate time-series of vertical mismatch rates (see below). For information about patterns of educational expansion and the composition of the labour force across cohorts, I rely on the large official population surveys carried out by the respective statistical office, the Labour Force Survey in the United Kingdom (UKLFS, 1979-2017), and the Mikrozensus in Germany (GMZ; 1976-2013). Using these data, my models can draw on information from people born between 1927 and 1986 (United Kingdom) and 1926 and 1983 (Germany). The UKLFS was fielded biannually from 1979 to 1983 and annually 1984 and 1991. From 1992 on, I draw on the spring-sample of the quarterly LFS, which is collected between April and June. The GMZ was collected biannually from 1976 to 1995 and annually since. In case where there is no annual data, I impute missing

values in the various time series with the average of the last and the following year.

Measuring mismatch for comparative analysis

The dependent variable is an individual's vertical mismatch status, that is, whether he/she is underqualified, overqualified or adequately qualified relative to the job he or she is performing. To determine mismatch status, I compare respondents' subjective assessment of the required qualification in their current job with their own qualification. In contrast to other measurement approaches, this so-called self-assessment approach to mismatch-measurement has the advantage that it produces mismatch-rates that can be meaningfully compared across time and contexts (Capsada-Munsech, 2019a).

In the GSOEP, respondents are queried "What type of education or training is usually required for this type of work?" to prompt their assessment of qualification requirements. This item focuses on *skill-requirements* to *perform* the job. In the UKSES, by contrast, the question used to elicit respondents' assessment is "If they were applying today, what qualifications, if any, would someone need to get the type of job you have now?". This is a question about *entry-requirements* to *get* the job. Based on these measures, levels of mismatch can therefore not be directly compared between the two countries. Note that using the UKSES-question will yield *lower* levels of overqualification, higher levels of underqualification and higher levels of matches than the GSOEP question in a labour market where education is a positional good. Likewise, the UKSES indicator will react more slowly to credential inflation than the German one. These differences need to be kept in mind when interpreting the results.

Sample definition

In the main analysis, I limit the analytical sample to employed people between the ages of 30 and 60, who are currently not enrolled in full-time education or training. I concentrate on prime-age workers in order to rule out that later entries into employment caused by longer education phases affect my results. In the GSOEP, which is a panel study, I only use information from the first wave in which a respondent was interviewed. This is to ensure better comparability with the UKSES data, which follows a repeated cross-section design. However, robustness analyses in Section C of the Appendix III demonstrate that the results are substantively unchanged if I use all observations or select observations within respondents randomly. I use a case-wise deletion approach to deal with item non-response. However, with just 0.4% (UKSES) and 0.05% (GSOEP) of cases showing missing values on at least one of my variables, this is only a minor issue. All in all, I can draw on 17878 (United Kingdom) and 21048 (Germany) cases for the overqualification, and on 16560 (United Kingdom) and 17591 (Germany) cases for the underqualification analyses.

Analytic strategy and independent variables

My approach is to compare members of different cohorts, at the same point in time, and in the same region. This allows me to estimate the relationship between educational expansion as a cohort-phenomenon and the contemporaneous qualification mismatch rate in different cohorts. In doing so, I adjust for individuals' own highest qualification obtained, which rules out that composition effects influence my results. Based on the available survey data I distinguish six groups, according to a respondent's highest qualification:

- no qualifications,
- (non-minimal) secondary qualifications,
- two categories of vocational qualifications
    - in the United Kingdom:
        - lower vocational qualifications from short programmes, i.e. level 1 or 2 in the NVQ classification, and
        - more advanced vocational qualifications (NVQ level 3), e.g. apprenticeships or SCOTEC/SCOTBEC qualifications;
    - in Germany:
        - workers with vocational training, and
        - workers with higher vocational training, i.e. *Meister* and *Techniker*,
- lower tertiary certificates
    - United Kingdom: NVQ level 4, e.g. university *certificates* or nursing degrees;
    - Germany: universities of applied sciences (*Fachhochschule*), and
- university graduates.

Workers who are not eligible for mismatch (university graduates cannot be underqualified and people without qualifications cannot be overqualified) are excluded from the respective models. I limit the comparison to cohort-variation by including year-region fixed-effects into my model, i.e. one fixed-effect for each year-region combination. This rids my estimates of any period and region variation. The rationale for this approach is that if changes in the relative demand for qualifications, due to, for example, business-cycle effects, technological change or offshoring, play out exclusively across historical time and geographical regions, i.e. that they do not differ across cohorts, it offers a way to isolate the effect of educational expansion across cohorts from that of occupational change. This approach also controls for supply-side confounders such as possible displacement dynamics due to immigration. I further discuss the assumptions of this strategy below.

In addition to these fixed-effects, I adjust for a range of other variables that might confound estimates of the effects of educational expansion. At the individual level, I control for respondents' migration background (Germany; "native", "born to at least one immigrant parent" and "born abroad"), or their ethnic group (United Kingdom; "white", "asian", "black" and "other"), respectively, and an interaction of gender with their partnership status (partnered vs. not-partnered). Gender-specific results can be found in Section A of the Online Supplement. At the period-region-cohort level, I adjust for the size of a cohort (people born within +- 3 years from the base year), relative to the entire working age population 30 to 65 in that year in that region. This is to account for the possibility that members of relatively larger cohorts might face increased competition in accessing matching jobs or (Easterlin, 1968). While the selection of covariates is based on common practice and theory, the specification of the final model always reflects subjective choices made by the researcher. In order to transparently communicate these choices' implications, I report specification curves for the main results, which show the full range of estimates obtained for all plausible specifications, in Section D of the Online Supplement.

My main independent variables are indicators of the share of people of a given qualification level at a given point in time, in a given region, in a given cohort (again defined as above as people born within +- 3 years from one another). In the United Kingdom, I distinguish six categories (below secondary education, any non-minimal secondary education qualification, lower vocational qualifications, vocational qualifications including trade apprenticeships, lower tertiary qualifications, and tertiary qualifications) and in Germany three (secondary or lower, vocational qualifications, and tertiary qualifications). These coding choices reflect a compromise between two different goals: variables should accurately reflect important distinctions in the qualification

spaces of the respective systems and need to be codable in a consistent way across the time-series of labour force surveys.

To estimate the relationship between educational expansion, measured as the cohort-specific share of qualification Q_l, and the probability to be mismatched, I use the following random-effects linear probability model:

$$p(MM_{i,r,c,t} = 1) = \sum_{l=1}^{l=L} \alpha_l Q_{r,c,t,l} + \sum_{k=1}^{k=K} (\beta_k X_{k,i}) + \delta_{r \times t} + u_c + \epsilon_i.$$

This model estimates the probability that an individual i, member of cohort c, surveyed in region r (9 English government office regions, Wales, Northern Ireland and Scotland in the United Kingdom, and 10 *Länder* in West Germany) at historical time t will be mismatched, i.e. $MM_{i,r,c,t} = 1$. In this model $\delta_{r \times t}$ represents the period-region fixed-effects, u_c is a cohort-level random effect to account for the clustering of observations and measures within cohorts, ϵ_i an individual error term, and the term $\sum_{k=1}^{k=K}(\beta_k X_{k,i})$ represents K control variables including individual education as explained above. The quantities of interest in this model are the α_l, the estimates of the partial relationship between the cohort-specific share of qualification Q_l in r, at t (l indexes the qualification levels) and the corrsponding mismatch-probability. If α_l is positive, mismatches are more likely, where Q_l is more common. Below, I estimate different versions of this equation, and discuss the respective interpretation of α_l.

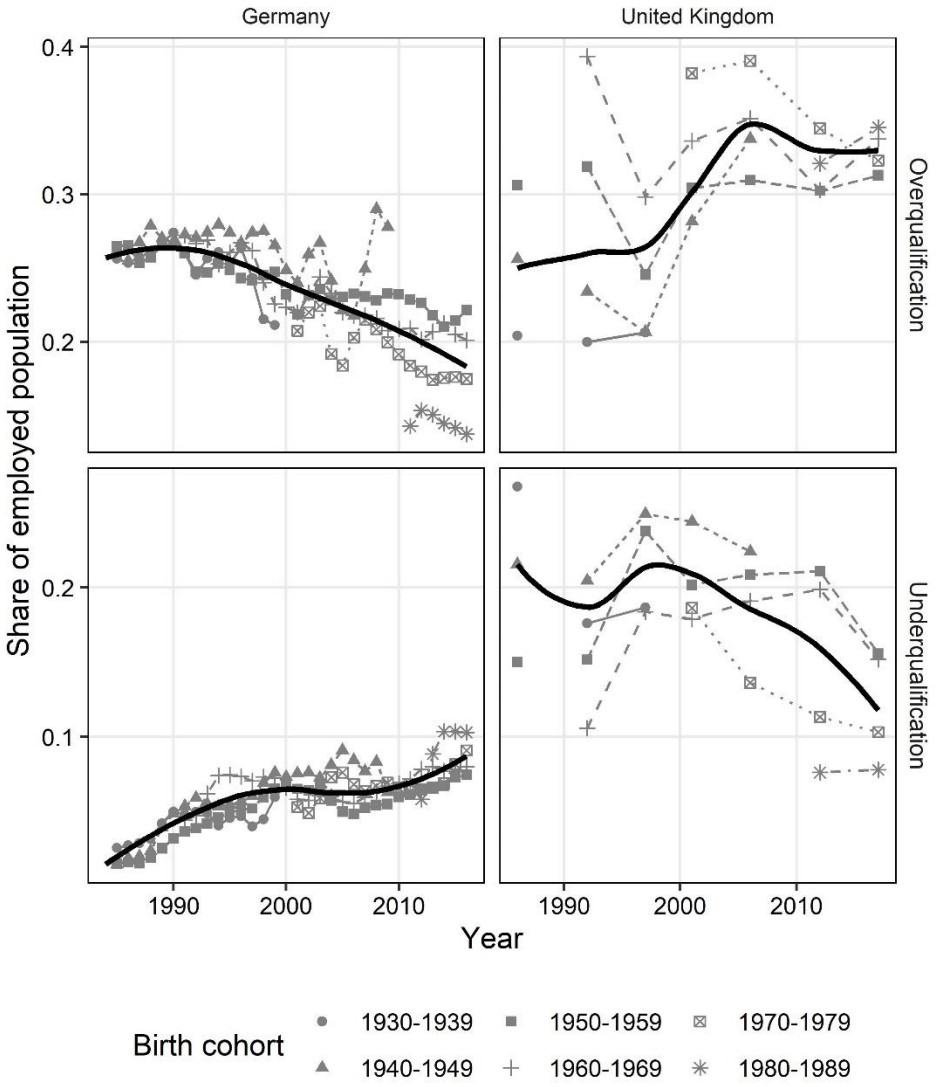
Results

I proceed by analysing descriptive trends in mismatch prevalence in the United Kingdom and Germany, followed by different multivariate analyses of increasing complexity.

Mismatch trends

What insights do trends in mismatch rates hold for the debate on skill-shortages and credential inflation? Figure 4-1 offers a first assessment.[27] Figure 4-1 documents that mismatch-trends in the United Kingdom and in Germany have been strikingly different. While there are signs of credential inflation in the United Kingdom, Germany's labour market seems to be moving into a mild skill-shortage. Overall overqualification rates rose in the United Kingdom but declined in Germany. The opposite is true for underqualification. The second difference between the two countries is that there are only small differences between cohorts in Germany, whereas British cohorts face vastly different situations, even at the same point in time. In fact, cohort differences in mismatch at any one point in time are often as large as the development that members of a single cohort experienced over their entire career. Respective younger cohorts faced the highest risk to be overqualified, and the lowest risk to be underqualified during almost all survey-years. Rising rate of overqualification and the declining rate of underqualification thus appear to be mainly driven by cohort-replacement. Trends in Germany, on the other hand, appear to take place mainly at the period-level, with mismatch rates of different cohorts being almost indistinguishable. If anything, younger cohorts appear to show *lower* overqualification rates from the late 2000s onward. Note that country differences thus evolve in the opposing direction to any possible bias introduced by the slightly differing item-wording in the United Kingdom and in Germany.

[27] Note that the first round of the British survey was not carried out in all regions. 1986 figures are hence not strictly comparable to later periods.



Solid line gives the LOWESS-smoothed overall incedence of mismatch.
Data source: UKSES 1986-2017, GSOEP 1984-2016.
Own calculation. German cohort figures are smoothed using a 2 year moving average.

Table 4-1 Trends in mismatch rates in the United Kingdom and in Germany

Educational expansion and qualification mismatch at the cohort level

Figure 4-1 suggests that skill-shortages and credential-inflations are a highly context-dependent phenomena. However, any definite conclusion at this point would be premature. The results in Figure 1 do not account for the fact that with educational expansion, a higher share of workers becomes eligible for overqualification in the first place, and likewise is no longer at risk of underqualification. What is more, the analysis in Figure 1 is largely silent about the source of differing trends in the two countries. At this point, it is unclear, as to whether mismatch trends are predominantly driven by the demand or the supply side. I thus now turn to models that link mismatch-incidence to cohort-level qualification shares, in order to probe explicitly whether educational expansion has been absorbed on the British and German labour markets. Table 4-2 gives the relationship between region-cohort qualification shares and the respective mismatch rate obtained from the model described in Equation 1, that is, net of individual education, other controls, and all variation between period-regions. Table 4-2 reports coefficients obtained from a reduced model, where every qualification-level Q_l is entered separately.

Table 4-2: Relationship between educational expansion and qualification mismatch, individual RE-LPM results

	United Kingdom												Germany					
	Overqualification						Underqualification						Overqualification			Underqualification		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Expansion of … no qualifications	-0.301*** (-4.21)						0.383*** (6.15)						0.195 (1.51)			-0.0758 (-0.88)		
…secondary		0.233*** (3.86)						-0.270*** (-5.06)										
…lower voc.			-0.657** (-3.22)						0.623*** (3.35)									
…vocational				-0.458** (-2.98)						0.638*** (4.83)				0.399** (2.89)			0.0295 (0.31)	
…lower tert.					-0.170 (-0.60)						0.396 (1.49)							
…tertiary qualifications						0.280** (2.96)						-0.580*** (-6.16)			-0.607*** (-4.44)			0.0634 (0.67)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	17878	17878	17878	17878	17878	17878	16560	16560	16560	16560	16560	16560	21489	21489	21489	17971	17971	17971
N_{Years}	7	7	7	7	7	7	7	7	7	7	7	7	29	29	29	29	29	29
$N_{Regions}$	12	12	12	12	12	12	12	12	12	12	12	12	10	10	10	10	10	10
$N_{Cohorts}$	61	61	61	61	61	61	61	61	61	61	61	61	56	56	56	56	56	56
Variance components																		
$Var_{Intercept}$	0.0000957	0.000104	0.000117	0.000158	0.000279	0.000218	0.0000214	0.0000167	0.000125	0.0000357	0.000360	0.000105	0.0000620	8.00e-14	6.25e-10	1.83e-23	1.43e-22	1.67e-17
$Var_{Residual}$	0.227	0.227	0.227	0.227	0.227	0.227	0.170	0.170	0.170	0.170	0.170	0.170	0.154	0.154	0.153	0.0610	0.0610	0.0610

t statistics in parentheses. Cohort random effects. Individual controls: Interaction gender and partnership status, and ethnicity. Cohort controls: relative size of cohort. Results controlled for period-region fixed-effects.

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Using a conceptually different approach, Table 4-2 confirms the significant difference in the relationship between expansion and mismatch in the two countries: credential inflation in Britain, but an overall balance in Germany. Starting with overqualification, the most important finding from these specifications is that a larger share of university graduates in a region-cohort is associated with rising overqualification in the United Kingdom, but with sinking overqualification in Germany. Vice versa, more people without qualifications in a cohort went together with less overqualification in that cohort in the United Kingdom. Interestingly, a higher share of people with middling vocational qualifications is associated with less, not more overqualification. Turning to underqualification, the results are the mirror-image of those for overqualification in the United Kingdom. Underqualification sank, where and when graduation from university expanded and those without any qualifications became less common. In Germany there is hardly any relationship between changing qualification patterns and underqualification at the region-cohort-level.

Results from the reduced specification presented in Table 4-2 accurately convey relationships at the cohort-level. However, they do not reflect the fact that qualification shares are mutually dependent. A rise in university graduates also implies a sinking share of workers with qualifications below university-level. Single coefficients as in Table 4-2 confound these two forces. Table 4-3 therefore reports results, when all qualification-shares are entered simultaneously. Of course, these models are only identified when one reference category is omitted. Here, I present results for omitting the "no qualification"-category. The counterfactual evoked by my models is thus one, where expansion in any one category happens at the expense of the "no qualification"-category. Results for using other references can be found in Section C of the Online Supplement. These additional estimates underline the robustness of my results.

	United Kingdom		Germany	
	Overqualification	Underqualification	Overqualification	Underqualification
	(1)	(2)	(3)	(4)
Expansion of…				
…secondary	0.192*	-0.195*		
	(1.98)	(-2.29)		
…lower voc.	-0.264	0.151		
	(-0.96)	(0.61)		
…vocational	0.0293	0.0953	0.173	0.0636
	(0.14)	(0.54)	(1.14)	(0.61)
…lower tert.	-0.175	0.382		
	(-0.58)	(1.40)		
…tertiary	0.259*	-0.495***	-0.535***	0.0879
education	(2.41)	(-4.89)	(-3.55)	(0.85)
Individual controls	Yes	Yes	Yes	Yes
Cohort controls	Yes	Yes	Yes	Yes
N	17878	16560	21489	17971
N_{Years}	7	7	29	29
$N_{Regions}$	12	12	10	10
$N_{Cohorts}$	61	61	56	56
Variance components				
$Var_{Intercept}$	0.0000668	2.22e-20	1.51e-15	3.18e-17
$Var_{Residual}$	0.227	0.170	0.153	0.0610

t statistics in parentheses. Cohort random effects. Individual controls: Interaction gender and partnership status, and ethnicity. Cohort controls: relative size of cohort. Results controlled for period-region fixed-effects.
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4-3 Relationship between educational expansion and qualification mismatch, jointly estimated RE-LPM results

Table 4-3 suggests that British expansion at both the lower and the upper end of the qualification hierarchy was only partially absorbed by labour markets. Expansion also severely limited previous opportunities for the upward mobility of less qualified workers, i.e. for underqualification. Importantly, I do not find any evidence of a comparable credential-inflation in the German data. The specifications reported in Table 4-3 are thus in line with my previous findings: tertiary expansion went along with rising overqualification and sinking underqualification in the United Kingdom, but with sinking overqualification

in Germany. At the same time, where secondary qualifications increased at the expense of the share of people without qualifications in the United Kingdom, underqualification decreased and overqualification increased. The effect sizes I find are large: I estimate that a 10 percentage point increase in the number of graduates has historically been associated with a 2.6 percentage point increase in overqualified and a 5 percentage point reduction in underqualified workers in the United Kingdom. In Germany, overqualification reduced at more than half the rate at which tertiary education expanded.

How did British displacement dynamics play out across different levels of education? And what kinds of workers found it easier to move out of overqualification in Germany? Figure 4-22 breaks down the association between expansion and mismatch for different qualification groups. Like Table 4-3 it is based on a random-effects linear probability model but includes additional terms for the interaction between own education and region-cohort qualification shares. In Figure 4-2, rows correspond to the qualification group analysed and columns to the outcome and the country analysed. Markers give the marginal effects of the expansion of different levels of education, relative to the "no qualifications"-category.

The first interesting take-away is that the overqualification-increasing effect of tertiary expansion in the United Kingdom is *not* driven by people with a university diploma themselves. Rather, displacement seems to have occurred for people with lower tertiary degrees and for workers with vocational qualifications. These groups were more affected by overqualification, where and when university education expanded. It is important to note that this pattern might be related to the phrasing of the UKSES qualification requirement item (see above). If credential inflation caused firms' hiring standards to rise, a university degree might be needed to *get* even if it may not be needed to *do* many jobs. In this case, there would be a displacement of lower tertiary and vocationally trained workers in non-executive positions by graduates – a pattern

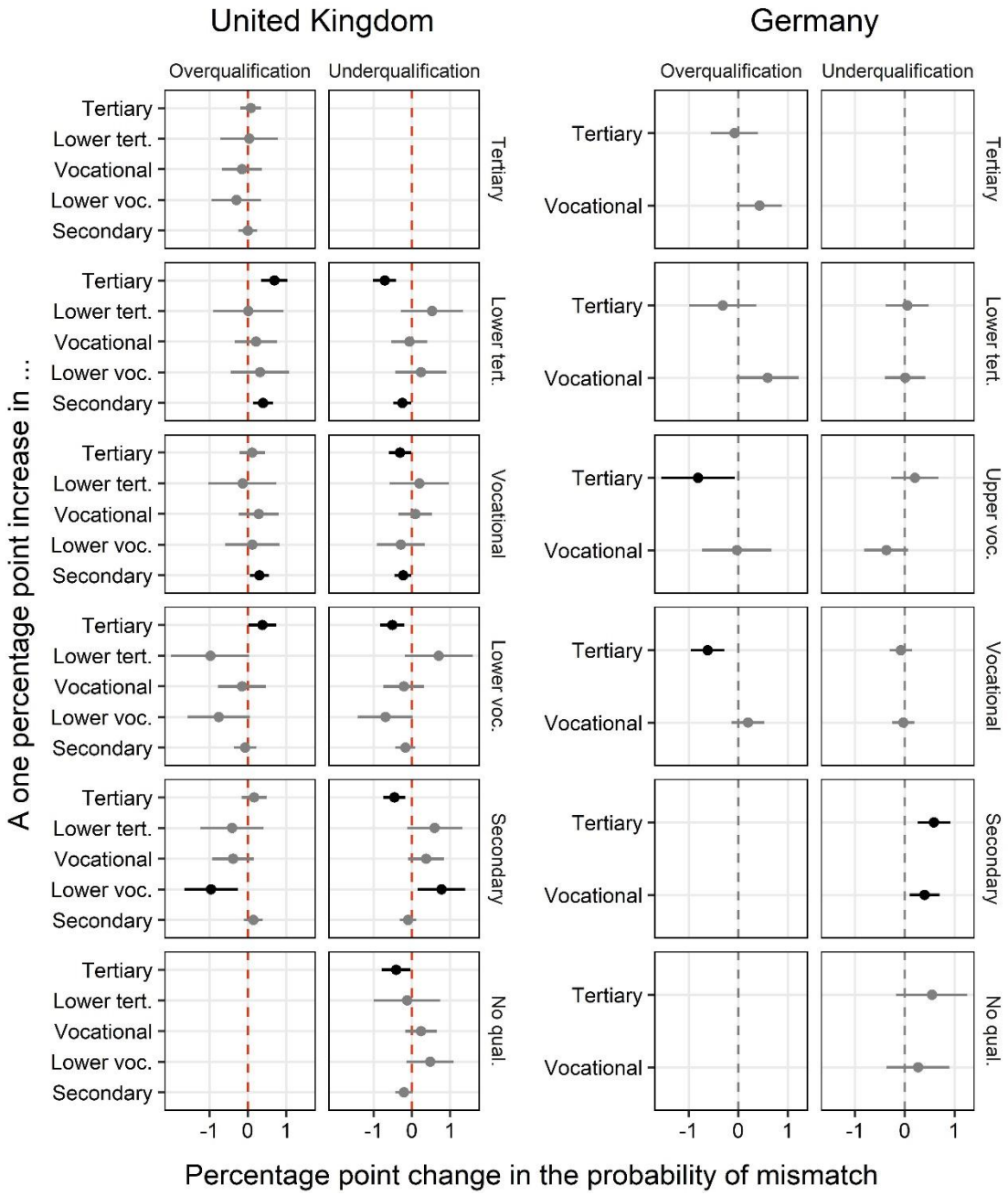
that is indeed consistent with Figure 4-2. My analysis should therefore not be taken to imply that the likelihood of British graduates to find fitting work has not changed, but rather as demonstrating that displacement dynamics trickle down the qualification hierarchy. In a similar vein, tertiary expansion also meant that British workers of all qualification levels became less likely to be underqualified, suggesting that high and medium-skill jobs are increasingly saturated with graduates.

In Germany, I find that overqualification decreased among those with vocational training, including those with advanced vocational qualifications (*Meister*, and *Techniker*), where and when tertiary education expanded, but not among the tertiary educated themselves. While I cannot determine the final cause of this pattern, I note that it is consistent with a process, where accelerating demand for higher qualified workers across region-cohorts is met at the tertiary level (hence the absence of a relationship there), but less so in the middle of the qualification hierarchy, leading to falling overqualification among people with these qualifications. This explanation is consistent with the observation of rising underqualification among workers with lower qualifications. These figures would thus indicate a decline in the provision of vocational training relative to demand for it in dynamic regions. Taken together, these results suggest that British degree inflation had implications for workers in large parts of the qualification structure. Germany, on the other hand, faces a mild skill-shortage – however not at the top, but rather in the middle of the qualification structure.

