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Under- or overexpansion of education?

Trends in qualification mismatch in the United Kingdom and Germany, 1984-2017

Jonas Wiedner

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Abstract

Prominent theoretical positions in sociology and labor economics disagree whether educational expansion has outstripped the demand for qualified labor (overexpansion), or whether economies face a skill shortage despite increases in education (underexpansion). Focusing on the United Kingdom and West Germany, two countries with dissimilar skill formation institutions, patterns of expansion, and labor markets, this paper asks to what degree expansion of education has been absorbed. I point out shortcomings of wage-centered analyses and develop an approach that focuses on trends in self-assessed over- and underqualification. Using repeated surveys among workers and official labor market statistics, I estimate regression models that link the cohort-level expansion of education to the cohort-level prevalence of mismatch. Results suggest overexpansion in the United Kingdom, with overqualification increasing and underqualification decreasing over historical times and cohorts. West Germany, on the other hand, shows signs of underexpansion. While dominant theoretical accounts focus on the under-/overexpansion of tertiary education, my results show that mismatch-dynamics in both contexts are strongest for workers without university degrees.

Keywords: educational expansion, mismatch, occupational change, comparative research

1. 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 programs (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, p. 335 ff.). This dramatic expansion of education has been recognized by sociologists as one of the major forces shaping social change (Collins 1979; Baker 2014).

Whether these growing numbers of higher-educated workers have been able to find adequate work is central to understanding stratification systems in modern societies. Yet, social science scholarship offers two contradictory answers to this question, each backed up by empirical literature. The first, mainly associated with sociological theories of social closure and credential inflation, argues that there are now too many higher qualified workers for labor markets to absorb in fitting work (Freeman 1976; Collins 1979; Wolf 2002). The second, rooted in variants of skill-biased technological change (SBTC) arguments in economics, argues that, given changes in skill demand, there are still too little (Goldin and Katz 2010; Acemoglu and Autor 2011; Carnevale and Rose 2014). I refer to these contrasting assessments as the diagnosis of over- or underexpansion of education, respectively.

An important implication of either over- or underexpansion is that they increase the numbers of vertical education mismatches: in the case of underexpansion, workers whose education and training fall short of what is usual or nominally required in their occupation (underqualification), or, in the case of overexpansion, whose education and training are in excess of what is usual or required (overqualification) (Capsada-Munsech 2019). Trends in qualification mismatch are therefore indicative of the degree of labor market absorption of educational expansion.¹

¹ I use the term “qualification” to refer to certificates of graduation from education or training programs and to skill-certificates more broadly. I prefer the term “qualification” over “education” because it includes

Against this background and focusing on the United Kingdom and Germany, this article sets out to answer the following two questions: First, to what degree has expansion of education in these two societies been absorbed by labor markets? Is there evidence of overexpansion, with higher levels of overqualification, or do we see underexpansion, with increasing underqualification? Second, to which extent does this differ between the two countries? A focus on Germany and the United Kingdom, as, within the European context, very dissimilar cases, allows probing the extent of variation in different countries' experience. The United Kingdom and Germany represent different varieties of capitalism with vastly different education systems (choice-driven progression in the United Kingdom, rigidly tracked in Germany), industry structures, labor market rules and patterns of expansion (strong expansion across all levels in the United Kingdom; a moderate expansion of tertiary education in Germany) (Müller and Gangl 2003; Hall and Soskice 2001).

My analysis adds to an emerging literature that uses alternative measures to assess the labor market absorption of educational expansion directly. Evidence of underexpansion of education has traditionally been a byproduct of studies of increasing wage inequality, and therefore focused on wage-differences between education groups (Goldin and Katz 2010). Here, I develop a new approach which focuses on period and cohort trends in self-reported vertical mismatches between individuals' education and their jobs, that is, on over- and underqualification. I use time-series of mismatch-incidence based on repeated surveys (United Kingdom: Skills and Employment Survey), or a panel study (Germany: Socioeconomic Panel Study), respectively, as well as contextual information from official labor force surveys. My formal models use differences in education between cohorts in the same region and during the same time to estimate the relationship between a cohorts' incidence of mismatch and its qualification structure.

certified skills that have not been acquired in a formal educational setting, which have been central to training-policy debates particularly in the United Kingdom (Wolf 2002). My usage of the term "qualification" does, however, not include non-certified skills, abilities, and experience, such as general cognitive ability, physical strength, or work experience, which are sometimes subsumed under the term.

As an empirical contribution, I provide estimates of vertical mismatch-trends for the period 1986-2017 and for cohorts born between the 1920s and 1980s for the United Kingdom and Germany, and offer a novel, cohort-based perspective on the relationship between increasing educational levels and qualification mismatch (but cf. Horowitz 2018; and Pollmann-Schult and Mayer 2004). In contrast to most previous work (c.f., Shin and Bills 2021), my analyses include underqualification and systematically consider expansion at different qualification levels. I show that the relationship between educational expansion and qualification mismatch is highly contingent on institutional regimes. Educational expansion went hand in hand with increasing over- and falling underqualification in the United Kingdom, but not in Germany. This finding supports recent arguments that global forces of technological and social change have very different effects in different institutional contexts (Oesch and Rodriguez Menes 2011; Fernández-Macías and Hurley 2017). Finally, my results document that changes in mismatch-rates with educational expansion are most pronounced for workers with qualifications below the university-level.

In the next section, I review the two most important theories of the changing labor market balance of education and demand for it, skill-biased technological change and credential inflation, and examine the role of institutional context. I then introduce the data and the analytical approach I use. In section 4, I present descriptive and multivariate results before I summarize my findings and draw conclusions.

2. Theoretical background and previous research

Perspective 1: technological change results in an underexpansion of education

The dominant view on the changing balance between educational expansion and demand for it in economics is that of an increasing skill shortage (at least at stable prices, i.e. wages). While SBTC theory's main concern is with increasing wage-inequality, the mechanism it assumes is that of an underexpansion of education. SBTC theory therefore has implications for

mismatch-trends. SBTC claims are rooted in the idea that technological innovations complement the productivity of workers with higher levels of education, but often substitute for less educated workers (Tinbergen 1956; Goldin and Katz 2010; Acemoglu and Autor 2012). Technological progress thus increases the relative demand for skilled vs. unskilled workers. Education's value on the labor 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 highly educated relative to less educated wages (Goldin and Katz 2010). From an SBTC perspective, increasing wage inequality thus reflects a shortage of skilled labor, that is underexpansion of education (Carnevale and Rose 2014).

