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From School to Career: Towards A Career Perspective on the Labor Market Returns to Education

Section a. State-of-the-art and objectives

Over the last decades European labor markets have changed rapidly. Wage inequality has increased in virtually all western societies (Atkinson, 2015), for a large part between educational groups (Goldin & Katz, 2009). Technological change, globalisation, and the automatization of job tasks have changed labor markets: occupations for middle-educated workers are disappearing, while employment at the top and bottom is growing (Goos et al., 2014, but see Oesch & Piccitto, 2019). These changes present societies with a challenge: how should they educate a workforce that is well-prepared for the labor market of the future? Is it still sensible to equip students with a narrow set of occupation-specific skills, given that what is demanded in the labor market is under rapid change?

A large sociological literature studies how wages, employment, and occupational destinations differ between graduates with vocational and general educational qualifications—net of their educational level (Shavit & Müller, 1998). The key distinction between vocational and general is in the extent to which students are equipped with occupation-specific skills: vocational qualifications (e.g., heat plumbing) are highly occupation-specific, whereas general qualifications (e.g., administration) prepare students for a large set of occupations. While vocational education mostly takes place in upper secondary education and at the lower tertiary level, university programs can be vocational too (e.g., medicine, dentistry).

Vocational graduates are argued to have a smoother transition from school to work than graduates with general qualifications. Their occupation-specific skills make vocational school-leavers immediately productive and thus attractive for employers (Becker, 1962), and the institutionalized linkage between apprenticeships and the labor market pave the way to a successful start of the career (Bol, 2014; Bol & Weeden, 2015). Empirical studies indeed find that in the early career, vocational graduates outperform workers with a general qualification in terms of unemployment, job search time, or working in a matched occupation (Arum & Shavit, 1995; Breen, 2005; Levels et al., 2014; Müller & Gangl, 2003; Ryan, 2001; Wolbers, 2007; Wolter & Ryan, 2011).

From school to career: a life course perspective

While the existing literature on labor market returns to general and vocational education has made large contributions, it has suffered from two important shortcomings.

First, it has almost exclusively investigated the effect of vocational and general education in the early career, treating a labor market outcome as something rather static. As a result, we do not know *how* full career trajectories differ for workers with different educational qualifications—a lacuna in the literature that has been signalled by many scholars (Hout, 2012, p. 387; Kleinert & Jacob, 2019; Müller & Jacob, 2008, p. 161), but has not been addressed. Moreover, we remain in the dark on what mechanisms explain *why* careers of vocational or general graduates might develop differently.

Second, it has been acknowledged across different disciplines that labor markets are changing rapidly. Job tasks are being automated, and what is demanded from workers is completely different now than it was twenty years ago (Acemoglu & Autor, 2011; Kalleberg, 2009; Oesch, 2013). However, the consequences of these processes for individual workers remain unclear. How and why are labor markets changing, and how does this affect workers at different points in their working lives? Are careers of workers with occupation-specific qualifications as resilient to changing labor demands as the careers of workers with a broader set of skills?

This research program answers these essential questions. The theoretical point of departure is life course theory (Mayer, 2009), which has as its main premise that individual's outcomes are path dependent: a life course is a set of interrelated life stages (Cheng, 2014; Heckhausen & Buchmann, 2019). Parallel to this, we investigate and theorize a labor market career as a set of interdependent career stages (DiPrete et al., 1997; Kalleberg & Mouw, 2018; Mills et al., 2008). The real value of education in the labor market can therefore only be understood if we extend the window of analysis beyond the early career and study full careers.

Throughout the project our core concept—vocational or general education—is defined in two ways. First, in the traditional, dichotomous, way: a qualification is either vocational *or* general (Shavit & Muller, 1998). Second, following a recent literature initiated by the PI (e.g., Bol et al., 2019; DiPrete et al., 2017; Forster & Bol, 2018; Rözer & Bol, 2019), we use a continuous definition that avoids this artificial dichotomy: a qualification can be more or less vocational. There is vast heterogeneity within the two dichotomous

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categories: sociology and medicine are traditionally both defined as "general," but a medical degree is clearly more vocational.

Comparative scope

In answering its questions, the project uses a comparative perspective and studies six diverse European countries: Germany, the Netherlands, Poland, Sweden, Switzerland, and the United Kingdom (UK). Country selection in CAREER is based on a diverse case design (Gerring, 2006): the countries have diverse institutional contexts, that offer vast variation in the organization of the labor market (Hall & Soskice, 2001) and education system (Bol & Van de Werfhorst, 2013). Labor markets across the six countries range from highly coordinated market economies (Germany) to liberal market economies (the UK). To have this cross-national variation among our cases is important: how technological change affects the occupational structure depends the institutional setup of the labor market (Oesch & Menés, 2011).

The countries also differ in the extent to which their vocational education is occupation-specific (Busemeyer, 2009). In some countries vocational education takes place in apprenticeships and is largely workbased (Germany, Switzerland), others offer a mixture of school- and work-based training (the Netherlands, Poland) or rely mostly on school-based vocational training (Sweden, the UK). Vocational education has a different meaning across the six countries, and this variation is required to achieve the project's aim to understand how macro-contexts affect micro-outcomes.

Although the project has a comparative focus, many subprojects also focus on within-country heterogeneity, for example between occupations or sectors (Bechter et al., 2012) or in educational returns (DiPrete et al., 2017).

Project design

CAREER has four key objectives organized in four subprojects, summarized in Figure 1. It will map how labor markets are changing (SP1). It will demonstrate how changing labor markets affect workers with different educational backgrounds (SP2). To achieve this, it will study how careers of vocational and general graduates develop (SP3). Finally, it will expose the theoretical mechanisms that drive career effects (SP4). Methodologically, CAREER takes a mixed methods approach and uses ground-breaking big data (vacancy texts, register data), panel surveys, qualitative interviews, and factorial survey experiments to accomplish its ambitious objectives. We discuss the state-of-the-art and the specific aims for each of the four objectives (and thus subprojects) separately.



Figure 1. Schematic overview of the project

SP1. Changing labor markets: State-of-the-art and objectives

Perspectives on labor market change

Technological change and globalisation have led to a polarization of the occupational structure: employment at the top and the bottom is growing, whereas middle occupations are losing ground (Autor et al., 2006; Goos et al., 2009; Oesch, 2013; Wright & Dwyer, 2003, but see Oesch & Piccitto, 2019). Routine occupational tasks are being automated, leading to a decreasing demand for occupations such as administration or machine operating. Occupational change is also explained by outsourcing: western countries increasingly outsource

manual labor to low-wage countries, whereas the service sector is growing—both at the top and bottom of the occupational distribution. While it is clear that the labor market is changing, we do not if educational groups are similarly exposed to these changes. There are some signals that technological change affects vocational graduates more than general graduates (Keller & Utar, 2016), but other studies argue that "vocational systems [...] succeeded in keeping up with technological changes" (Oesch, 2013, p. 146).

The most influential empirical approach for studying changing labor market demands is by describing changes in the occupational structure. While this has been very important, the approach relies on two strong assumptions. First, due to data limitations, demand for labor is never directly measured. All studies use occupational employment shares, and do not map how many vacancies there were for a particular occupation. They thereby implicitly assume that the observed share of workers in an occupation corresponds perfectly to the demand for that occupation. Second, again in absence of good data, the literature assumes that demand does not change *within* occupations over time: a car mechanic in 2000 is still coded as car mechanic in 2019, although the content of their daily work has experienced enormous changes.

