Under- or overexpansion of education?

Trends in qualification mismatch in the

United Kingdom and Germany, 1984-2017

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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. Results show overexpansion in the United Kingdom and a partial underexpansion of education in West-Germany.

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

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 (Collins 1979; Freeman 1976; 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 (Acemoglu and Autor 2011; Goldin and Katz 2010). 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 2019a). Trends in qualification mismatch are therefore indicative of the degree of labor market absorption of educational expansion.

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Moreover, vertical mismatches are sociologically important in their own right, especially when they are subjectively experienced (Vaisey 2006). Overqualification indicates inefficient investments in human capital (McGuinness 2006; Brunello and Wruuck 2021), and has been linked to lower wages, and lower job and life satisfaction (Korpi and Tåhlin 2009; Allen and van der Velden 2001; Wiedner 2021). Underqualification, on the other hand, is associated with higher job and life satisfaction, and greater satisfaction with the political system (Wiedner 2021). Since vertical qualification mismatches concern the link between individuals' education and their occupation, they also have direct consequences for (intergenerational) social mobility (Bernardi and Ballarino 2016; Capsada-Munsech 2015, 2019b; Wiedner and Schaeffer 2020). Subjectively experienced mismatches between workers' formal education and what is considered normal in a given job are highly important for the individuals concerned, but also for perceptions of fairness and, ultimately, societal cohesion (Freeman 1976). Knowing whether educational expansion has outstripped its absorption on labor markets or lacks behind growing demand, and how this is reflected in levels of mismatch is therefore an important question to students of social stratification.

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? Given an absence of comparative studies of mismatch-trends, 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).

Drawing on comparative political economy scholarship, I argue that institutional environments affect individuals' risks to become mismatched *given* labor market conditions. Moreover however, such environments also shape the overall supply of and the demand for workers of different qualification levels, i.e. labor market conditions, in the first place (Busemeyer and Trampusch 2012; Wren 2013).

Empirically, I use time-series of mismatch-incidence based on repeated surveys (United Kingdom: Skills and Employment Survey; Germany: Socioeconomic Panel Study) as well as contextual information from official labor force surveys. 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. 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.

This analysis adds to an emerging literature that uses alternative measures to assess the labor market absorption of educational expansion more directly than in traditional, wage-based analyses (Goldin and Katz 2010; Horowitz 2018). 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. Results document that educational expansion has had strong effects on levels of underqualification, too, and on qualification mismatch patterns below the graduate level. Finally, 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 (Fernández-Macías and Hurley 2017; Oesch and Rodríguez Menes 2011).

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 in Section 5.

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. 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 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.

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 and Dorn 2013; Autor, Levy, and Murnane 2003). 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.

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 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 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. 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.

Evidence on over- and underexpansion

Existing empirical studies on overexpansion and technology-induced skill shortages produce inconsistent results. Wage-based analyses often conclude that there has been underexpansion (c.f. Bar-Haim, Chauvel, and Hartung 2019), but studies using other approaches overwhelmingly find support for the overexpansion thesis. 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 a relative underexpansion of education, had a part in increasing wage inequality in Germany (Dustmann, Ludsteck, and Schönberg 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 that infer changes in the ratio of demand of higher educated workers to its supply from wage data also face criticism (Cappelli 2015; Kalleberg 2011). In order to provide evidence in favor 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-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, Kohn, and Lembcke 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.

Rates of qualification mismatch can serve as an alternative measure of the degree of absorption of educational expansion by labor markets. A common distinction is that between horizontal (mismatches between field of study/training and job) and vertical (mismatch between skill levels of training and skill level of employment) mismatch (Di Stasio 2017). While educational expansion has implications for the horizontal matching between workers and jobs (Elbers, Bol, and DiPrete 2021), under- and overexpansion are most clearly expressed by rates of vertical mismatch that is by over- and underqualification. Under SBTC, rates of overqualification should decrease, as employers seek to exploit the capacities of the relatively few 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 more expansion, as ever higher levels of education swamp the capacity of labor markets to absorb job entrants in nominally fitting positions.

What do the findings of previous research tell us about these relationships? Analyses that estimate the relationship between expansion and mismatch cross-sectionally from variation between European countries tend to find evidence against the underexpansion and in favor of the overexpansion hypothesis (Di Pietro 2002; Verhaest and Van der Velden 2013; c.f., Croce and Ghignoni 2012). Longitudinal studies, too, support the idea that educational expansion has outstripped demand in Europe and the United States (Davia, McGuinness, and O'Connell

2017; Horowitz 2018; but c.f. the replication of Furey 2021). By contrast, Pollman-Schult and Mayer (2004) report relatively constant overqualification risks in vocationally trained Germans from cohorts born between 1919 and 1971. Their results therefore suggest that experiences differ over countries and skill formation systems. Nevertheless, mismatch scholarship overall puts the dominant SBTC inspired skill shortage thesis into question. My research builds on these studies but extends them by considering underqualification, workers at different qualification levels, and by adding a comparative dimension.