A newer refinement of SBTC argues that the kinds of tasks that are being replaced by automation are not low-skill per se, but routine in nature. These, its proponents argue, predominate not in low, but in middle-skill occupations (Autor et al. 2003; Autor and Dorn 2013). The consequence of such routine-biased technological change (RBTC) would thus not be an upgrading, but a polarization of skill-demand. While SBTC's and RBTC's implications for educational expansion absorption coincide in the upper half of the education distribution, RBTC would expect not an under- but an overexpansion of middling certificates — assuming that educational upgrading is linear.

Wage-based studies of underexpansion

Work by economists on the United States documents dramatically increasing wage inequality between, but also within qualification groups, which is linked to the stagnation of college completion rates since the 1970s (Katz and Murphy 1992; Goldin and Katz 2010). Variants of the skill shortage thesis of SBTC are hence widely accepted among US economists (but cf. Card and DiNardo 2002; Acemoglu and Autor 2011).² In Germany, increases in wage inequality

² It should be noted, however, that dissident labor market analysts have challenged the uncomplicated applicability of the polarization-thesis to the US labor market (Holzer and Lerman 2007, 2009; Holzer 2015). Drawing on disaggregated occupation-level wage and employment trends, they show that the supposed wide decline of middle-skill work is all but uniformly evident. Rather than expecting a secular decline of middle-skill work, they argue that institutional shortcomings in worker training are in part responsible for observed declines in some sub-segments of the skill-middle. As a consequence, and in

have been more moderate, which might reflect the substantial expansion of the education system since the 1950s. Nevertheless, studies conclude that SBTC, and hence a relative under-expansion of education, had a part in increasing wage inequality in Germany (Dustmann et al. 2009). In the United Kingdom, educational expansion was even more pronounced. At the same time, however, inequality between education groups – and wage inequality overall – have risen dramatically, suggesting that institutional changes may have played a dominant role there (Gosling and Lemieux 2004).

Studies inferring changes in the ratio of demand of higher educated workers to its supply from wage data face criticism, however (Kalleberg 2011; Cappelli 2015). In order to provide evidence in favor of SBTC, they 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-unionization 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 education. The SBTC conclusion that wage inequality rose because of a shortage of highly educated labor may therefore be premature. Vice versa, this also puts important evidence in favor of the underexpansion thesis into question.

Perspective 2: Credential inflation, social closure and relative education result in an overexpansion of education

An important assumption of both variants of the technological change argument, SBTC and RBTC, is that skill and education are to a large extent synonymous. SBTC and RBTC are 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

contrast to polarization theorists, they recommend policies to encourages skill-formation and better matching among middle-skill workers (Carnevale and Desrochers 2002).

then translate into high productivity and earnings. By contrast, many sociological approaches highlight that education's role for students and society goes beyond technical know-how: formal education and productive skills are not the same thing. While these theories differ in the causal mechanisms they focus on, they agree that an increasing value attached to education for non-technical reasons has resulted in its expansion beyond labor markets' absorption capacity. Prominent theories around the notion of credential inflation, for instance, argue that schooling is important to policy makers, parents, students and employers because it instils obedient work attitudes (Bowles and Gintis 1977), legitimizes social stratification (Bourdieu and Passeron 1970), equips students with cultural currency that gives access to closed occupational positions (Collins 1979), or is a means of self-realization and a symbol of family prestige (Baker 2014). Such ideological, political, or cultural reasons for expansion bear little connection to technological requirements. Expansion for these non-technical reasons is therefore likely to exceed employers' demand for more highly qualified workers and result in overexpansion.

Other social scientists point to micro-level processes which lead rational actors to acquire education beyond labor market demand and result in overexpansion. The central argument in such analyses is that education has a relative rather than an absolute value. According to the labor 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 described as the relative or positional education hypothesis (Horowitz 2018). If education is positional, educational expansion translates into a heightened individual 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 jobs' actual skill requirement, will be very prevalent as companies' hiring standards escalate.

To sum up: If forces other than technology-induced demand are behind increased qualification uptake, as argued by many sociological approaches, there will be overexpansion. In this

situation, holders of higher degrees will find it increasingly hard to find fitting work. Expansion will lead to higher rates of overqualification.

Mismatch and the absorption of educational expansion

As reviewed above, the evidence in favor of the underexpansion thesis has traditionally been a byproduct of studies of increasing wage inequality, and faces methodological concerns. In line with this criticism, studies using other approaches overwhelmingly find support for the overexpansion thesis. The principal alternative strategy focuses on mismatches between workers' qualifications and the requirements of their jobs. Rates of (vertical) qualification mismatch can serve as an immediate measure of the degree of absorption of educational expansion by labor markets.³ In contrast to inference based on relative wage-trends, mismatches offer a direct way to gauge the absorption of someone's education on the labor market. The main advantage of mismatch-trend-based assessments of over- and underexpansion is that unobserved processes (like changing minimum wages, de-unionization, or increasingly oligopsonic labor markets) do not directly affect the measurement of a qualification imbalance on the labor market in the way they do in relative-wage-based strategies. Even though mismatch-measurement may introduce ambiguities of its own (see Appendix B in the Online Supplement), substantive conclusions in a debate as central to policy and social science as the under-/overexpansion question should not rest on a single methodological approach.

From a mismatch-perspective, rates of overqualification should decrease under SBTC, as employers seek to exploit the capacities of the relatively scarce highly qualified workers. At the same time, rates of underqualification should increase, as firms hire workers for positions above their nominal level of education to avoid interruptions of their business. Credential inflation, social closure and relative education approaches would expect the inverse pattern: rising overqualification and sinking underqualification over historical time, and in cohorts subject to

³ According to standard understandings in the literature, mismatch can be horizontal (between field of study/training and job) or vertical (between skill levels of training and skill level of employment) (Di Stasio 2017). While educational expansion has implications for the horizontal matching between workers and jobs (Elbers et al. 2021), under- and overexpansion are most clearly expressed by rates of vertical mismatch that is by over- and underqualification.

more expansion, as ever higher levels of education swamp the capacity of labor markets to absorb job entrants in nominally fitting positions.