Finally, labor markets are not just changing by shifts in demand; there is institutional change as well. A recent literature documents that precarious work in on the rise: a growing number of workers have employment relations that offer low pay, little job security, and a high level of uncertainty (Kalleberg, 2009, 2011). Similarly, studies have documented the erosion of unions (Ebbinghaus & Visser, 2000). These are all factors that need to be taken into account to understand how shifts in labor demand are changing labor markets, as they might mitigate (unions) or intensify (flexibilization) potential effects for workers.

Objective 1: Mapping changing labor markets

SP1 addresses these challenges and will describe how the demand in the labor market is changing, and for whom it is changing most: vocational or general graduates. Much better than before, SP1 brings together different sources of data on changing labor market demand within and between occupations, and provides a comprehensive overview of labor market change by taking the (changing) institutional context into account.

To achieve its objectives, SP1 relies on different data sources. First, for the six countries it brings together the best repeated cross-sectional survey data from the early 1990s to now: (a) the harmonized European Labour Force Survey (EU-LFS), (b) national labor force surveys, and (c) employee surveys on job tasks (see <u>Table 1</u>, Section b). With these survey data we describe occupational change, and zoom in on how vocational and general graduates are potentially exposed differently. To provide a more complete picture, we expand these data with cross-temporal and cross-national information on the institutional setup of the labor market, for example the level of coordination, unionization, and employment protection (Visser, 2019).

A major innovation of CAREER is that the research team will analyze labor market change using novel big data on millions of (online) job vacancies across Germany, the Netherlands, Switzerland, and the UK. For reasons of feasibility and the availability of vacancy data, this part of CAREER is only executed in four out of the six countries. For Switzerland vacancy data were already collected in the Swiss Job Market Monitor (Buchmann et al., 2019; Kriesi et al., 2010). We will follow its example for the other three countries, and will collect and analyze novel big data on (online) job vacancies and vacancy texts from the mid-2000s until now (see Section b for specifications of the data).

Collecting these new data on labor market change is a big empirical advancement, but it has serious theoretical implications too. First, these new data allow us to describe how the demand for occupations really changed in the past decades. We do not just observe the vacancies that were filled—like in the labor force surveys—, we observe the real demand. Triangulating the existing survey data with the big data from online vacancies leads to the best-possible depiction of labor market change.

Second, vacancy data are unparalleled when it comes to detail (Hershbein & Kahn, 2018). The millions of job vacancies will be analyzed using text analysis techniques in a machine learning framework (Blei, Ng, & Jordan, 2003, see <u>Section b</u>), isolating crucial information from the vacancy texts, such as information on the required educational qualifications or demanded skill. This means that we can describe changing demand *within* occupations: to what extent did educational and skill requirements change, and how does this affects graduates with vocational and general education differently?

This project is the first to analyze and collect vacancy data cross-nationally, providing a unique opportunity to understand how labor markets are changing differently across countries. By describing the between- and within-occupation changes in demand through a country-comparative lens using both survey and vacancy data, SP1 describes how the countries' institutional contexts affect changing labor demands.

The methodological strategy used to achieve Objective 1 is outlined in Section b in the description of <u>SP1</u>.

SP2. Effects of changing labor markets on worker's careers: State-of-the-art and objectives

How changing labor markets affect careers

While the occupational structure is changing, surprisingly little is known on how this affects individual workers (cf. Cortes, 2016; Murphy, 2014). To what extent are worker's careers affected by labor market change, and to what extent does this differ between workers with general or occupation-specific educational qualifications? These are the main research questions that drive the second subproject. In order to answer these questions, SP2 takes an institutionalist perspective, arguing that micro-level processes can only be understood if they are analyzed in their relevant macro-contexts (Brinton & Nee, 1975; Scott, 2008).

Our main theoretical prediction is that the potentially adverse effects of changing labor demands (i.e., job loss) will be more severe for workers with vocational than with general qualifications. Highly specific vocational training often provides a clear pathway to only one, or sometimes a few, occupation(s). With a general qualification, in contrast, graduates can move to many different destinations in the labor market (DiPrete et al., 2017). This strong link is precisely the factor that explains the smooth vocational graduates' comparatively smooth transition from school to work (Shavit & Müller, 1998). At the same time, the narrow focus of vocational programs is argued to hamper graduates' later labor market mobility.

A substantial literature has investigated labor market mobility (DiPrete et al., 1997; Jarvis & Song, 2017; Kalleberg & Mouw, 2018), in rare occasions looking at the role of education (Mills et al., 2008), but never focusing on how labor market mobility differs between workers with vocational or general qualifications. There are, however, clear indications that workers with highly occupation-specific education are less likely to be mobile between different occupations or organizations than workers with general schooling (Allmendinger, 1989). Studies for example find that labor market mobility is lower in occupational labor markets (Germany, Switzerland), where vocational education provides clear pathways to work, than in organizational labor markets (the UK), where the link between school and occupation is weaker (Doeringer & Piore, 1985; Hillmert, 2011; Maurice et al., 1986).

Following these arguments, we expect that vocational graduates are more affected by changing labor demands than general graduates. If occupation-specific qualifications indeed hinder occupational mobility, a decline in occupational demand results in a comparatively stronger labor market penalty for workers with vocational qualifications. For example, demand for sewing machine operators and administration workers is declining, but getting re-employed will be harder for a vocationally trained sewing machine operator than a generally educated administrator. SP2 will look at the institutional context too, and study if the adverse effects of changing demand (unemployment, downward mobility) are particularly large when institutions that can mitigate them (e.g., unions, employment protection) are absent or eroding.

Objective 2: Understand how labor market change affects vocational and general graduates' careers

The second objective is to connect the macro-processes described under Objective 1 to micro-outcomes: how are work careers affected by changing labor markets? The main aims are (a) to describe what happens to workers that are employed in occupations for which demand is in decline, (b) to describe what happens to workers that are employed where demand for tasks within the occupation is changing, and (c) to describe how these two processes vary across general and vocational graduates.

In order to achieve this objective, we connect the macro data (repeated surveys, vacancy data) obtained in SP1 to micro data. For all six countries under study we use the best available sources of panel data, both from longitudinal surveys, but also from population registers (see <u>Table 1</u> in Section b). The panel data allow for following individual careers as the labor market changes. With this unique combination of macro- and microdata, CAREER will be the first to test how the labor market change affects individual careers, and how this process varies between workers with vocational and general educational qualifications.

A key empirical contribution is that the research team will harmonize the panel data sources for this project, and will release the harmonization code to the academic field to enhance comparative research. For the harmonization we use state-of-the art methods to align educational (Schneider, 2010) and occupational (Bol & Weeden, 2015; Weeden et al., 2007) classifications both cross-nationally and cross-temporally.

The methodological strategy used to achieve Objective 2 is outlined in Section b in the description of <u>SP2</u>.

SP3. Career effects of vocational and general education: State-of-the-art and objectives

Career effects of vocational and general education

Existing studies unequivocally find vocational graduates to have a smoother transition from school to work (Ryan, 2001). They are less likely to enter unemployment (Breen, 2005; Müller & Gangl, 2003), find a first job more quickly (Wolbers, 2007; Wolter & Ryan, 2011), and more often enter the labor market in a matched occupation (Arum & Shavit, 1995; Bol et al., 2019; Levels et al., 2014). Different theories explain this good start: occupation-specific provides vocational school-leavers with productivity-enhancing skills that makes

them attractive for employers (Becker, 1962), and the often institutionalized linkages between vocational training and the labor market in the form of apprentices pave the way to a successful career start (Bol, 2014).