These findings provide a clear answer to my research question. But can my estimates also be interpreted as causal effects? That is, can we base quantitative predictions what mismatch patterns would have looked like under alternative education policies on this study? These questions are interesting ones, but space constraints force me to move their discussion into the Online Supplement. Section B of the Online Supplement offers an extensive discussion of

the principal assumptions necessary for a causal interpretation of Table 4-3 and Figure 4-2. I conclude that while the German results should not be treated as causal parameters, such an interpretation is in principal possible for the British data. Section B also discusses two more specific sources of bias: endogenous migration and selection-bias related to unemployment. I address these issues using three strategies. First, I tackle endogenous migration, the possibility that people at risk of it move across regions to avoid overqualification, by replacing possibly endogenous indicators of expansion with an exogenous one, the historic share of a region's cohort in (academic) full time education at age 17. Second, I restrict the analysis to exogenous variation in the expansion measure by using the historic share as an instrument for the contemporaneous share. Third, analyses using an encompassing indicator of qualification underutilization, being either unemployed or overqualified, address sample-section bias. Results obtained from these alternative specifications confirm my previous findings. Educational expansion in a cohort is associated with higher overqualification and lower underqualification-rates in this cohort in the United Kingdom, but with less overqualification in Germany. Point estimates obtained from an IV-analysis suggest that the coefficients Table 4-2 are likely not strongly underestimated in the United Kingdom, as both approaches yield coefficients that are very similar in magnitude. In Germany, IV-estimation is less successful, all but preventing interpretation. Finally, using the alternative measure of qualification-underutilization, I find that the negative relationship between educational expansion and skill-underutilization in Germany is even more pronounced than appears from Table 4-2. These results demonstrate that my substantive conclusions are unlikely to be driven by non-causal biases.

Figure 4-1 Relationship between educational expansion and qualification mismatch at different levels of education



Discussion and conclusion

This study seeks to advance the debate on the absorption of educational expansion on the labour markets of Western countries. The two most prominent hypotheses on this question do not only differ in the mechanisms they emphasize, their assessment of what is to be explained are strikingly different: SBTC sees a shortage of well-trained workers on the labour market, whereas credential inflation theorists think there are too many workers with advanced education for all of them to find adequate work. I have argued that traditional wage-based analyses of this question need to be supported by studies using more direct measures of absorption and have proposed rates of self-assessed mismatch as such an indicator.

The results of the present study indeed shed new light on this debate, sometimes in unexpected ways. Most importantly, I find evidence for credential inflation in the United Kingdom and for a mild skill-shortage in Germany. This finding contrasts with much conventional wisdom, which is often informed by wage-trends and SBTC theory. While it is widely accepted that Germany has witnessed relatively modest increases in wage inequality (between qualification groups), the United Kingdom is among the countries with the strongest increases during the last quarter of the 20th century (Nolan et al., 2014). From the perspective of SBTC one would hence expect more of a skill-shortage in the United Kingdom than in Germany. However, my empirical results consistently show the opposite pattern. No matter whether I look at trends across historical time or across cohorts, in simple descriptive or in a wide range of multivariate analyses, the conclusion is the same: during the second half of the 20th century overqualification rose strongly and underqualification declined in the United Kingdom, and this is linked to educational expansion across cohorts. In Germany the opposite is true in many respects. The fact that wages of British graduates rose disproportionately, even though

the expansion of their numbers was associated with more overqualification, suggests that wage-trends alone are a poor measure of skill-demand and supply. My study therefore adds to a growing literature that puts the SBTC interpretation of educational expansion, skill-needs of the economy and wage-inequality into question (Cappelli, 2015; Kristal and Cohen, 2017; Horowitz, 2018).

It is worth noting that the striking differences in mismatch prevalence and trends between the two countries coincide with different patterns of educational expansion, which are in turn linked to vastly different institutions of the education system. This study is therefore in line with scholarship on educational systems (Bol and van de Werfhorst, 2011; Busemeyer, 2009; Heisig, 2018). Many elements of the German system – its strict tracking, its vocationalism, the occupational specificity even of tertiary education – act as a brake on educational expansion. In the United Kingdom, vice versa, education has become a positional good so that expansion fuels the need for yet more expansion (Di Stasio, 2017; Di Stasio et al., 2016). This paper does not attempt to disentangle the complex workings of different institutions. But it illustrates the different trends experienced and likely produced by different systems and therefore complements research on the matching between qualifications and jobs by offering a novel temporal dimension (Bol et al., 2019).

A third contribution of this study is to take a holistic approach by studying mismatch and expansion across levels of education. This perspective affords important nuanced insights. I find that tertiary expansion in Britain was not associated with overqualification of university graduates (at least with respect to nominal requirements to *get* the job), but of graduates of lower tertiary institutions and vocational programmes – suggesting a labour queue model, in which expansion at the top also affects workers with middling qualifications, as jobs are increasingly filled with graduates. My analysis of the German data suggests that any possible skill-shortage is not to be found among the most highly qualified workers, university graduates, but among workers with

(advanced) vocational qualifications. If this interpretation is correct, educational policy in Germany should focus on shoring up the vocational sector, rather than expanding university access further.

The analysis I base these conclusions on are not without limitations. First, the dependent variable was not measured in the same way in the two countries. While Germans were asked what was necessary to *do* their job, Britons were asked what it would take to *get* their job. However, the country differences I find run opposite to any possible bias introduced by this difference, suggesting that they are under- rather than overstated. Second, since the main explanatory variable in my analyses, educational composition, was not assigned randomly across cohorts, the degree to which my estimates can be interpreted as causal rather than as descriptive relationships depends on several strong assumptions. Relatedly, my analysis cannot account for general equilibrium effects, like the educational composition in one cohort affecting mismatch in another. I discuss these issues extensively in the Online Supplement and offer a number of robustness checks. These supplementary analyses show that the substantive conclusions of this paper likely hold despite these issues.

Trends in mismatch-prevalence can tell us something about the workings of educational systems and labour markets. They are, however, also important for people in their own right (Vaisey, 2006). Underqualification can be experienced as redemption of the promise of upward mobility through hard work; its decline may offer fewer of such experiences to the less educated. Vice versa, overqualification can be experienced as a promise of social status not kept (Wiedner, 2020). My analyses have documented that the prevalence of both types of mismatch have changed dramatically since the 1980s. Future research should investigate what the wider societal consequences are for countries, which, like Germany and the United Kingdom, experience different kinds of mismatch trends.

References

Acemoglu D and Autor D (2011) Skills, Tasks and Technologies: Implications for Employment and Earnings. In: Ashenfelter O, Layard R, and Card D (eds) *Handbook of Labor Economics*. Amsterdam; New York: Elsevier, pp. 1043–1171.

Acemoglu D and Autor D (2012) What Does Human Capital Do? A Review of Goldin and Katz's The Race between Education and Technology. *Journal of Economic Literature* 50(2): 426–463.

Allen J and van der Velden R (2001) Educational mismatches versus skill mismatches: effects on wages, job satisfaction, and on-the-job search. *Oxford Economic Papers* 53(3): 434–452. DOI: 10.1093/oep/53.3.434.

Arrow KJ and Capron WM (1959) Dynamic Shortages and Price Rises: The Engineer-Scientist Case. *The Quarterly Journal of Economics* 73(2): 292. DOI: 10.2307/1883726.

Baker D (2014) *The Schooled Society: The Educational Transformation of Global Culture*. Stanford University Press.

Battu H, Belfield CR and Sloane PJ (1999) Overeducation Among Graduates: a cohort view. *Education Economics* 7(1): 21–38. DOI: 10.1080/09645299900000002.

Berg IE and Gorelick S (2003) *Education and Jobs : The Great Training Robbery*. Clinton Corners, N.Y. : Percheron Press. Available at: http://archive.org/details/educationjobsooberg (accessed 22 August 2019).

Bernardi F and Ballarino G (2016) Education as the great equalizer: a theoretical framework. In: *Education, Occupation and Social Origin: A Comparative Analysis of the Transmission of Socio-Economic Inequalities*.

Bol T (2015) Has education become more positional? Educational expansion and labour market outcomes, 1985-2007. *Acta Sociologica* 58(2): 105–120. DOI: 10.1177/0001699315570918.

Bol T and van de Werfhorst HG (2011) Signals and closure by degrees: The education effect across 15 European countries. *Research in Social Stratification and Mobility* 29(1): 119–132. DOI: 10.1016/j.rssm.2010.12.002.

Bol T and Weeden KA (2015) Occupational Closure and Wage Inequality in Germany and the United Kingdom. *European Sociological Review* 31(3): 354–369. DOI: 10.1093/esr/jcu095.

Bol T, Ciocca Eller C, van de Werfhorst HG, et al. (2019) School-to-Work Linkages, Educational Mismatches, and Labor Market Outcomes. *American Sociological Review* 84(2): 275–307. DOI: 10.1177/0003122419836081.

Bourdieu P and Passeron J-C (1970) *La Reproduction: Éléments pour une théorie du système d'enseignement*. Minuit.

Bowles S and Gintis H (1977) *Schooling In Capitalist America: Educational Reform And The Contradictions Of Economic Life*. New edition. New York: Basic Books.

Burris V (1983) The Social and Political Consequences of Overeducation. *American Sociological Review* 48(4): 454. DOI: 10.2307/2117714.

Busemeyer MR (2009) Asset specificity, institutional complementarities and the variety of skill regimes in coordinated market economies. *Socio-Economic Review* 7(3): 375–406. DOI: 10.1093/ser/mwp009.

Busemeyer MR (2014) The politics of education and training reform. In: *Skills and Inequality: Partisan Politics and the Political Economy of Education Reforms in Western Welfare States*. Cambridge: Cambridge University Press, pp. 58–122. DOI: 10.1017/CBO9781107477650.

Cappelli PH (2015) Skill Gaps, Skill Shortages, and Skill Mismatches Evidence and Arguments for the United States. *ILR Review* 68(2): 251–290. DOI: 10.1177/0019793914564961.

Capsada-Munsech Q (2015) The role of social origin and field of study on graduates' overeducation: the case of Italy. *Higher Education* 69(5): 779–807. DOI: 10.1007/s10734-014-9805-2.

Capsada-Munsech Q (2019a) Measuring Overeducation: Incidence, Correlation and Overlaps Across Indicators and Countries. *Social Indicators Research* 145(1): 279–301. DOI: 10.1007/s11205-019-02112-0.

Capsada-Munsech Q (2019b) Overeducation, skills and social background: the influence of parental education on overeducation in Spain. *Compare: A Journal of Comparative and International Education* 50(2): 216–236. DOI: 10.1080/03057925.2019.1579085.

Card D and DiNardo JE (2002) Skill-Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles. *Journal of Labor Economics* 20(4): 733–783.

Collins R (1979) *The Credential Society : An Historical Sociology of Education and Stratification*. New York : Academic Press. Available at: https://trove.nla.gov.au/version/10058848 (accessed 17 October 2018).

Croce G and Ghignoni E (2012) Demand and Supply of Skilled Labour and Overeducation in Europe: A Country-level Analysis. *Comparative Economic Studies* 54(2): 413–439. DOI: 10.1057/ces.2012.12.

Davia MA, McGuinness S and O'Connell PJ (2017) Determinants of regional differences in rates of overeducation in Europe. *Social Science Research* 63: 67–80. DOI: 10.1016/j.ssresearch.2016.09.009.

Di Pietro G (2002) Technological change, labor markets, and 'low-skill, low-technology traps'. *Technological Forecasting and Social Change* 69(9). IPTS S.I.: 885–895. DOI: 10.1016/S0040-1625(01)00182-2.

Di Stasio V (2017) Who Is Ahead in the Labor Queue? Institutions' and Employers' Perspective on Overeducation, Undereducation, and Horizontal Mismatches. *Sociology of Education* 90(2): 109–126. DOI: 10.1177/0038040717694877.

Di Stasio V, Bol T and Van de Werfhorst HG (2016) What makes education positional? Institutions, overeducation and the competition for jobs. *Research in Social Stratification and Mobility* 43: 53–63. DOI: 10.1016/j.rssm.2015.09.005.

Dustmann C, Ludsteck J and Schönberg U (2009) Revisiting the German Wage Structure. *Quarterly Journal of Economics* 124(2): 843–881. DOI: 10.1162/qjec.2009.124.2.843.

Easterlin RA (1968) The American baby boom in historical perspective. In: *Population, Labor Force, and Long Swings in Economic Growth: The American Experience*. NBER, pp. 77–110. Available at: http://www.nber.org/chapters/c1119.pdf (accessed 8 September 2016).

Esping-Andersen G (1999) *Social Foundations of Postindustrial Economies*. Oxford University Press. Available at: https://www.oxfordscholarship.com/view/10.1093/0198742002.001.0001/acprof-9780198742005 (accessed 8 May 2019).

Felstead, Gallie, Green, et al. (2014) Skills and Employment Surveys Series Dataset, 1986, 1992, 1997, 2001, 2006 and 2012. Colchester, Essex: UK Data Archive. Available at: https://doi.org/10.5255/UKDA-SN-7467-2 (accessed 11 October 2016).

Fernández-Macías E and Hurley J (2017) Routine-biased technical change and job polarization in Europe. *Socio-Economic Review* 15(3): 563–585. DOI: 10.1093/ser/mww016.

Fitzenberger B, Kohn K and Lembcke AC (2013) Union Density and Varieties of Coverage: The Anatomy of Union Wage Effects in Germany. *ILR Review* 66(1): 169–197. DOI: 10.1177/001979391306600107.

Geißler R (2014) *Die Sozialstruktur Deutschlands*. Wiesbaden: Springer Fachmedien Wiesbaden. DOI: 10.1007/978-3-531-19151-5.

Goldin C and Katz LF (2010) *The Race between Education and Technology*. 2/28/10 edition. Cambridge, Mass.: Belknap Press.

Gosling A and Lemieux T (2004) Labor Market Reforms and Changes in Wage Inequality in the United Kingdom and the United States. In: Card D, Blundell R, and Freeman RB (eds) *Seeking a Premier Economy: The Economic Effects of British Economic Reforms, 1980-2000*. University of Chicago Press. DOI: 10.7208/chicago/9780226092904.001.0001.

Hall PA and Soskice D (2001) Introduction to Varieties of Capitalism. In: *Varieties of Capitalism. The Institutional Foundations of Comparative Advantage*. Oxford, New York: Oxford University Press, pp. 1–68.

Heisig JP (2018) Measuring the signaling value of educational degrees: secondary education systems and the internal homogeneity of educational groups. *Large-scale Assessments in Education* 6(1): 9. DOI: 10.1186/s40536-018-0062-1.

Horowitz J (2018) Relative Education and the Advantage of a College Degree. *American Sociological Review* 83(4): 771–801. DOI: 10.1177/0003122418785371.

House of Commons (2012) *Education: Historical statistics*. Standard Note SN/SG/4252, 27 November. London.

Iversen T and Wren A (1998) Equality, Employment, and Budgetary Restraint: The Trilemma of the Service Economy. *World Politics* 50(4): 507–546. DOI: 10.1017/S0043887100007358.

Kalleberg AL (2008) The mismatched worker: When people don't fit their jobs. *The Academy of Management Perspectives* 22(1): 24–40.

Kalleberg AL (2011) *Good Jobs, Bad Jobs : The Rise of Polarized and Precarious Employment Systems in the United States, 1970s-2000s*. American Sociological Association's Rose Series in Sociology. New York: Russell Sage Foundation. Available at: https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1069711&site=ehost-live (accessed 22 August 2019).

Katz LF and Murphy KM (1992) Changes in Relative Wages, 1963-1987: Supply and Demand Factors. *The Quarterly Journal of Economics* 107(1): 35–78. DOI: 10.2307/2118323.

Korpi T and Tåhlin M (2009) Educational mismatch, wages, and wage growth: Overeducation in Sweden, 1974–2000. *Labour Economics* 16(2): 183–193. DOI: 10.1016/j.labeco.2008.08.004.

Kristal T and Cohen Y (2017) The causes of rising wage inequality: the race between institutions and technology. *Socio-Economic Review* 15(1): 187–212. DOI: 10.1093/ser/mww006.

Lenski GE (1954) Status Crystallization: A Non-Vertical Dimension of Social Status. *American Sociological Review* 19(4): 405–413. DOI: 10.2307/2087459.

Machin S and Reenen JV (1998) Technology and Changes in Skill Structure: Evidence from Seven OECD Countries. *QUARTERLY JOURNAL OF ECONOMICS* 113(4): 30.

Mayer KU, Müller W and Pollak R (2007) Germany: institutional change and inequalities of access in higher education. In: Shavit Y, Arum R, and Gamoran A (eds) *Stratification in Higher Education: A Comparative Study*. Stanford, California: Stanford University Press.

McGuinness S (2006) Overeducation in the labour market. *Journal of economic surveys* 20(3): 387–418.

Müller W and Gangl M (2003) *Transitions from Education to Work in Europe: The Integration of Youth Into Eu Labour Markets*. Oxford ; New York: Oxford Univ Pr.

Nolan B, Salverda W, Checchi D, et al. (eds) (2014) *Changing Inequalities and Societal Impacts in Rich Countries: Thirty Countries' Experiences*. Oxford, New York: Oxford University Press.

OECD (2019) *Education at a Glance 2019: OECD Indicators*. Education at a Glance. OECD. DOI: 10.1787/f8d7880d-en.

Oesch D (2013) *Occupational Change in Europe: How Technology and Education Transform the Job Structure*. Oxford: Oxford Univ Pr.

Oesch D and Piccitto G (2019) The Polarization Myth: Occupational Upgrading in Germany, Spain, Sweden, and the UK, 1992–2015. *Work and Occupations* 46(4): 441–469. DOI: 10.1177/0730888419860880.

Oesch D and Rodriguez Menes J (2011) Upgrading or polarization? Occupational change in Britain, Germany, Spain and Switzerland, 1990-2008. *Socio-Economic Review* 9(3): 503–531. DOI: 10.1093/ser/mwq029.

Powell JJW and Solga H (2011) Why are higher education participation rates in Germany so low? Institutional barriers to higher education expansion. *Journal of Education and Work* 24(1–2): 49–68. DOI: 10.1080/13639080.2010.534445.

Thurow LC (1975) *Generating Inequality: Mechanisms of Distribution in the U.S. Economy*. Basic Books.

Tinbergen J (1956) On the Theory of Income Distribution. *Weltwirtschaftliches Archiv* 77: 22.

Vaisey S (2006) Education and its discontents: Overqualification in America, 1972–2002. *Social Forces* 85(2): 835–864.

Verhaest D and Van der Velden R (2013) Cross-country Differences in Graduate Overeducation. *European Sociological Review* 29(3): 642–653. DOI: 10.1093/esr/jcs044.

Wagner GG, Frick JR and Schupp J (2007) The German Socio-Economic Panel study (SOEP)-evolution, scope and enhancements. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1028709 (accessed 29 November 2016).

Weeden KA and Grusky DB (2014) Inequality and Market Failure. *American Behavioral Scientist* 58(3): 473–491. DOI: 10.1177/0002764213503336.

Wiedner J (2020) Social and political consequences of qualification mismatches. *Unpublished PhD Dissertation Chapter*.

Wiedner J and Schaeffer M (2019) Career Trajectories into Undereducation. Which Skills and Resources Allow Individuals to Develop Careers That Lie Beyond Their Formal Education? *(unter Begutachtung bei: Research in Social Stratification and Mobility)*.

Wolf A (2002) *Does Education Matter? Myths About Education and Economic Growth*. Penguin Books Limited.

Wren A (ed.) (2013) *The Political Economy of the Service Transition*. Oxford, UK: Oxford University Press. Available at: https://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780199657285.001.0001/acprof-9780199657285 (accessed 8 May 2019).

5 Conclusion

Vertical qualification mismatches are an important aspect of social stratification. They change the well-being, wages, and identities of workers affected by it, even on top of occupational effects. Underqualified people are more satisfied with their lives and jobs and attach greater significance to their professional identity. Overqualification, on the other hand, has a marked negative effect on these outcomes. Who ends up mismatched is moreover far from random. While there is a significant role of individual merit in the form of (non-) cognitive skills, underqualification is enjoyed overwhelmingly by people of privileged backgrounds. Previous research has shown that overqualification can, vice versa, be avoided predominantly by people of higher class origins (Capsada-Munsech 2015; 2020). Taken together, this demonstrates that the social stratification of mismatch is a powerful mode of the intergenerational reproduction of social status. Vertical qualification mismatches shape the lives of large numbers of people in highly unequal ways.

In some sense this finding is the core message of this dissertation. In the introductory essay I noted that mismatch is a somewhat controversial concept among scholars of social stratification. If the proof of the cake is in the eating, I hope that the three empirical essays presented here can convince critics that the concept is useful. Social scientists are often encouraged to think that education is destiny. But while it is not to be disputed that education is a highly important social determinant of individuals' life chances, attitudes and fundamental to how they perceive the world, we should not lose sight of the fact that for most people education phases end relatively early, but that life continues to leave its impression on them. My research on mismatches shows that processes of social mobility and reproduction continue after leaving education—but derive special significance in relation to it.

Research findings and implications

In the introductory chapter I raised four questions about mismatches and their role for social stratification. How can mismatches be explained, first, at the micro-, and, second, at the macro-level? What are its consequences for workers? And how does it differ over time and countries? In the following, I bring together the answers to these questions my research has yielded and relate my contributions to the existing literature. In doing so, I emphasize interrelationships between the various answers by grouping them thematically.

Tailwinds, invisible hands and the strength to grab them

Previous research has shown that overqualification is socially selective. Educational pioneers, those who are the first from their family to attain a certain level of qualification, find it harder than their more established colleagues to convert their formal qualification into a well-salaried, qualification-adequate job (Capsada-Munsech 2015; 2020). Is the same true for underqualification? As I have noted in the introduction, it is far from clear *a priori*, whether underqualification is in the main an employment situation representative of upward mobility or of status maintenance. The empirical research in this dissertation, however, conclusively shows that underqualification is more often enjoyed by people, who already started from relatively advantageous positions. Underqualification thus has a significant part in reproducing pre-existing status differences between families.

From a life-course perspective, socially selective underqualification can be interpreted as a rebound after the setback of a disappointing school-career. Volumes of research attest to the advantages of children from relatively privileged backgrounds in the education system(Hillmert and Jacob 2010; 2003; Pfeffer 2008; Bukodi, Erikson, and Goldthorpe 2014; Schoon 2010; Breen, Ermisch, and Helske 2019; Breen and Jonsson 2005). For those, who in spite of

these advantages, still do not attain the qualification level they can be expected to, based on their background, underqualification provides yet another chance for status maintenance. Many of the underqualified have used this second chance. Socially selective underqualification thus means that class-gaps in *occupational* attainment apply to even more people than implied by the already significant class-effects on *educational* attainment. Not only are they less likely to fall—if they do, privileged children are more likely to spring back as well.

The class-gradient in underqualification demonstrates that children of upper classes do not only profit from a head start over their less fortunate peers, as consistently documented by work in educational sociology. They enjoy a continuous tailwind throughout their life. The findings in Chapter 2 demonstrate that this tailwind does not only operate at the beginning of careers that is when people enter new employment relationships, it continuous into typical mid-career situations like promotions. During all these important switch-points, those from advantaged backgrounds have a higher chance to end up in an occupation supposedly beyond their reach. An assessment of the social mechanisms behind these patterns within the confines of a survey framework such as adopted here is hard, even with the high-quality longitudinal data at my disposable. Nevertheless, my research shows that outright patronage is unlikely to be the driving mechanism behind these patterns. Underqualification does not seem to come about by relatives or their friends bluntly securing face-keeping jobs for their underachieving kin. The results are, however, consistent with qualitative research on the mechanisms of class-based advantage in professional careers(Friedman and Laurison 2019, Chapter 6). In their interviews Friedman and Laurison identify one element frequently shared by highly successful career trajectories of people of privileged backgrounds. This element is the *invisible hand* of an informal sponsor in a senior position. Invisible hands are disproportionately extended to people whose backgrounds resemble the elite-position of the sponsor. They disburse sponsorship and patronage in

more subtle ways than the nepotism covered by the survey item I draw on. It is likely that such processes explain part of the class-based difference in mismatch-mobility I document even at later stages of the career.

Importantly, Friedman and Laurison argue that invisible hands target sponsees *not* simply because of who they *know*, but because of their *qualities*. These qualities may include the aesthetic judgements and life-style choices highlighted by Bourdieusian sociology in the wake of *La distinction* (Bourdieu 1984). Critically, however, *merit*, i.e. skills and abilities themselves, trigger sponsors' attention—if they are showcased in the right way. In other words, the social capital mechanisms identified by Friedman and Laurison to explain the continuing importance of *ascribed* characteristics (social origin) in the course of a career, rely on *achieved* characteristics (merit, cognitive and non-cognitive skills) and on class-specific ways of self-presentation to become effective. My quantitative results in Chapter 2 are in line with this qualitative observation. First, I find that social origin does not offer a one-off, but a continuing benefit. This is compatible with the interpretation centered on durable individual qualities proposed here. Second, individual cognitive and non-cognitive skills partially account for the importance of social background. Of course, this also means that part of the individual-merit component of mismatch can in the final analysis be traced back to class-origin differences. In order to benefit from the pull of the invisible hands up, workers need to have the individual strength to grab it. In this sense, the effects on unusual underqualification careers of achieved and ascribed characteristics, of individual skill and inherited privilege should be seen less as competing or opposing forces, but as something that often comes together.

It is quite clear from our results that the underqualified are also genuinely more able than the average person with the same education. In line with the literature on overqualification (Levels, van der Velden, and Allen 2014), underqualification thus arises in part because of skill-heterogeneity among people

with the same nominal level of education. Of course, this begs the question, how a significant share of students ends-up leaving education with qualifications that understate their cognitive ability as it can be measured in standardized tests. Future work should investigate this important topic.[28]

Returning to my first research question, how mismatch can be explained at the micro-level, the answers of my research are clear: First, by workers successfully exploiting and signaling unusual abilities, second, by drawing on the resources of an advantaged social origin. One first answer to my question on the consequences of mismatch has also become apparent: One important effect of mismatches is to reproduce existing status-differences between families.