While the implications of under-/overexpansion for rates of vertical mismatch are straightforward, how to concretely determine workers' mismatch status is not. The literature distinguishes three main approaches: the *realized-matches approach* (RM), where mismatch is judged relative to the observed distribution of qualifications within occupations, and workers are classified as mismatched if their own qualification deviates substantially from the observed occupation mean, mode, or median; the *objective approach* (OA), where *experts* judge the objective qualification requirements of an occupation; and the *subjective approach* (SA), where *workers* are prompted to state the qualification requirements of their current job. Of these three, RM has been shown to be unsuitable for period- and country-comparisons, because the mismatch rates it produces depend solely on the shape and the dispersion of the distribution of qualifications within occupations, but not on its central tendency (Capsada-Munsech 2019). I discuss properties, advantages and disadvantages of the three measurement approaches in greater detail in Appendix B to this article.

Bearing in mind these issues, how do the findings of previous mismatch research speak to the over-/underexpansion debate? Di Pietro (2002) analyses the aggregated country-level incidence of overqualification and finds a positive relationship of SA overqualification rates to 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 overqualification (relying on the arguably unsuitable RM methodology) in a sample of European countries. Similarly focusing on graduates and a country-comparison, Verhaest and van der Velden (2013) find that graduate oversupply is strongly predictive of SA overqualification rates. Overall, between-country thus suggest that educational expansion goes hand in hand with higher rates of overqualification, although the well-known limitations of cross-sectional country comparisons (e.g., omitted variable bias) of course apply to these studies.

Longitudinal studies, 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 RM graduate mismatch rates and find a positive relationship. 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 (but c.f. the replication of Furey 2021). By contrast, Pollman-Schulte and Mayer (2004) report relatively constant SA overqualification risks in vocationally trained Germans from cohorts born between 1919 and 1971. Likewise, McGuinness et al. (2018) and Delaney et al. (2020), both focusing on numerous European countries in longitudinal designs, likewise find no evidence that RM overqualification uniformly increased, or that greater expansion increases overqualification rates, respectively.

In sum, thus, the reported null-findings on the relationship of expansions to overqualification, with the exception of Pollman-Schulte and Mayer (2004), result from the questionable RM approach, while mismatch scholarship overall puts the dominant SBTC inspired skill shortage thesis into question. My research builds on these studies and extends them by considering underqualification, and workers at different qualification levels in a comparative setting.

Institutional correlates of under- and overexpansion

The United Kingdom and Germany exemplify different institutional environments and socio-economic models. 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 signaling value of qualifications is low, and the correspondence of education to jobs is weak, whereas Germany's occupation specific labor 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). This suggests that ceteris paribus, as a result of a lower salience of occupational distinctions in the United Kingdom, mismatch will be more prevalent in the United Kingdom than in Germany.

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 labor queue (Di Stasio 2017). In the United Kingdom, by contrast, expanding education at all levels has long been a policy priority. There are now many routes into higher education and education providers' reliance on tuition fees has resulted in outright competition for students (Busemeyer 2014). The generalist nature of the British education system also means that there is a high individual incentive to aim for higher qualifications, as argued by positional education theorists (Di Stasio et al. 2016; Horowitz 2018).

On the demand side of the labor 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 growth in liberal market economies like the United Kingdom is driven by high- and low-skill services, just as predicted by RBTC, 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, p. 111 ff.; Hall and Soskice 2001; Oesch and Rodriguez Menes 2011; Wren 2013; Fernández-Macías and Hurley 2017; Oesch and Piccitto 2019).

In summary, the United Kingdom and Germany emerge as contrasting cases in terms of their extent and form of educational expansion, but also with respect to the kind of occupational upgrading they have experienced. This should result in the United Kingdom experiencing, first, stronger mismatch dynamics and, second, overexpansion: growing overqualification rates over time, and more overqualification in cohorts subject to more expansion. To the degree that occupational upgrading and shifts in relative skill demand in the United Kingdom were indeed polarized, we would expect that overexpansion is felt most strongly in the middle of the

educational distribution. Germany, by contrast, should show better qualification-to-job matching and, if anything, underexpansion. Before I test these claims, I now introduce my methodological strategy.

3. Data and Methods

Data sources

I rely on two kinds of data sources. For information on individuals, I use population representative survey data 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 labor force across cohorts (the contextual level, see below), 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 draw on information from people born between 1927 and 1986 (United Kingdom) and 1926 and 1983 (Germany). From 1992 on, I draw on the spring-sample of the quarterly UKLFS, which is collected between April and June. In cases where there is no annual data, I impute missing education shares with the average of the last and the following year. This concerns the year 1980 and 1982 in the British labor market data, as the UKLFS was collected bi-annually prior to 1983, and the uneven years between 1976 to 1995 for Germany, where the GMZ was similarly collected bi-annually. Since the imputed figures concern relatively slow-moving indicators, I do not expect that this strategy introduces bias.

I limit the analytical sample to workers between the ages of 30 and 60, who are currently not enrolled in full-time education or training. I concentrate on prime-age workers to rule out that later entries into employment caused by longer education phases or (early) retirement affect my results. In the GSOEP, I only use information from the first wave in which a respondent was interviewed. Robustness analyses in Section E of the Online Appendix demonstrate that the results are unchanged if I use all observations or select observations within respondents randomly. I do not use information from respondents in East Germany, because harmonized labor market and survey data is not available for older cohorts there. I use a case-wise deletion approach to deal with item non-response. However, just 0.4% (UKSES) and 0.05% (GSOEP) of cases show missing values on at least one of my variables. All in all, I can draw on 17,878 (United Kingdom) and 21,048 (West Germany) cases for the overqualification, and on 16,560 (United Kingdom) and 17,591 (West Germany) cases for the underqualification analyses. I use the cross-sectional post-stratification weights provided with the data to ensure that results generalize to the population of residents of private households. Details on the generation of weights in the two studies can be found in Goebel et al. (2019) and Gendinning et al. (2018).

Measuring mismatch

The dependent variable in my analyses is whether a worker is underqualified, overqualified, or adequately qualified relative to the job they are performing. To measure a worker's mismatch-status, I follow the subjective assessment approach and compare respondents' assessment of the required qualification in their current job with their own qualification. The self-assessment approach has been widely used in empirical studies (e.g., Burris 1983; Capsada-Munsech 2019) and produces mismatch rates that can be compared across time, and which can readily be interpreted as the respective fraction of workers who think that more or less education or training is needed for their job than they have. This approach allows inference about actual labor market qualification imbalances in so far as they are perceived by workers. I discuss other approaches to mismatch-measurement, the limitations of subjective self-assessment,

and explain why it is nevertheless preferable for comparative purposes in Appendix B of the Online Supplement.