Whereas the literature has focused extensively on the transition from school to work, it has remained surprisingly silent on how full careers might differ, while recent studies indeed document such life cycle effects (e.g., Forster et al., 2016; Golsteyn & Stenberg, 2017; Hanushek et al., 2017; Korber & Oesch, 2019). This phenomenon is schematically depicted in Figure 2: vocational education provides a good labor market entry (A), but becomes a burden in the late-career (B).





The core explanation for late-career penalties is that with their more narrow educational qualifications, vocational graduates cannot be as mobile in the labor market as the more broadly schooled general graduates. This inflexibility becomes a problem for vocational graduates over their careers: their occupation-specific skills might hinder upward labor mobility, and when their specific skills become obsolete over time, they will have more difficulties to change occupation.

Cumulative disadvantage theory (Bol et al., 2018; DiPrete & Eirich, 2006) also predicts different careers for vocational and general graduates, again because of labor market mobility. Early-career setbacks (unemployment, working in a mismatched occupation) lead to an accumulation of disadvantage over careers (Cheng, 2014; Gangl, 2006), but this disadvantage is likely to be stronger for vocational graduates. After an early-career setback, their limited mobility gives them fewer occupational alternatives than the more flexible general graduates, leading to large late-career gaps between workers with vocational and general schooling.

Labor market mobility is also the dominant mechanism used to predict cross-national variation in career effects. Hanushek et al. (2017) argue that late-career penalties to vocational education are larger in countries where vocational education is highly occupation-specific (e.g., Germany, Switzerland) than in countries with school-based systems (e.g., Sweden, UK). The key argument, again, is that late-career mobility is more difficult when skills (or qualifications) are more specific, resulting in larger penalties.

Remarkably, the hypothesized importance of labor market mobility in explaining career effects has not been tested empirically. This lacuna is mostly explained by data issues: almost all studies used cross-sectional designs (Kleinert & Jacob, 2019, p. 300), in which it is not possible to follow individuals over time and uncover the process by which their careers develop. Moreover, cross-sectional designs compare labor market outcomes of different young and old workers, mixing age, period, and cohort effects (Ryder, 1965), and implicitly relying on the (strong) assumption that careers between these different individuals are comparable. The absence of comparable panel data so far also prevented a reliable test of how the vocational specificity of a countries' education system affects life cycle effects of vocational and general education.

Objective 3: Describe how careers develop differently between vocational and general graduates

In SP3 we fully focus on the micro level, and investigate how returns to education vary over the life course. The third objective of CAREER is therefore to take an explicit life course perspective and study career effects of vocational and general education. The main aims are: (a) to describe how careers develop differently for vocational and general graduates and via what processes (e.g., occupational or organizational mobility, unemployment, promotion), (b) to investigate if vocational graduates are indeed less mobile over their careers than general graduates, (c) to describe the lasting effects of early-career setbacks, and (d) to investigate cross-national variation in career effects. The diverse case selection of the six countries with respect to their

vocational training systems provides the strongest possible setup to critically evaluate if career effects are indeed more pronounced in countries with highly occupation-specific vocational systems than in countries where vocational education is more general.

In order to meet these aims and achieve the third objective, we rely on the panel data described in <u>Table 1</u> in Section b. The panel data allow for opening the black box by which the careers of individual workers develop. Moreover, in contrast to the studies relying on cross-sectional designs, we are able to understand to what extent the effects are driven by age or period effects. To get an even better grasp on the role of mobility, in one study SP3 analyzes population data for the Netherlands and Sweden. Both countries' registers contain detailed and unique time-varying information on workers' wages and organizational affiliations, making it possible to expose the processes (e.g., occupational, organizational, and wage mobility) by which careers of—otherwise similar—vocational and general graduates develop. This focus on organizations is important, particularly because a growing literature in sociology highlights organizations as the crucial structural unit to understand labor market inequality (Tomaskovic-Devey & Avent-Holt, 2019).

The methodological strategy used to achieve Objective 3, and details on the data are outlined below in Section b in the description of $\underline{SP3}$.

SP4. Uncovering mechanisms for late-career penalties: State-of-the-art and objectives

Late-career penalties to vocational education

Recent studies have documented a late-career penalty to vocational education, but it remains unclear *why* this is the case. This research program is the first to investigate the causal mechanisms that drive late-career penalties (Figure 2, B). In SP4 we formulate and test different sociological and economic theories.

First, the late-career penalty can be explained by human capital theory (Becker, 1962). Rapid technological innovations change demands in the labor market, and the specific skills that were useful when entering the labor market have become obsolete in the late-career (De Grip & Van Loo, 2002). This skill gap between vocational and general graduates increases even more because vocational graduates participate comparatively little in lifelong learning programs (Vogtenhuber, 2014), making it harder for them to keep their skills up to date.

Second, even if their late-career skills of vocational graduates are on par with those of general graduates (Heisig & Solga, 2015), employers might still be less inclined to hire older workers with vocational qualifications because at that age a vocational qualification is a negative signal (Spence, 1973). Employers or recruiters assume late-career workers with a vocational qualification to be less flexible, leading to a penalty that is not based on actual skills, but on vocational qualifications as negative signals.

Third, factors beyond education are crucial in understanding which older workers are hired (Karpinska et al., 2013). For most of their careers, vocational and general graduates work in different segments of the labor market. Their different labor market histories might determine their likelihood for old-age employment. Vocational graduates could be more likely to have physically straining work, which affects late-career employment prospects (Karpinska et al., 2013; Kratz et al., 2019). Moreover, while vocational graduates build careers in labor markets with strong occupational boundaries, workers with general qualifications are argued to move across labor market segments (Allmendinger, 1989). If for employers past career mobility is an important criterion for hiring older workers (Bills, 1990; Oude Mulders et al., 2018), the hypothesized lower mobility of vocational graduates might in itself be an explanation for their late-career penalty.

Disentangling these mechanisms is theoretically innovative, but crucial for potential policy interventions too: lifelong learning programs (Bassanini et al., 2005; Ehlert, 2017), for example, will only circumvent late-career penalties for vocational graduates if skill depreciation is indeed a main driver.

Objective 4: Uncover the theoretical mechanisms that drive late-career penalties

The fourth objective is to unravel the causal mechanisms that drive the late-career penalty to vocational education. In achieving this objective, SP4 takes the perspective of the employer (Bills et al., 2017): why do they decide to (not) hire older workers? The subproject takes a mixed methods approach and collects novel interview data, factorial survey experiments, and survey data among recruiters. For reasons of viability it only focuses on two countries: the UK and either Germany or the Netherlands (see Section b for details). If there are important between-country differences in the theoretical drivers, we expect to find them across these two countries.

Following Di Stasio (2014, 2017) we use the chambers of commerce in the two countries to approach companies in four different labor market sectors. The individuals within the organizations that are responsible for hiring are then approached to take part in the study. First, recruiters are approached for a semi-structured

interview (Wengraf, 2001). Qualitative interviews provide rich information on hiring decisions (Rivera, 2012), and can unveil important criteria for hiring older workers.