Failing and surpassing

Mismatch is not only a mode of changing one's objective position in the occupational structure, its experience has significant effects on subjective outcomes as well. Under-, and even more strongly, overqualification affect well-being and identities. In other words, post-education occupational mobility has distinct effects on people. This finding, too, serves to highlight the fact that people's prospects are not set in stone, once they leave the education system. The identity and well-being effects of educational mismatch thus parallel the effects of over- and underachieving set goals for *educational* attainment in important respects. Status maintenance theory in social mobility research argues

[28] Such a pattern is of course the logical result of secondary effects of social origin on educational attainment, i.e. of differences in educational levels by social origin that are not explained by differences in ability or performance (Boudon 1974). If students drop out early because they are from underprivileged origins, regardless of their innate ability, then early school-leavers from disadvantaged backgrounds possess on average higher cognitive ability (under some assumptions which I discuss below). If this were the driving factor, however, we would expect more underqualification among the children of the working classes. My results consistently show the opposite. I discuss this as an important puzzle for future work below.

that class-differences in educational choices reflect children's and parents' desire to maintain family status (Keller and Zavalloni 1964; Breen and Goldthorpe 1997). For students, achieving at least their parents' level of education is paramount (Stocké 2007). In line with prospect theory (Kahneman and Tversky 1979), parents' education constitutes the reference point, relative to which offspring's status attainment is evaluated. Recent research similarly shows that people of immigrant origin, who do not reach their parents' level of education report higher levels of perceived discrimination. The assumed mechanism for this pattern is that disappointment over unfulfilled attainment aspirations are externalized and attributed to a hostile social context (Schaeffer 2019).

The research presented in Chapter 3 provides evidence that such processes are not limited to educational attainment and to ethnic minorities. Educational attainment itself provides an important reference point. Occupational attainment is judged relative to it. The analyses using my novel bounding technique document that failing, but also surpassing these conditional expectations have significant independent effects on measures of well-being and professional identify that cannot be reduced to working in different occupations under plausible assumptions. People who work in jobs that do not require their formal education are less satisfied with their jobs, attach less importance to their professional roles and are overall less satisfied with their lives, and of course they earn less then adequately employed colleagues with the same education. These findings are the second answer to my research question on the individual-level consequences of mismatch.

These results have important implications for educational policy. They suggests that expanding education beyond the capacity of labor markets to employ new graduates in fitting jobs risks producing a growing group of dissatisfied citizens. While my research also shows that the initial apocalyptic claims of status inconsistency theory regarding the political realm (Lenski

1954; 1967; Portes 1972)—ranging from disengagement to communist uprising—are overstated, systematic consequences for workers' well-being need to be born in mind, when deciding upon future expansion. Especially a "skills-lead strategy", which seeks to foster economic growth by systematically upgrading labor market entrants' educational credentials, such as that proclaimed by British governments since New Labour (see Leitch 2006 for an important document from that era), appears to be riskier than appreciated in this regard. Forcing technological upgrading via the supply-side of the labor market by producing ever higher number of graduates, comes at the cost of those, who will not be able to find adequate employment. Unmet educational expansion instills expectations in many young people that the labor market cannot satisfy. Educational policy makers have to tread a tightrope between overexpansion, which leads to overqualification and dissatisfaction caused by it, and skill-undersupply, which may act as a break on technological upgrading and risks increasing unemployment and wage inequality. Educational expansion is desirable for many reasons, but the fact that its positive effects can be counteracted by growing overqualification needs to be spelled out.

Neither having a cake, nor eating it

Given these findings on the consequences of mismatch, it is perhaps disheartening that the central result of Chapter 4 is that educational expansion in the United Kingdom has to a significant degree not been absorbed by the labor market. The skills-strategy pursued by the United Kingdom has resulted in precisely the scenario I have sketched as a cautionary tale above. Nominally, education expanded significantly, meaning that ever higher proportions of the population hold ever higher credentials. Notwithstanding tremendous changes, the labor market, by contrast, did not expand its demand for higher qualified workers at the same rate, or at least not at all levels and in all sectors. As a result, individual level overqualification increased significantly over years

and cohorts since the beginning of the dataset used in these analyses, and underqualification declined. Even more worrisome is that over the same period income inequality in the United Kingdom rose as well, as is well documented in the literature (OECD 2011a; Nolan et al. 2014). It is now the highest in Western Europe. British education and labor market policy thus combine, as it were, the worst of both worlds: high wage inequality and high and rising overqualification.

The research presented in this dissertation suggests that skills-policy alone is not enough to ensure equitable growth. This conclusion is in strong contrast to the conventional wisdom derived from analysis carried out by economists, where improvement of individuals' and nations' human capital has long been hailed as the prime solution to rising levels of income inequality (e.g. by the OECD in the press release to their 2011 report, OECD 2011b; or, more cautiously, in OECD 2015). In this view, educational expansion improves the lot of the least fortunate in a country's labor market in two ways. Firstly, it offers them a direct way to improve their skills and consequently engage in more demanding and thus better paid work. Secondly, by increasing the number of skilled relative to less-skilled workers, it shifts the market situation in the favor of the less-skilled group and allows them to command higher relative wages (Goldin and Katz 2010). For these predictions to work out, however, a very flexible labor market has to be assumed. In other words, explanations for, and policies to address, rising inequality that limit themselves exclusively to human capital mechanisms have to gloss over many of the institutional features of real-world labor markets. This orthodox perspective, which has been embraced notably by New Labour under Tony Blair (for a critical assessment, see Wolf 2002), is at odds with my empirical results. In Britain, despite educational expansion beyond the labor market's absorbing capacity, incomes nevertheless diverged.

On the level of theory, this finding suggests that the orthodox perspective needs to consider important qualifiers—most importantly ones that are

related to the institutional regulation of industrial relations and the world of work. It is noteworthy that the most significant increases in labor market inequity in Britain coincided with the pro-market reforms of the Thatcher-era that dramatically curbed unions' coverage and bargaining power (Gosling and Lemieux 2004). Naturally, the educational composition of the labor force, vice versa, stayed more or less constant during the same period, at least in the short run. As a description of the actual forces shaping people's experience on the labor market, the orthodox theory is simply not valid in its generality. On the level of policy, my results imply that if the goal is to ensure that labor markets evolve in directions that profit all qualification groups, policy makers need to look beyond skills policy. More direct interventions into labor markets and reinvigoration of unions may be needed next to education policy.

At the same time, the data also show that underqualification declined in Britain. As chapter 3 has argued, underqualification can bring about distinct benefits with regards to wages and well-being to people with less education. The decline of underqualification in Britain is noteworthy, because Britain is often regarded, along with the United States, as an exemplar case of high labor market mobility in the comparative stratification and political economy literature (Longhi and Brynin 2010; Hall and Soskice 2001; Marsden 1990; Diprete et al. 1997). My results suggest show this mobility is now rather down- than upward, relative to workers' educational attainment. Notwithstanding the highly unequal social patterning of underqualification documented in Chapter 2, undereducation is always a route to and a testimony of occupational success that circumvents the, as it were, official way through the education system. This route used to be open to able but not academically inclined types—just think of Philipp Green, with whose example this dissertation opened. In Britain, such routes are now present less and less. More than ever, decent work in the United Kingdom is available only after significant investments into education and training.

Germany has emerged as an interesting counterexample to this pessimistic assessment from my country comparison. In contrast to the British, there is no evidence in the German data that overqualification has risen with educational expansion in West Germany. If anything, underqualification has increased slightly. I take this finding to suggest that some of the oft-criticized features of the German education system—it's strict tracking, it's continuing reliance on vocational training programs, the relatively low share of students it admits to university—sustain a system of education-to-job linkages that is more effective than the choice-driven British one, and that in contrast to some analysists' concerns (Wren 2013), it continues to function well even in the face of sustained labor market change (similar: Bol et al. 2019; Bol and van de Werfhorst 2013). Compared to their British peers, German students can be relatively sure that their educational investments will land them an adequate job.

Considering mismatch may even reverse some widely held believes about the much-criticized lack of intergenerational fairness in the German education system. More British students of relatively disadvantaged origins may be able to attain university, but if overqualification is highly stratified by social origin, as my research on underqualification and the international evidence suggest (Capsada-Munsech 2015; 2020), the more selective German model may turn out to be just as fair, or unfair, in allocating life-chances on net. While this conjecture remains purely speculative, it illustrates how a dedicated focus on mismatch may lead to putting some of the established findings of educational sociology in perspective.

Returning to my research questions, my analysis at the macro-level shows two things: First, regarding the macro-conditions suitable to mismatch, I find that individual overqualification is more frequent when educational expansion exceeds labor markets' absorption capacity. Underqualification, vice versa, can be found, when a dynamic and relatively knowledge-intensive economy receives relatively few labor market entrants with higher level

qualifications. In other words, individual-level mismatch reflects a mismatch of skill-, and thus qualification-demand and -supply at the societal level. Second, regarding country-differences and institutional effects, the macro-analysis shows that the two country-cases have experienced vastly different mismatch-trends that can be traced back to their different patterns of educational expansion and labor market change. These are rooted in turn in different institutional setups in the way that is consistent with my discussion in the introduction. The overall low levels of mismatch in Germany depend on a system that sorts students into educational tracks and occupational fields early and that limits access to university. The more fluid British system, where tertiary education is strongly encouraged, on the other hand, has resulted in a strong prevalence of overqualification.

Puzzles and future research

This dissertation has provided clear answers to the research questions I introduced in Chapter 1. However, the findings generated by my research also pose some important puzzles for social stratification research that should be addressed by future work. The first puzzle is how my findings on the relationship between social origin, underqualification and cognitive ability can be reconciled with established theories in educational sociology and social mobility research . I find that people from privileged backgrounds are more likely to be underqualified. I also find that part of this association is mediated by cognitive ability. This implies that given a level of education (below university), people from advantaged backgrounds have, on average, higher cognitive ability. The extensive literature on secondary effects of social origin on educational attainment, by contrast, implies that high-SES school-leavers below the university level should have lower cognitive skills (Birkelund 2020; Schindler and Lörz 2012; Boudon 1974). This is because secondary effects ensure that even mediocre students of high-SES backgrounds go on to earn relatively high

qualifications. In causal terms, educational attainment is a collider-variable in the relationship between social origin and innate cognitive skills (Elwert and Winship 2014). Holding it constant, for instance by controlling for education in occupational attainment or mismatch-models, should therefore introduce a non-causal negative association between SES-origin and cognitive ability.

Why is this relationship positive in the SOEP and in the UKLHS data? Two hypotheses should be investigated. The first is that there is a strongly positive causal effect of social origin on measured cognitive ability, and that the effect of cognitive ability on educational attainment, and/or the direct effect of SES-origin on educational attainment are relatively weak. It is in this scenario, which is not entirely consistent with the view in the literature, that the positive causal effect of SES-origin on cognitive ability overrides the non-causal relationship generated by conditioning on educational attainment.

The second hypothesis focuses on the timing of measurement. The measures for cognitive skills in my data sets have been measured among the adult population. This opens the possibility that the relationship between cognitive ability, SES-origin, and final qualification is as expected among the young, i.e. with low-attaining low-SES-origin youth having higher measured cognitive ability than low-attaining high-SES-origin youth, but somehow reverses as they age. This would imply either that (often adequately employed) low-attaining low-SES-origin people lose some of their cognitive skills as they move into adulthood, or that (often underqualified) low-attaining high-SES-origin people somehow gain them. To test this hypothesis, longitudinal data on cognitive ability is necessary. If it was found to be true, this hypothesis would make a powerful *efficiency* argument for seeking to reduce secondary effects in education.

The second puzzle concerns the country comparison in my dissertation. I find minimal difference between countries in Chapters 2 and 3, that is in the effects of predictors and in consequences of mismatch, but very large

differences in Chapter 3, that is in the prevalence and trends. How can this be reconciled? One answer is that the first two chapters examine, as it were micro-level processes that are unlikely to be influenced by country-level institutions. They focus on psychological antecedents and consequences and these are just too basal to be affected by, say, the stratification of education. This answer takes the results at face value and interprets them as a near identity in the substantive processes. There is, however, also the possibility, that really existing country differences are masked by the realized-matched indicator used in these chapters to measure mismatch. This indicator is intrinsically relative in that it essentially compares workers at different positions within the occupation-specific distribution of education. It answers the question, who will have less education than others in the same occupation, or what the effects are of having more education than others in the same occupation, without needing a measure for objective job requirements. So maybe the determinants and effects of *relative* mismatch understood in these terms are indeed similar between countries, but an objective measure of job-requirements would lead to different conclusions. While no such indicator is available in datasets that support the highly harmonized, rich analyses carried out in this project, it needs to be born in mind that the finding of great similarity in Chapters 2 and 3 hinges on a relative conception of mismatch.

The small and the big

I began this dissertation with the story of Philipp Green, the retail Tycoon, whose long career is interesting, but clearly unusual. Nevertheless, my research has shown that Green's colorful life story is in many ways representative of the experience of mismatch and of undereducation. Green, while, according to his own acknowledgements, not bookish, is clearly highly intelligent and open to new challenges—mirroring the central results of Chapter 2. Moreover

and despite his stylization as a self-taught self-made man, Green is actually from a privileged family of property developers and retailers: his first steps in retail he undertook in his mother's shoe shop (Langley 2009). His case illustrates, as do my results, that a rise far beyond what grades and diplomas imply is possible—if one has the brains, the ambition, and, maybe because of family influences, knows one's way in one's chosen field. Finally, but this is speculation, it can also be assumed that a career like his, whose first promotion was from shop assistant to wholesale buyer of shoes, would hardly be possible in the United Kingdom today, where even mid-level positions are advertised for graduates only.

The story of Green illustrates not only that the conclusions I draw from highly abstract analyses of statistical data find some, however unscientific, confirmation in the biography of a flesh-and-blood human. It also shows that even the seemingly exceptional conforms to social regularities. As I explained in the introduction, this has been then motivation guiding this project from the beginning: to move what is commonly regarded as the error term, the unexplained rest of status attainment, to the focus of attention. I hope that readers agree that my endeavor has at least in parts been successful. The genesis of education-to-job mismatches, their contextual antecedents, and their consequences all show strong and meaningful sociological patterning, Mismatch, in other words, is an important sociological phenomenon in its own right.

Literature

Birkelund, Jesper Fels. 2020. "Sources of Change in the Primary and Secondary Effects of Social Class Origin on Educational Decisions: Evidence from Denmark, 2002–2016." Research in Social Stratification and Mobility 68 (August): 100504. https://doi.org/10.1016/j.rssm.2020.100504.

Bol, Thijs, Christina Ciocca Eller, Herman G. van de Werfhorst, and Thomas A. DiPrete. 2019. "School-to-Work Linkages, Educational Mismatches, and Labor Market Outcomes." *American Sociological Review* 84 (2): 275–307. https://doi.org/10.1177/0003122419836081.

Bol, Thijs, and Herman G. van de Werfhorst. 2013. "Educational Systems and the Trade-Off between Labor Market Allocation and Equality of Educational Opportunity." *Comparative Education Review* 57 (2): 285–308. https://doi.org/10.1086/669122.

Boudon, Raymond. 1974. Education, Opportunity, and Social Inequality: Changing Prospects in Western Society. Wiley Series in Urban Research. New York: Wiley.

Bourdieu, Pierre. 1984. *Distinction*. Cambridge, MA: Harvard University Press.

Breen, Richard, John Ermisch, and Satu Helske. 2019. "Educational Reproduction in Europe: A Descriptive Account." *Demographic Research* 41 (December): 1373–1400. https://doi.org/10.4054/DemRes.2019.41.49.

Breen, Richard, and John H. Goldthorpe. 1997. "Explaining Educational Differentials Towards a Formal Rational Action Theory." *Rationality and Society* 9 (3): 275–305. https://doi.org/10.1177/104346397009003002.

Breen, Richard, and Jan O. Jonsson. 2005. "Inequality of Opportunity in Comparative Perspective: Recent Research on Educational Attainment and Social Mobility." *Annual Review of Sociology* 31 (1): 223–43. https://doi.org/10.1146/annurev.soc.31.041304.122232.

Bukodi, Erzsébet, Robert Erikson, and John H Goldthorpe. 2014. "The Effects of Social Origins and Cognitive Ability on Educational Attainment: Evidence from Britain and Sweden." *Acta Sociologica* 57 (4): 293–310. https://doi.org/10.1177/0001699314543803.

Capsada-Munsech, Queralt. 2015. "The Role of Social Origin and Field of Study on Graduates' Overeducation: The Case of Italy." *Higher Education* 69 (5): 779–807. https://doi.org/10.1007/s10734-014-9805-2.

———. 2020. "Overeducation, Skills and Social Background: The Influence of Parental Education on Overeducation in Spain." *Compare: A Journal of Comparative and International Education* 50 (2): 216–36. https://doi.org/10.1080/03057925.2019.1579085.

Diprete, Thomas A., Paul M. De Graaf, Ruud Luijkx, Michael Tåhlin, and Hans-Peter Blossfeld. 1997. "Collectivist versus Individualist Mobility Regimes? Structural Change and Job Mobility in Four Countries." *American Journal of Sociology* 103 (2): 318–58. https://doi.org/10.1086/231210.

Elwert, Felix, and Christopher Winship. 2014. "Endogenous Selection Bias: The Problem of Conditioning on a Collider Variable." *Annual Review of Sociology* 40 (1): 31–53. https://doi.org/10.1146/annurev-soc-071913-043455.

Friedman, Sam, and Daniel Laurison. 2019. *The Class Ceiling: Why It Pays to Be Privileged*. Bristol, UK ; Chicago, IL: Policy Press.

Goldin, Claudia, and Lawrence F. Katz. 2010. *The Race between Education and Technology*. 2/28/10 edition. Cambridge, Mass.: Belknap Press.

Gosling, Amanda, and Thomas Lemieux. 2004. "Labor Market Reforms and Changes in Wage Inequality in the United Kingdom and the United States." In *Seeking a Premier Economy: The Economic Effects of British Economic Reforms, 1980-2000*, edited by David Card, Richard Blundell, and Richard B. Freeman. University of Chicago Press. https://doi.org/10.7208/chicago/9780226092904.001.0001.

Hall, Peter A., and David Soskice. 2001. "Introduction to Varieties of Capitalism." In *Varieties of Capitalism. The Institutional Foundations of Comparative Advantage*, 1–68. Oxford, New York: Oxford University Press.

Hillmert, Steffen, and Marita Jacob. 2003. "Social Inequality in Higher Education. Is Vocational Training a Pathway Leading to or Away from University?" *European Sociological Review* 19 (3): 319–34. https://doi.org/10.1093/esr/19.3.319.

———. 2010. "Selections and Social Selectivity on the Academic Track: A Life-Course Analysis of Educational Attainment in Germany." *Research*

in Social Stratification and Mobility, New Directions in Education Transitions Research, 28 (1): 59–76. https://doi.org/10.1016/j.rssm.2009.12.006.

Kahneman, Daniel, and Amos Tversky. 1979. "Prospect Theory: An Analysis of Decision under Risk." *Econometrica* 47 (2): 263–91.

Keller, Suzanne, and Marisa Zavalloni. 1964. "Ambition and Social Class: A Respecification." *Social Forces* 43 (1): 58–70. https://doi.org/10.2307/2575967.

Langley, William. 2009. "Sir Philip Green, the Maverick Taking the High Street to Broadway," April 4, 2009, sec. Comment. https://www.telegraph.co.uk/comment/5105407/Sir-Philip-Green-the-maverick-taking-the-High-Street-to-Broadway.html.

Leitch, Sandy. 2006. Prosperity for All in the Global Economy. World Class Skills. London: Stationery Office.

Lenski, Gerhard E. 1954. "Status Crystallization: A Non-Vertical Dimension of Social Status." *American Sociological Review* 19 (4): 405–13. https://doi.org/10.2307/2087459.

———. 1967. "Status Inconsistency and the Vote: A Four Nation Test." *American Sociological Review* 32 (2): 298–301. https://doi.org/10.2307/2091819.

Levels, M., R. van der Velden, and J. Allen. 2014. "Educational Mismatches and Skills: New Empirical Tests of Old Hypotheses." *Oxford Economic Papers* 66 (4): 959–82. https://doi.org/10.1093/oep/gpu024.

Longhi, Simonetta, and Malcolm Brynin. 2010. "Occupational Change in Britain and Germany." *Labour Economics* 17 (4): 655–66. https://doi.org/10.1016/j.labeco.2010.02.001.

Marsden, David. 1990. "Institutions and Labour Mobility: Occupational and Internal Labour Markets in Britain, France, Italy and West Germany." In *Labour Relations and Economic Performance: Proceedings of a Conference Held by the International Economic Association in Venice, Italy*, edited by Renato Brunetta and Carlo Dell'Aringa, 414–38. International Economic Association Series. London: Palgrave Macmillan UK. https://doi.org/10.1007/978-1-349-11562-4_17.

Nolan, Brian, Wiemer Salverda, Daniele Checchi, Ive Marx, Abigail McKnight, István György Tóth, and Herman G. van de Werfhorst, eds. 2014. *Changing Inequalities and Societal Impacts in Rich Countries: Thirty Countries' Experiences*. Oxford, New York: Oxford University Press.

OECD, ed. 2011a. Divided We Stand: Why Inequality Keeps Rising. Paris: OECD.

———. 2011b. "Society: Governments Must Tackle Record Gap between Rich and Poor, Says OECD." December 5, 2011. https://www.oecd.org/els/soc/societygovernmentsmusttacklerecordgap-betweenrichandpoorsaysoecd.htm.

———. 2015. *In It Together: Why Less Inequality Benefits All*. OECD. https://doi.org/10.1787/9789264235120-en.

Pfeffer, Fabian T. 2008. "Persistent Inequality in Educational Attainment and Its Institutional Context." *European Sociological Review* 24 (5): 543–65. https://doi.org/10.1093/esr/jcn026.

Portes, Alejandro. 1972. "Status Inconsistency and Lower-Class Leftist Radicalism." *The Sociological Quarterly* 13 (3): 361–82. https://doi.org/10.1111/j.1533-8525.1972.tb00820.x.

Schaeffer, Merlin. 2019. "Social Mobility and Perceived Discrimination: Adding an Intergenerational Perspective." *European Sociological Review* 35 (1): 65–80. https://doi.org/10.1093/esr/jcy042.

Schindler, Steffen, and Markus Lörz. 2012. "Mechanisms of Social Inequality Development: Primary and Secondary Effects in the Transition to Tertiary Education Between 1976 and 2005." *European Sociological Review* 28 (5): 647–60. https://doi.org/10.1093/esr/jcr032.

Schoon, Ingrid. 2010. "Childhood Cognitive Ability and Adult Academic Attainment: Evidence from Three British Cohort Studies." *Longitudinal and Life Course Studies* 1 (3): 241–158. https://doi.org/10.14301/llcs.v1i3.93.

Stocké, Volker. 2007. "Explaining Educational Decision and Effects of Families' Social Class Position: An Empirical Test of the Breen–Goldthorpe Model of Educational Attainment." *European Sociological Review* 23 (4): 505–19. https://doi.org/10.1093/esr/jcm014.

Wolf, Alison. 2002. Does Education Matter? Myths About Education and Economic Growth. Penguin Books Limited.

Wren, Anne. 2013. "Introduction: The Political Economy of Post-Industrial Societies." In *The Political Economy of the Service Transition*, edited by Anne Wren, 1–70. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199657285.003.0001.

APPENDICES

I. Appendix to Chapter 2

A. Coding of virtual years of education

We use information on the detailed highest qualification attained to construct a metric variable of years of education. We consider elementary, secondary, tertiary, and vocational education, in so far it results in nationally recognized qualifications. Further education programs that are company specific, or not certified, do not enter our estimation of formal education requirements. Importantly, our measure is based on the *typically* required time for the completion of qualification as opposed to the *actual* time spent on attaining it (Schneider 2010). The conversion took place using the translation keys displayed in Tables A1 and A2, which are based on background information on countries' education systems (DoE 2013, 2018; Jones 2016; KMK 2017a; b; Ofqual 2009; Schneider 2008). In cases where these background sources did not provide guidance on how to treat British vocational qualifications, we used the observed median duration needed by respondents to attain the respective qualifications to calculate its contribution to respondents' years of education.

To then derive the typical years of schooling in each occupation, we calculated the mean years of schooling and their standard deviation in 3-digit ISCO-groups from our data. To increase precision, we pooled education information within a 11-year window to form a moving average of an occupation's observed years of education. By dropping repeated observations of respondent- occupation combinations within that window, we made sure that each respondent contributed to the calculated mean and standard deviation of any occupation

in a given year only once. We further distinguished between East/West Germany and (non-)/London, respectively, and employed the appropriate cross-sectional poststratification weights. In each country, this leaves us with around 100 different occupations, for which we possess information on typical education profiles. In the main article, we drop cases with an occupation-year combination, for which less than 30 education observations are available to calculate occupational education requirements. Appendix J shows the results for different cut-off points.

Detailed as the translation key displayed in Tables A-1 and A-2 may be, the decision to use a metric variable to calculate undereducation may appear questionable, given the highly discrete nature of both countries' qualification systems. However, using a metric indicator conveys significant advantages for our application. It allows us, for instance, to calculate occupation-specific standard deviations of education and thereby ensures that we consider only undereducation that is substantial, relative to the observed norm. This is the big advantage compared to other measurement strategies, for instance the self-assessed undereducation indicator that we discuss in Appendix D below, where it is much less clear, how undereducation perceptions are formed. Our measure is also inherently relative in that actually realized education-job matches form the basis of our estimation of qualification requirements. This perspective is appropriate given our substantive questions, which focus on the substitution of formal schooling through other skills and resources.