In the UKSES the question used to elicit respondents' assessment of qualification requirements is "If they were applying today, what qualifications, if any, would someone need to get the type of job you have now?". In the GSOEP, respondents are queried "What type of education or training is usually required for this type of work?".⁴ Respondents' can then choose from a range of detailed qualification levels, corresponding to the educational system of their country. Since similar lists are used in the studies to measure respondents' attained qualification level, I operationalize overqualification/underqualification as respondents' having a higher/lower level of formal qualification than what they say is required in their job. This results in two binary variables indicating over- and underqualification, respectively (see Glendinning et al. 2018; and the resources in Goebel et al. 2019 for the precise formulation of response categories).

Regression models

The basic approach in the formal models below is to compare the mismatch rates of members of different cohorts (defined as people born in the same calendar year), during the same round of data collection, and in the same region (9 English government office regions, Wales, Northern Ireland and Scotland in the United Kingdom, and 10 Länder in West Germany).⁵ This allows me to estimate the relationship between educational expansion as a cohort phenomenon and individuals' risk of qualification mismatch in different cohorts. This is the relationship at the

⁴ Note that the UKSES item is a question about *entry requirements* to *get* the job, while the SOEP item is ambiguous in whether it refers to qualifications necessary to *get*, or to requirements to *perform* the job. Based on these measures, *levels* of mismatch are possibly not entirely comparable between the two countries. If anything, using the UKSES-question will yield *lower* nominal levels of overqualification, higher nominal levels of underqualification and higher levels of matches than the GSOEP question in a labor 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. However, I highlight that any bias introduced by the different wording runs counter theoretically expected differences and is thus conservative.

⁵ Appendix A in the Online Supplement contains case numbers for every birth-cohort-region combination.

heart of the overexpansion debate. In line with my theoretical reasoning, I interpret a positive relationship as evidence of overexpansion.

Independent variables

My main independent variables are indicators of the contextual share of people of a given qualification level at a given point in time, in a given region, in a given extended cohort (defined as people born within ± 3 years from the cohort base year). I measure them using official labor market surveys. At this extended-cohort-region-period-level, 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) in the United Kingdom, and in Germany three categories (secondary or lower, vocational qualifications, and tertiary qualifications). This analytical choice reflects the consistently distinguishable levels of education in the different rounds of the labor force surveys I use.

Control variables

I adjust my estimates for individuals' *own* highest qualification, which rules out that composition effects influence results. Based on the available individual-level survey data, I distinguish six (United Kingdom) and five (Germany) groups, according to a respondent's highest qualification:

- no qualifications,
- (non-minimal) secondary qualifications (these two are combined in Germany),
- two categories of vocational qualifications
 - in the United Kingdom:
 - lower vocational qualifications from short programs, 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.

I limit the comparison to cohort variation by including survey year-region fixed-effects into my model. Such fixed effects rid my estimates of any period and region variation. This strategy therefore holds changes on the demand side constant (if they do not differ across cohorts) and allows me to focus interpretation on supply-side changes, i.e., the role of educational expansion. It also controls for supply-side confounders such as immigration. I further discuss the assumptions of this approach in the Online Appendix C.

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), or their ethnic group (United Kingdom), respectively, and an interaction of gender with their partnership status. Gender-specific results can be found in Section D of the Online Supplement. At the period-region-cohort level, I adjust for the size of workers' extended cohort (as above defined as 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. In Section F of the Online Supplement, I report specification curves for the main results, which show the full range of estimates obtained for all plausible specifications.

Analytical strategy

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

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

This model estimates the probability that an individual i , member of cohort c , surveyed in region r at historical time t will be mismatched. 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, and the term $\sum_{k=1}^{k=K} (\beta_k X_{k,i})$ represents K control variables including individual education. I estimate Eq. 1 separately for under- and overqualification as the mismatch outcome. When estimating the probability of overqualification, underqualified workers form part of the reference category of non-overqualified workers, and vice versa. Workers who cannot indicate a mismatch in the survey questionnaire (university graduates, for instance, cannot be formally underqualified and people without qualifications cannot be overqualified) are excluded from the respective models. The quantity of interest in both kinds of models are the α_l , the partial relationship between the cohort-specific share of qualification Q_l in r , at t (l indexes the qualification levels) and the corresponding under- or overqualification probability. The Online Supplement C discusses the principal conditions under which a causal interpretation can be assigned to this coefficient. There are two more specific threats to identifying the causal effects of educational expansion in my framework: endogenous migration in response to labor market conditions and sample selection bias arising from selective unemployment. I describe my strategy to tackle these issues, and the resulting estimates in Appendix G of the Online Supplement.

4. Results

Educational expansion, occupational upgrading, and mismatch trends

Before I turn to the question of how rates of vertical mismatch have evolved, Figure 1 gives a descriptive impression of the supply of qualifications, the change of the occupational structure, and the resulting demand for qualifications on British and German labor markets. Panel A of Figure 1 takes a birth-cohort perspective and shows the highest qualification reported by 30-year-olds in large-scale labor force surveys. It documents significant educational expansion in

the United Kingdom, and, to a lesser degree, in Germany for cohorts born between the mid-1950s and the mid-1980s. While roughly a fifth of a cohort born in the 1950s has undergone tertiary education in both societies, the figure for Germany stood at 25% in the 1983 cohort and at more than 35% in the same birth-cohort in the United Kingdom. A second difference between the two countries is that German expansion was limited to the top, i.e., to tertiary education, with the share of those without any vocational qualifications not showing any clear trend. British education, on the other hand, expanded at all levels, thereby dramatically decreasing the share of those without formal vocational education from over 60% of a cohort born in the 1950s to around 30% for cohorts born in the 1980s. This figure is, however, still more than twice as high as the share of 30-year-old Germans without vocational qualifications.

Panel B of Figure 1 changes perspectives and shows the evaluation of the occupational structure of the German and the British Labor markets over historical time. It uses the first digit of the ISCO88 classification to define occupational groups. In both countries, higher skilled occupations (managers, professionals, technicians) expanded, while lower-skilled ones (craft workers, machine operators, elementary occupations) contracted between the 1980s and the 2010s. However, there are differences, when it comes to the overall frequency of occupations: by the end of the 2010s, for instance, I estimate the share of workers in the manager category to be approximately 3.3 times higher in the United Kingdom than in Germany, (20% vs. 6%), while the opposite is true for technicians (15% vs 25%). There is thus clear evidence of occupational upgrading and no evidence of polarization—at least at the relatively coarse level of occupational groups—in both countries, but the descriptive analysis also documents persistent differences in the composition of the two labor markets.