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, Müller, and Pollak 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, Bol, and Van de Werfhorst 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, much like predicted also 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 1999:111 ff.; Hall and Soskice 2001; Oesch and Rodriguez Menes 2011; Wren 2013).

Empirical assessments agree that a general upgrading of occupational structures has taken place but disagree about the precise form relative skill demand shifts took in the two countries. An emerging consensus from empirical studies, however, is that universalist, technological arguments like SBTC and RBTC fail to account for the diversity in occupational dynamics witnessed across European countries. This observation suggests the primacy of institutional factors (Fernández-Macías and Hurley 2017). Overall, Germany appears to have undergone a rather clear-cut upgrading of the occupational structure, while the United Kingdom shows some sign of polarization as predicted by both RBTC and political economy arguments (c.f. Fernández-Macías and Hurley 2017; Oesch and Piccitto 2019; Oesch and Rodriguez Menes 2011).

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.

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

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 affect my results. In the GSOEP, I only use information from the first wave in which a respondent was interviewed.

Robustness analyses in Section C of the Online Appendix demonstrate that the results are 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, 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 17878 (United Kingdom) and 21048 (Germany) cases for the overqualification, and on 16560 (United Kingdom) and 17591 (Germany) cases for the underqualification analyses. I use the cross-sectional post-stratification weights provided with the data to ensure representativity.

Measuring mismatch for comparative analysis

Social scientists commonly distinguish two kinds of qualification mismatch: horizontal, that is a mismatch between *field* of training and of employment, and vertical, a mismatch in *level* of training and of employment (Di Stasio 2017). My analysis focusses on vertical mismatch because under- and overexpansion have largely been conceptualized in vertical terms. The dependent variable in my analyses is thus whether a worker is underqualified, overqualified, or adequately qualified relative to the job they are performing. However, mismatch measurement and especially the construction of time-series of mismatch incidence are not straightforward. The often-used realized matches approach that relies on the distribution of education within occupations to determine *relative* mismatch status, for instance, understates historical change in mismatch (Capsada-Munsech 2019a). To circumvent this problem, I compare respondents' subjective assessment of the required qualification in their current job with their own qualification. This so-called self-assessment approach produces mismatch rates that can be compared across time: 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. As an advantage over the practice of constructing occupation-level measures of objective skill requirements (e.g., Chevalier 2003), the subjective approach allows an analysis at the level of the actual job performed, and therefore does not rely on coarse and possibly artificial occupational groupings. It also frees analysts from the task of specifying an occupation's true qualification

requirement. While studies show that perceived *qualification* mismatch is only moderately reflective of *skill* mismatch (Capsada-Munsech 2019a), the question at stake in my analysis is in how far the *nominal* output of the education system matches demand.

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?".²

Analytic strategy and independent variables

The basic approach in the formal models below is to compare the mismatch rates of 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 individuals' risk of qualification mismatch in different cohorts. In line with my theoretical reasoning, I interpret a positive relationship as evidence of overexpansion. In doing so, I adjust for individuals' own highest qualification, which rules out that composition effects influence my results. Based on the available 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

² 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.

- 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. This rids my estimates of any period and region variation. The rationale for this approach is that it eliminates confounding changes in the relative demand for qualifications in so far as they play out across historical time and regions, i.e. when they do not differ across cohorts. It also controls for supply-side confounders such as immigration. I further discuss the assumptions of this strategy in the Online Appendix A.

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 B 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. In Section D of the Online Supplement, I report specification curves for the main results,

which show the full range of estimates obtained for all plausible specifications, i.e. combinations of covariates and sample-selection rules, and document that the preferred specification reported in the main text yields estimates that are far from being outliers.

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) and are measured using official labor market surveys. 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 categories (secondary or lower, vocational qualifications, and tertiary qualifications).

In order 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:

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

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. 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. The quantity of interest in this model 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 mismatch-probability. If α_l is positive, mismatches are more likely in cohorts, where qualification Q_l is more common. The Online Supplement A 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 E of the Online Supplement.

Results

Before I turn to the question of how rates of vertical mismatch have evolved, Figures 1 and 2 give a descriptive impression of the supply of qualifications and the demand for them on British and German labor markets. Figure 1 focuses on the highest qualification reported by 30-year-olds in large-scale labor force surveys and shows 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 cohort³ and at more than 35% in the same year 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.

Changing perspectives, Figure 2 shows the qualifications workers reported were needed for their current job. It presents evidence of 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

³ German tertiary education has expanded significantly for cohorts born after 1985, which, however, falls outside the sample definition of this study (Geißler 2014:335 ff.).