Second, in a factorial experiment (Auspurg & Hinz, 2014), those responsible for the hiring process are asked to score fictive resumes ("vignettes") of older workers in their likelihood to invite them for a job talk or hire them (Di Stasio, 2017; Oude Mulders et al., 2018; Protsch & Solga, 2015; Quadlin, 2018). By randomly changing or leaving out characteristics on the fictive resumes, we aim to uncover the black box of *why* workers with vocational qualifications suffer a late-career penalty. The vignettes vary on factors that closely align with the mechanisms described above: vocational qualification (yes/no), skill level (indicated by having with sector-relevant skills), previous work experience (sector(s) of employment), career mobility (number of different occupations/sectors one was employed in), and lifelong learning (extra courses during career). With this approach we can, for example, isolate the signaling mechanism by comparing vignettes of workers with similar skills, work experience, career mobility, and lifelong learning, but a different educational qualification (vocational or general).

The methodological strategy used to achieve Objective 3, and details on the data are outlined below in Section b in the description of $\underline{SP4}$.

Section b. Methodology

CAREER is broken down into four sub-projects that align with the four objectives (see Figure 3). SP1 and SP2 focus primarily on the macro-level, SP3 and SP4 on the micro-level. To ensure cohesion between the subprojects, the research team will collaborate in theoretically and empirically integrated joint papers that connect the macro- to the micro-level. This integrative design of the project ensures a high level of intellectual exchange, which will benefit the learning process of the junior scholars. Each subproject relies on different data (see Table 1), research designs, and methodologies. Section b discusses these in detail for each subproject separately.



Figure 3. Workflow of the subprojects

SP1: Changing labor markets (PI + Postdoc)

With SP1 we will achieve Objective 1. The main goals of SP1 are (1) to describe how labor markets are changing, (2) how demand for labor is changing, and how this differs for vocational and general graduates, and (3) how institutions affect changes in demand.

Data sources

SP1 will follow two main empirical strands. First, it will use repeated cross-sectional survey data. Second, it will collect novel big data on labor market demand from job vacancies.

Repeated cross-sectional data

The repeated cross-sectional data come primarily from the European Labour Force Surveys (1993-now), appended with national labor force surveys (see <u>Table 1</u>). These repeated cross-sectional data allow for

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describing occupational change, and for investigating if occupations for vocational graduates have been shrinking (or growing) at a different rate than for general graduates. The national labor force surveys are used because they include more detailed occupational and educational classifications, that might be necessary to truly understand how countries' labor markets are changing (Oesch, 2013). To get an even better grasp on how task demands have changed in the labor market, SP1 uses employee surveys that contain information on job tasks, use of technologies, and occupational requirements. These are only available for Germany and the UK. The objective of SP1 is to describe changing labor markets, and in doing so it will look at institutional change too, using macro-indicators (Visser, 2019).

	SP1		SP2, SP3	SP4
	Repeated cross-sectional data	Job vacancy data	Panel data sources	Factorial experiments; qualitative interviews
Germany	Microcensus; BIBB-BAuA Employment Surveys (1986-now)	To be collected	Socio-Economic Panel (SOEP), 1984-now	To be collected ^b
Netherlands	Dutch Labor Force Survey (1994-now)	To be collected	Labor Supply Panel merged to population registers, 1985-now	
UK	Quarterly Labor Force Survey; British Skills Surveys (1986-now)	To be collected	British Household Panel Study; Understanding Societies, 1991-now	To be collected
Switzerland	Swiss Labor Force Survey (1991-now)	Swiss Job Market Monitor	Swiss Household Panel (SHP), 1999-now	
Poland	Polish Labor Force Survey (1994-now)		Polish Panel Survey (POLPAN), 1998-2013	
Sweden	Population registers ^a (1985- now)		Population registers, 1985-now	
Cross- national	European Labour Force Survey (1993-now); ICTWSS database			

Table 1: Overview of data sources for CAREER

^a. Since Swedish register data is only available on-site, prof. Hällsten has agreed to be a partner to the project and host the research team (see "<u>Academic advisory board</u>").

^b. Depending on the language proficiency of the PhD-student that will be hired for SP4 we will either study Germany or the Netherlands (see <u>SP4</u> in Section b).

Job vacancy data

The major empirical advancement of SP1 is that it will collect, harmonize, and analyze big data on millions of job vacancies from the mid-2000s to now in Germany, the Netherlands, Switzerland, and the UK. Because of data availability and feasibility, this part of the project can only focus on these four countries.

In all countries, the PI has obtained access to vacancy data. For Switzerland data on job vacancies are already gathered (Buchmann et al., 2019), and the Swiss Job Market Monitor will be used as a benchmark when collecting and coding the data in the three other countries. For Germany we use a dataset from the Federal Employment Agency containing about half a million job openings per year, supplemented with online vacancy data from *Jobfeed* (2011-now). For the Netherlands we analyze millions of vacancies from the monopolist on the Dutch online vacancy market, *De Nationale Vacaturebank* (2005-now). *De Nationale Vacaturebank* contains about half a million job postings per year, and has agreed on cooperating with the project and releases all their data to the PI for the benefit of this research project. For the UK we use data from *Burning Glass* (2008-now), which includes 10 million unique vacancies and vacancy texts per year that were collected from different vacancy websites.

Existing sociological work on changing demand has mostly used (samples of) printed job vacancy texts (Dörfler & Van de Werfhorst, 2009; Jackson, 2007). An important question is whether the data from online vacancy sites are representative: are all occupations covered there, or are some occupations (selectively) missing? There are indications that particularly high-skill occupations are more likely to be advertised on online vacancy sites (Kureková et al., 2014). At the same time many studies point to the benefits of online vacancy data: the sample sizes are very large and the data are highly detailed (Azar et al., 2018; Hershbein & Kahn, 2018). Moreover, by weighing the online vacancies appropriately one is able to make claims with a high

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level of external validity (Thurgood et al., 2018). In SP1 we will weigh the online vacancy data using available national information on sectoral job vacancy rates (Eurostat, 2019). Moreover, issues of selectivity and external validity are of less importance when we analyze the *within*-occupation change in demands.

Methods

The two empirical strands in SP1 require different methods. Following the state-of-the-art, we will analyze labor market change with the repeated cross-sectional data using descriptive methods: how did employment shares across occupations change? Regression techniques are used to predict the (linear) probability that a vocational or general graduate works in a shrinking occupation.

The online job vacancy texts will be analyzed using automated text analyses. With the rise of computational methods, social scientists increasingly analyze text as data (Grimmer & Stewart, 2013). Automated text analysis relies on algorithms to detect (co-occurrence of) words in existing texts and classifies them. Classification can be based on known categories (e.g., name of occupational code [ISCO-2008 category]; required educational level) or unknown categories (e.g., required skills).

Known categories will be classified using both dictionary methods (i.e., a list of words that all belong to a category) and supervised learning techniques (Collingwood et al., 2013; Gnehm, 2018). For supervised learning we train an algorithm on a small sample of vacancies to assign, for example, the correct occupational code to a vacancy text. Recent studies have shown this to be a very successful method to map occupational classifications to millions of vacancy texts (Thurgood et al., 2018). Unknown categories will be identified by using topic modelling (Blei et al., 2003), where latent concepts are derived from large bodies of texts. In our case we aim to obtain information on the specific skill demands within occupations by letting computer algorithms find common sets of words within vacancy texts. Since how skill requirements are described in vacancy texts will likely differ across sectors, we use structural topic models (Roberts et al., 2014) that allow for using information of the vacancy (i.e., sector, occupation) when assigning topics.

The coded vacancies will be analyzed descriptively to highlight both between- and within-occupation changes in demand. How is demand for different occupations changing, how are demands (e.g., skills, educational requirements) within-occupations changing over time, and how do these processes differ across countries?