Table A-1 Virtual years of education, United Kingdom

Years of education assigned	Qualification/certificate
8	none
10	school leaving certificate, standard/ordinary grade, cse, gcse/o-level
12	a-levels and equivalents
14	Diploma in higher education
15	1st degree level including foundation degree, graduate of professional institute, pgce
17	university higher degree (e.g. Msc, Phd)
to which we added a maximum of one of the following further education qualifications if respondents did not report tertiary education (values based on median duration times)	
3	hnc/hnd, onc/ond
2	modern/trade apprenticeship, scotvec, scotec, scotbec, other vocational, technical or professional qualification, city and guilds certificate, gnvq/gsvq, nvq/svq-level 1-2, btec/bec/tec/edexcel/lql,
1	rsa/ocr, clerical/commercial qualification, youth training certificate, key/basic skills, entry level qualifications (wales)
Foreign qualifications of respondents	
3	none
5	completed primary school
10	completed secondary school
11	post-secondary vocational training (up to 1 year)
12	post-secondary vocational training (2 and more years)
14	post-secondary academic below-degree level qualification
15	Bachelors or equivalent first degree qualification
16	postgraduate academic below-masters level qualification
17	Masters or equivalent higher degree level qualification
20	PhD
Qualifications of respondents' parents	
4	no schooling reported
9	left school with no qualifications or certificates
10	left school with some qualifications or certificates
12	post-school qualifications or certificates (e.g. City & Guilds)
16	university degree or higher degree

Table A-2 Virtual years of education, Germany

Years of education assigned	**Qualification/certificate**
7	none
9	general secondary school (*Hauptschule*)
10	intermediate secondary school (Realschule)
10.5	general secondary school + other vocational training
11.5	intermediate secondary school + other vocational training
12	general secondary school + apprenticeship or equivalent, vocational maturity certificate (Fachabitur)
13	general maturity certificate (Abitur), intermediate secondary school + apprenticeship or equivalent
14.5	vocational maturity certificate + other vocational training
15	vocational maturity certificate + apprenticeship or equivalent
16	Bachelors or equivalent, general maturity certificate + apprenticeship or equivalent
18	Masters/PhD or equivalent
Qualifications of respondents' parents	
3	none
5	general secondary school (*Hauptschule*)
10	intermediate secondary school (Realschule)
12	vocational maturity certificate (Fachabitur)
13	general maturity certificate (Abitur)
to which we added the following vocational qualifications if applicable	
1	unspecified vocational training
3	apprenticeship or equivalent
5	crafts-master (Meister), technician-degree, technical tertiary degree (FH) or equivalent
6	university degree

Immigrants were assigned the closest German equivalent.

B. Full LPM regression tables

The main article displays our results as coefficient plots to ease interpretation. Here we show the full regression tables underlying those plots. Table B-1 shows results underlying Figure 2-1, and Table B-1 shows the results displayed in Figure 2.

Table B-1 Linear probability models of being undereducated

	United Kingdom		Germany	
Cognitive ability	2.76***	(8.19)	0.99+	(1.90)
Conscientiousness	-0.51	(-1.53)	-0.88+	(-1.91)
Neuroticism	0.030	(0.09)	-0.48	(-1.16)
Agreeableness	0.076	(0.24)	0.56	(1.30)
Extraversion	-0.035	(-0.12)	-0.34	(-0.76)
Openness	1.00**	(3.18)	1.10*	(2.47)
Risk tolerance	0.21	(0.70)	-0.54	(-1.36)
Internal locus of control	0.91**	(3.05)	0.67+	(1.67)
Parents' average ISEI	1.51***	(5.58)	2.45***	(5.50)
Controls				
Years of Schooling	-20.3***	(-55.60)	-16.6***	(-39.76)
Years of schooling^2	12.3***	(66.15)	10.4***	(37.75)
Age	0.92**	(3.28)	-0.0039	(-0.01)
Age^2	-0.37	(-1.39)	-0.34	(-1.05)
Ref. Male	0	(.)	0	(.)
Female	4.66***	(8.30)	-0.072	(-0.09)
Ref. West			0	(.)
East			0.48	(0.59)
Ref. UK	0	(.)		
London	4.95***	(5.00)		
Ref. Native	0	(.)	0	(.)
Immigrant	-1.69+	(-1.81)	-2.58*	(-1.99)
2. generation	0.45	(0.58)	1.08	(0.69)
Mental health	0.19	(0.59)	-0.55	(-1.36)
Physical health	0.74**	(2.65)	0.56	(1.47)
Ref. Interview 2007			0	(.)
Ref. Interview 2012	0	(.)		
Interview 2013	-0.19	(-0.36)	1.62+	(1.65)
Interview 2014	-1.47	(-1.15)		
Constant	0.84	(1.46)	-0.14	(-0.12)
N	10964		12348	
Imputations	100		100	

Realized matches results. All continuous predictors standardized. Robust t-values in parentheses.
***P<0.001; **P<0.01; *P <0.05; +P<0.10.

Table B-2 Linear probability models of entering undereducation

	w/o controls for prior attainment				w/ controls for prior attainment			
	UK		Germany		UK		Germany	
	Entry	Prom.	Entry	Prom.	Entry	Prom.	Entry	Prom.
Cognitive ability	0.86	0.25***	0.73	0.16	0.57	0.18**	0.53	0.053
	(1.59)	(3.93)	(1.29)	(1.31)	(1.06)	(2.85)	(0.97)	(0.43)
Compliance enhancing traits	0.13	-0.069	-0.73	-0.074	0.12	-0.070	-0.66	-0.026
	(0.26)	(-1.02)	(-1.34)	(-0.74)	(0.24)	(-1.03)	(-1.25)	(-0.27)
Entrepreneurialism	0.40	0.22**	0.67	0.23*	0.48	0.20**	0.47	0.11
	(0.79)	(3.25)	(1.03)	(2.36)	(0.94)	(2.95)	(0.79)	(1.18)
Parents' av. ISEI	0.72	0.067	2.43***	0.49***	0.46	0.029	1.87**	0.35***
	(1.55)	(1.25)	(4.06)	(4.90)	(0.98)	(0.53)	(3.08)	(3.58)
Controls								
Y. of schooling	-13.9***	-1.48***	-14.1***	-3.26***	-15.2***	-1.78***	-16.0***	-4.22***
	(-21.99)	(-9.80)	(-24.99)	(-12.87)	(-23.43)	(-10.07)	(-24.93)	(-14.76)
Y. of schooling^2	11.2***	0.81***	10.2***	2.24***	11.2***	0.87***	9.55***	2.24***
	(26.29)	(6.36)	(26.47)	(9.15)	(26.79)	(6.75)	(23.09)	(8.92)
Age	-0.45	-0.16*	-0.57	-0.26*	-0.80+	-0.17*	-0.53	-0.23*
	(-0.98)	(-2.48)	(-1.04)	(-2.40)	(-1.77)	(-2.50)	(-1.02)	(-2.08)
Age^2	-0.20	0.093	0.36	0.047	-0.24	0.12+	0.30	0.028
	(-0.47)	(1.37)	(0.86)	(0.61)	(-0.56)	(1.66)	(0.78)	(0.37)
Ref. Male	0	0	0	0	0	0	0	0
Female	2.94***	0.24*	0.59	0.059	2.13*	0.078	-0.43	-0.17
	(3.37)	(2.17)	(0.65)	(0.34)	(2.25)	(0.63)	(-0.43)	(-0.80)
Ref. West			0	0			0	0
East			2.26*	0.26			3.18**	0.75***
			(2.20)	(1.56)			(3.19)	(4.19)
Ref. UK	0	0			0	0		
London	1.67	0.16			1.67	0.088		
	(1.23)	(1.23)			(1.22)	(0.67)		
Ref. Native	0	0	0	0	0	0	0	0
Immigrant	0.64	-0.17	2.21	-0.36	1.55	-0.024	4.91*	0.40
	(0.50)	(-1.13)	(1.12)	(-1.14)	(1.24)	(-0.16)	(2.57)	(1.19)
2. generation	1.07	-0.13	-1.02	-0.25	0.47	-0.15	-0.66	-0.23
	(0.90)	(-1.10)	(-0.73)	(-0.75)	(0.40)	(-1.28)	(-0.50)	(-0.72)
Mental health	0.40	-0.017	0.49	-0.016	0.46	-0.010	0.35	-0.034
	(1.08)	(-0.35)	(1.20)	(-0.21)	(1.26)	(-0.21)	(0.85)	(-0.46)
Physical health	0.68	0.10+	0.48	0.12+	0.50	0.075	0.41	0.042
	(1.62)	(1.77)	(1.04)	(1.67)	(1.19)	(1.36)	(0.93)	(0.57)
Tenure		-0.0025		0.016		-0.0045		-0.0017
		(-0.25)		(1.56)		(-0.46)		(-0.16)
Overtime l. year		-0.80		1.62		-0.69		0.49
		(-1.48)		(1.62)		(-1.62)		(0.50)
Part-time last year		-0.036		-0.29		0.054		-0.022
		(-0.22)		(-1.28)		(0.35)		(-0.09)
Last wages						-0.000014		0.0000040
						(-0.46)		(0.09)
Constant	-0.33	0.11	-0.71	0.75+	1.29	8.49*	-3.58	5.12***
	(-0.21)	(0.52)	(-0.36)	(1.87)	(0.57)	(2.39)	(-0.81)	(3.92)
Year of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of spell	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Transition origin	Yes	No	Yes	No	Yes	No	Yes	No
Last occ. pos. FE	No	No	No	No	Yes	Yes	Yes	Yes
Last industry FE	No	No	No	No	Yes	Yes	Yes	Yes
Size of l. empl. FE	No	No	No	No	No	Yes	No	Yes
N	3698	27594	7161	53304	3698	27594	7161	53304
$N_{cluster}$	3191	10256	4926	13904	3191	10256	4926	13904
Imputations	100	100	100	100	100	100	100	100

Realized matches results. All continuous predictors standardized. Cluster-robust t-values in parentheses. ***P<0.001; **P<0.01; *P <0.05; +P<0.10.

C. Generalized linear models

To facilitate between-country comparisons, we rely on linear probability models (LPM) in the main text. This section demonstrates that the substantive conclusions are identical, when we estimate generalized linear models (GLM) for binary outcomes instead. Table C-1 replicates the main analyses using a logit link function for the cross-sectional and entry-into-undereducation models, and a complementary log-log link function for the promotion models. While the logit is widely applied in the social sciences, the complementary log-log link is somewhat less common. It is given by $\eta_i = \log(-\log(1-\pi_i))$. The complementary log-log transformation is similar to the logit-transformation in that it maps the probability π to observe a positive outcome from a [0,1] interval onto η, a random variable defined over the interval $[-\infty, +\infty]$, which can be conveniently modelled. However, unlike the logit, the complementary log-log link is not symmetric around $\pi = 0.5$ and it approaches zero slower than the logit transformation. Hence it is especially useful when predicting outcomes that are rare. For this reason, the complementary log-log is often used in discrete-time survival analysis. Another important property of the complementary log-log model in this context is that its coefficients have a direct interpretation in terms of effects on the hazard ratio, which makes it the discrete time equivalent of the continuous time Cox model. Since our promotion models are in effect survival models, we opted for the complementary log-log as the appropriate link function.

Table C-1 shows patterns that are very similar to those reported in the main article. Of course, effect sizes are not directly comparable between the LPM and GLM specifications. If we concentrate on the pattern of t-values, however, we find little substantive differences between Table C-1 and those reported in

Appendix B, save for the fact that estimates in the GLM tend to be substantially more precisely estimated (as indicated by their t-ratios).

Table C-1 Generalized linear models of being in and entering undereducation

	United Kingdom			Germany		
	Overall	Entry	Promo-tion	Overall	Entry	Promo-tion
Cognitive ability	0.35***	0.13	0.33**	0.034***	0.18	0.14
	(7.18)	(1.47)	(3.27)	(4.63)	(1.33)	(1.49)
Conscientiousness	-0.091+			-0.020**		
	(-1.67)			(-2.80)		
Neuroticism	-0.013			-0.015*		
	(-0.25)			(-2.20)		
Agreeableness	-0.00039			0.00018		
	(-0.01)			(0.03)		
Extraversion	-0.047			-0.0022		
	(-0.87)			(-0.34)		
Openness	0.17**			0.026***		
	(3.19)			(3.75)		
Risk tolerance	0.044			-0.0075		
	(0.86)			(-1.23)		
Internal locus of control	0.18**			0.020**		
	(3.19)			(3.29)		
Compliance enhancing traits		0.0074	-0.15		-0.17	-0.023
		(0.07)	(-1.30)		(-1.31)	(-0.32)
Entrepreneurialism		0.099	0.37**		0.20	0.17*
		(0.83)	(3.04)		(1.28)	(2.31)
Parents' average ISEI	0.30***	0.20	0.16	0.047***	0.57***	0.42***
	(5.56)	(1.54)	(1.46)	(7.56)	(4.22)	(5.82)
Constant	-4.50***	-4.98***	-6.47***	0.10***	-3.80***	-4.70***
	(-33.05)	(-10.78)	(-15.00)	(6.26)	(-9.01)	(-21.72)
N	10964	3697	27356	12348	7117	49060
$N_{cluster}$		3191	10233		4926	13841
Imputations	100	100	100	100	100	100

Realized matches results. All continuous predictors standardized. (Cluster-)robust t-values in parentheses. ***P<0.001; **P<0.01; *P <0.05; +P<0.10.
Controls as in Table B.1 and Table B.2 respectively. No controls for prior attainment.

D. Self-assessed undereducation

The most contentious methodological issue in mismatch-scholarship is the measurement of mismatches. It is well known that different strategies to measure mismatches, most prominently the realized-matches approach and the self-assessment approach, produce relatively low agreement on who should be regarded as undereducated (Leuven and Oosterbeek 2011; Verhaest and Omey 2011).

Fortunately, we are able to test the robustness of our core findings against a second indicator of undereducation that is based on the self-assessment approach in Germany. Here respondents assess the qualification requirements of their current job themselves, after being prompted by the question "What type of education or training is usually required for this type of work?", with the four answers ranging from "None" to "a tertiary degree". We define respondents as undereducated if their actual formal education falls short against their own assessment of requirements. This approach has the advantage that it does not rely on years of education as a metric variable. Another advantage is that it captures actual mismatch-situations which are perceived by workers themselves. In contrast to the realized-matches approach, self-assessment also does not rely on the assumption that education requirements have to be constant within occupations as defined by ISCO-codes. Yet, this approach has the disadvantage that it cannot distinguish typical from untypical and thus substantial undereducation. What is more, by relying on just four qualification levels, it identifies undereducation in relatively coarse terms. And of course, workers' self-assessment can be wrong or outdated.

Table D-1 shows results based on this alternative indicator of undereducation. Model 1 replicates the results for Germany displayed in Figure 2-1 of the main article. Model 2 and Model 3 replicate the career trajectories into undereducation results displayed in Figure 2. Across the three models, we see that

the overall pattern of results remains largely similar to the realized-matches approach. Yet, a clear divergence from the results reported in the main article is the null-result for cognitive ability and entrepreneurial traits in Model 1. Parental SES is a systematic predictor of undereducation and external entries into self-rated undereducation. Like in the main article, there are no benefits to compliance increasing traits (i.e., conscientiousness, agreeableness, and neuroticism), and entrepreneurial traits predict promotions into undereducation.

Table D-1 Linear probability models of being in and entering self-assessed undereducation

	(1) Overall		(2) Entry		(3) Promotion	
Cognitive ability	-0.090	(-0.12)	-0.16	(-0.21)	-0.14	(-0.98)
Conscientiousness	-1.50*	(-2.27)				
Neuroticism	-0.74	(-1.29)				
Agreeableness	0.19	(0.32)				
Extraversion	0.57	(1.07)				
Openness	0.71	(1.27)				
Risk tolerance	-0.55	(-1.02)				
Internal locus of control	0.14	(0.28)				
Compliance enhancing traits			-0.14	(-0.25)	-0.079	(-0.67)
Entrepreneurialism			0.33	(0.51)	0.23*	(2.18)
Parents' average ISEI	3.88***	(4.95)	1.64*	(2.28)	0.24	(1.62)
Controls						
Years of Schooling	1.92	(1.16)	0.83	(0.43)	2.28***	(5.63)
Years of schooling^2	4.71***	(5.47)	2.94***	(3.38)	1.99***	(5.75)
Age	0.020	(0.04)	-1.49*	(-2.40)	-0.29*	(-2.35)
Age^2	-0.11	(-0.29)	0.18	(0.42)	0.15	(1.44)
Ref. Male	0	(.)	0	(.)	0	(.)
Female	-5.66***	(-5.48)	-1.55	(-1.50)	-0.70**	(-3.22)
Ref. West	0	(.)	0	(.)	0	(.)
East	-1.67	(-1.45)	1.41	(1.05)	-0.21	(-1.01)
Ref. Native	0	(.)	0	(.)	0	(.)
Immigrant	-3.75*	(-2.11)	0.34	(0.17)	-0.73*	(-1.96)
2. generation	-1.30	(-0.80)	-2.21	(-1.60)	-0.35	(-1.10)
Mental health	-0.40	(-0.76)	0.53	(1.10)	-0.096	(-0.98)
Physical health	1.44**	(3.08)	0.070	(0.16)	0.15+	(1.85)
Tenure					0.024*	(2.47)
Share overtime last year					3.77**	(2.85)
Part-time last year					-0.13	(-0.58)
Last wages						
Constant	11.9***	(8.47)	5.57*	(2.34)	2.99***	(6.51)
Year of interview	Yes		Yes		Yes	
Number of spell	No		Yes		Yes	
Transition origin	No		Yes		No	
N	8995		5630		35400	
$N_{cluster}$			3855		9441	
Imputations	100		100		100	

Self-assessed undereducation results. All continuous predictors standardized. Cluster-robust t-values in parentheses.
***P<0.001; **P<0.01; *P <0.05; +P<0.10.

E. Metric depth of undereducation and alternative definitions

The information on which the realized matches indicator in the main text is based is metric in nature: The deviation from the occupation mean years of education expressed in occupation-specific standard deviations. As Equation 2-1 in the main text shows, we dichotomize this information in order to generate consistency with prior research, and to give a clear interpretation to the concept of *transitions* into undereducation. However, the choice of one standard deviation as the cut-off is largely conventional, and disposes of valuable information in the dependent variable. In this section, we therefore replicate the analyses in the main text using the original metric depth of undereducation and alternative cut-off values for dichotomisation.

To generate a metric indicator of the depth of undereducation, we code workers, who have more education than the mean in their occupation with a zero and assign all others the deviation from their occupation mean years of education in units of occupation-specific standard deviations. In the cross-sectional models, we simply model the expected metric undereducation as a function of our covariates using ordinary least squares. For the promotion models, we regress the annual *change* in metric undereducation on our variables of interest. These models tell us about likely undereducation trajectories of people with different characteristics.

We cannot provide a metric specification of our entry-into-undereducation models, because the *transition* into undereducation after job-change or labour market entry is not well defined as a metric variable. For these models to be meaningful, it is important to control undereducation in the last job, which is however not defined for labour market entrants. Other than in the

dichotomous case, finally, simply excluding those job-changers, who have been undereducated before, is impossible given the lack of a clear criterion.

We further provide results for two alternative cut-off rules to define somebody as undereducated in the dichotomous case in Table E-2. The first of these is based on simply using *half* a standard deviation around the occupation mean to define education-matched employees. This specification addresses the possible issue that undereducation might be too rare to be picked up efficiently by our models, by somewhat balancing the distribution of the dichotomous outcome variable. However, this comes at the expense of a less strict definition of undereducation. The second rule is based on the median and on the inter-quartile range (IQR) instead of mean and standard deviation, respectively. Here we define employees as undereducated if they have less than their occupation-median minus half an IQR of education.

Tables E-1 and E-2 demonstrate that the results of the alternative specifications are largely in line with the specification presented in the main article. It is also apparent, however, that the metric formulation tends to have more statistical power, as standard errors are consistently smaller and t-values larger. Especially in Germany, we find that relationships that bordered the level of statistical significance in the dichotomous specification are often clearly significant in the metric specification. This demonstrates that a lack of statistical significance in any one model should not be prematurely dismissed as indicating a lack of association.

Table E-1 Linear models of (changes in) metric undereducation

	United Kingdom		Germany	
	Overall	Promotion	Overall	Promotion
Cognitive ability	0.060***	0.0030**	0.034***	-0.0019
	(13.00)	(3.21)	(4.63)	(-0.77)
Conscientiousness	-0.010*		-0.020**	
	(-2.27)		(-2.80)	
Neuroticism	0.0059		-0.015*	
	(1.25)		(-2.20)	
Agreeableness	0.0047		0.00018	
	(1.04)		(0.03)	
Extraversion	0.0028		-0.0022	
	(0.68)		(-0.34)	
Openness	0.025***		0.026***	
	(5.46)		(3.75)	
Risk tolerance	0.0036		-0.0075	
	(0.87)		(-1.23)	
Internal locus of control	0.019***		0.020**	
	(4.39)		(3.29)	
Compliance enhancing traits		-0.0013		-0.000088
		(-1.47)		(-0.05)
Entrepreneurialism		0.00097		-0.00029
		(1.18)		(-0.18)
Parents' average ISEI	0.034***	0.0010	0.047***	0.0041*
	(8.32)	(1.34)	(7.56)	(2.56)
Constant	0.17***	0.0016	0.10***	0.0094
	(20.20)	(0.54)	(6.26)	(1.16)
N	10785	26250	12348	58173
$N_{cluster}$		9799		14905
Imputations	100	100	100	100

The dependent variable is the (change in the) difference between own education and the occupation mean in occupation-specific standard deviations. All continuous predictors standardized. (Cluster-)robust t-values in parentheses. ***P<0.001; **P<0.01; *P <0.05; +P<0.10.

Controls as in Table B.1 and Table B.2 respectively. No controls for prior attainment.

Table E-2 Linear probability models of being in and entering undereducation

	United Kingdom						Germany					
	Overall IQR	Overall .5SD	Entry IQR	Entry .5SD	Promotion IQR	Promotion .5SD	Overall IQR	Overall .5SD	Entry IQR	Entry .5SD	Promotion IQR	Promotion .5SD
Cognitive ability	0.028***	0.031***	0.0047	0.024***	0.0020*	0.0034***	0.012*	0.026***	0.0083	0.012+	0.0017	0.0040*
	(7.93)	(7.87)	(0.81)	(3.67)	(2.42)	(3.68)	(2.24)	(3.72)	(1.48)	(1.67)	(1.58)	(2.14)
Conscientiousness	-0.0031	-0.0011					-0.0078	-0.0095				
	(-0.91)	(-0.27)					(-1.60)	(-1.50)				
Neuroticism	0.00056	0.0072+					-0.0055	-0.010+				
	(0.16)	(1.83)					(-1.26)	(-1.67)				
Agreeableness	-0.00052	-0.0016					0.0034	0.00075				
	(-0.15)	(-0.41)					(0.73)	(0.13)				
Extraversion	0.00061	0.000028					-0.0030	0.00058				
	(0.19)	(0.01)					(-0.66)	(0.09)				
Openness	0.011**	0.0078*					0.014**	0.021***				
	(3.04)	(2.01)					(2.90)	(3.39)				
Risk tolerance	0.0036	0.00053					-0.0061	-0.0053				
	(1.10)	(0.14)					(-1.41)	(-0.95)				
Internal locus of control	0.0092**	0.0091*					0.0055	0.016**				
	(2.88)	(2.46)					(1.28)	(2.96)				
Compliance enhancing traits			0.0012	-0.0026	-0.00041	0.00025			-0.0050	-0.0013	-0.0014	-0.0022
			(0.23)	(-0.38)	(-0.50)	(0.25)			(-0.91)	(-0.18)	(-1.39)	(-1.25)
Entrepreneurialism			0.0097	0.0024	0.0020*	0.00098			0.0081	0.014+	0.0029**	0.0039*
			(1.62)	(0.35)	(2.49)	(0.97)			(1.37)	(1.85)	(3.05)	(2.56)
Parents' average ISEI	0.016***	0.018***	0.0081	0.016**	0.00029	0.00044	0.022***	0.034***	0.017***	0.026***	0.0039***	0.0071***
	(5.47)	(5.12)	(1.61)	(2.68)	(0.43)	(0.56)	(4.82)	(5.86)	(3.46)	(3.47)	(4.05)	(4.68)
Constant	0.025***	0.17***	0.0025	0.14***	0.0026	0.0082*	-0.0053	0.094***	0.0056	0.060*	0.0039	0.027***
	(3.87)	(21.47)	(0.14)	(5.79)	(1.07)	(2.47)	(-0.46)	(6.48)	(0.30)	(2.32)	(0.97)	(4.39)
N	10785	10964	3553	3458	27027	23337	12348	12014	7130	6680	51955	45868
$N_{cluster}$			3075	3007	10048	8822			4911	4690	13642	12392
Imputations	100	100	100	100	100	100	100	100	100	100	100	100

Realized matches results. All continuous predictors standardized. (Cluster-)robust t-values in parentheses. ***P<0.001; **P<0.01; *P <0.05; +P<0.10.
Controls as in Table B.1 and Table B.2 respectively. No controls for prior attainment.