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. Figure 1 documents that it was limited to tertiary degrees. This hints at a first source of underexpansion 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), the United Kingdom therefore shows some signs of polarized upgrading. It is at this point unclear, what these various trends imply for the over-/underexpansion debate more broadly. However, these descriptive figures already underline that countries' experience regarding demand and regarding supply differ markedly, which puts the applicability of universalist theories like SBTC, RBTC or credential inflation into question, and instead suggests an important role for institutions in mediating the qualification demand and expansion nexus (Fernández-Macías and Hurley 2017; Oesch and Rodriguez Menes 2011).

Figure 1: Educational expansion in the United Kingdom and in Germany
Source: Own calculation based on GMZ 1976-2013, and UKLFS 1979-2017

Figure 2: Upgrading of jobs' qualification requirements in the United Kingdom and Germany
Source: Own calculation based on 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, and the expectations based on institutional scholarship discussed above, before I turn to a formal assessment of the relationship between expansion and mismatch at the cohort level.

Figure 3 shows the overall and cohort-specific trend in mismatch rates in the two countries and thereby offers a first descriptive assessment.⁴ It documents that mismatch trends in the United Kingdom and in Germany have been strikingly different. While there are signs of overexpansion 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,

⁴ The first round of the British survey was not carried out in all regions. 1986 figures are hence not strictly comparable to later periods.

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. 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* overqualification rates from the late 2000s onward.⁵

⁵ 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 3 Trends in mismatch rates in the United Kingdom and in Germany

Figure 1 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. What is more, 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 mismatch incidence to cohort-level qualification shares — the main

indicator of educational expansion. These models probe explicitly what role educational expansion has played, and to what degree it has been absorbed on the British and German labor markets. Table 1 reports results, when all qualification shares are entered simultaneously, omitting the “no qualification” category. Results for using other references and for models that look at one level at a time can be found in Section B of the Online Supplement. These additional estimates underline the robustness of my results.

Using a conceptually different approach, Table 1 confirms the significant difference in the relationship between expansion and mismatch in the two countries: 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, 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. 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.

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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

As I discuss in more detail in the Online Supplement A, 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, presumably changing demand in younger cohorts. Even without a causal interpretation, this pattern rules out the overexpansion thesis for the German case.

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 breaks down the association between expansion and mismatch for different qualification groups. Like Table 1, 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,

rows correspond to the qualification group analyzed and columns to the outcome and the country analyzed. Markers give the marginal effects of the expansion of different levels of education, relative to the “no qualifications” category.

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

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.

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.⁶ Figure 4 therefore implies that any excess expansion trickles down the qualification hierarchy. Tertiary expansion furthermore meant that British workers of all qualification levels became less likely to be underqualified, again 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 thus indicate a decline in the provision of vocational training, relative to demand for it, in dynamic regions.

Taken together, the results in Figure 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.

In Appendix E of the Online Supplement, I show that endogenous migration and selection bias related to unemployment do little to change this conclusion or even the relative strength of effects. Results obtained from these alternative specifications confirm my previous findings.

⁶ It is important to note that this pattern might be 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 4.

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, 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.

The results of the present study indeed shed new light on this debate, sometimes in unexpected ways. Most importantly, and in line with studies of changes in the occupational structure (Fernández-Macías and Hurley 2017; Oesch and Piccitto 2019; Oesch and Rodríguez Menes 2011), 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 a mild underexpansion 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 perspectives of SBTC and RBTC, one would hence expect more of a 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, 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. Here, I do not find more overqualification, and, if anything, more underqualification in cohorts that

experienced more educational expansion. 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 and RBTC interpretations of educational expansion, skill needs of the economy and wage inequality into question (Cappelli 2015; Kristal and Cohen 2017; Horowitz 2018; Fernández-Macías and Hurley 2017).

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 appears to have become a positional good so that expansion fuels a drive towards yet more expansion (Di Stasio 2017; Di Stasio et al. 2016). This paper does not attempt to disentangle the complex workings of different institutions. Nevertheless, it illustrates the different trends experienced and likely produced by different systems and therefore complements research on the matching between qualifications and jobs by considering a novel temporal dimension (Bol et al. 2019). In sum, this study underlines that institutional environments condition global forces like educational expansion and occupational change in decisive ways.

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 (at least with respect to nominal requirements to *get* the job), but of graduates of lower tertiary institutions and vocational programs – suggesting a labor 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 underexpansion 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.

Trends in mismatch prevalence can tell us something about the workings of educational systems and labor markets. But they are also important for people in their own right (Vaisey 2006; Wiedner 2021). Underqualification is a form of intragenerational upward mobility: Relatively low qualified individuals find middling jobs or people with middling qualifications find top-end jobs (Wiedner and Schaeffer 2020). Undereducations' decline in the United Kingdom may offer fewer of such experiences. Vice versa, overqualification can be experienced as education's promise of social status not kept: it is a form of intragenerational downward mobility. 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.

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