Panel C moves to the core of my analysis and shows the qualifications workers reported were needed for their current job in a given survey-year. It presents evidence that the occupational upgrading apparent in Panel B translated into a significantly increasing demand for (higher) qualifications on both British and German labor markets. This is true even though my subjective measure of mismatch likely underestimates the extend of actual demand shifts, as qualification requirements of unfilled vacancies are not counted.

In Germany, the share of jobs requiring no formal qualifications at all has halved between 1984 and 2018, from more than 44% to 22%, while tertiary-education-requirements expanded from 11% of jobs to 26%. This shows that, against RBTC-arguments, demand upgrading was linear: not only did demand for highly qualified workers grow, but the relative demand for not formally qualified workers shrank. Interestingly, this is different from the form of educational expansion. Panel A documents that it was limited to tertiary degrees. This hints at a first source of under-expansion in the German case: the collapsing demand for untrained workers.

In the United Kingdom, no vocational education beyond secondary school diplomas was required to get into half of jobs in 1986, in 2017, this was only true for a third. A tertiary-education requirement rose from a quarter of jobs in the 1980s to just under half in 2017. In contrast to Germany, these two trends imply that the demand for middling post-secondary, non-tertiary vocational qualifications declined markedly, from 37% to 18% in 2017. In line with Oesch and Picitto (2019), and in contrast to the trends at the level of coarse occupational groups in Panel B, the United Kingdom therefore shows some signs of polarized upgrading.

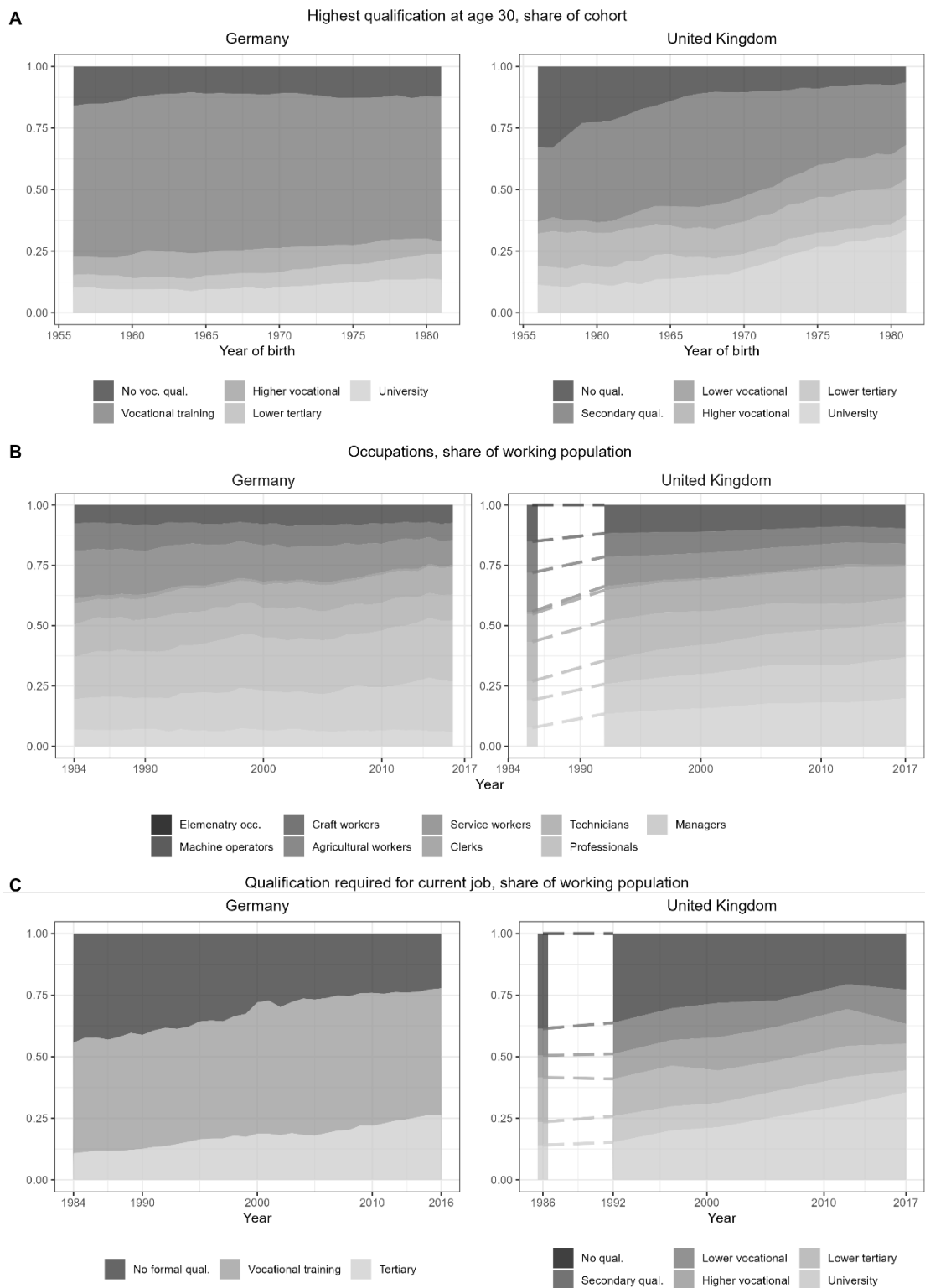
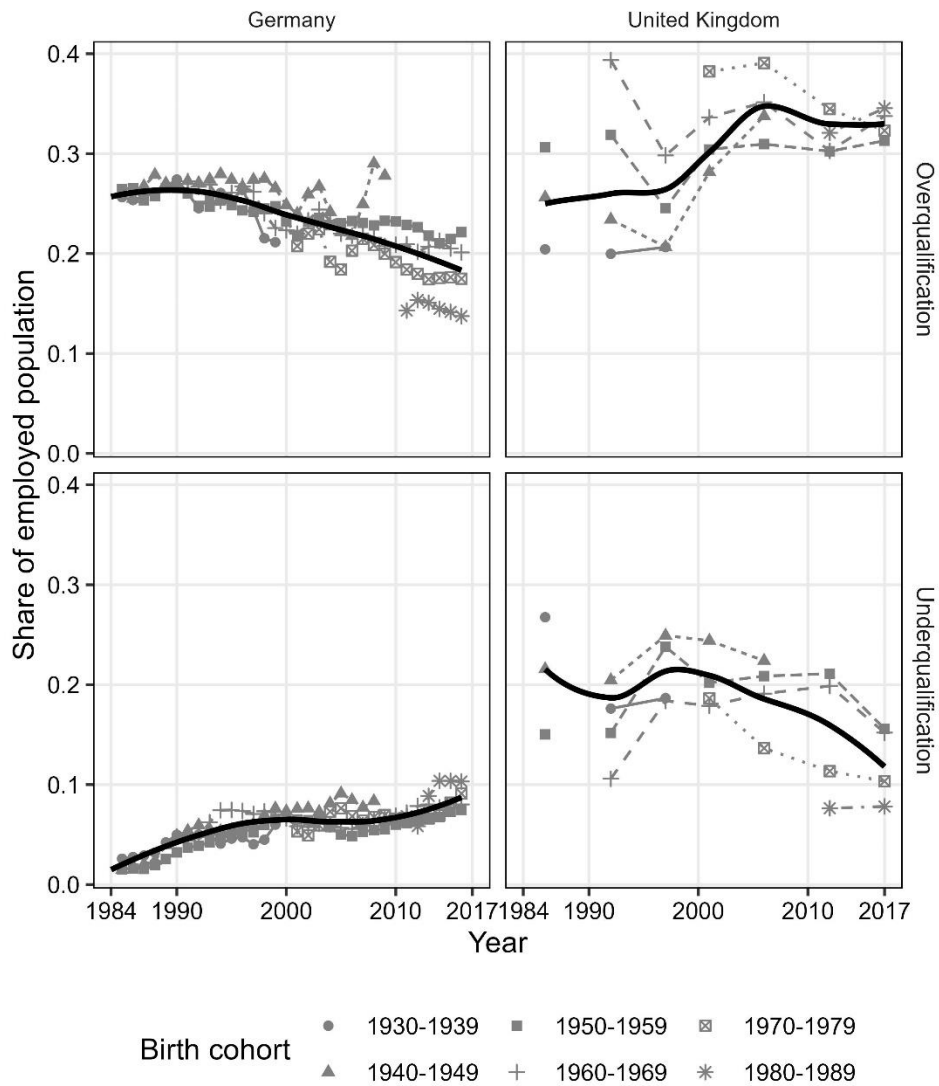