F. Parental education and occupation

The main article uses average parental ISEI as the best indicator of respondents' SES backgrounds. Here we report results that instead use average years of parental education as well as both average parental ISEI and education as predictors of undereducation. The robustness test is based on the results displayed in Table 2 of the main manuscript. Table F-1 shows the results. Model 1 repeats the results shown in the main article. Model 2 instead uses average parental years of education, based on the coding described in Appendix A, as alternative indicator. Just as parental ISEI, parental education is a strong and significant predictor of undereducation in Germany, but not in the UK. Model 3 finally uses both parental ISEI and education as indicators in the same model. Because both are indicators of parental SES, their simultaneous inclusion reduces their coefficients, but nevertheless both remain strong and systematic predictors of undereducation in Germany. One could therefore even claim that the German results discussed in the main article provide only a lower bound for the overall importance of parental SES, because dimensions not reflected in parental ISEI seem to matter as well. In the UK, by contrast, background effects are exclusively due to parents' occupational standing, but not their education.

Table F-1 Linear probability model of being undereducated

	(1) United Kingdom	(2) United Kingdom	(3) United Kingdom	(4) Germany	(5) Germany	(6) Germany
Parents' average ISEI	1.51***		1.58***	2.45***		1.69**
	(5.58)		(5.23)	(5.50)		(3.29)
Education		0.42	-0.20		2.49***	1.61**
		(1.42)	(-0.61)		(4.76)	(2.65)
N	10964	10964	10964	12348	12348	12348
Imputations	100	100	100	100	100	100

Realized matches results. All continuous predictors standardized. Robust t-values in parentheses. All other variables as in Table B.1. ***P<0.001; **P<0.01; *P <0.05; +P<0.10.

G. Relative socio-economic background

At several points of the main text, we evoke the status maintenance motive as a possible explanation for higher undereducation probabilities of workers from high status backgrounds (Breen and Goldthorpe 1997; Goldthorpe 1996; Keller and Zavalloni 1964). However, our modelling approach considers only an *absolute* measure of social origin, whereas, strictly speaking, higher undereducation-probabilities due to the status maintenance motive should be driven by the *differences* between own attainment and parental status. An absolute measure of social status, on the other hand, can be argued to provide a good proxy for parental *resources*, which may be beneficial to undereducation careers independently of one's own position. Relative and absolute measures of status are of course strongly correlated, and so our models test both mechanisms jointly.

So why do we not estimate models with relative, or relative and absolute measures of status simultaneously? The reason lies in the nature of our dependent variable, which is itself a relative construct, based on two other variables, education and occupation, and the resulting need to control for own educational attainment in all models. If we were to include a relative measure of parental status, say the difference in own years of education from that of parents', the portion of this variable's variance that identifies parents' attainment would be strictly identical to that of the absolute measure, since own attainment is held constant. For the same reason—perfect collinearity—it is impossible to simultaneously include own attainment, parents' attainment, and the difference between the two in the same model. We have thus no analytical leverage to strictly discriminate between differential effects of absolute vs relative parental status.

However, there are two limited and imperfect strategies which might allow us to approximate relative status effects. The first of these exploits the fact that educational attainment is at least partially a positional good, i.e. that its status-generating value depends on its relative scarcity. The status-value of a given qualification-level was different in the 1940s, when few people had attained it, as in the 1980s, when it had become all but universal. However, insofar a given qualification is consistently required to perform certain occupations or attaining it conveys a certain educational content, a given level of qualification might be assumed to give access to specific resources with less changes over time. We exploit this ambiguity by calculating the z-standardised *relative position* of a respondent's parents in the education distribution of other respondents' parents from the same respondent-birth cohort (defined as an 11-year moving window). We pool all observations across survey-years available to us, in order to increase the leverage to detect differences by birth-cohort, which identify our relative measure. This inflates the sample by a factor of about 6 and accounts for the fact that parental education is a significant predictor of undereducation in the results presented below (in contrast to Section F). For this analysis, we use the highest degree of parents on the assumption that this degree, rather than the average of both parents will inform status aspirations. The absolute, here as before in terms of parents' average years of education, and the relative measures of parental education correlate at $r = 0.88$ in both countries, highlighting the fact that by far most of their variance is actually shared.

Table G-1 shows the results when we use this cohort-based relative measure of parental status alone and together with the absolute measure to predict undereducation in a pooled model. It emerges that the relative measure is a consistently better predictor than the conventional one, which even loses statistical significance, once we include the other measure.

What can we conclude from this exercise? At the very least, Table G-1 demonstrates that parental education effects are not *all* due to their absolute value, and that there is an aspect of positionality in parental education that plays a role here. However, our approximate set-up does not allow us to judge where this positionality stems from. It might be that parents with a given qualification in the 1950s inspired higher status aspirations in their children, than parents with the nominally same qualification did in the 1980s, due to differential status associated with the qualification. This interpretation would be consistent with the status maintenance motive hypothesis. It might, however, also be that the concrete monetary and occupational returns to a given qualification are partly positional (Bol 2015). This would mean that parental education's positionality also influences the level of *resources* available to parents.

To further discriminate between these two possibilities, we employ a second test. Here, we investigate how the importance of parental background varies with one's own education. If undereducation careers were driven by the motive to maintain parental status, we should witness a stronger effect of parental status at lower levels of education, where the difference to parents is likely to be highest. Figure G-1 shows that this is not the case. Undereducation is dramatically more likely for those with less education, which motivated us to always control for own education in the first place. However, higher parental status only shifts the curve up, it does not change its shape. Hence, there is no evidence that parental status matters any more for less educated workers than for others in explaining access to undereducation.

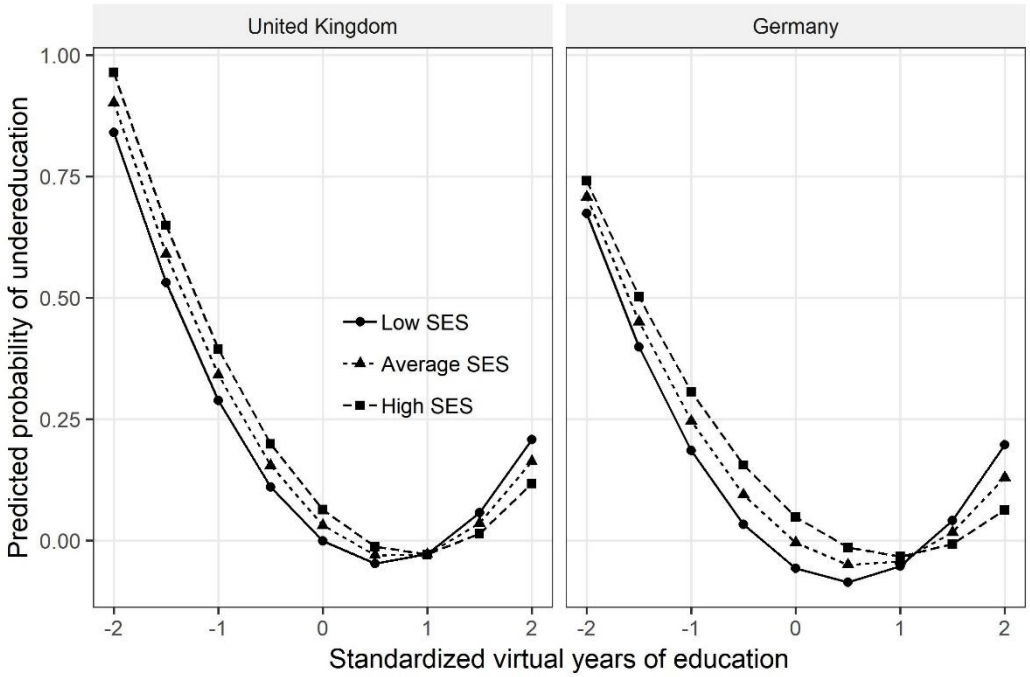
While these two approximate tests certainly cannot provide definite answers, the patterns they demonstrate are hard to square with at least a simple version of the status maintenance motive hypothesis.

Table G-1 Linear probability model of being undereducated

	(1) United Kingdom	(2) United Kingdom	(3) United Kingdom	(4) Germany	(5) Germany	(6) Germany
Parents' average education	0.17		1.10***	0.57		2.30***
	(0.32)		(4.72)	(0.74)		(6.66)
Relative parental education	1.05+	1.21***		1.89*	2.36***	
	(1.90)	(4.88)		(2.32)	(6.40)	
Controlled for age effects	Yes	Yes	Yes	Yes	Yes	Yes
N	65782	65782	65782	76553	76553	76553
$N_{cluster}$	16282	16282	16282	17416	17416	17416
Imputations	100	100	100	100	100	100

Realized matches results. All continuous predictors standardized. Cluster-robust t-values in parentheses. Results controlled for education, health, gender, and region. ***P<0.001; **P<0.01; *P <0.05; +P<0.10.

Figure G-1 Predicted probabilities of undereducation by own education and parental SES



H. Controls for final school grades

Determining mismatches only with regards to *levels of education* overlooks the stratification of graduates *within* levels of education. An obvious example are school leaving grades, which are also observable to employers. From the standpoint of our wider argument, it would be worrying, if undereducation only reflected within-education-group stratification in terms of grades. We are able to address this potential objection with the German SOEP data because it contains information about the school leaving grades of respondents in German and Math, respectively. Results reported in Table H1 show that while good (German) grades do have a positive impact on the likelihood of later undereducation, the coefficients of personality, SES-background and cognitive ability remain virtually unchanged, hence, considering grades does not put into question our conclusions.

Table H-1 Linear probability models of being in and entering undereducation

	Overall		Entry		Promotion	
Cognitive ability	0.98^{+}	(1.88)	0.70	(1.24)	0.15	(1.30)
Conscientiousness	-0.99*	(-2.17)				
Neuroticism	-0.43	(-1.03)				
Agreeableness	0.57	(1.34)				
Extraversion	-0.27	(-0.61)				
Openess	1.12*	(2.52)				
Risk tolerance	-0.51	(-1.28)				
Internal locus of control	0.61	(1.55)				
Compliance enhancing traits			-0.78	(-1.42)	-0.081	(-0.82)
Entrepreneurialism			0.63	(0.98)	0.22*	(2.28)
Parents' average ISEI	2.36***	(5.31)	2.38***	(4.00)	0.48***	(4.82)
Final grade German	1.21*	(-2.06)	0.95	(-1.39)	0.22^{+}	(-1.81)
Final grade Math	-0.66	(-1.41)	-0.40	(-0.70)	-0.030	(-0.29)
Constant	5.00*	(2.42)	3.03	(1.06)	1.44**	(2.71)
Year of interview	Yes		Yes		Yes	
Number of spell	No		Yes		Yes	
Transition origin	No		Yes		No	
N	12347		7161		53304	
$N_{cluster}$			4926		13904	
Imputations	100		100		100	

Realized matches results. All continuous predictors standardized. (Cluster-)robust t-values in parentheses. Controls as in Table B.1 and Table B.2 respectively. No controls for prior attainment.
***P<0.001; **P<0.01; *P <0.05; +P<0.10.

I. Tests of parental SES mechanisms

Figure 2-3 in the main article presents results of several mediation analyses. Here we present the full regression models underlying these results. We calculated the mediation ratios visualised in Figure 2-3 of the main article as one minus the ratio of the SES-coefficient in the respective full model to the coefficient of the baseline model. Confidence intervals were constructed from a non-parametric bootstrap procedure. We followed the MI-BS algorithm described in Schomaker and Heumann (2018) and pooled 50 bootstrap replications from each of the 100 imputed datasets. In a next step we determined the 90% and 95% confidence intervals by calculating the $97.5^{th}/2.5^{th}$ and $95^{th}/5^{th}$ percentile of the resulting distribution of mediation-ratio estimates. This procedure ensures that the non-normal sampling distribution of the ratio of two coefficients is adequately reflected in asymmetric confidence intervals.

Table I-1 Mediators of social background effects on undereducation, coefficient estimates

	UK				Germany					
	Ref.		(Non-)cognitive skills		Ref.		(Non-)cognitive skills		Social capital	
Parents' ISEI	1.97***	(7.26)	1.51***	(5.58)	2.61***	(5.88)	2.45***	(5.50)	2.60***	(5.85)
Ref. Publ. empl. agency									0	(.)
Priv. empl. agency									-2.75	(-0.90)
Job ad									0.17	(0.080)
Friends/family									-1.34	(-0.67)
Former employer									1.67	(0.75)
Other									2.45	(1.22)
Constant	1.81**	(3.15)	0.84	(1.45)	-0.58	(-0.5)	-0.14	(-0.12)	-1.27	(-0.61)
(Non-)cog. skills	No		Yes		No		Yes		No	
N	10967		10967		12349		12349		12349	
Imputations	100		100		100		100		100	

OLS-models of undereducation controlled for region, years of schooling, years of schooling2, gender, migration status, year, health, and self-employment. Realized matches results. All continuous predictors standardized. Robust t-values in parentheses. ***P<0.001; **P<0.01; *P <0.05; +P<0.10.

Table I-2 Interactions of social background and potential mediators

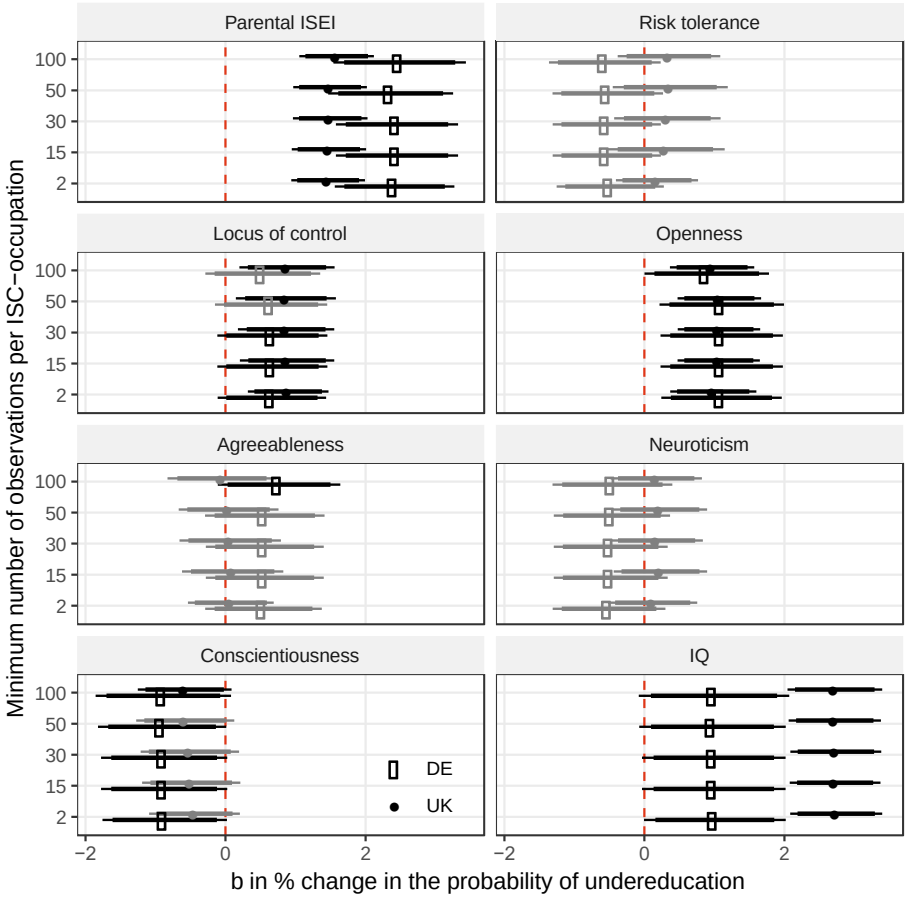
	UK		Germany			
	(Non-)cognitive skills		(Non-)cognitive skills		Social capital	
Parents' average ISEI	1.61***	(5.72)	2.52***	(5.60)	2.55	(1.48)
Conscientiousness	-0.54+	(-1.66)	-0.87+	(-1.87)		
Openess	0.94**	(3.03)	1.05*	(2.33)		
Extraversion	-0.024	(-0.082)	-0.30	(-0.67)		
Neuroticism	0.026	(0.080)	-0.46	(-1.12)		
Agreeableness	0.064	(0.21)	0.54	(1.25)		
Risk tolerance	0.21	(0.71)	-0.52	(-1.32)		
Internal locus of control	0.89**	(2.97)	0.60	(1.48)		
Cognitive ability	2.61***	(7.88)	0.95+	(1.83)		
Conscientiousness x par. ISEI	0.41	(1.29)	0.23	(0.59)		
Openness x par. ISEI	-0.69*	(-2.37)	-0.64	(-1.53)		
Extraversion x par. ISEI	-0.20	(-0.75)	0.75+	(1.80)		
Neuroticism x par. ISEI	-0.070	(-0.25)	0.087	(0.23)		
Agreeableness x par. ISEI	-0.27	(-0.90)	-0.12	(-0.31)		
Risk tolerance x par. ISEI	-0.11	(-0.39)	0.21	(0.55)		
Internal locus of control x par. ISEI	-0.20	(-0.74)	-0.60	(-1.54)		
Cognitive ability x par. ISEI	-0.80**	(-2.72)	-0.52	(-1.28)		
Publ. empl. agency					0	(.)
Priv. empl. agency					-2.90	(-0.96)
Job ad					0.19	(0.092)
Friends/family					-1.21	(-0.59)
Back to former employer					1.83	(0.81)
Other					2.48	(1.22)
Priv. empl. agency x par. ISEI					-1.58	(-0.53)
Job ad x par. ISEI					-0.020	(-0.011)
Friends/family x par. ISEI					0.67	(0.34)
Back to former employer x par. ISEI					1.12	(0.53)
Other x par. ISEI					-0.62	(-0.33)
Constant	1.02+	(1.75)	-0.066	(-0.057)	-1.29	(-0.61)
N	10967		12349		12349	
Imputations	100		100		100	

OLS-models of undereducation controlled for region, years of schooling, years of schooling^2, gender, migration status, year, health, and self-employment. Realized matches results. All continuous predictors standardized. Robust t-values in parentheses. ***P<0.001; **P<0.01; *P <0.05; +P<0.10.

J. Sensitivity to cell density

We use a realized matches approach and estimate the required education in an occupation from the data. Thus, there might be concerns that this strategy yields implausible results if the number of observations in a given occupation is small. If there is only one observation per occupation, over- and undereducation are essentially ruled out. In all the analyses presented elsewhere, we require at least 30 unique observations per occupation in the 11-year window to rule out this problem. Here, we probe the sensitivity of our analyses to this choice and compare the coefficients of interest in our simplest cross-sectional model across different values for the minimally required observations per occupation. Reassuringly, Table J-1 demonstrates that the estimated size of coefficients is highly consistent over different choices of the cut-off value.

Table J-1 Coefficients' sensitivity to occupation-cell density



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 schooling2, gender, migration status, year, and health.

K. Alternative scales for non-cognitive skills

We report a condensed version of our personality measures in our transition-models in order to ease interpretation. This section contains results for the transition models using the full inventory of personality dimension and explains how the condensed scales were constructed. To arrive at a two-factor model of undereducation-related non-cognitive skill, we postulated two latent traits, e*ntrepreneurialism* and *compliance*, and investigated whether they mapped onto the personality-items at our disposal. For the two surveys, we used the entire sample between the ages of 20 and 60 in the survey-year during which the last set of personality items were collected to carry out the confirmatory factor analysis (CFA). While we acknowledge that mapping items that were *designed* to capture independent dimensions of personality on a two-factor structure may be questionable from a psychometric point of view, our results show that the two-factor model in fact represents covariance-patterns in the data satisfactorily. In any case, our purpose in this exercise is much less *realistic* than *heuristic*, to facilitate presentation, and full results using the detailed scales are below.

We proceed in a stepwise fashion, starting with the full set of items that entered our measures of non-cognitive skills, and drop items that appeared to be insufficiently related to the postulated latent traits. We found that the neuroticism and extraversion-items were largely unrelated to the compliance-dimension. Our final model thus uses the FFM items for openness, the internal locus of control item, and the question on risk tolerance to infer entrepreneurialism, and conscientiousness and agreeableness to infer compliance. We imposed no restriction on the correlation between the two factors, but the variance of both latent traits is set to one. The model was estimated using a maximum-likelihood procedure using the SEM command in Stata 15.1, excluding

missing values (which were later imputed along with other missing data). As Table K-1 shows, the final model has a reasonable fit to the data. The Table also shows that the relationship between measured and latent variables is very similar in the two countries, and that entrepreneurialism tends to be dominated by the openness-items. In both countries there is a significant negative correlation between the two latent traits.

Table K-1 Regression coefficients and indices of fit in the CFA model

		UK		Germany	
	Item	Coefficient	Std. Error	Coefficient	Std. Error
Entrepre-neurialism	Locus of Control	0.13	0.013	0.26	0.015
	Risk	0.78	0.024	0.55	0.023
	Openness 1	1.07	0.014	0.96	0.015
	Openness 2	0.89	0.016	0.84	0.018
	Openness 3	1.08	0.014	0.87	0.015
Compliance	Agreeableness 1	0.40	0.013	0.63	0.008
	Agreeableness 2	-0.67	0.014	-0.72	0.014
	Agreeableness 3	0.85	0.012	0.72	0.009
	Conscientiousness 1	-0.70	0.015	-0.4	0.017
	Conscientiousness 2	0.44	0.015	0.42	0.013
	Conscientiousness 3	-0.82	0.012	-0.54	0.010
Cor(Entrepren,Compli)		-0.41	0.010	-0.36	0.011
N		14088		13586	
RMSEA		0.083		0.093	
CFI		0.816		0.761	
TLI		0.765		0.694	
SRMR		0.061		0.072	

All coefficients are significant at P<0.001. RMSEA= Root mean squared error of approximation; CFI=Comparative fit index; TLI=Tucker-Lewis index; SRMR= Standardized root mean squared residual

Table K-2 Linear probability model of being undereducated using alternative scales

	United Kingdom		Germany	
Cognitive ability	2.85***	(8.54)	1.04*	(2.02)
Compliance enhancing traits	-0.17	(-0.50)	-0.57	(-1.25)
Entrepreneurialism	0.84*	(2.50)	1.01*	(2.21)
Parents' average ISEI	1.55***	(5.79)	2.51***	(5.76)
Controls				
Years of Schooling	-20.2***	(-56.11)	-16.5***	(-40.35)
Years of schooling^2	12.3***	(67.12)	10.4***	(38.25)
Age	0.84**	(3.04)	0.21	(0.52)
Age^2	-0.31	(-1.16)	-0.24	(-0.74)
Ref. Male	0	(.)	0	(.)
Female	4.51***	(8.29)	0.30	(0.42)
Ref. West			0	(.)
East			0.70	(0.89)
Ref. UK	0	(.)		
London	5.12***	(5.31)		
Ref. Native	0	(.)	0	(.)
Immigrant	-1.69+	(-1.86)	-2.78*	(-2.20)
2. generation	0.74	(0.93)	1.48	(0.96)
Mental health	0.21	(0.75)	-0.33	(-0.91)
Physical health	0.79**	(2.87)	0.61	(1.64)
Ref. Interview 2007			0	(.)
Ref. Interview 2012	0	(.)		
Interview 2013	-0.18	(-0.34)	1.52	(1.57)
Interview 2014	-1.41	(-1.14)		
Constant	0.79	(1.38)	-0.41	(-0.37)
N	11125		12660	
Imputations	100		100	

Realized matches results. All continuous predictors standardized. Robust t-values in parentheses.
***P<0.001; **P<0.01; *P <0.05; +P<0.10.

Table K-3 Linear probability models of entering undereducation using alternative scales

	UK		Germany	
	Entry	Prom.	Entry	Prom.
Cognitive ability	0.86	0.23***	0.71	0.15
	(1.58)	(3.70)	(1.25)	(1.25)
Conscientiousness	-0.78+	0.057	-0.36	-0.17+
	(-1.66)	(0.92)	(-0.73)	(-1.73)
Neuroticism	0.78	0.055	0.12	-0.12
	(1.60)	(0.77)	(0.23)	(-1.35)
Agreeableness	0.43	-0.12+	-0.68	0.13
	(0.96)	(-1.88)	(-1.30)	(1.56)
Extraversion	0.47	-0.022	-0.19	0.093
	(1.03)	(-0.38)	(-0.41)	(1.08)
Openness	0.72	0.19**	0.51	0.21*
	(1.56)	(3.18)	(0.94)	(2.21)
Risk tolerance	0.52	0.085	0.50	-0.085
	(1.09)	(1.27)	(1.09)	(-1.06)
Internal locus of control	0.23	0.064	0.70+	0.20*
	(0.51)	(1.09)	(1.67)	(2.38)
Parents' average ISEI	0.67	0.063	2.41***	0.47***
	(1.43)	(1.16)	(4.00)	(4.69)
Constant	-0.17	0.11	-0.74	0.77+
	(-0.11)	(0.52)	(-0.38)	(1.94)
Year of interview	Yes	Yes	Yes	Yes
Number of spell	Yes	Yes	Yes	Yes
Transition origin	Yes	No	Yes	No
N	3698	27594	7161	53303
$N_{cluster}$	3191	10256	4926	13904
Imputations	100	100	100	100

Realized matches results w/o controls for prior attainment. Other controls as in Table B.2. Cluster-robust t-values in parentheses. All continuous predictors standardized.

Literature

Bol, T. 2015 'Has education become more positional? Educational expansion and labour market outcomes, 1985-2007', *Acta Sociologica* 58(2): p.105–120.

Breen, R. and Goldthorpe, J.H. 1997 'Explaining Educational Differentials Towards a Formal Rational Action Theory', *Rationality and Society* 9(3): p.275–305.

DoE 2018 'The national curriculum', *GOV.UK*. Available at: https://www.gov.uk/national-curriculum [Accessed September 22, 2018].

DoE 2013 *The national curriculum in England*, Department for Education.