Output

SP1 will deliver three academic articles: (1) how did the demand change differently for vocational and general graduates across countries (using repeated cross-sectional data), (2) a methodological article on using online vacancy texts to measure shifts in demand within- and between occupation for a sociological audience (comparing repeated cross-sectional and vacancy data), and (3) a paper on (cross-national differences in) the within-occupation changes in demand (vacancy data). Moreover, the data collection in SP1 will form the basis of a monograph on changing labor markets and the effects for workers with different educational backgrounds. The unique cross-national vacancy data will form an important pillar of the book.

SP2: Effects of changing labor markets (PI + Postdoc)

The main goal of SP2 is to describe how work careers of vocational and general graduates are differently affected by changing labor markets. SP2 therefore explicitly connects the macro-context (SP1) to micro-outcomes (see also SP3 and SP4).

Data sources

SP2 will rely on panel data for the six countries under study. The specific datasets and the range of years that they cover are available in Table 1. Existing cross-national panel data does exist, but it often uses very crude classifications that do not contain the level of detail to identify specific occupations educational qualifications (the CNEF panel data), or span only a short period (EU-SILC). For this reason SP2 uses the best available country-specific source(s) of panel data. In some countries this means that we rely on survey data (Germany, Poland, Switzerland, the UK), while in others we use population registers (Sweden) or a combination of register and survey data (the Netherlands). Each panel dataset includes information on education, occupation, and a set of labor market outcomes (employment, unemployment, wages).

We link the micro-level panel data to the macro data obtained from SP1. For example, for each country we aim to use macro data on the change in occupational employment shares to predict the individual level labor market penalty (length of unemployment, wage or occupational status of re-employed position) associated with unemployment. SP2 predicts that the adverse effects are largest for workers in occupations where demand in declining, and particularly for vocational graduates. Similarly, we will also match occupation-level information on within-occupation changes in demand from the vacancy data to the micro-level panel data. This

allows us to estimate if the penalty associated with job loss is larger for vocational graduates that are employed in occupations where the demand for job tasks is rapidly changing.

The final aim of SP2 is to compare these processes across the countries under study: do we find that the national institutional context matters? A challenge is to make the panel data comparable across the countries. In order to achieve this we rely on existing crosswalks and methods for harmonizing occupational and educational classifications (Schneider, 2010; Weeden, 2005). An important empirical contribution of SP2 is that the harmonization code will be released to the academic field (see "Deliverables").

Methods

Because we combine the macro data of SP1 with micro-level panel data, the data of SP2 have a nested structure: workers are, for example, nested in occupations and years. In order to analyze the effects of changing labor markets on vocational and general graduates, we rely on state-of-the-art fixed effects, random effects, and hybrid regression models that account for this nested structure (Allison, 2009; Firebaugh et al., 2013). In random effects models with workers *i* nested in occupations *j*, we would estimate cross-level interactions, which for example would predict how the wage effects of job loss for individual *i* depend on the change of employment share of occupation *j*. In individual fixed-effects models we would only model the within-individual changes over their life course, meaning that time-constant factors (such as type of educational qualification) can only enter the model in interaction terms.

Given that men and women are known to work in different occupations and that this affects their labor market prospects (Charles & Grusky, 2005; Levanon & Grusky, 2016), all models will be estimated separately for men and women. Moreover, in all models we will control for a series of factors that might confound (or moderate) the relation between labor market change and individual outcomes, such as sector of employment or parental background.

Output

SP2 will deliver three academic articles: (1) effects of changing labor markets on vocational and general graduates' labor market outcomes, (2) effects of within-occupation change in skill demands on vocational and general graduates' labor market outcomes, and (3) cross-national differences in the effects of changing labor markets on labor market outcomes.

SP3: Career effects of vocational and general education

In SP3 we focus on the micro-level and take a career perspective. Its key objective is to estimate how labor market returns to vocational and general education vary over the life cycle, and how this process varies across the countries under study. An important aim is to understand crucial role the literature has assigned to labor market mobility: are vocational graduates indeed less mobile than general graduates, and is this a key driver behind life cycle effects (see Figure 2)?

Data sources

Similar to SP2, SP3 relies on the (harmonized) panel data for the six countries under study (see <u>Table 1</u>). Next to the detailed panel data, for one study in SP3 we zoom in on the two countries with highly detailed register data: the Netherlands (Dutch Labor Force Survey, supplemented with register data) and Sweden (registers). Their population registers allow for an even more fine-grained test of labor market mobility. Both data sources contain time-varying information on organizational affiliation, occupation, and wages. In the Netherlands information on organizational affiliation and wage is available for all Dutch employees on a monthly basis. In Sweden these data are available on a yearly basis. The inclusion of information on organizational affiliation and general graduates are mobile between organizations, and how this might affect their career perspectives.

Methods

There are two main reasons to rely on panel data instead of cross-sectional data when estimating career effects. First, with panel data we can track the same individuals over their careers instead of comparing different individuals at different time points in their work life. Second, we can separate age effects from period or cohort effects. The methods that we use in SP3 are tailor-made to exploit these strengths of the panel data.

SP3 will rely on different types of fixed and random effects regression models to estimate how the returns to vocational and general education vary over the life course. We will model different outcomes: employment, unemployment, wage, mobility (i.e., switching of occupation and/or organization) and occupational status. These different dependent variables are used to explain how labor market careers of vocational and general

graduates develop. They are also used to expose how labor market mobility might differ between the two groups, and if the mobility is downward or upward with respect to wage or occupational status (Ganzeboom et al., 1992). Although age, period, and cohort can never be fully separated, when estimating career effects we use models that do account for cohort change.

Following the hypothesis that the accumulation of disadvantage following early-career setbacks are particularly large for vocational graduates—and that this might partly explain career differences between workers with general and vocational qualifications—SP3 also analyzes the long-term effects of early-career setbacks. We track a group of young graduates, where some enter the labor market unemployed or in a mismatched occupation, whereas others find a job quickly or enter an occupations that is linked to their educational qualification. Using regression models we predict what the long-term effects will be of these early-career setbacks, and how they are different across vocational and general graduates.

A key challenge in SP3—and indeed the literature on vocational education (Forster & Bol, 2018, p. 189; Korber & Oesch, 2019, p. 5)—is to overcome selection bias (Morgan & Winship, 2015). Workers with vocational or general qualifications might work in different sectors; have different socio-economic backgrounds, or different ability levels. It might be these factors that explain why their careers develop differently, and not that they have a vocational or general qualification. In CAREER we will explicitly address this issue. In order to get closer to the causal effect of type of education, we use matching techniques next to the regular regression-based approaches. More specifically, we will use coarsened exact matching (Iacus et al., 2012) to create matched control samples. This matching strategy, combined with regular regression approaches, provides us with the best-possible estimates of career effects.

Output

SP3 will deliver three academic articles in the form of a PhD dissertation: (1) career effects of vocational and general education across six European countries, (2) the importance of labor market mobility for understanding vocational career effects, and (3) early career setbacks and long-term effects.

SP4: Theoretical mechanisms for late-career penalties to vocational education

The main objective of SP4 is to unravel the causal mechanisms that drive late-career penalties to vocational education. While some recent studies have documented a late-career penalty, SP4 has as its main goal to find the relative importance of the different theoretical mechanisms.