Figure 1: Educational expansion, occupational change, and upgrading of jobs' qualification requirements in the United Kingdom and in Germany

Source: Own calculation based on GMZ 1976-2013, UKLFS 1979-2017, GSOEP 1984-2017, and UKSESS 1986-2017. The first round of the UKSESS was not carried out in all regions. 1986 figures are hence not strictly comparable to later periods.

Combining demand- and supply-side perspective, I now move to an examination of mismatch rates. I first examine what descriptive trends in mismatch prevalence can tell us about the validity of the two universalist theoretical perspectives, before I turn to a formal assessment of the relationship between expansion and mismatch at the cohort level.

Figure 2 shows the overall and cohort-specific trend in self-reported mismatch rates over survey-years in the two countries and thereby offers a first descriptive assessment, limiting the analysis to workers between the ages of 30 and 60. It documents that mismatch trends in the United Kingdom and in Germany have been strikingly different. While there are signs of over-expansion in the United Kingdom, Germany's labor market seems to be moving into a mild qualification shortage. Overall, overqualification rates rose in the United Kingdom but declined in Germany. The opposite is true for underqualification. A second noteworthy observation is that there are only small differences between cohorts (lines in gray) in Germany, whereas British cohorts face vastly different situations, even at the same point in time. Respective younger cohorts faced the highest risk to be overqualified, and the lowest risk to be underqualified during almost all survey years. The 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 self-assessed overqualification rates from the late 2000s onward. Note that country differences, thus, evolve in opposing directions to any possible bias introduced by the slightly differing item wording in the United Kingdom and in Germany.



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

Figure 2 Trends in mismatch rates in the United Kingdom and in Germany

Figure 2 suggests that over- and underexpansion are highly context-dependent phenomena. However, it does 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. Moreover, at this point, it is unclear whether mismatch trends are predominantly driven by the demand or the supply side. I thus now turn to models described in Eq. 1 that link over- and underqualification incidence to cohort-level qualification shares — the main indicator of educational expansion.

Evidence from regression models

Table 1 provides a global assessment of the link between educational expansion over birth-cohorts and cohort level-over-/underqualification incidence. It answers the core question at stake in the overexpansion debate whether we observe more or less over-/underqualification in cohorts where higher levels of education are more widespread. Using a conceptually different approach, it confirms the significant difference in the relationship between expansion and mismatch in the two countries suggested by Figure 1: overexpansion in the United Kingdom, but an overall balance in Germany. Table 1 suggests that British expansion at both the lower and the upper end of the qualification hierarchy was only partially absorbed by labor markets. Even net of own qualifications, and net of period-region differences in demand, overqualification is higher in region-cohorts, where the share of upper tertiary and secondary educated workers is higher. Expansion also severely limited underqualification: this type of mismatch is dramatically lower in region-cohorts where upper tertiary and secondary education is more prevalent. Expansion of middling qualification levels, however, is not associated with changed mismatch rates.

I do not find any evidence of a comparable overexpansion in the German data. On the contrary, column 3 shows that in Germany overqualification *decreased* in cohort regions, where tertiary education 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.