Goldthorpe, J.H. 1996 'Class Analysis and the Reorientation of Class Theory: The Case of Persisting Differentials in Educational Attainment', *The British Journal of Sociology* 47(3): p.481–505.

Jones, K. 2016 Education in Britain: 1944 to the Present, Wiley.

Keller, S. and Zavalloni, M. 1964 'Ambition and Social Class: A Respecification', *Social Forces* 43(1): p.58–70.

KMK 2017a *Basic Structure of the Education System in the Federal Republic of Germany*, Berlin: Secretariat of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany. Available at: https://www.kmk.org/fileadmin/Dateien/pdf/Dokumentation/en_2017.pdf [Accessed September 22, 2018].

KMK 2017b *The Education System in the Federal Republic of Germany 2015/2016*, Bonn: Secretariat of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany. Available at: https://www.kmk.org/fileadmin/Dateien/pdf/Eurydice/Bildungswesen-engl-pdfs/dossier_en_ebook.pdf [Accessed September 22, 2018].

Leuven, E. and Oosterbeek, H. 2011 'Overeducation and Mismatch in the Labor Market' in E. A. Hanushek, S. Machin, and L. Woessmann (eds) *Handbook of the Economics of Education*, Elsevier.

Ofqual 2009 *Explaining Qualifications*, Office of the Qualifications and Examinations Regulator. Available at: http://webarchive.nationalarchives.gov.uk/+/http://www.ofqual.gov.uk/2368.aspx [Accessed September 22, 2018].

Schneider, S.L. 2010 'Nominal comparability is not enough: (In-)equivalence of construct validity of cross-national measures of educational attainment in the European Social Survey', *Research in Social Stratification and Mobility* 28(3): p.343–357.

Schneider, S.L. 2008 'The application of the ISCED-97 to the UK's educational qualifications' in The International Standard Classification of Education (ISCED-97). An evaluation of content and criterion validity for 15 European Countries, Mannheim: MZES. Available at: http://www.mzes.uni-mannheim.de/publications/misc/isced_97/schn08e_the_application_of_the_isced-97_to_the_uks_educat.pdf [Accessed September 20, 2016].

Schomaker, M. and Heumann, C. 2018 'Bootstrap inference when using multiple imputation', *Statistics in Medicine* 37(14): p.2252–2266.

Verhaest, D. and Omey, E. 2011 'Overeducation, Undereducation and Earnings: Further Evidence on the Importance of Ability and Measurement Error Bias', *Journal of Labor Research* 33(1): p.76–90.

II. Appendix to Chapter 3

A. Details on the measurement of variables

Coding of virtual years of education

We use information on the detailed highest qualification attained to construct a metric variable of years of education. We consider elementary, secondary, tertiary, and vocational education, in so far it results in nationally recognized qualifications. Further education programs that are company specific, or not certified, do not enter our estimation of formal education requirements. Importantly, our measure is based on the *typically* required time for the completion of qualification as opposed to the *actual* time spent on attaining it (Schneider 2010). The conversion took place using the translation keys displayed in Tables A-1 and A-2, which are based on background information on countries' education systems (DoE 2013, 2018; Jones 2016; KMK 2017a, 2017b; Ofqual 2009; Schneider 2008). In cases where these background sources did not provide guidance on how to treat British vocational qualifications, we used the observed median duration needed by respondents to attain the respective qualifications to calculate its contribution to respondents' years of education.

To then derive the typical years of schooling in each occupation, we calculated the mean years of schooling and their standard deviation in 3-digit ISCO-groups from our data. To increase precision, we pooled education information within a 11-year window to form a moving average of an occupation's observed years of education. By dropping repeated observations of respondent-

occupation combinations within that window, we made sure that each respondent contributed to the calculated mean and standard deviation of any occupation in a given year only once. We further distinguished between East/West Germany and (non-)/London, respectively, and employed the appropriate cross-sectional poststratification weights. In each country, this leaves us with around 100 different occupations, for which we possess information on typical education profiles.

Table A-1 Virtual years of education, United Kingdom

Years of education assigned	**Qualification/certificate**
8	none
10	school leaving certificate, standard/ordinary grade, cse, gcse/o-level
12	a-levels and equivalents
14	Diploma in higher education
15	1st degree level including foundation degree, graduate of professional institute, pgce
17	university higher degree (e.g. Msc, Phd)
to which we added a maximum of one of the following further education qualifications if respondents did not report tertiary education (values based on median duration times)	
3	hnc/hnd, onc/ond
2	modern/trade apprenticeship, scotvec, scotec, scotbec, other vocational, technical or professional qualification, city and guilds certificate, gnvq/gsvq, nvq/svq-level 1-2, btec/bec/tec/edexcel/lql,
1	rsa/ocr, clerical/commercial qualification, youth training certificate, key/basic skills, entry level qualifications (wales)
Foreign qualifications of respondents	
3	none
5	completed primary school
10	completed secondary school
11	post-secondary vocational training (up to 1 year)
12	post-secondary vocational training (2 and more years)
14	post-secondary academic below-degree level qualification
15	Bachelors or equivalent first degree qualification
16	postgraduate academic below-masters level qualification
17	Masters or equivalent higher degree level qualification
20	PhD
Qualifications of respondents' parents	
4	no schooling reported
9	left school with no qualifications or certificates
10	left school with some qualifications or certificates
12	post-school qualifications or certificates (e.g. City & Guilds)
16	university degree or higher degree

Table A-2 Virtual years of education, Germany

Years of education assigned	**Qualification/certificate**
7	none
9	general secondary school (*Hauptschule*)
10	intermediate secondary school (Realschule)
10.5	general secondary school + other vocational training
11.5	intermediate secondary school + other vocational training
12	general secondary school + apprenticeship or equivalent, vocational maturity certificate (Fachabitur)
13	general maturity certificate (Abitur), intermediate secondary school + apprenticeship or equivalent
14.5	vocational maturity certificate + other vocational training
15	vocational maturity certificate + apprenticeship or equivalent
16	Bachelors or equivalent, general maturity certificate + apprenticeship or equivalent
18	Masters/PhD or equivalent
Qualifications of respondents' parents	
3	none
5	general secondary school (*Hauptschule*)
10	intermediate secondary school (Realschule)
12	vocational maturity certificate (Fachabitur)
13	general maturity certificate (Abitur)
to which we added the following vocational qualifications if applicable	
1	unspecified vocational training
3	apprenticeship or equivalent
5	crafts-master (Meister), technician-degree, technical tertiary degree (FH) or equivalent
6	university degree

Immigrants were assigned the closest German equivalent.

B. Measurement of control variables

In our analyses, we control for respondents' cognitive and non-cognitive skills. A rarity in population studies, both the UKHLS and SOEP contain direct measures of cognitive ability, 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 using a chained equation approach as explained in the main article.

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 and 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. Two other measures of personality we take into account, risk aversion and locus of control, were measured using standard single item scales in both survey (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").

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. For the UKHLS, we obtain ISEI-values through a translation routine provided by the CAMSIS project (Lambert and Prandy 2008). *Parental education* is also inferred from respondents' reports. We use a metric variable that was derived from survey respondents according to the key in Appendix A. Like for SES, we use the average virtual years of education of respondents' parents as our indicator of parental education.

C. Measurement of dependent variables

In the following, we list the questions from the two surveys we use to measure our dependent variables:

Table C-5-1 Dependent variable items

Variable	Item UKLHS	Response categories UKLHS	Item SOEP	Response categories SOEP
Trust	Are you generally a person who is fully prepared to take risks in trusting strangers or do you try to avoid taking such risks?	0 Avoid taking risks in trusting strangers – 10 Fully prepared to take risks in trusting strangers	How do you evaluate your attitude towards risk regarding the following areas? How is it about confidence regarding foreign people?	0 risk averse -- 10 fully prepared to take risks
Satisfaction with democracy	On the whole, are you very satisfied, fairly satisfied, a little dissatisfied or very dissatisfied with the way democracy works in this country?	Very satisfied, Fairly satisfied, A little dissatisfied, Very dissatisfied	How satisfied are you today with the following areas of your life: - With democracy as it exists in Germany?	Completely dissatisfied 0 – 10 Completely satisfied
Job satisfaction	Please look at this card and tell me, all things considered, which number best describes how	1 completely dissatisfied – 7 completely satisfied	- With your job?	

	satisfied or dissatisfied you are with your present job overall?			
Life Satisfaction	Please tick the number which you feel best describes how dissatisfied or satisfied you are with the following aspects of your current situation: - Your life overall		How satisfied are you currently with your life in general?	
Importance politics	Please think about each of the following and tick the box that indicates whether you think it is very important, fairly important, not very important or not at all important to your sense of who you are: - Your political beliefs?	very important, fairly important, not very important, not at all important	Different things are important to different people. How important are the following things to you? - Being politically and/or socially involved	Very important, important, less important, not at all important?
Importance profession	- Your profession?		- Being successful in my career	

Two other dependent variables of our analyses are voting intentions for left-wing parties and voting intentions for far-right parties. In the UK party support was coded in three steps: In a first step, we used information from an item that asked, which party the respondent would vote for if there was a

general election tomorrow. However, about 16% of respondents answered "None", yielding a total of just 53% of usable party nominations. Thus, if information on that variable was missing, we relied on an item that asked, which party a respondent "felt closest to". If again no information was recorded, we coded party-support using information on which party had voted for during the last election. In the end, 62% of respondents in our sample could be assigned a party affiliation. In Germany, we were able to carry out only the second step, yielding just over 40% of usable nominations.

We here list the parties we counted as left and far-right, respectively:

Variable	**UK**	**Germany**
Left-wing voting intention	Labour, SNP, Plaid Cymru, Green Party, SDLP, Sinn Fein	SPD, Greens, and Die Linke
Far-right voting intention	Ulster Unionists, UKIP, BNP	DVU, Republikaner, NPD, AfD

Table C-5-2 Left-wing and Right-wing parties in the UK and in Germany

D. Results for Different Specifications

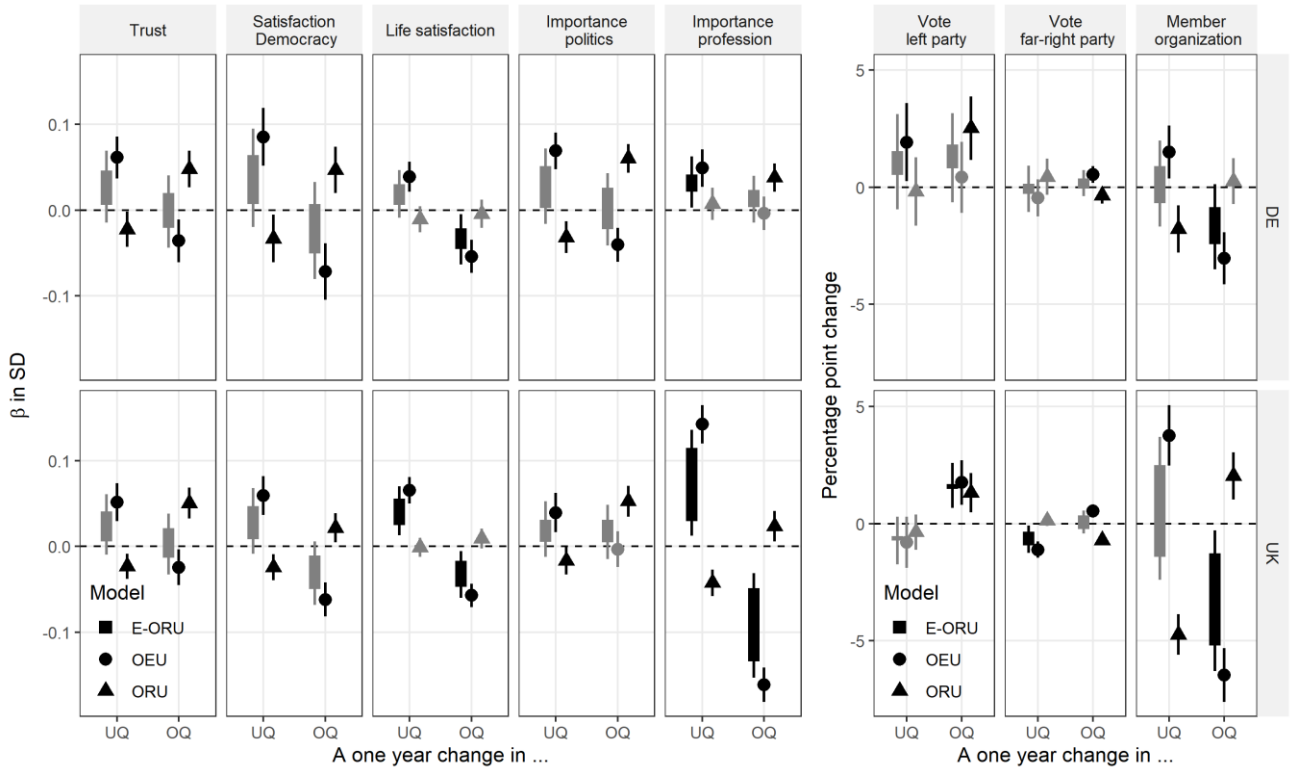
Figure B-1 present the results of our analysis of pooled data using three different specifications: the E-ORU model described in the main text, the classic ORU decomposition, and the OEU model, where instead of education the effect of required education is assumed to be zero (see page 23 of the main manuscript). In the OEU model the comparison is between matched and mismatched workers in occupations with the same requirements. In ORU, it is between matched and mismatched workers with the same education. E-ORU, finally, aims to isolate the mismatch-effect net of education and occupation. All of the differences we report are net of our control variables, but essentially cross-sectional.

The first take-away from Figure B-1 is that in general both education and occupation have sizeable true main effects on the outcomes. This is indicated by the fact that for virtually all dependent variables the mismatch parameters obtained from the OEU and the ORU specifications have different signs. This is because matched and mismatched workers differ not only in their mismatch-status, they also differ in their education, or, depending on the model, their occupation. This pattern underlines that the main effects of occupation and of education cannot simply be assumed to be zero. Had we naively assumed that OEU and ORU returned the effects of mismatches proper, our conclusions would have differed starkly between specifications. This fact illustrates the importance of gaining a theoretical understanding of the structural model implied by empirical approaches. In our view it also explains the failure of past research to produce consistent findings.

Underqualified workers are more trusting, more satisfied with politics, their lives, identify more with their profession, put a larger emphasis on

political involvement, are more likely to be members of an organization, and less likely to intent to vote for a party of the far-right, compared to matched workers *with the same education*. However, if we compare mismatched workers with matched workers *in a similar occupation*, we tend to find the opposite. Now underqualified workers appear as less trusting, less satisfied with politics, their lives (n.s. in the UK), attach less importance to politics and their profession, and are less likely to be members of an organization. For overqualified workers the picture is again generally the inverse.

Figure D-1 Social and political attitudes, and wages among mismatched workers, results for different specifications



Note: Constrained least squares models estimated on pooled data. Confidence intervals based on cluster-robust standard errors and ten imputations. Results controlled for personal characteristics.

E. Gender specific results

Figures B-1 and B-2 replicate the analyses of the main text separately for men and women. As can be seen, the results are largely identical for both genders. However, due to the reduced sample size, some of the results that were clearly significant in the combined analysis only border conventional levels of significance, when estimated separately.

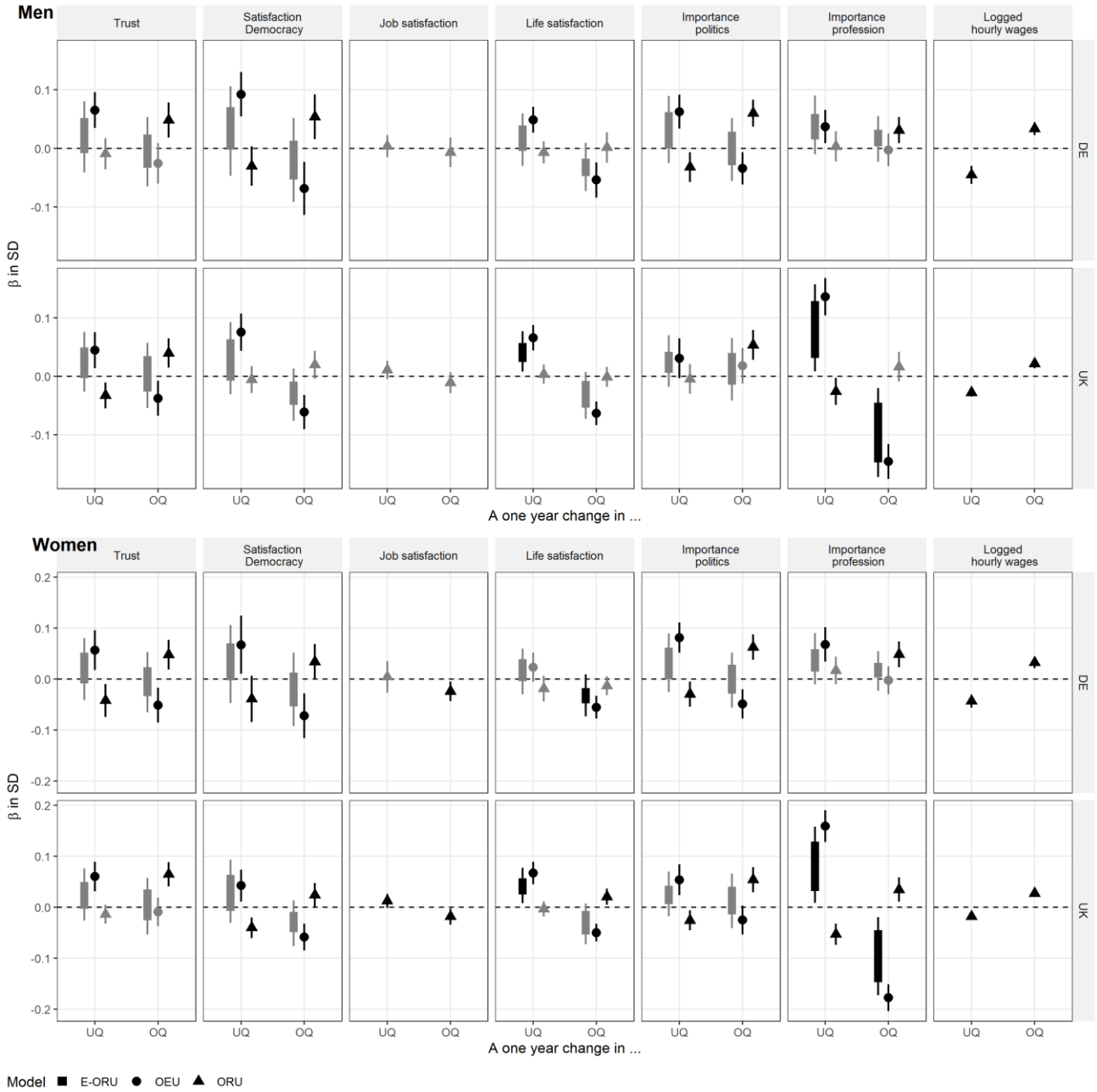
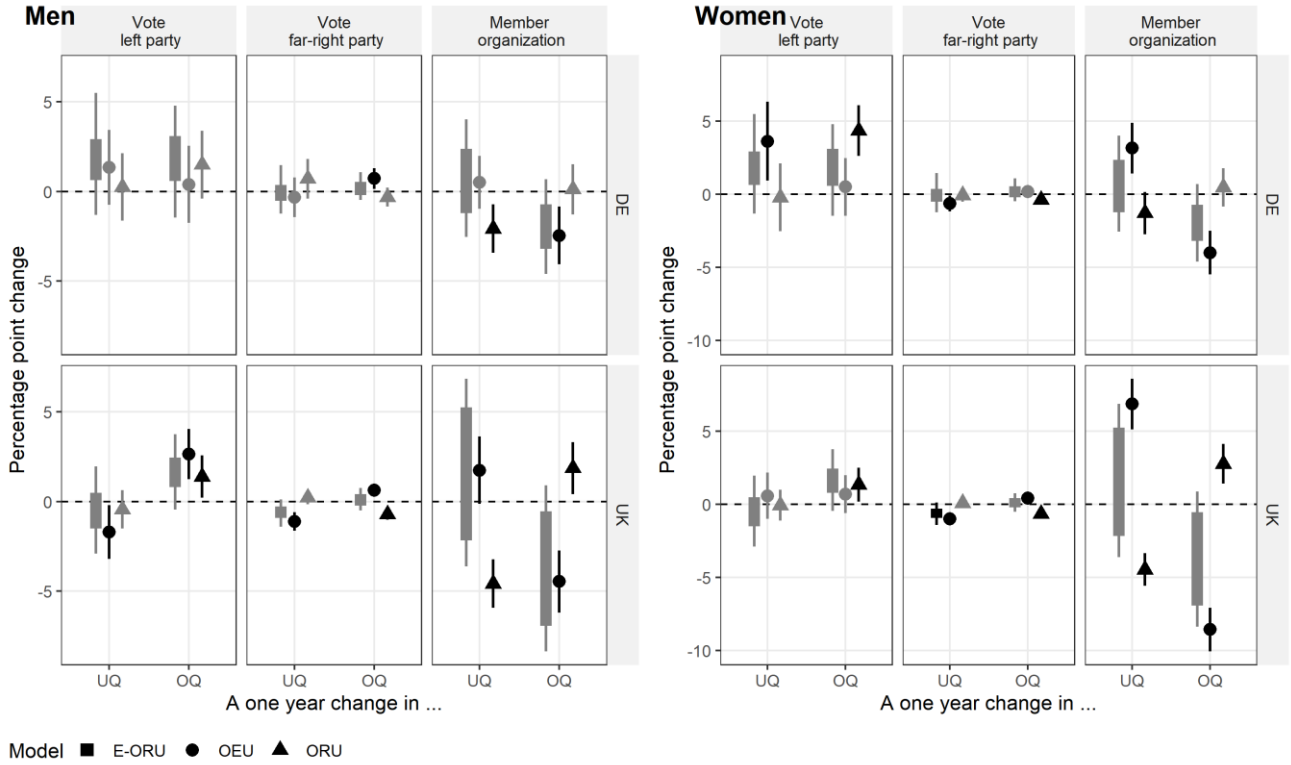


Table E-1 Social and political attitudes, and wages among mismatched workers, by gender

Note: Constrained least squares models estimated on pooled data. Confidence intervals based on cluster-robust standard errors and ten imputations. Logged hourly wages: effects given in log-points. Results controlled for personal characteristics.

Figure E-2 Social and political behaviors among mismatched workers, by gender



Note: Constrained linear probability models estimated on pooled data. Confidence intervals based on cluster-robust standard errors and ten imputations. Results controlled for personal characteristics.

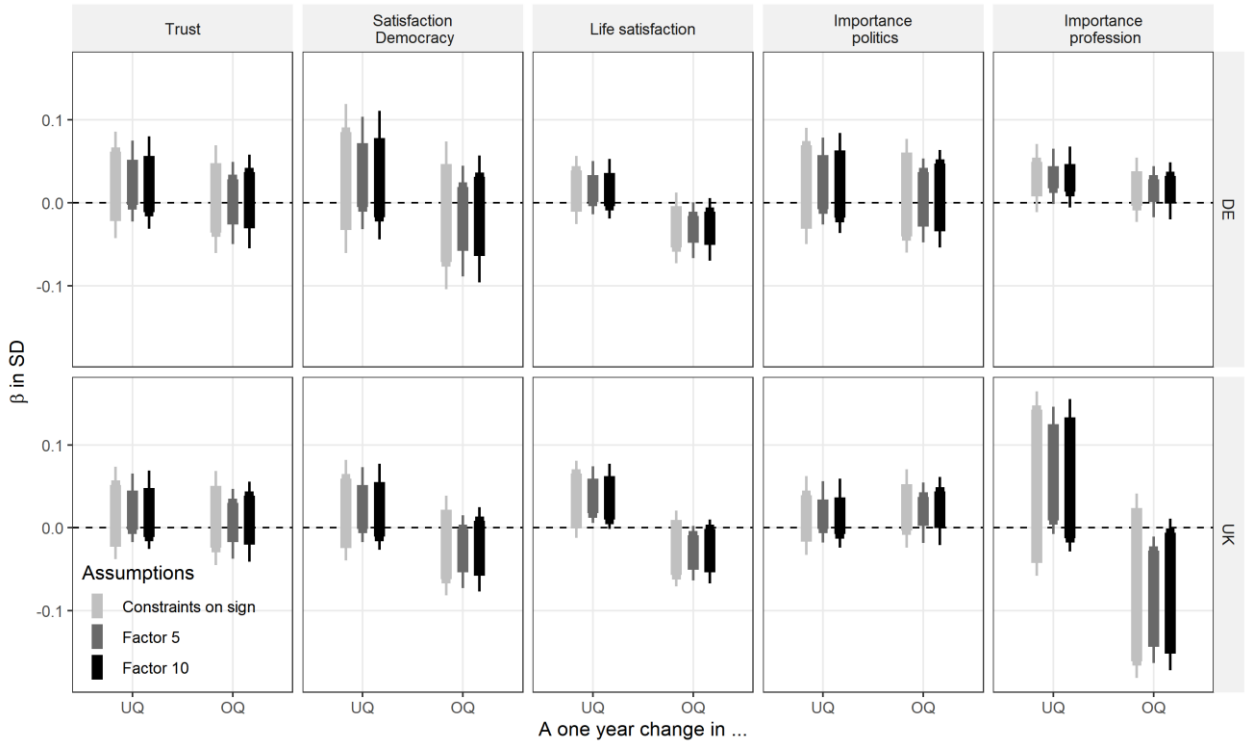
F. Sensitivity analysis for alternative identifying restrictions

Figures F-1 and F-2 replicate our main analysis employing different assumptions about the relative importance of education and occupation for our outcomes of interest. In the analyses reported in the main text, mismatch-effects are identified using the constraint $\frac{\beta_E}{3} < \beta_O^{min} < 3\beta_E$, i.e. we assume that the effect of education is not three times larger or three times smaller than that of occupational status. Here we report results for using the factors five or ten instead, which imply weaker constraints on the relative weight of education and occupation.