Data sources

SP4 takes a mixed methods approach and collects novel interview data, factorial survey experiments, and survey data among recruiters. For reasons of viability SP4 only focuses on the UK and either Germany or the Netherlands. Since a PhD-student will be primarily responsible for gathering the interview and factorial survey experimental data, the choice for Germany or the Netherlands will be based on the language proficiency of that student, in order to ensure a successful data collection.

Following Di Stasio (2014, 2017) we use the chambers of commerce in the Netherlands/Germany and the UK to recruit 400 (200 per country) companies in four different labor market sectors. The design of SP4 thereby explicitly allows for analyzing sectoral differences within countries (Bechter et al., 2012). The individuals within the organizations that are responsible for hiring are then approached to take part in the study. In the first year of the project, in consultation with the academic board we will decide which sectors to include.

First, from the 200 a random subset of 32 recruiters per country is approached for a semi-structured interview (Wengraf, 2001). Existing research has shown the importance of qualitative data sources in understanding hiring decisions (Rivera, 2012). Using interview data is of vital importance to achieve SP4's main objective in unveiling why some older workers are (not) hired. The interviews take place at the start of SP4 (year 2, see <u>Table 2</u>) and will form important input for the factorial survey. At this moment we know virtually nothing on the mechanisms that drive late-career penalties for vocational graduates, and the project therefore leaves the option open that it will adjust the vignette-design based on the qualitative interviews.

Second, all 200 selected organizations participate in a factorial survey experiment (Auspurg & Hinz, 2014). Those that are responsible for the recruitment are asked to score fictive resumes ("vignettes") of older workers in their likelihood to invite them for a job talk or hire them (Di Stasio, 2017; Oude Mulders et al., 2018; Protsch & Solga, 2015). In determining the number of vignettes that each recruiter will receive, SP4 follows recent studies and uses a D-efficient design, where balance and orthogonality are simultaneously optimized (Dülmer, 2016). The factorial experiments are pilot-tested before going in the field, and external validity of factorial experiments is found to be high (Hainmueller et al., 2015). After the factorial experiments, recruiters participate in a short survey about themselves and their organization.

Bol

Part B2

The factors that we plan to include in the vignettes align with the theories discusses above and include, for example, the type of educational qualification (vocational or general), skills (having sector-relevant skills yes/no), previous work experience, previous career mobility, participation in lifelong learning.

Methods

The qualitative interviews are recorded and will be transcribed. SP4 uses specialist software, ATLAS/ti (Friese, 2019), to analyze the transcribed texts in a structural way. This means that we try to structure the interpretation of the data analysis of the qualitative data. Moreover, the classification schemes that are used for coding and interpreting the interviews will be released to the academic community after the project to advance and encourage replication or re-analysis.

The data from the factorial survey experiment are analyzed in regression models with random effects, fixed effects, and hybrid models that account for both (e.g., Quadlin, 2018). In this case vignettes are nested within the recruiters that rank them. Methodologically this means that in SP4 we (a) can account for between-recruiter variance (random effects models), (b) eliminate all between-recruiter variance and only model the variation in rankings within recruiters (fixed effects), or (c) use a combination of both (hybrid). The factors that are used in the vignettes to operationalize the different theoretical mechanisms (see Section a for a tentative list) are then included in the regressions.

Output

SP4 will deliver three academic articles in the form of a PhD dissertation: (1) Mechanisms for late-career penalty (interviews, factorial experiment), (2) Relative importance of mechanisms (factorial experiment), (3) Organizational and recruiter predictors (factorial experiment, recruiter survey).

Bol

References

- Acemoglu, D., & Autor, D. (2011). Skills, Tasks and Technologies: Implications for Employment and Earnings. In David Card and Orley Ashenfelter (Ed.), *Handbook of Labor Economics: Vol. Volume* 4, Part B (pp. 1043–1171).
- Allison, P. D. (2009). Fixed effects regression models (Vol. 160). SAGE publications.
- Allmendinger, J. (1989). Educational systems and labor market outcomes. *European Sociological Review*, 5(3), 231–250.
- Arum, R., & Shavit, Y. (1995). Secondary vocational education and the transition from school to work. *Sociology of Education*, 187–204.
- Atkinson, A. B. (2015). Inequality. Harvard University Press.
- Auspurg, K., & Hinz, T. (2014). Factorial survey experiments (Vol. 175). Sage Publications.
- Autor, D. H., Katz, L. F., & Kearney, M. S. (2006). The Polarization of the U.S. Labor Market. American Economic Review, 96(2), 189–194.
- Azar, J. A., Marinescu, I., Steinbaum, M. I., & Taska, B. (2018). *Concentration in US labor markets: Evidence from online vacancy data*. National Bureau of Economic Research.
- Bassanini, A., Booth, A., Brunello, G., Paola, M. D., & Leuven, E. (2005). Workplace Training in Europe. 187.
- Bechter, B., Brandl, B., & Meardi, G. (2012). Sectors or countries? Typologies and levels of analysis in comparative industrial relations. *European Journal of Industrial Relations*, 18(3), 185–202.
- Becker, G. S. (1962). Investment in Human Capital: A Theoretical Analysis. *The Journal of Political Economy*, 9–49.
- Bills, D. B. (1990). Employers' Use of Job History Data for Making Hiring Decisions: *The Sociological Quarterly*, 31(1), 23–35.
- Bills, D. B., Di Stasio, V., & Gërxhani, K. (2017). The Demand Side of Hiring: Employers in the Labor Market. Annual Review of Sociology, 43(1), 291–310.
- Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent dirichlet allocation. *Journal of Machine Learning Research*, *3*(Jan), 993–1022.
- Bol, T. (2014). Economic Returns to Occupational Closure in the German Skilled Trades. *Social Science Research*, *46*, 9–22.
- Bol, T., Ciocca Eller, C., van de Werfhorst, H. G., & DiPrete, T. A. (2019). School-to-Work Linkages, Educational Mismatches, and Labor Market Outcomes. *American Sociological Review*, 84(2), 275– 307.
- Bol, T., De Vaan, M., & Van de Rijt, A. (2018). The Matthew effect in science funding. *Proceedings of the National Academy of Sciences*, *115*(19), 4887–4890.
- Bol, T., & Van de Werfhorst, H. G. (2013). Educational systems and the trade-off between labor market allocation and equality of educational opportunity. *Comparative Education Review*, 57(2), 285–308.
- Bol, T., & Weeden, K. A. (2015). Occupational Closure and Wage Inequality in Germany and the United Kingdom. *European Sociological Review*, *31*(3), 354–369.
- Breen, R. (2005). Explaining Cross-national Variation in Youth Unemployment: Market and Institutional Factors. *European Sociological Review*, 21(2), 125–134.
- Brinton, M. C., & Nee, V. (1975). The new institutionalism in sociology. Russell Sage Foundation.
- Buchmann, M., Buchs, H., Gnehm, A., Hevenstone, D., Klarer, U., Müller, M., ... von Ow, A. (2019). Erhebung von Stelleninseraten 1950-2018 [Dataset]. Universität Zürich-Philosophische Fakultät-Soziologisches Institut. Distributed by FORS, Lausanne.
- Busemeyer, M. R. (2009). Asset specificity, institutional complementarities and the variety of skill regimes in coordinated market economies. *Socio-Economic Review*, 7(3), 375–406.
- Charles, M., & Grusky, D. B. (2005). *Occupational ghettos: The worldwide segregation of women and men* (Vol. 200). Stanford University Press Stanford, CA.
- Cheng, S. (2014). A Life Course Trajectory Framework for Understanding the Intracohort Pattern of Wage Inequality. *American Journal of Sociology*, *120*(3), 633–700.
- Collingwood, L., Jurka, T., Boydstun, A. E., Grossman, E., & van Atteveldt, W. H. (2013). *RTextTools: A supervised learning package for text classification*.
- Cortes, G. M. (2016). Where have the middle-wage workers gone? A study of polarization using panel data. *Journal of Labor Economics*, 34(1), 63–105.
- De Grip, A., & Van Loo, J. (2002). The economics of skills obsolescence: A review. In *The economics of skills obsolescence* (pp. 1–26). Emerald Group Publishing Limited.
- Di Stasio, V. (2014). *Why education matters to employers: A vignette study in Italy, England and the Netherlands.* Dissertation, University of Amsterdam.