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

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

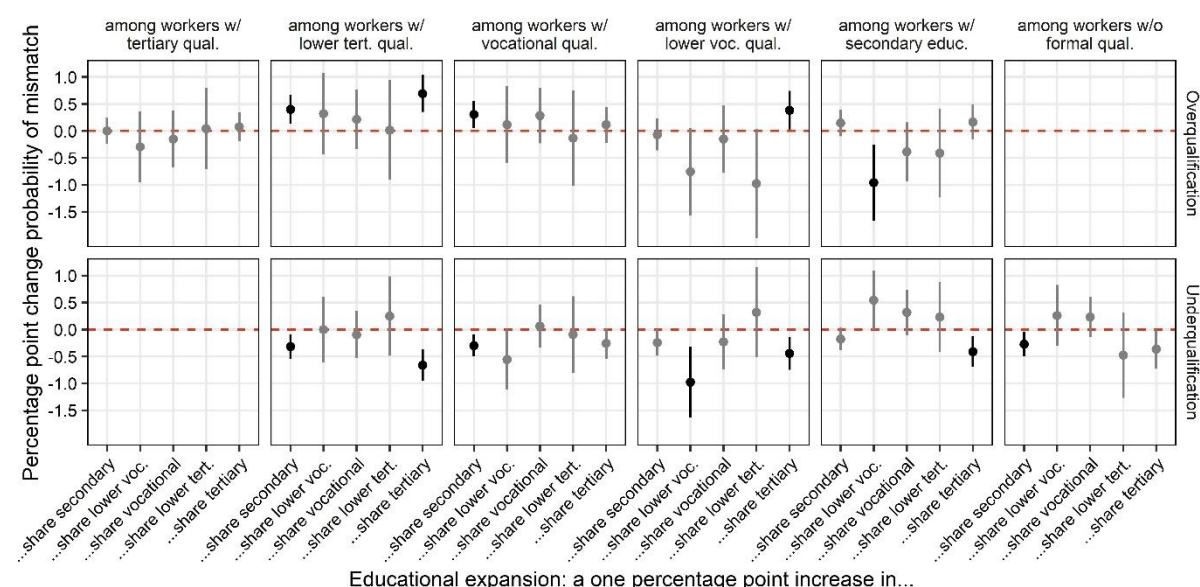
Table 1 Relationship between educational expansion and qualification mismatch, RE-LPM results

Table 1 reports results, when all qualification shares are entered simultaneously, omitting the “no qualification” category. Results for using other references categories can be found in Section E of the Online Supplement. These additional estimates underline the robustness of my results. As I discuss in more detail in the Online Supplement C, no causal interpretation can be applied to the German results. A valid, but more cautious interpretation of columns 3 and 4 in Table 1 is that tertiary expansion in Germany was not enough to stabilize rates of overqualification, which were falling for other reasons. Even without a causal interpretation, this pattern rules out the overexpansion thesis for the German case.

How did the apparent overexpansion of British secondary and tertiary education play out across different levels of education? And what kinds of workers found it easier to move out of overqualification in Germany? Figures 3 and 4 break down the association between expansion

and mismatch for workers with different qualifications, corresponding to its columns of panels. Like Table 1, Figures 3 and 4 are based on the random-effects linear probability model in Eq.1 but include additional terms for the interaction between respondents' own education and region-cohort qualification shares. Markers give the marginal effects (y-axis) of the expansion of different levels of education (x-axis), relative to the “no qualifications” category. A tabular presentation of these results, and details on the regression equation can be found in Appendix H of the Online Supplement.

Figure 3 Relationship between educational expansion and qualification mismatch among workers with different levels of education in the United Kingdom



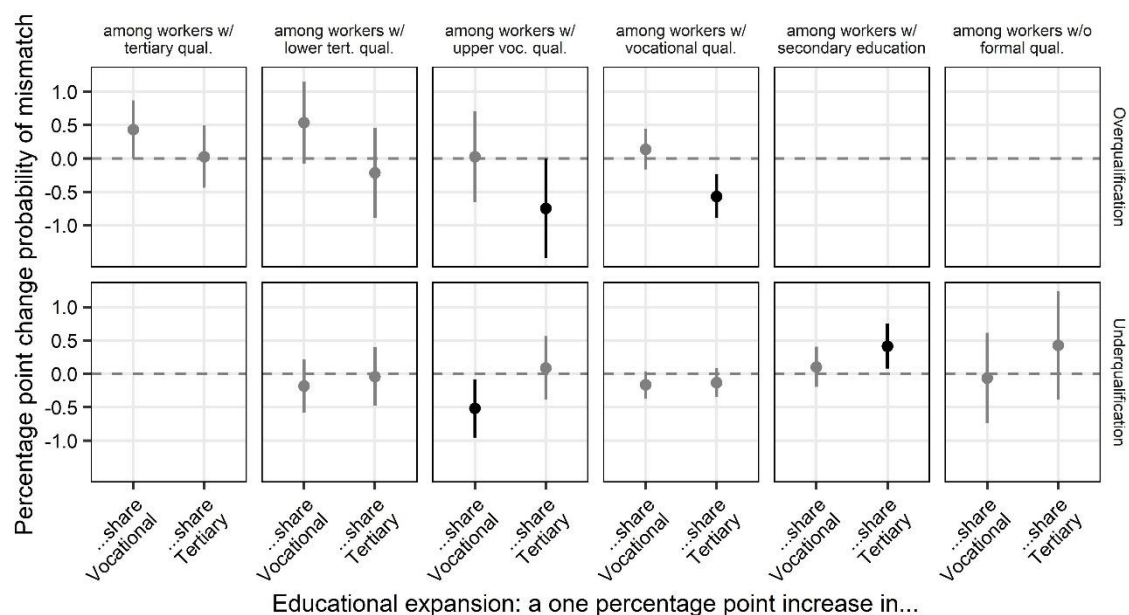
Notes: Results of linear probability models with cohort random effects. Bars give 95% confidence intervals, coefficients plotted in grey are not statistically significant at that level. Individual controls: Interaction gender and partnership status, and ethnicity. Cohort controls: relative size of cohort. Results controlled for period-region fixed-effects.

Starting with the top-left panel of Figure 3, for example, we see that among workers with a tertiary degree, expansion of any qualification is not statistically significantly associated with more subjective overqualification. The first take-away from Figure 3 is, thus, that the overqualification-increasing effect of tertiary expansion in the United Kingdom evident in Table 1 is not driven by people with a university diploma themselves. Moving to the panels for workers with lower tertiary and (lower) vocational qualifications, suggests that, rather, tertiary expansion is connected to overqualification among people with middling qualifications: For workers with

lower tertiary and lower vocational qualifications, there is a strong and significant association of the share of tertiary educated cohort members to individual overqualification probability. In cohorts with one percentage point more tertiary graduates, for instance, workers with lower tertiary degrees are around .75 percentage points more likely to be overqualified in their current job. These patterns suggest that higher numbers of graduates crowd out workers with lower tertiary and lower vocational degrees in jobs that used to require such qualifications. Tertiary graduates in those same cohorts, however, do not perceive more overqualification themselves, perhaps because social expectations, job titles and content have seen simultaneous upgrading.⁶ Additional analyses presented in Section E of the Online appendix support this assessment using an objective measure: Tertiary expansion across cohorts is associated with decreased access to executive and professional positions among those with lower tertiary education, but not among those with full tertiary education. The panels in the second row of Figure 3 furthermore show that tertiary expansion meant that British workers of all qualification levels became less likely to be underqualified, again suggesting that high and medium-skill jobs, which once were open to people without degrees, are increasingly saturated with graduates. Figure 3 therefore implies that excess expansion at the top trickles down the qualification hierarchy. As in Table 1, finally, Figure 3 documents that in Britain both tertiary and non-vocational secondary expansion have been associated with increasing overqualification and declining underqualification, whereas expansion at middling vocational qualification levels had no such effects.