In a final specification, we merely constrain β_E and β_O to have the same sign. This excludes the possibility, for instance, that education has a positive effect on life satisfaction, but that working in a job that requires more education has a negative one. This is a very weak constraint and hence produces likely overly conservative bounds on the true effect size.

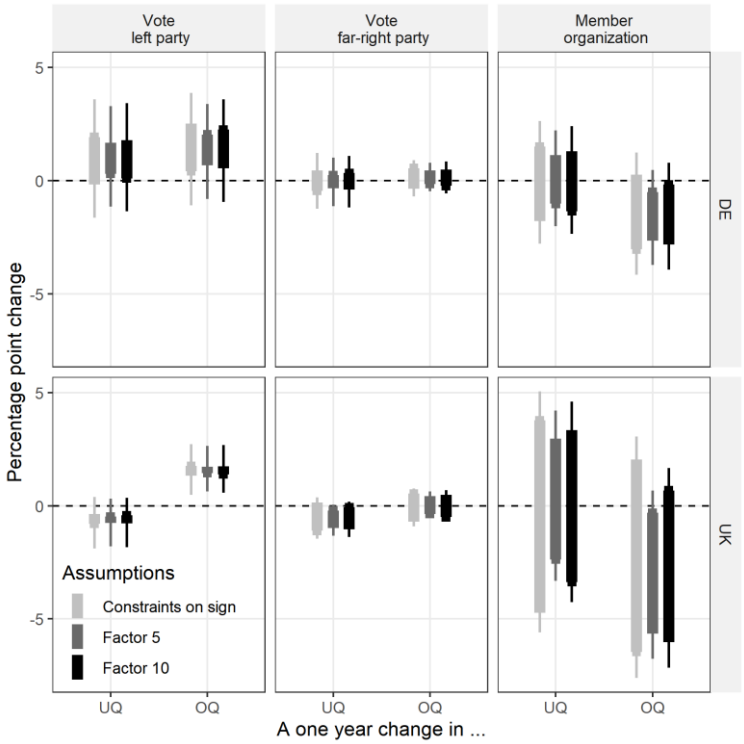
As can be seen, the picture that emerges using these alternative values is strikingly similar to the results reported in the main text. However, in some instances, making weaker assumptions sometimes results in identification-bounds crossing zero. This is true for trust, life satisfaction, the satisfaction with democracy, the importance of politics, and organizational membership. Note however, that in these cases, extreme conditions are necessary to rule out mismatch effects. For instance, a zero or negative impact of underqualification on life-satisfaction is only compatible with our data, if the direct effect of education is regarded as close to zero. As soon as some effect of education is granted, the estimates for underqualification effects turn positive. Not all estimates within the identification bounds are equally likely.

Figure F1 Social and political attitudes, and wages among mismatched workers, under different identifying assumptions



Note: Constrained least squares models estimated on pooled data. Confidence intervals based on cluster-robust standard errors and ten imputations. Logged hourly wages: effects given in log-points. Results controlled for personal characteristics.

Figure F-2 Social and political behaviors among mismatched workers under different identifying assumptions



Note: Constrained linear probability models estimated on pooled data. Confidence intervals based on cluster-robust standard errors and ten imputations. Results controlled for personal characteristics.

Literature

Dehne, Max and Jürgen Schupp. 2007. *Persönlichkeitsmerkmale Im Sozio-Oekonomischen Panel (SOEP) - Konzept, Umsetzung Und Empirische Eigenschaften*.

DoE. 2013. *The National Curriculum in England*. Department for Education.

DoE. 2018. 'The National Curriculum'. *GOV.UK*. Retrieved 22 September 2018 (https://www.gov.uk/national-curriculum).

Jones, Ken. 2016. Education in Britain: 1944 to the Present. Wiley.

KMK. 2017a. *Basic Structure of the Education System in the Federal Republic of Germany*. Berlin: Secretariat of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany.

KMK. 2017b. *The Education System in the Federal Republic of Germany 2015/2016*. Bonn: Secretariat of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany.

Lambert, Paul and Kenneth Prandy. 2008. 'CAMSIS Project: Files for Distribution Covering Occupational Unit Codes and Translations'. Retrieved 19 July 2018 (http://www.camsis.stir.ac.uk/occunits/distribution.html#UK).

McFall, Stephanie. 2013. 'Understanding Society: Cognitive Ability Measures'. *Understanding Society User Manual* 20.

Ofqual. 2009. *Explaining Qualifications*. Office of the Qualifications and Examinations Regulator.

Schneider, Silke L. 2008. 'The Application of the ISCED-97 to the UK's Educational Qualifications'. Pp. 281–300 in The International Standard Classification of Education (ISCED-97). An evaluation of content and criterion validity for 15 European Countries. Mannheim: MZES.

Schneider, Silke L. 2010. 'Nominal Comparability Is Not Enough: (In-)Equivalence of Construct Validity of Cross-National Measures of Educational Attainment in the European Social Survey'. *Research in Social Stratification and Mobility* 28(3):343–57.

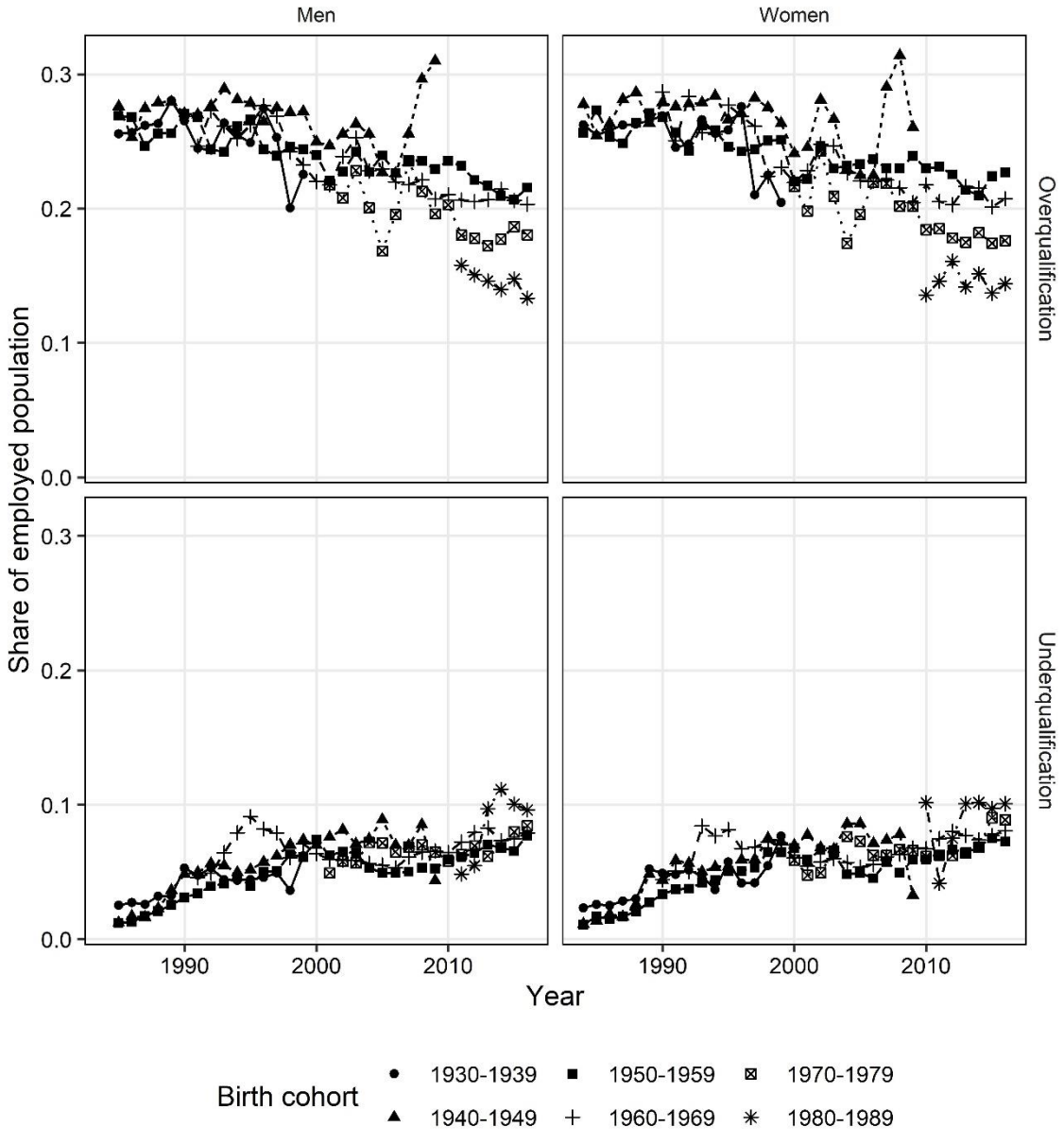
Schupp, Jürgen, Sabrina Herrmann, Peter Jaensch, and Frieder R. Lang. 2008. *Erfassung Kognitiver Leistungspotentiale Erwachsener Im Sozio-Oekonomischen Panel (SOEP)*. 32. Berlin: DIW.

III. Appendix to Chapter 4

A. Gender specific results

Figures A-1 and A-2 reproduce Figure 4-1 of the main text but are split by gender. In Germany trends and pattern among men and women are virtually identical. In the UK, the main pattern discussed in the main article, an overall-trend towards more overqualification and less underqualification that is driven by cohort-replacement, is visible for all genders. Differences between cohorts appear to be somewhat less pronounced than in the combined graph, however, especially among men. This is likely due to increased sampling error in the reduced sample and does not invalidate our overall conclusions.

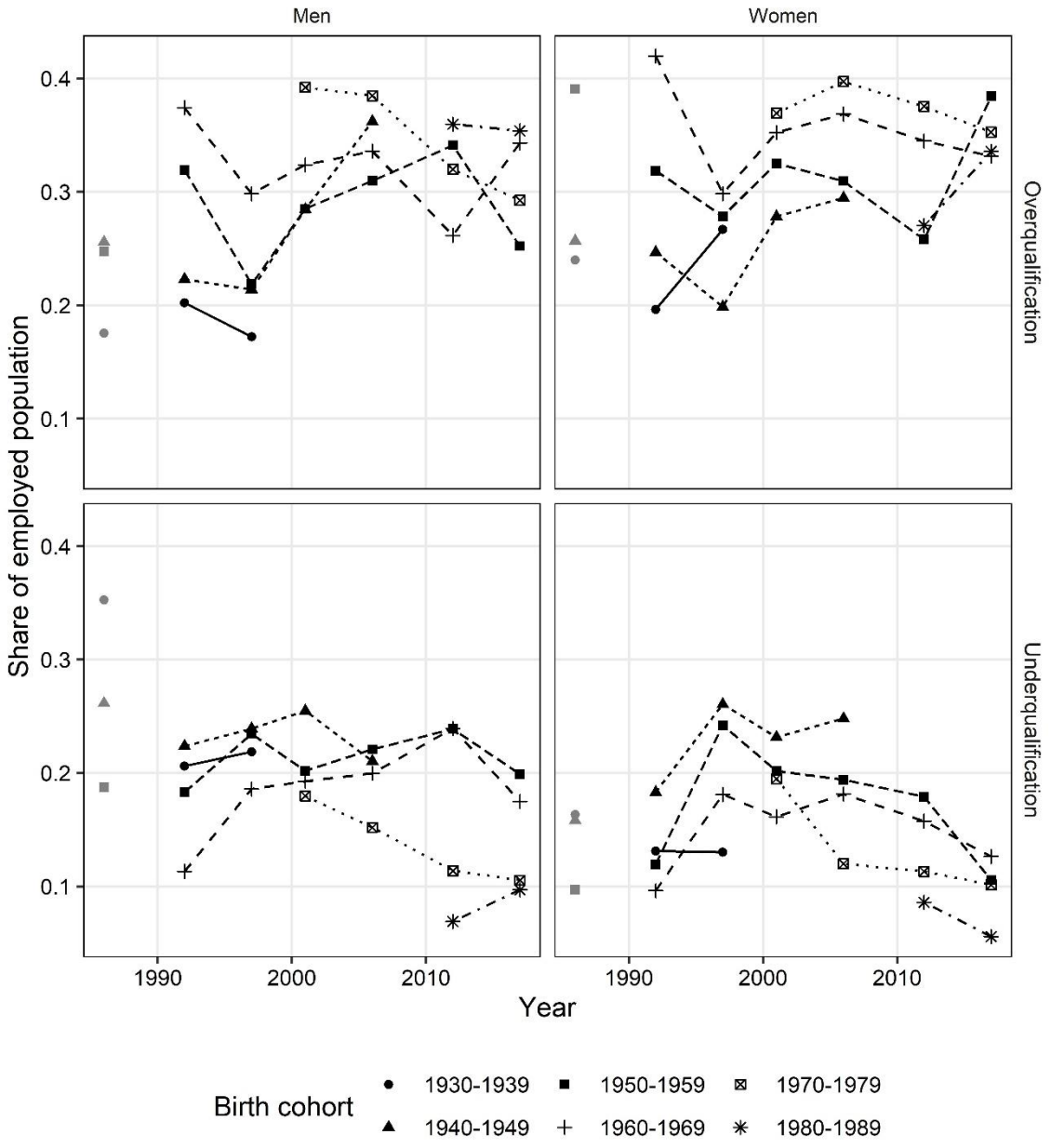
Table A-1 reproduces Table 4-2 of the main text. Among all genders, we find the pattern discussed in the main text. Effects of tertiary expansion, however, seem to be somewhat stronger in magnitude among women than among men. Vice versa, British secondary expansion has reduced underqualification and increased overqualification more among men than among women.



Solid line gives the LOWESS-smoothed overall incedence of mismatch.
Data source: GSOEP 1984-2016.
Own calculation. Cohort figures are smoothed using a 2 year moving average.

Figure A-1 Trends in mismatch rates among men and women in Germany

Figure A-2 Trends in mismatch rates among men and women in Great Britain



Solid line gives the LOWESS-smoothed overall incedence of mismatch.
Data source: UKSES 1986-2017.Own calculation,

Table A-3 Relationship between educational expansion and qualification mismatch, jointly estimated RE-LPM results by gender

	United Kingdom				Germany			
	Overqualification		Underqualification		Overqualification		Underqualification	
	Men	Women	Men	Women	Men	Women	Men	Women
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Expansion of…								
…secondary	0.285*	0.0973	-0.375**	0.0126				
	(2.07)	(0.71)	(-3.20)	(0.10)				
…lower voc.	-0.196	-0.352	0.0282	0.294				
	(-0.48)	(-0.86)	(0.09)	(0.96)				
…vocational	0.304	-0.180	-0.399	0.645**	0.0113	0.258	0.106	0.0301
	(0.93)	(-0.64)	(-1.57)	(2.73)	(0.06)	(0.90)	(0.84)	(0.25)
…lower tert.	-0.493	0.196	0.151	0.573				
	(-1.24)	(0.48)	(0.43)	(1.25)				
…tertiary	0.221	0.328+	-0.539***	-0.409***	-0.232	-0.983***	0.00806	0.159
education	(1.41)	(2.00)	(-4.27)	(-3.55)	(-1.28)	(-3.77)	(0.05)	(1.08)
N	9109	8769	8175	8385	11739	9750	9728	8243
N_Y	7	7	7	7	29	29	29	29
N_R	12	12	12	12	10	10	10	10
N_C	61	61	61	61	55	51	55	51

t statistics in parentheses. Cohort random effects. Individual controls: Partnership status, and ethnicity. Cohort controls: relative size of cohort. Results controlled for period-region fixed-effects.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B. Causal interpretation

Necessary assumptions about labor markets

Can we base quantitative predictions what mismatch patterns would have looked like under alternative education policies on this study? That is, to what degree can my estimates be regarded as causal? In the following, I refer to a *causal effect* as the effect that a counterfactual intervention in educational expansion would have had, given the historical pattern of demand change. Under what assumptions can this quantity be recovered from the data?

The three main challenges to estimate the causal effect of expansion are that, first, mismatch-incidence depends on the demand as well as on the supply of qualifications, but industry's demand for qualifications is unobserved in our data. Second, educational expansion was not assigned exogenously across cohorts. Third, equilibrium effects might spoil our central comparison. To address these challenges in the framework of our analytic design, two crucial assumptions are necessary.

The first assumption is that in the aggregate, firms' demand for qualifications does not discriminate between different cohorts and ages, net of our controls. If this is the case, the different cohorts we are comparing in the same region and period essentially confront the same demand. The qualifications required by the economy may vary over regions (reflecting different sectoral compositions), across historical time (reflecting the business cycle and secular change), and even across the interaction of the two (reflecting differing trajectories of different regions) – causal effects of educational expansion in the above sense would still be recoverable in our fixed-effects design. What has to be ruled out, however, is that the way different cohorts are affected by qualification demand differs, e.g. because firms have a preference for younger graduates. Such preferences would essentially act as omitted variables in our design.

The second assumption is that workers are in competition exclusively with others of their own cohort, i.e. that the labour market is rigidly stratified by cohort. If expansion of tertiary education in one cohort reduces undereducation in another, a comparison of mismatch rates of different cohorts, cannot be used to identify causal effects.[29] This assumption amounts to assume the absence of equilibrium effects. It implies that the relative incidence of mismatch in a cohort compared to others is basically determined at labour market

[29] In technical terms, this pattern would violate what is known as the SUTVA, the stable unit treatment value assumption, in the causal inference literature following the potential outcome framework. SUTVA holds that the treatment must not change outcomes for the control group (Imbens and Rubin, 2015: 9).

entry. Cycles of boom and bust may shift a cohort's qualification balance up and down, but relative to other cohorts, it stays constant over time. While we acknowledge that the absence of equilibrium effects is a strong assumption, we note that it receives support from the empirical finding of long lasting scarring effects of conditions at labour market entry (Gangl, 2006; Raaum and Røed, 2006), and of substantial and stable cohort differentials in labour market outcomes (Easterlin, 1968).

If the workings of the real German and British labour markets meet these assumptions, the coefficients in Table 4-2 of the main text correspond in principle to the causal effects of educational expansion on mismatch rates. We argue that the necessary conditions are clearly not met for Germany but can be more plausibly assumed for the British labour market. Figure 4-2 shows that German mismatch-differences between cohorts are negligible at the beginning of the time series and fan out after the mid-2000s. This suggests a violation of our first assumption in Germany, as the demand for higher qualifications has likely grown more for younger cohorts after the mid-2000s. The estimates in columns 3 and 4 of Table 4-2 of the main text can hence not be regarded as causal. This makes sense: A negative causal effect of tertiary expansion on overqualification is hard to conceive of. The more cautious interpretation we can apply to columns 3 and 4 is therefore that tertiary expansion in Germany was not enough to stabilize overqualification, which was falling for other reasons in younger cohorts. In the UK, we find no obvious violations of the criteria for causal interpretation. Figure 4-1 of the main text shows large and relatively stable differences between cohorts. This suggests long lasting effects of cohort-level imbalances at labour market entry and is thus in line with both of our assumption.

The fact that imperfect visual tests show no violations of crucial assumptions in the UK, does not prove that they are in fact met. We note that the bias introduced by a violation of the first assumption depends on the direction in

which demand is heterogenous across cohorts. If the growth of demand for highly-qualified workers is relatively slower in younger cohorts, we might overstate the impact of educational expansion in the UK. However, this scenario is unlikely, as skill-intensive innovations, if anything, are introduced with younger, rather than older workers. A violation of the second assumption that labour markets are rigidly stratified by cohort would lead to an underestimation of the true mismatch-effects of educational expansion. Therefore, the British estimates in Table 4-2 likely provide lower bounds for the true causal effect of educational expansion, while no causal interpretation can be assigned to the German estimates.

Endogenous migration and unemployment

The previous section has examined basic conditions for causal interpretation. Yet there are two further challenges: internal migration and sample selection bias. The first challenge arises from the fact that the qualification composition of a region might be endogenous as people move to places where they are less likely to be overqualified, or more likely to be underqualified. If this is the case, we underestimate causal mismatch-effects of credential inflation. The second challenge is due to the fact that increased competition within education-groups does not only increase the risk of overqualification, but also of unemployment. Since our main analyses take place only among the employed population, we risk underestimating the effect of expansion on overqualification, as people decide to leave the labour market to avoid mismatch.

To take into account migration, we follow two strategies. First, we replace our detailed, but potentially endogenous indicators of educational expansion with a measure that is arguably exogenous to any relocation decision during the working life: the historic share of a regional cohort that participated in post-compulsory full-time education at age 17 in the UK, and the share of a cohort that underwent schooling in the academic track (Gymnasium) at age 17

in Germany. The rationale for these alternative measures is that one's place of secondary education is arguably not determined by one's labour market prospects at least 13 years into the future. Note that values of these variables pertain to people raised in a particular region, regardless of their current location, not to current residents. But since people can migrate after finishing secondary education, these "reduced form" figures, too, represent lower bounds. Secondly, we therefore use this historical measure to instrument the contemporaneous share of university graduates, controlling for the contemporaneous share of other qualifications. The conditional exclusion restriction underlying this specification is that, *net of the contemporaneous share of other qualifications*, historic rates of post-compulsory education attendance of a cohort are related to contemporaneous mismatch rates of that cohort only through increasing the share of higher educated individuals in this cohort. The additional data for this exercise comes from the UKLFS and the MZ, respectively, both of which feature questions on current educational activities of minors. For reasons of data availability, the estimates in columns 2, 4, 7, and 9 of Table B-1 are based on restricted samples, covering only the cohorts 1962 to 1986 (UK) and 1965 to 1983 (Germany), respectively.

Table B-1 Relationship between educational expansion and qualification mismatch, RE-LPM results by estimation strategy and dependent variable

	United Kingdom				Germany					
	(1) Over-qualification OLS	(2) Over-qualification IV	(3) Under-qualification OLS	(4) Under-qualification IV	(5) Under-employment OLS	(6) Over-qualification OLS	(7) Under-employment OLS	(8) Over-qualification IV	(9) Under-qualification OLS	(10) Under-qualification IV
Share of 17 y.o. in FT education	0.149^{+}		-0.261**							
	(1.74)		(-3.22)							
Share higher tertiary education		0.531		-0.850	-1.052***			-2.220*		0.450
		(0.93)		(-1.33)	(-6.81)			(-2.49)		(0.67)
Share of 17 y.o. in academic track						-0.329*	-0.105		0.0645	
						(-2.35)	(-0.71)		(0.65)	
N	8245	8245	6176	6176	22911	11349	12384	11349	9546	9546
N_{Years}	6	6	6	6	24	19	19	19	19	19
$N_{Regions}$	12	12	12	12	10	10	10	10	10	10
$N_{Cohorts}$	25	25	25	25	56	19	19	19	19	19
Variance components										
$Var_{Intercept}$	0.000419		4.96e-14		5.12e-16	1.05e-18	4.18e-26		6.27e-25	
$Var_{Residual}$	0.229		0.159		0.187	0.153	0.189		0.0625	
Underidentifcation statistics										
Kleibergen-Paap LM statistic		61.59		57.94				32.54		31.53
p-value		0		0				0		0

t statistics in parentheses. Cohort random effects. Individual controls: Interaction gender and partnership status, and ethnicity. Cohort controls: relative size of cohort. Results controlled for period-region fixed-effects.

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

To tackle sample selection bias, we provide additional results using an encompassing indicator of skill-underutilization in columns 5 and 7 of Table B-1. This alternative indicator is defined for the entire workforce and not just employed people. Respondent are counted as "underemployed" if they are either overqualified or unemployed. If excess-expansion increased the likelihood of either of those conditions, it will show up in our results. This circumvents potential sample selection issues among our main analyses. Since the UKSES is only collected among working people in the UK, however, this alternative indicator is available for Germany only. In Germany, results using the alternative measure confirm our findings in the main text. Tertiary expansion was associated with lower levels of underemployment across cohorts. There is hence no evidence supporting the potential objection that the negative relationship reported in the main text is due to increased unemployment of highly educated people at the risk of overqualification.

C. Sensitivity analyses

Selection of German observations

Table C-1 reproduces the German estimates of Table 4-2 of the main text for alternative ways of selecting observations. In columns 1 and 3, we used all observations of the SOEP. Note that in this case, the random effects where estimated at the level of individuals rather than at the level of cohorts. In columns 2 and 4 we randomly selected one observation from all observations available for each individual. When it comes to overeducation, the results in Table C-1 are virtually indistinguishable from the results presented in the main text. For undereducation, we obtain coefficients that are similar in magnitude. But due to the larger sample and increased power of the specification presented in

columns 3, we now find a significant and positive relationship between under-education and educational expansion at all levels in Germany. Note that this does not change our substantive conclusion: Educational expansion in Germany did not outstrip supply, and possibly even lacked behind it.