Di Stasio, V. (2017). Who is ahead in the labor queue? Institutions' and employers' perspective on overeducation, undereducation, and horizontal mismatches. *Sociology of Education*, *90*(2), 109–126.

- DiPrete, T. A., Bol, T., Eller, C. C., & van de Werfhorst, H. G. (2017). School-to-Work Linkages in the United States, Germany, and France. *American Journal of Sociology*, *122*(6), 1869–1938.
- DiPrete, T. A., De Graaf, P. M., Luijkx, R., Tahlin, M., & Blossfeld, H.-P. (1997). Collectivist versus individualist mobility regimes? Structural change and job mobility in four countries. *American Journal of Sociology*, 103(2), 318–58.
- DiPrete, T. A., & Eirich, G. M. (2006). Cumulative Advantage as a Mechanism for Inequality: A Review of Theoretical and Empirical Developments. *Annual Review of Sociology*, *32*, 271–297.

Doeringer, P. B., & Piore, M. J. (1985). Internal labor markets and manpower analysis. ME Sharpe.

- Dörfler, L., & Van de Werfhorst, H. G. (2009). Employers' demand for education and skills: Increased merit selection in Austria, 1985–2005. *European Societies*, 11(5), 697–721.
- Dülmer, H. (2016). The factorial survey: Design selection and its impact on reliability and internal validity. *Sociological Methods & Research*, *45*(2), 304–347.
- Eurostat. (2019). Job vacancies in number and % NACE Rev. 2, B-S, quarterly data. *Retrieved from* https://ec.europa.eu/eurostat/web/labour-market/job-vacancies/main-tables, October 10, 2019.
- Ebbinghaus, B., & Visser, J. (2000). Trade Unions in Western Europe Since 1945. Springer.
- Ehlert, M. (2017). Who Benefits from Training Courses in Germany? Monetary Returns to Non-formal Further Education on a Segmented Labour Market. *European Sociological Review*, 33(3), 436–448.
- Firebaugh, G., Warner, C., & Massoglia, M. (2013). Fixed Effects, Random Effects, and Hybrid Models for Causal Analysis. In S. L. Morgan (Ed.), *Handbook of Causal Analysis for Social Research* (pp. 113– 132).
- Forster, A. G., & Bol, T. (2018). Vocational Education and Employment over the Life Course Using a New Measure of Occupational Specificity. *Social Science Research*, 70, 176–197.
- Forster, A. G., Bol, T., & Van de Werfhorst, H. G. (2016). Vocational Education and Employment over the Life Cycle. *Sociological Science*, *3*, 473–494.
- Friese, S. (2019). Qualitative data analysis with ATLAS. ti. SAGE Publications Limited.
- Gangl, M. (2006). Scar effects of unemployment: An assessment of institutional complementarities. *American Sociological Review*, 71(6), 986–1013.
- Ganzeboom, H. B. G., De Graaf, P. M., & Treiman, D. J. (1992). A standard international socio-economic index of occupational status. *Social Science Research*, 21(1), 1–56.
- Gerring, J. (2006). Case Study Research: Principles and Practices. Cambridge: Cambridge University Press.
- Gnehm, A.-S. (2018). Text Zoning for Job Advertisements with Bidirectional LSTMs. *Proceedings of SwissText 2018, 2226, 66–74.*
- Goldin, C. D., & Katz, L. F. (2009). *The Race between Education and Technology*. Cambridge: Harvard University Press.
- Golsteyn, B. H., & Stenberg, A. (2017). Earnings over the life course: General versus vocational education. Journal of Human Capital, 11(2), 167–212.
- Goos, M., Manning, A., & Salomons, A. (2009). Job Polarization in Europe. *The American Economic Review*, 99(2), 58–63.
- Goos, M., Manning, A., & Salomons, A. (2014). Explaining job polarization: Routine-biased technological change and offshoring. *The American Economic Review*, *104*(8), 2509–2526.
- Grimmer, J., & Stewart, B. M. (2013). Text as data: The promise and pitfalls of automatic content analysis methods for political texts. *Political Analysis*, 21(3), 267–297.
- Hainmueller, J., Hangartner, D., & Yamamoto, T. (2015). Validating vignette and conjoint survey experiments against real-world behavior. *Proceedings of the National Academy of Sciences*, 112(8), 2395–2400.
- Hall, P. A., & Soskice, D. (2001). Varieties of capitalism: The institutional foundations of comparative advantage. Cambridge: Oxford University Press.
- Hanushek, E. A., Schwerdt, G., Woessmann, L., & Zhang, L. (2017). General education, vocational education, and labor-market outcomes over the lifecycle. *Journal of Human Resources*, 52(1), 48– 87.
- Heckhausen, J., & Buchmann, M. (2019). A multi-disciplinary model of life-course canalization and agency. *Advances in Life Course Research*, 41, 100246.
- Heisig, J. P., & Solga, H. (2015). Secondary Education Systems and the General Skills of Less- and Intermediate-educated Adults A Comparison of 18 Countries. *Sociology of Education*, 88(3), 202– 225.