⁶ It is important to note that this pattern might be partly related to the phrasing of the UKSES qualification requirement item (see above). If overexpansion 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 3.

Figure 4 Relationship between educational expansion and qualification mismatch among workers with different levels of education in Germany



Notes: See notes for Figure 3.

Moving to the German case in Figure 4, I find, first of all, again no evidence that educational expansion led to more subjective overqualification: across qualification groups coefficients in the top row are either insignificant or negative.⁷ Instead, overqualification decreased among those with vocational training (third and fourth column), including those with advanced vocational qualifications (Meister, and Techniker), in region-cohorts where tertiary education expanded. Interestingly, overqualification did not decline among the tertiary educated themselves with tertiary expansion. 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

⁷ This is, however, not true for an objective measure of placement: Expansion across cohorts went hand in hand with decreased access to executive and professional positions among those with tertiary education, as Figure E-3 in the Online Appendix shows.

underqualification among workers with lower qualifications, as documented in the German underqualification panels for people with just secondary or no qualifications. These figures can thus be taken to indicate a decline in the provision of vocational training, relative to demand for it, in dynamic regions.

Taken together, the results in Figures 3 and 4 suggest that British overexpansion at the tertiary level had implications for workers across large parts of the qualification structure. Germany, on the other hand, faces a mild underexpansion – however not at the top, but rather in the middle of the qualification structure.

Robustness analyses

In Appendix G of the Online Supplement, I draw on exogenous *historic staying-on rates* in a region to predict mismatch at the cohort-region-level, and use a wider definition of *underemployment*. The results suggest that endogenous migration and selection bias related to unemployment do little to change conclusions or even the relative strength of effects. Appendix E and F furthermore present the results of several sensitivity analyses, including specification curves. These alternative specifications confirm my previous findings.

5. Discussion and conclusion

This study seeks to advance the debate on the absorption of educational expansion on the labor 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 and RBTC see a relative shortage of well-trained workers on the labor market, and, thus, an underexpansion of education, whereas credential inflation theorists think there are too many workers with advanced education for all of them to find adequate work, that is overexpansion. 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.

Despite its potential advantages, it is important to be aware of some limitations of the methodology proposed here. First, the survey item used to measure workers' assessment of qualification requirements is not fully harmonized in the two countries I study. However, the results I found are conservative with respect to potential biases stemming from different measures. Second, for reasons of data availability, considering fields of study in this analysis was beyond the scope of the present article. While it is well established that some fields of study result in higher overqualification rates than others (Capsada-Munsech 2015; Rossen et al. 2019), future work should investigate in more detail what role selective expansion in some areas had for mismatch *trends*. Third, as with all subjective assessments, it cannot be fully ruled out that unobserved factors systematically affected respondents' estimation of qualification requirements, and perhaps differently so across survey rounds and countries. Labor markets in Britain and Germany have changed drastically over the period I study, and it stands to reason that this has affected workers' qualification evaluations over and above changes in the sheer technical aspects of jobs and tasks. While the overall conclusiveness of different analytical strategies in this study is reassuring, this has to be borne in mind, when relating the findings of the present study to over-/underexpansion arguments. Supplementary analyses in Online Appendix E, which show slightly different patterns in Germany using an objective (if somewhat crude) measure of graduate absorption further underline this point.

The subjective nature of the mismatch-measure used here, can, however, also reveal important sociological insights. Research shows that mismatches, far from being just a measure of qualification absorption, have significant consequences for people in their own right, and surprisingly similarly so across contexts (Allen and van der Velden 2001; Vaisey 2006; Korpi and Tåhlin 2009; Wiedner 2021). This article demonstrates that labor market change and educational policy have considerably increased some forms of self-assessed mismatch—particularly overqualification in the United Kingdom—and decreased others—particularly underqualification there. Against the background of the documented importance of subjectively experienced mismatch, these results are important findings in themselves—largely independent of their importance to the debate on drivers of over-/underexpansion.

The results of the present study do, in any case, shed new light on the over-/underexpansion debate, sometimes in unexpected ways. Most importantly, and in line with studies of changes in the occupational structure (Oesch and Rodriguez Menes 2011; Fernández-Macías and Hurley 2017; Oesch and Piccitto 2019), my results show that no single theory can account for the different experiences of educational absorption across countries. I find evidence for overexpansion in the United Kingdom and for mild underexpansion in Germany. These results partially diverge from those of recent comparative studies, which use a realized matches approach to measure mismatch, and report decreasing overqualification in Europe, particularly in countries with strong expansion (McGuinness et al. 2018; Delaney et al. 2020). Given the well-known limitations of realized matches approaches for comparative purposes (Capsada-Munsech 2019, also see Appendix B of the Online Supplement), my comparative analyses based on a, as I argue, more suitable subjective approach, gives grounds to critically re-examine these studies' results and conclusions.

My results also contrast with conventional wisdom on the relationship of educational expansion and occupational change, 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, 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 perspectives of SBTC and RBTC, one would hence expect more of an underexpansion 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 multivariate analyses, the conclusion is the same: during the second half of the 20th century, subjective overqualification rose strongly and subjective underqualification declined in the United Kingdom, and this is linked to educational expansion across cohorts. In Germany, the opposite is true in many respects. Here, I do not find more overqualification, and, if anything, more underqualification in cohorts that experienced more educational expansion. These patterns illustrate that it is predominantly specific institutional settings and not decontextualized global forces that shape countries' under- or overexpansion experience.

A third contribution of this study is to take a holistic approach by studying mismatch and expansion across levels of education. This perspective affords new insights. I find that tertiary expansion in the United Kingdom was not associated with overqualification of university graduates, but of graduates of lower tertiary institutions and vocational programs – suggesting a labor queue model in which expansion at the top fuels overqualification among workers with middling qualifications, as “their” jobs are increasingly filled with graduates. My analysis of the German data suggests that any possible underexpansion is not to be found among the most highly qualified workers, university graduates. Supplementary analyses even yielded some evidence that graduates’ access to executive positions has become somewhat harder with tertiary expansion. Instead, underexpansion seems to be located 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.

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