Table C-1 Relationship between educational expansion and qualification mismatch in Germany, RE-LPM results by method of selecting observations

	(1) Over-qualification all	(2) Over-qualification random	(3) Under-qualification all	(4) Under-qualification random
Expansion of...				
...vocational	0.00701	-0.0122	0.172***	-0.00119
	(0.13)	(-0.11)	(4.88)	(-0.02)
...tertiary education	-0.369***	-0.357**	0.0958**	0.0597
	(-6.65)	(-3.15)	(2.70)	(0.85)
N	160073	21815	141958	18812
N_{Years}	29	29	29	29
$N_{Regions}$	10	10	10	10
$N_{Cohorts}$	29428	59	25698	59
Variance Components				
$Var_{Intercept}$	0.109	0.0000618	0.0353	2.80e-23
$Var_{Residual}$	0.0598	0.158	0.0263	0.0600

t statistics in parentheses. Cohort random effects. Individual controls: Interaction gender and partnership status, and ethnicity. Cohort controls: relative size of cohort. Results controlled for period-region fixed-effects.

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Reference categories

In the main text, we present results in Table 4-2 that use the "no qualifications"-category as a reference. It is important to note that all estimated coefficients depend on this choice. In Figure C-1, we present estimates of our central coefficient – the effect of tertiary expansion – using other possible references. As can be seen in the upper panel, the German results hardly change at all, when using people with vocational education as the reference group to define educational expansion. In the United Kingdom, the estimates do vary somewhat. However, the direction of effect is the same for all specifications. What is more, no single coefficient falls outside the 95%-Confidence-Interval of the estimate presented in the main text. For the case of overeducation, the estimate reported in the main text is in the middle of the overall range of plausible estimates. For undereducation it appears to be towards the lower end of the different effect sizes.

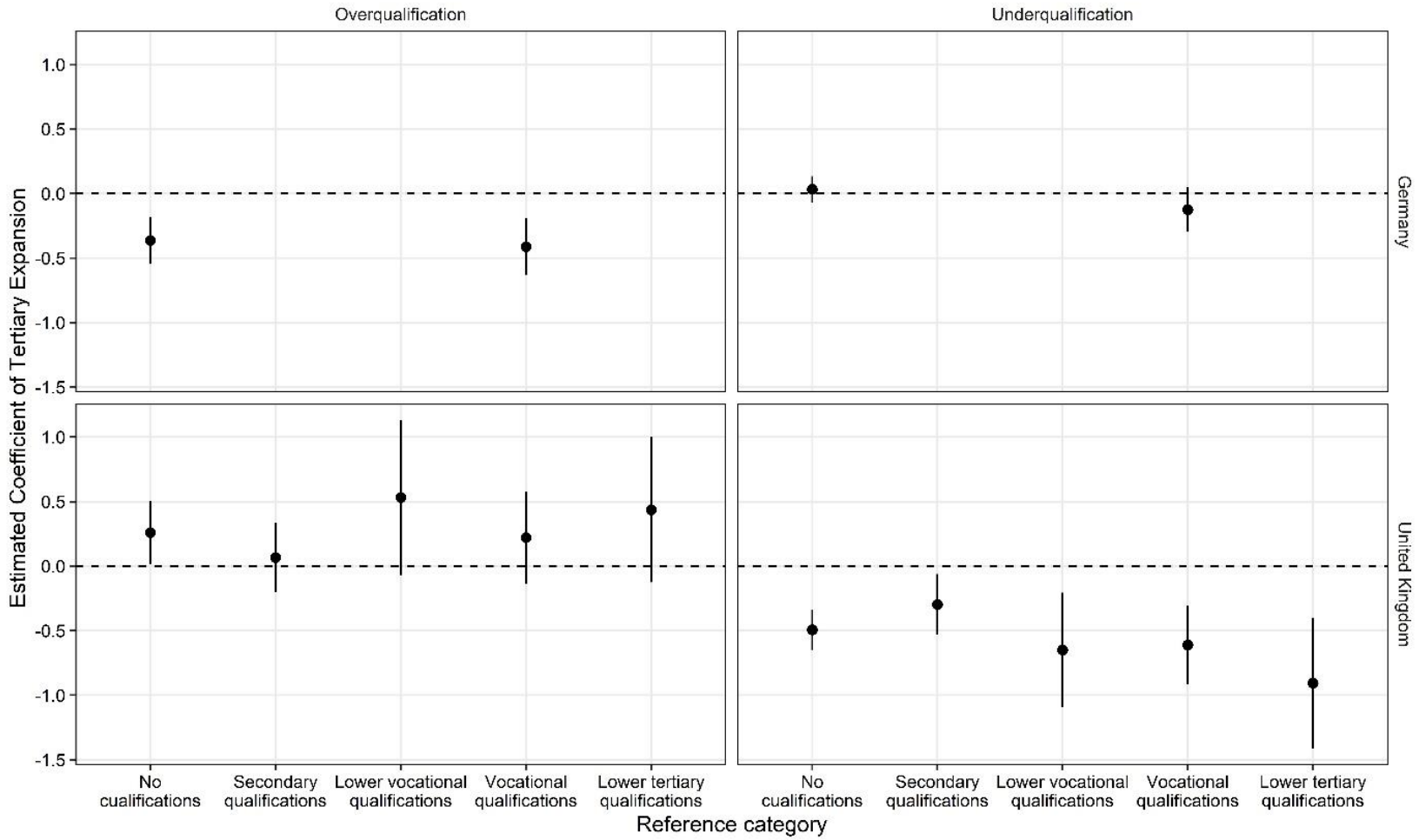


Figure C- Estimated coefficients of tertiary expansion using different reference categories

D. Specification curves

How sensitive are our results to different specifications of the underlying model? And in how far does the timing of data collection, especially in the UKSES data, which was collected only about every fourth year, affect our conclusions?

Figures D-1 through D-4 answer these questions by way of specification plots. These plots show how the estimated coefficient of tertiary expansion on subjective qualification mismatch (shown in the upper panel) changes with different model specifications (shown in the lower panel). If our models are robust, we would like to see that different plausible specifications give similar results. For our four models, this is the case.

Figure D-1 demonstrates that a non-significant estimate of the effect of tertiary expansion on overqualification in Britain can only be arrived at after exluding survey years. It also shows that the estimated effect size we present in the main article falls in the upper middle of the distribution of plausible estimates but is no way an outlier. Figure D-2 shows that the reported estimate of the effect of tertiary expansion on underqualification falls into the middle of plausible specifications. In order to arrive at substantially smaller estimates, the survey year 2012 would have to be excluded. Similarly, Figures D-3 and D-4 demonstrate for Germany that our results are robust under different specifications. If at all, differing conclusions would have to be based on estimates in the extreme ends of the specifcation curves.

Figure D-1 Specification curve for the effect of tertiary expansion on overqualification, United Kingdom

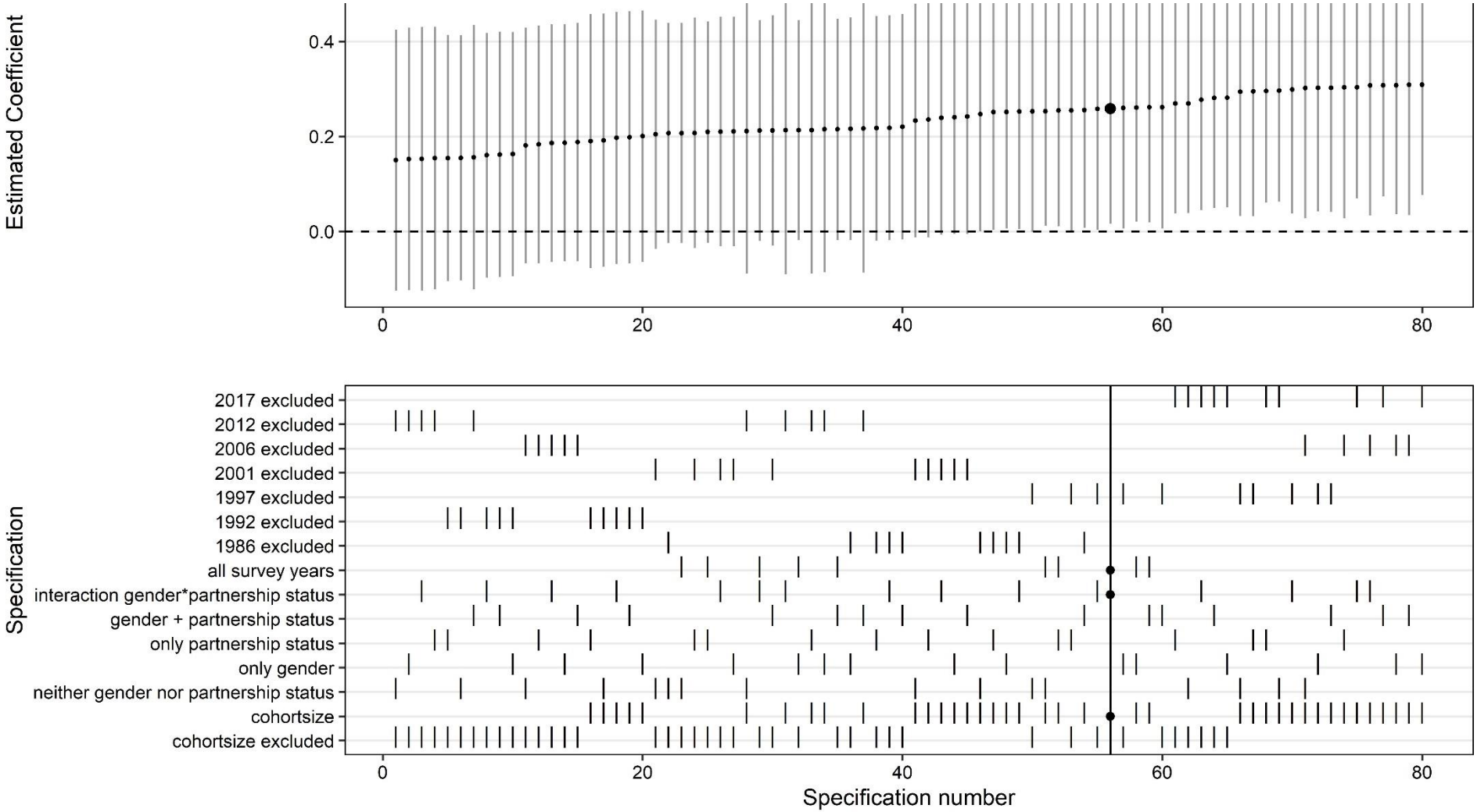


Figure D-2 Specification curve for the effect of tertiary expansion on underqualification, United Kingdom

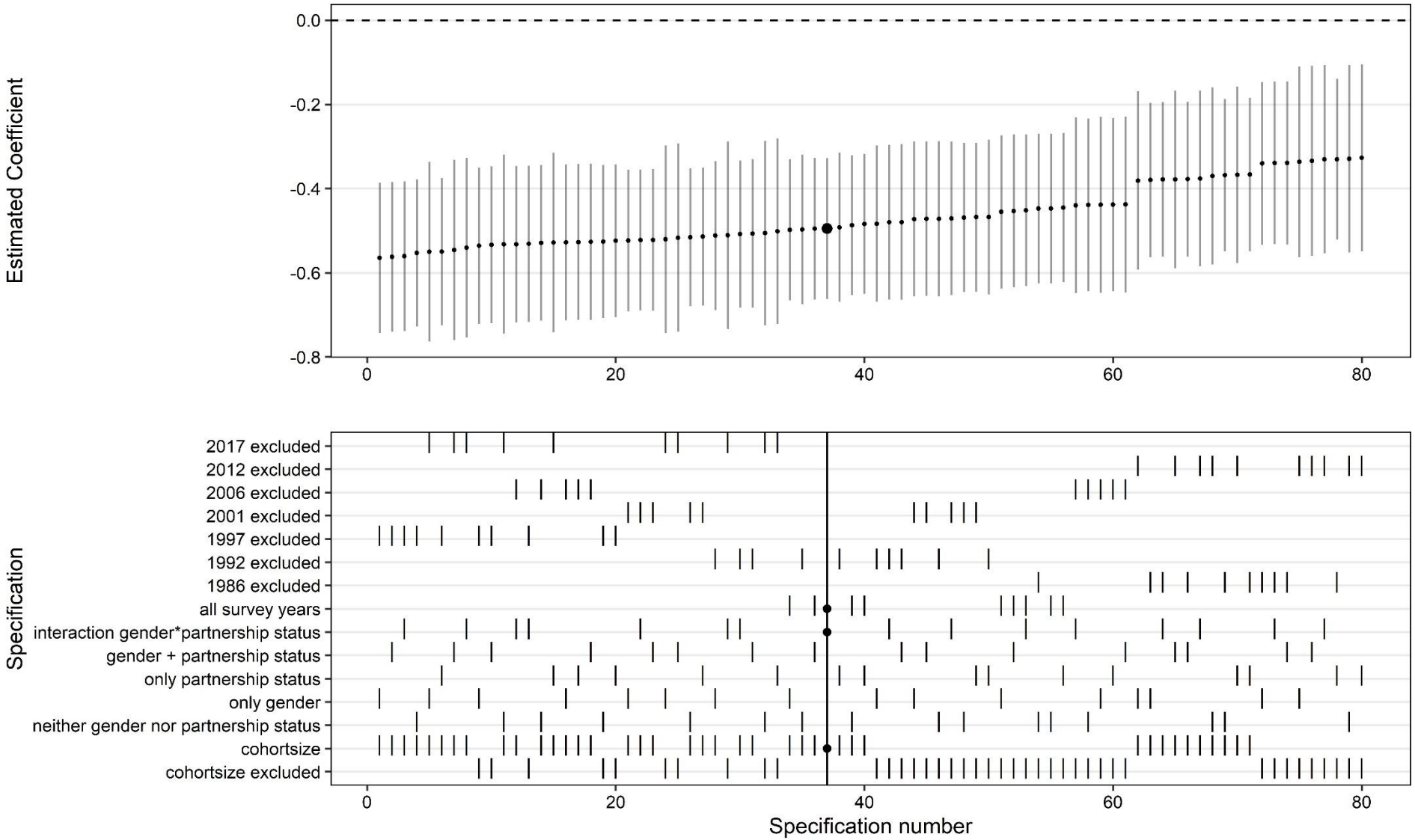


Figure D-3 Specification curve for the effect of tertiary expansion on overqualification, Germany

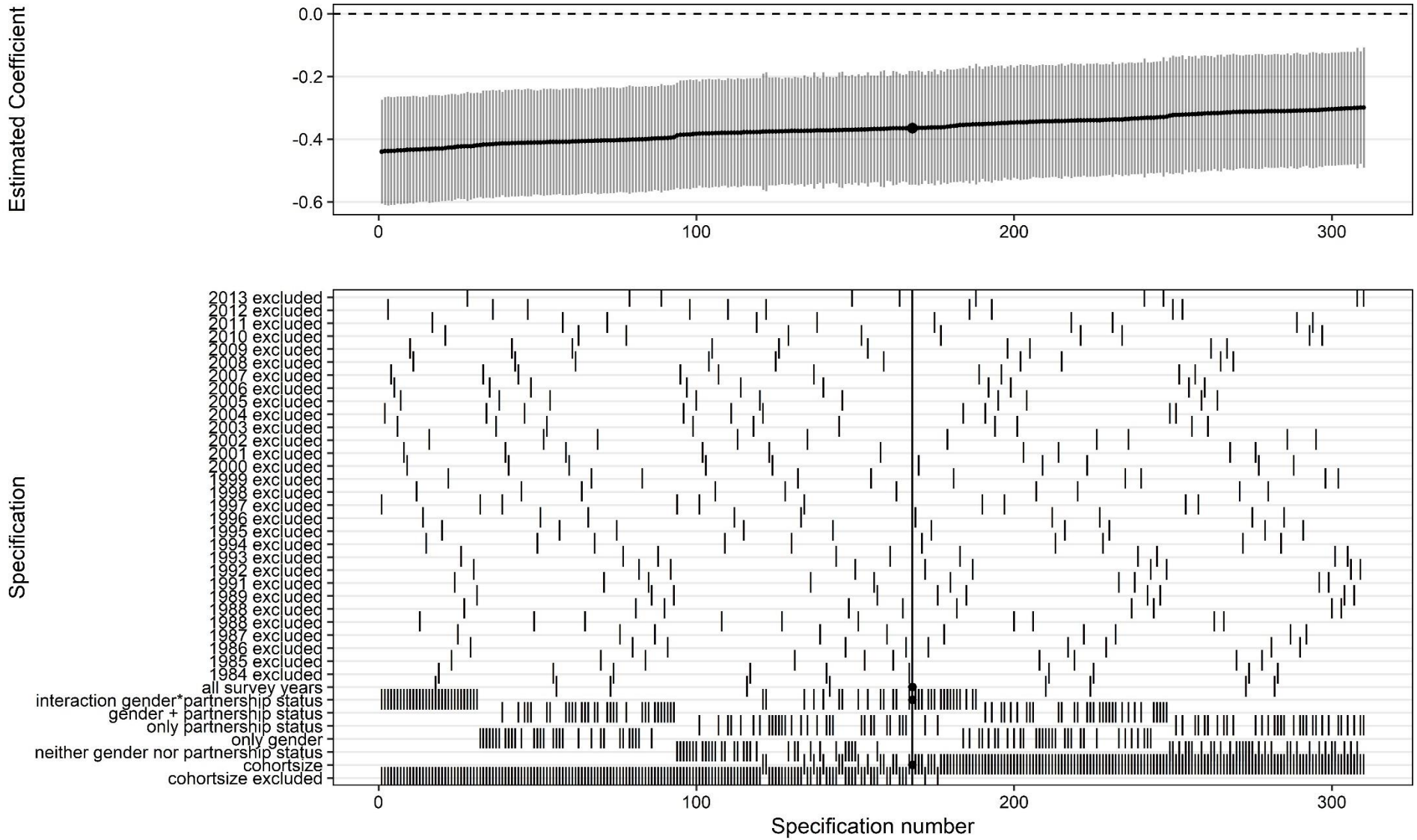
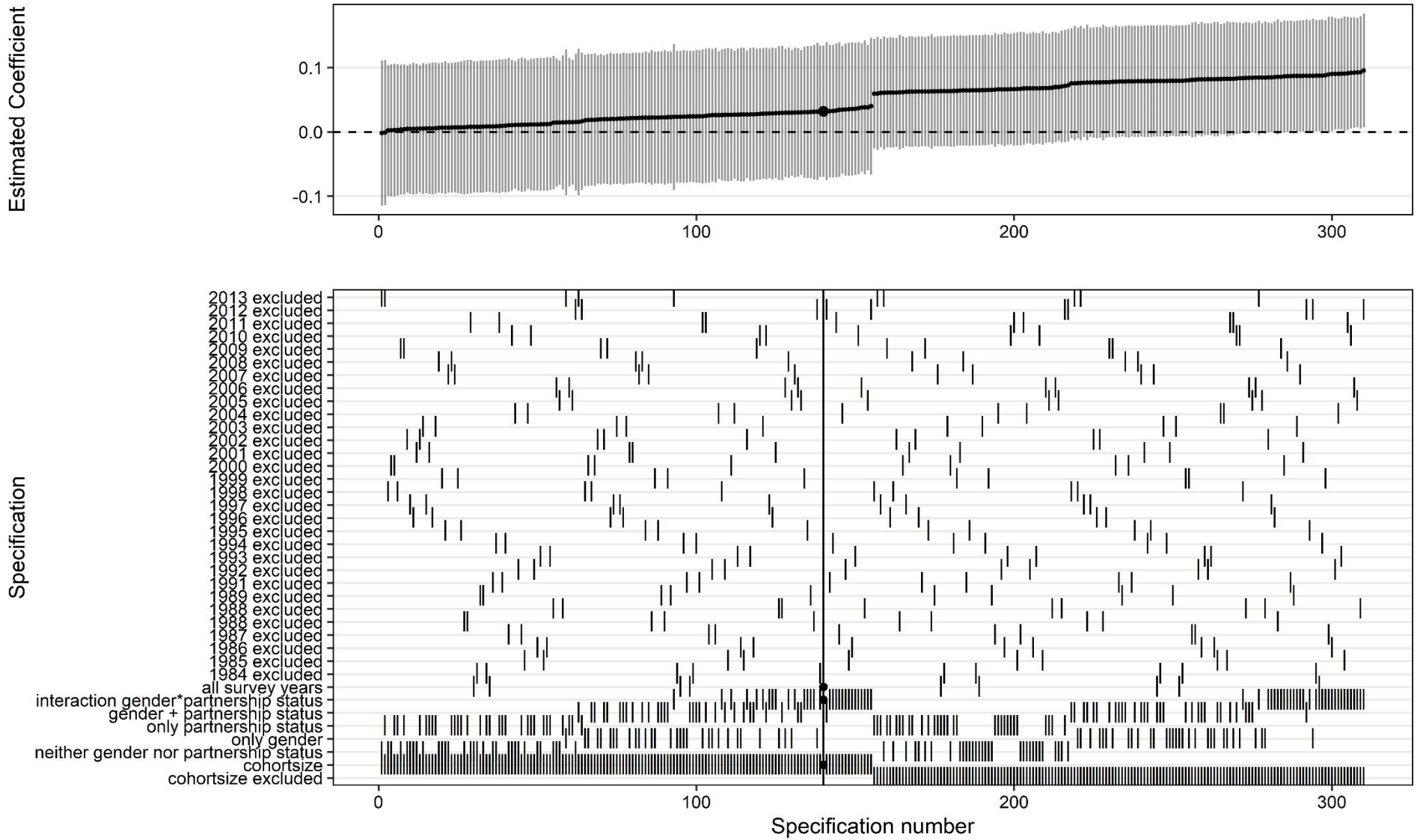


Figure D-4 Specification curve for the effect of tertiary expansion on underqualification, Germany



Literature

Dehne, Max and Jürgen Schupp. 2007. *Persönlichkeitsmerkmale Im Sozio-Oekonomischen Panel (SOEP) - Konzept, Umsetzung Und Empirische Eigenschaften*.

DoE. 2013. *The National Curriculum in England*. Department for Education.

DoE. 2018. 'The National Curriculum'. *GOV.UK*. Retrieved 22 September 2018 (https://www.gov.uk/national-curriculum).

Jones, Ken. 2016. Education in Britain: 1944 to the Present. Wiley.

KMK. 2017a. *Basic Structure of the Education System in the Federal Republic of Germany*. Berlin: Secretariat of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany.

KMK. 2017b. *The Education System in the Federal Republic of Germany 2015/2016*. Bonn: Secretariat of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany.

Lambert, Paul and Kenneth Prandy. 2008. 'CAMSIS Project: Files for Distribution Covering Occupational Unit Codes and Translations'. Retrieved 19 July 2018 (http://www.camsis.stir.ac.uk/occunits/distribution.html#UK).

McFall, Stephanie. 2013. 'Understanding Society: Cognitive Ability Measures'. *Understanding Society User Manual* 20.

Ofqual. 2009. *Explaining Qualifications*. Office of the Qualifications and Examinations Regulator.

Schneider, Silke L. 2008. 'The Application of the ISCED-97 to the UK's Educational Qualifications'. Pp. 281–300 in The International Standard Classification of Education (ISCED-97). An evaluation of content and criterion validity for 15 European Countries. Mannheim: MZES.

Schneider, Silke L. 2010. 'Nominal Comparability Is Not Enough: (In-)Equivalence of Construct Validity of Cross-National Measures of Educational Attainment in the European Social Survey'. *Research in Social Stratification and Mobility* 28(3):343–57.

Schupp, Jürgen, Sabrina Herrmann, Peter Jaensch, and Frieder R. Lang. 2008. *Erfassung Kognitiver Leistungspotentiale Erwachsener Im Sozio-Oekonomischen Panel (SOEP)*. 32. Berlin: DIW.

IV. Declaration on Sources

Hiermit versichere ich an Eides Statt, dass ich die vorgelegte Dissertation selbstständig und ohne die Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Die aus anderen Quellen direkt oder indirekt übernommenen Aussagen, Daten und Konzepte sind unter Angabe der Quelle gekennzeichnet. Bei der Auswahl und Auswertung folgenden Materials haben mir die nachstehend aufgeführten Personen in der jeweils beschriebenen Weise unentgeltlich geholfen: *niemand*

Weitere Personen neben den in der Einleitung der Dissertation aufgeführten Koautorinnen und Koautoren waren an der inhaltlich-materiellen Erstellung der vorliegenden Dissertation nicht beteiligt. Insbesondere habe ich hierfür nicht die entgeltliche Hilfe von Vermittlungs- bzw. Beratungsdiensten in Anspruch genommen. Niemand hat von mir unmittelbar oder mittelbar geldwerte Leistungen für Arbeiten erhalten, die im Zusammenhang mit dem Inhalt der vorgelegten Dissertation stehen. Die Dissertation wurde bisher weder im In- noch im Ausland in gleicher oder ähnlicher Form einer anderen Prüfungsbehörde vorgelegt. Ich versichere, dass ich nach bestem Wissen die reine Wahrheit gesagt und nichts verschwiegen habe.

V. Curriculum Vitae

Jonas Wiedner

Born November 28th, 1988 in Nürnberg

2008 Abitur, Wolfgang-Borchert-Gymnasium Langenzenn

2012 Visiting Student University of Amsterdam, The Netherlands
2013 B.A. Social Sciences, Humboldt-University Berlin

2013/14 Visiting Student City University of New York Graduate Center, United States
2016 M.A. Social Sciences, Humboldt-University Berlin

8/2016-2/2020 Research associate Institute for Sociology and Social Psychology, University of Cologne
Since 10/2016 Doctoral Student at the Institute for Sociology and Social Psychology, University of Cologne
2017 Guest researcher Institute for Social and Economic Research at the University of Essex, United Kingdom
2018 Guest researcher Department of Sociology, University of Copenhagen, Denmark
2019 Guest researcher Department of Sociology, University of Copenhagen, Denmark

Since 3/2020 Research associate WZB Social Science Research Center Berlin