- Hershbein, B., & Kahn, L. B. (2018). Do recessions accelerate routine-biased technological change? Evidence from vacancy postings. *American Economic Review*, 108(7), 1737–72.
- Hillmert, S. (2011). Occupational Mobility and Developments of Inequality Along the Life Course. *European Societies*, *13*(3), 401–423.
- Hout, M. (2012). Social and economic returns to college education in the United States. *Annual Review of Sociology*, *38*, 379–400.
- Iacus, S. M., King, G., & Porro, G. (2012). Causal inference without balance checking: Coarsened exact matching. *Political Analysis*, 20(1), 1–24.
- Jackson, M. (2007). How far merit selection? Social stratification and the labour market 1. *The British Journal of Sociology*, 58(3), 367–390.
- Jarvis, B. F., & Song, X. (2017). Rising intragenerational occupational mobility in the United States, 1969 to 2011. *American Sociological Review*, 82(3), 568–599.
- Kalleberg, A. L. (2009). Precarious work, insecure workers: Employment relations in transition. *American Sociological Review*, 74(1), 1–22.
- Kalleberg, A. L. (2011). Good jobs, bad jobs: The rise of polarized and precarious employment systems in the United States, 1970s-2000s. Russell Sage Foundation.
- Kalleberg, A. L., & Mouw, T. (2018). Occupations, Organizations, and Intragenerational Career Mobility. *Annual Review of Sociology*, 44, 283–303.
- Karpinska, K., Henkens, K., & Schippers, J. (2013). Retention of Older Workers: Impact of Managers' Age Norms and Stereotypes. *European Sociological Review*, 29(6), 1323–1335.
- Keller, W., & Utar, H. (2016). *International trade and job polarization: Evidence at the worker-level*. National Bureau of Economic Research.
- Kleinert, C., & Jacob, M. (2019). Vocational Education and Training in Comparative Perspective. In R. Becker (Ed.), *Research Handbook on the Sociology of Education* (pp. 284–307). Chetham: Edward Elgar Publishing.
- Korber, M., & Oesch, D. (2019). Vocational versus general education: Employment and earnings over the life course in Switzerland. *Advances in Life Course Research*, 40, 1–13.
- Kratz, F., Patzina, A., Kleinert, C., & Dietrich, H. (2019). Vocational Education and Employment: Explaining Cohort Variations in Life Course Patterns. *Social Inclusion*, 7(3), 224–253.
- Kriesi, I., Buchmann, M., & Sacchi, S. (2010). Variation in job opportunities for men and women in the Swiss labor market 1962–1989. *Research in Social Stratification and Mobility*, 28(3), 309–323. h
- Kureková, L. M., Beblavy, M., & Thum, A.-E. (2014). Using Internet Data to Analyse the Labour Market: A Methodological Enquiry. IZA Working Paper No. 8555
- Levanon, A., & Grusky, D. B. (2016). The Persistence of Extreme Gender Segregation in the Twenty-first Century. *American Journal of Sociology*, *122*(2), 573–619.
- Levels, M., van der Velden, R., & Di Stasio, V. (2014). From school to fitting work How education-to-job matching of European school leavers is related to educational system characteristics. *Acta Sociologica*, 57(4), 341–361.
- Maurice, M., Sellier, F., & Silvestre, J. J. (1986). *The social foundations of industrial power: A comparison of France and Germany*. Cambridge: The MIT Press.
- Mayer, K. U. (2009). New Directions in Life Course Research. Annual Review of Sociology, 35(1), 413-433.
- Mills, M., Blossfeld, H.-P., Buchholz, S., Hofäcker, D., Bernardi, F., & Hofmeister, H. (2008). Converging Divergences?: An International Comparison of the Impact of Globalization on Industrial Relations and Employment Careers. *International Sociology*, 23(4), 561–595.
- Morgan, S. L., & Winship, C. (2015). Counterfactuals and causal inference. Cambridge University Press.
- Müller, W., & Gangl, M. (2003). Transitions from education to work in Europe: The integration of youth into EU labour markets. Oxford: Oxford University Press.
- Müller, W., & Jacob, M. (2008). Qualifications and the Returns to Training Across the Life Course. In K. U. Mayer & H. Solga, *Skill Formation. Interdisciplinary and Cross-National Perspectives* (pp. 126– 172). Cambridge: Cambridge University Press.
- Murphy, E. C. (2014). Workers' movement out of declining occupations in Great Britain, Germany and Switzerland. *European Sociological Review*, *30*(6), 685–701.
- Oesch, D. (2013). Occupational Change in Europe: How Technology and Education Transform the Job Structure. Oxford: Oxford University Press.
- Oesch, D., & Menés, J. R. (2011). Upgrading or polarization? Occupational change in Britain, Germany, Spain and Switzerland, 1990–2008. *Socio-Economic Review*, 9(3), 503–531. h
- Oesch, D., & Piccitto, G. (2019). The Polarization Myth: Occupational Upgrading in Germany, Spain, Sweden, and the UK, 1992–2015. *Work and Occupations*.

- Oude Mulders, J., Henkens, K., Liu, Y., Schippers, J., & Wang, M. (2018). Managers' interview invitation decisions about older job applicants: Human capital, economic conditions and job demands. *Ageing & Society*, *38*(4), 839–864.
- Protsch, P., & Solga, H. (2015). How Employers Use Signals of Cognitive and Noncognitive Skills at Labour Market Entry: Insights from Field Experiments. *European Sociological Review*, 31(5), 521– 532.
- Quadlin, N. (2018). The mark of a woman's record: Gender and academic performance in hiring. *American Sociological Review*, *83*(2), 331–360.
- Rivera, L. A. (2012). Hiring as cultural matching: The case of elite professional service firms. *American Sociological Review*, 77(6), 999–1022.
- Roberts, M. E., Stewart, B. M., Tingley, D., Lucas, C., Leder-Luis, J., Gadarian, S. K., ... Rand, D. G. (2014). Structural topic models for open-ended survey responses. *American Journal of Political Science*, 58(4), 1064–1082.
- Rözer, J. J., & Bol, T. (2019). Labour Market Effects of General and Vocational Education over the Life-Cycle and across Time: Accounting for Age, Period, and Cohort Effects. *European Sociological Review 35*(5), 701-717.
- Ryan, P. (2001). The school-to-work transition: A cross-national perspective. *Journal of Economic Literature*, *39*(1), 34–92.
- Ryder, N. B. (1965). The cohort as a concept in the study of social change. *American Sociological Review*, 843–861.
- Schneider, S. L. (2010). Nominal comparability is not enough:(In-) equivalence of construct validity of cross-national measures of educational attainment in the European Social Survey. *Research in Social Stratification and Mobility*, 28(3), 343–357.
- Scott, W. R. (2008). Institutions and organizations: Ideas and interests. Sage.
- Shavit, Y., & Müller, W. (1998). From School to Work: A Comparative Study of Educational Qualifications and Occupational Destinations. Oxford: Clarendon Press.
- Spence, M. (1973). Job Market Signaling. The Quarterly Journal of Economics, 87(3), 355–374.
- Stojmenovska, D., Bol, T., & Leopold, T. (2017). Does diversity pay? A replication of Herring (2009). *American Sociological Review*, 82(4), 857–867.
- Stojmenovska, D., Bol, T., & Leopold, T. (2019). Teaching Replication to Graduate Students. *Teaching Sociology*, forthcoming.
- Thurgood, J., Turrell, A., Copple, D., Djumalieva, J., & Speigner, B. (2018). Using Online Job Vacancies to Understand the UK Labour Market from the Bottom-Up. *sBank of England*.
- Tomaskovic-Devey, D., & Avent-Holt, D. (2019). *Relational inequalities: An organizational approach*. Oxford University Press, USA.
- Visser, J. (2019). *ICTWSS Database. Version 6.0*. Amsterdam: Amsterdam Institute for Advanced Labour Studies (AIAS), University of Amsterdam.
- Vogtenhuber, S. (2014). Explaining country variation in employee training: An institutional analysis of education systems and their influence on training and its returns. *European Sociological Review*, 31(1), 77–90.
- Weeden, K. A. (2005). Stata algorithm for backcoding 2000 Census occupation codes into 1990 Census occupation codes. *Department of Sociology, Cornell University*.
- Weeden, K. A., Kim, Y.-M., Carlo, M. D., & Grusky, D. B. (2007). Social Class and Earnings Inequality. *American Behavioral Scientist*, 50(5), 702–736.
- Wengraf, T. (2001). *Qualitative research interviewing: Biographic narrative and semi-structured methods*. Sage.
- Wolbers, M. H. J. (2007). Patterns of labour market entry A comparative perspective on school-to-work transitions in 11 European Countries. *Acta Sociologica*, 50(3), 189–210.
- Wolter, S. C., & Ryan, P. (2011). Apprenticeship. In *Handbook of the Economics of Education* (Vol. 3, pp. 521–576). Elsevier.
- Wright, E. O., & Dwyer, R. E. (2003). The patterns of job expansions in the USA: A comparison of the 1960s and 1990s. *Socio-Economic Review*, *1*(3), 289–325.